Draft concept for a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues

September 2017
Andreas Manhart, Stefanie Degreif, Peter Dolega, Doris Schueler
(Oeko-Institut e.V.)

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STRADE is an EU-funded research project focusing on the development of dialogue-based, innovative policy recommendations for a European strategy on future raw materials supplies. In a series of policy briefs and reports, the project will offer critical analysis and recommendations on EU raw materials policy.

1. Overview

The STRADE project has developed a concept for a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues. It combines global and EU mining and trade data with information on environmental and socio-economic aspects. The target groups are policy-makers, analysts and decision-makers from industry (upstream and downstream), civil society organizations and academia.

The main objective is the data information on all three pillars of sustainability in an easily accessible format. Besides the use for policy making and the creation of public awareness, the information system shall support European companies' supply chain management and reduce companies costs for individual data collection in the context of the EU conflict mineral regulation and an extended due diligence engagement along the supply chain of products made from all kind of metals.

In the first stage, the information system shall focus on the most urgent issues in the supply chain. These are internationally traded and imported primary minerals from countries with weak governance – particularly conflict minerals - and imported minerals from countries which strongly depend economically on raw materials. The information system shall not only provide information on environmental and social risks, but shall also highlight the opportunities of mining for achieving the sustainable development goals of the mining countries and the initiatives which engage for responsible mining. In the second stage, information on mining and processing within the EU, which has been provided by several past and ongoing EU-projects, may be integrated. In the second stage, information on secondary raw material flows may also be integrated.

The Joint Research Center (JRC) of the European Commission is currently developing its RMIS 2.0, a raw material information system including economic, socio-economic and environmental dimensions. The STRADE concept is a proposal how to integrate particularly the socio-economic and environmental dimensions in RMIS 2.0 or a similar data platform.

The proposal includes raw material-specific and country-specific information. It is presented in more detail in Part I (raw material profiles) and Part II (country profiles). This data architecture allows coupling general and global raw material-specific information with mining-country-specific data and indices and shall be realized as web-based tool. In the Annex, background information on

relevant data provision initiatives and activities and more detailed considerations for the information system are given.

2. Objectives of the concept

The **target groups** of the concept of this data and knowledge platform are policy-makers, analysts and decision-makers from industry (upstream and downstream), civil society organizations and academia.

The objectives are:

Provide data and information on all three pillars of sustainability in an easily accessible format

- The information system shall offer a wide range of reliable data, information and data sources on raw material production, trade and related socio-economic and environmental issues. This should also encompass topics and data around development perspectives from mining, as well as existing initiatives aiming for environmentally and socially responsible development of the minerals sector.
- The knowledge system shall provide these data structured and easily accessible and provide raw material-specific data as well as country-specific data and information.
- The joint data provision of economic data and environmental and social data shall support the awareness of environmental and social impacts of raw material production within and outside Europe. A long-term sustainable raw material supply requires a holistic thinking from all involved stakeholders.

Support European companies' supply chain management

- The provided data and information shall support the European companies' supply chain management and their efforts to meeting the due diligence requirements. This encompasses the due diligence for conflict minerals in accordance with the EU regulation on conflict minerals as well as further voluntary industry engagement for responsible sourcing of mass metals and further minor metals.
- The concept aims at reducing the European companies' expenses for the collection on supply chain related raw-material and country-specific information. Currently, an increasing number of upstream and downstream companies and private and public institutions make great efforts to collect the proposed data individually. This aggregated working load will be significantly reduced if this information system is provided to a wide range of users. As a result, EU companies' competitiveness will be improved.

3. Focus of the concept

The draft concept focuses on:

Internationally-traded minerals

- The proposed raw material information system shall principally be designed for all internationally-traded minerals and not be limited to conflict minerals. However, it is supposed to be implemented in several stages. It is suggested to begin implementation with those minerals having good data availability (e.g. copper, zinc, nickel, lead, iron ore, gold) and those minerals with a high demand for information, particularly conflict minerals. In the next step, minerals and metals with less data availability, such as bauxite, molybdenum, and rare-earths, can be addressed. The data depth should also increase stepwise, with data gaps being closed gradually.

Imported primary minerals in the first stage

- In the first stage, the proposed concept has a strong focus on primary raw materials which are imported from outside the EU and are extracted in non-EU mining countries. This reflects the high EU import dependency and the fact that the majority of internationally-traded minerals, which are consumed in Europe, is coming from non-EU mining countries. Along with this, EU companies need particularly information on their supply chain which is connected to environmental and social risks and is located outside the EU.

Economic, social and environmental issues in the mining sector

- The information system focuses on data and information in all three sustainability dimensions in the mining sector: Economic, social and environmental issues.
- The concept shall not only point out risks from mining as starting point for a sound supply chain management. Opportunities of mining for the local population and the well-being of the mining countries are also considered.

Compiling and streamlining existing data and information in the first stage

- Due to the wealth of existing data sources, the information system shall firstly strive for integrating existing and freely available data into one information system.
- The information system is designed to serve as base information tool. In line with this, there is no urgent need to buy expensive monthly raw data. Instead, freely available annual data will be sufficient for most issues.
- The development of new indicators and data-sets might partly be relevant for socio-economic and environmental issues where existing data sources are still fragmentary.

Focus on developing and emerging countries in the first stage

- In the first stage, the proposed concept has a strong focus on non-EU raw material flows and non-EU mining developing and emerging countries - in particular countries with weak governance - because the related material flows are frequently associated with higher environmental and social risks while simultaneously showing important opportunities for achieving the sustainable development goals.

Integration of information on raw material mining and processing within the EU in the second stage

- STRADE acknowledges that currently many parallel research projects, e.g. within the Horizon 2020 programme, already work on EU data collection and EU data harmonization with focus on activities within the EU. Their results are expected to importantly contribute to the suggested information system. In order not to duplicate other's work, the STRADE project, with its work packages on cooperation with resource-rich non-EU countries, focuses this draft concept on the global material flows, EU import flows and the related challenges in non-EU mining countries.

Integration of secondary raw material data in the second stage

- STRADE proposes to also integrate data and information on secondary flows in the second stage.

4. Consideration on the host and the setting

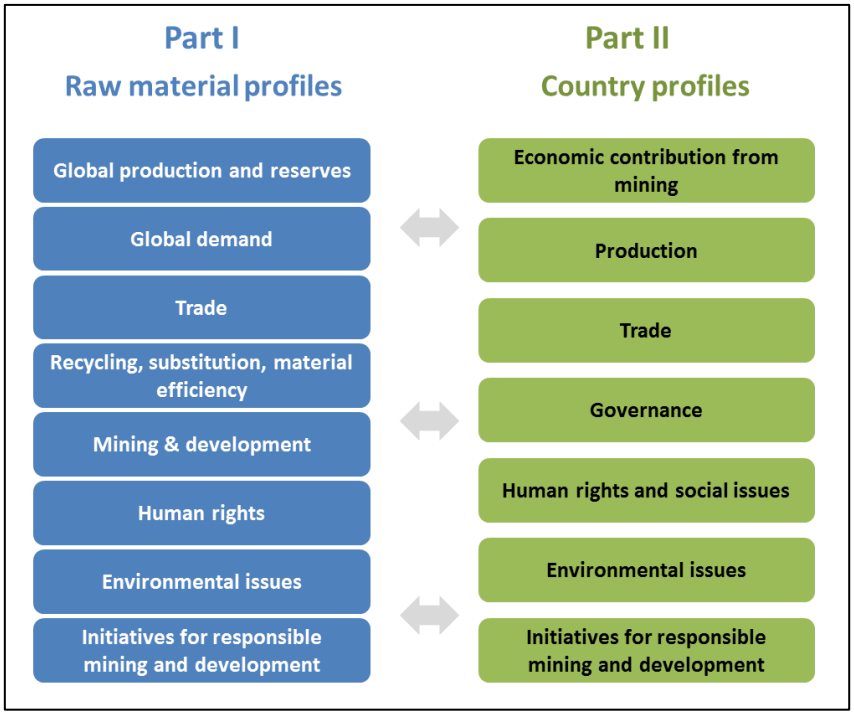
- The Joint Research Center (JRC) of the European Commission is currently developing a raw material information system including economic, socio-economic and environmental dimensions, the RMIS 2.0. Our concept is a proposal how to integrate particularly the socio-economic and environmental dimensions in RMIS 2.0 or a similar data platform.
- The information system has to be updated regularly and should also consider new developments in data availability. The high costs are supposed to be offset by European companies benefitting from the provided information.
- The presented set of information doesn´t claim completeness; it's seen as work in progress and needs further developments and regular updates.
- The RMIS is a web-based knowledge platform and will be a good tool to link the different data sets in an easily accessible manner.

5. Structure of the concept

The concept of the knowledge platform is divided into three parts:

- Part I: The raw material profiles provide raw- material specific information
- Part II: The country profiles provide country-specific information
- Annex with background information and review of existing data sources

The next figure illustrates the strong linkage between raw-material and country-specific information with both profiles focusing on all three dimensions of sustainability.



Part I: Raw material profiles

The raw material profiles are divided into eight chapters with a set of around 40 information and data. Traditional data like global production and reserves, demand and EU trade are included. This information is provided in different sources with annual review. Also opportunities of mining are addressed in the chapter mining & development. Information on environmental and social aspects as well as on initiatives for responsible mining ensures a comprehensive view on one specific raw material. The proposed raw material profile is illustrated with the example iron ore in Part I.

Example for the raw material profile's section on environmental issues:

This section provides raw material-specific information on life cycle assessment data, the association with radioactive substances and heavy metals, acid mine drainage, dam bursts, mining waste, the use of chemical additives in extraction and beneficiation. Also site-specific environmental risks are addressed which has a strong linkage to the country profiles.

Part II: Country profiles

The country profiles are divided into seven chapters with a preliminary set of around 80 data and facts. Traditional data like production and trade in the respective country are included. Furthermore, country-specific information on socio-economic (economic contribution from mining, human rights and social issues) and environmental issues is provided. Another focus is the view on initiatives for responsible mining and how to support sustainable development. The country profile is illustrated in Part II with the example Brazil.

Example for the country profile's section on human rights and social issues:

This section provides information – if data are available - on socio-economic mine site performance, recent violent conflicts with the involvement of the mining sector, the recognition of the Core Labour Standards of the ILO, prevalence of child and forced labour and the general human rights situation.

Project Background

The Strategic Dialogue on Sustainable Raw Materials for Europe (STRADE) addresses the long-term security and sustainability of the European raw material supply from European and non-European countries.

Using a dialogue-based approach in a seven-member consortium, the project brings together governments, industry and civil society to deliver policy recommendations for an innovative European strategy on future EU mineral raw-material supplies.

The project holds environmental and social sustainability as its foundation in its approach to augmenting the security of the European Union mineral raw-material supply and enhancing competitiveness of the EU mining industry.

Over a three year period (2016-2018), STRADE shall bring together research, practical experience, legislation, best practice technologies and know-how in the following areas:

1. A European cooperation strategy with resource-rich countries
2. Internationally sustainable raw-material production & supply
3. Strengthening the European raw-materials sector

Project Identity

Project Name	Strategic Dialogue on Sustainable Raw Materials for Europe (STRADE)
Coordinator	Oeko-Institut; Doris Schueler, Project Coordinator, d.schueler@oeko.de
Consortium	OEKO-INSTITUT E.V. – INSTITUT FUER ANGEWANDTE OEKOLOGIE Merzhauser Strasse 173, Freiburg 79100, Germany
	SNL Financial (AB) Olof Palmes gata 13, Se -111 37, Stockholm, Sweden
	PROJEKT-CONSULT BERATUNG IN ENTWICKLUNGS-LAENDERN GMBH Laechenstrasse 12, Bad Vilbel 61118, Germany
	UNIVERSITY OF DUNDEE Nethergate, DD1 4HN Dundee, United Kingdom
	GEORANGE IDEELLA FORENING Box 43, Mala 93070, Sweden
	UNIVERSITY OF WITWATERSRAND JOHANNESBURG Jan Smuts Avenue 1, Johannesburg 2001, South Africa
	DMT-KAI BATLA (PTY) LTD P.O Box 41955, Craighall, 2024, South Africa
Funding Scheme	This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689364
Duration	1.12.2015 – 30.11.2018
Budget	EU funding: €1 977 508.75
Website	www.STRADEproject.eu

Funded by the Horizon 2020 Programme of the European Union

Draft concept for a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues:

Part I
Draft concept of raw material profiles

(September 2017)

Öko-Institut e.V.

STRADE

Part I

Draft concept of raw material profiles

Content:

- **Global production and reserves**
- **Global demand**
- **EU trade**
- **Recycling / substitution / material efficiency**
- **Mining & development**
- **Human rights**
- **Environmental issues**
- **Initiatives for responsible mining**

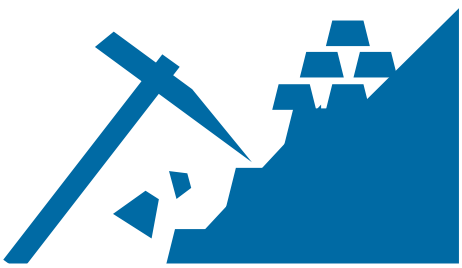
Preface

This document is Part I of the “Draft concept for a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues”. The Annex examines the necessity and feasibility of a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues.

The data is broadly structured into:

- Part I – Raw-material-specific information and
- Part II – Country-specific information.

Part I here presents a concrete example of compiling a raw material profile and offers iron as the example. The data collection for these examples does not claim completeness but builds on easily available data to illustrate the underlying concept and serve as a basis for a general discussion of the structure of the information system. Further data collection will be necessary to elaborate comprehensive raw material and country profiles if the STRADE team and the requested stakeholders agreed upon their principal architecture.



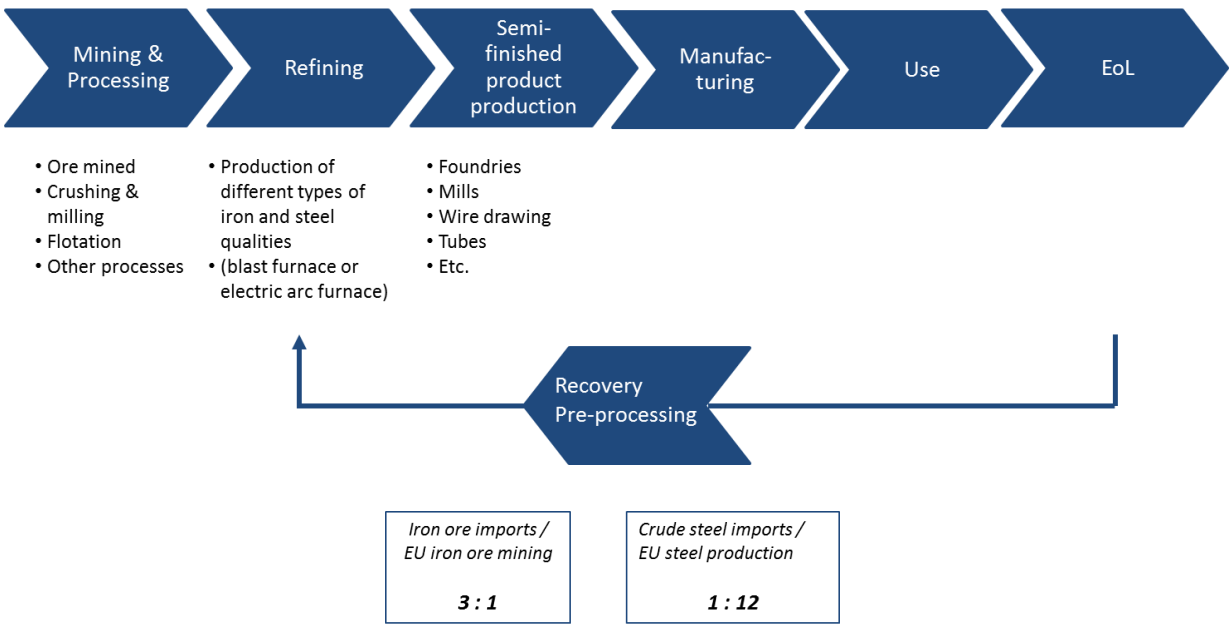
Introduction

Introduction
Overview

Key data on iron

Iron (Fe) is the fourth most abundant element in the Earth's crust, with a concentration of 4.7%. Iron has the highest production volume of all metals globally – in 2016 2.2 billion tonnes iron ore (usable) were mined. Almost every industrial sector depends on iron; moreover Europe is the second largest manufacturer of steel and iron globally.

Supply chain



Reference

- Used source for mining data: BGS
- Used source for import iron ore data: COMTRADE Further source: Eurostat
- Used source for crude steel import and production: eurofer.eu
- European Commission 2014
- USGS 2017

Further Reading

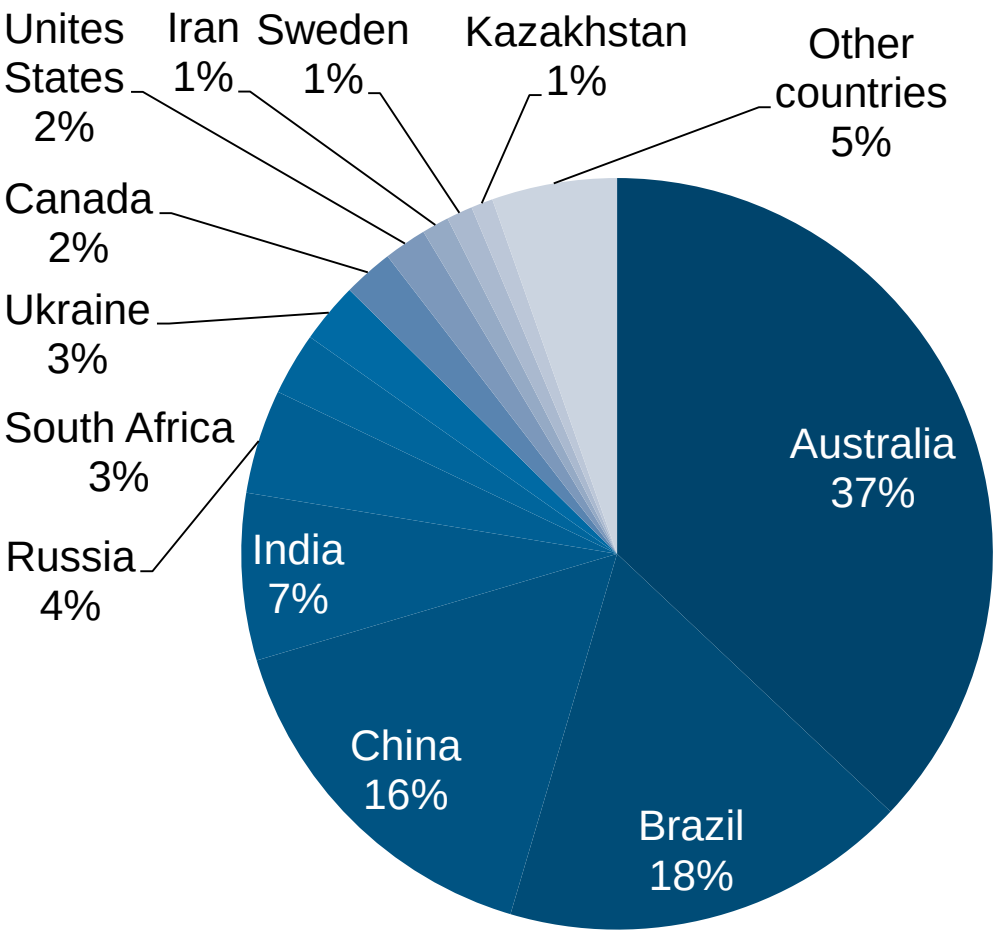
- Detailed information on the main production processes are available on www.eurofer.eu

Global production and reserves

Global production and reserves

Primary production and reserves

Global primary production 2016



Global primary mine production 2016 (usable iron ore):
Total 2,230 million metric tonnes

Reference

- USGS 2017

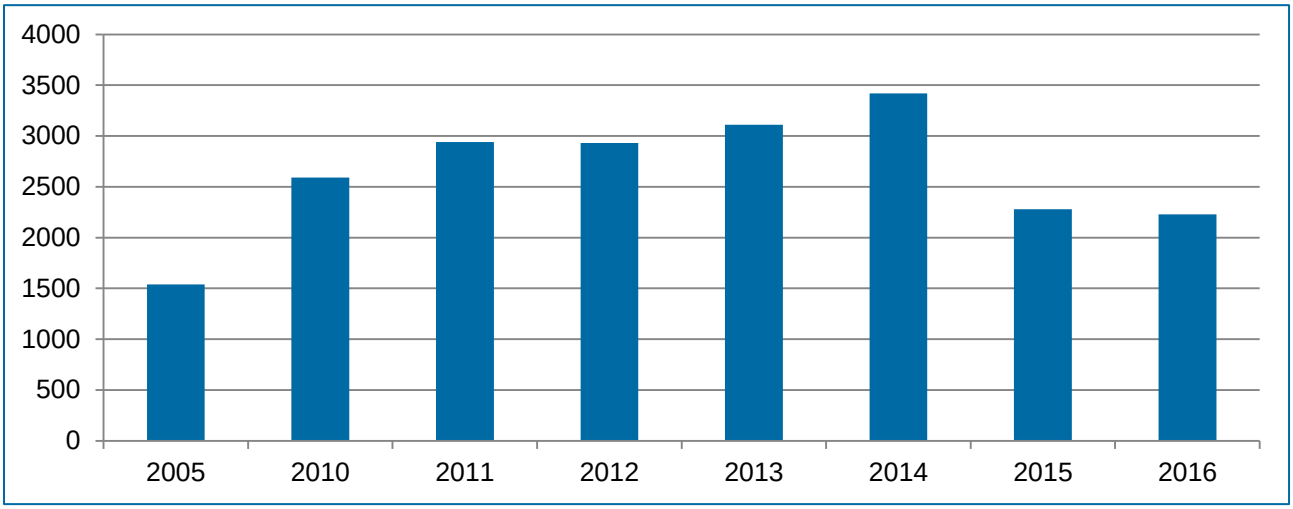
Further Reading:

- BGS
- respective International Study Groups
- UNCTAD (unctad.org)

Global production and reserves

Primary production and reserves

Historical development of primary production



Historical development of primary production (usable iron ore) in million metric tonnes: The decrease in 2015 is a result of new data from China (since 2015 China with usable ore data; before China included with crude ore data – till 2015 China with around 1,300 mio. tonnes; as usable ore ca. 375 mio. tonnes)

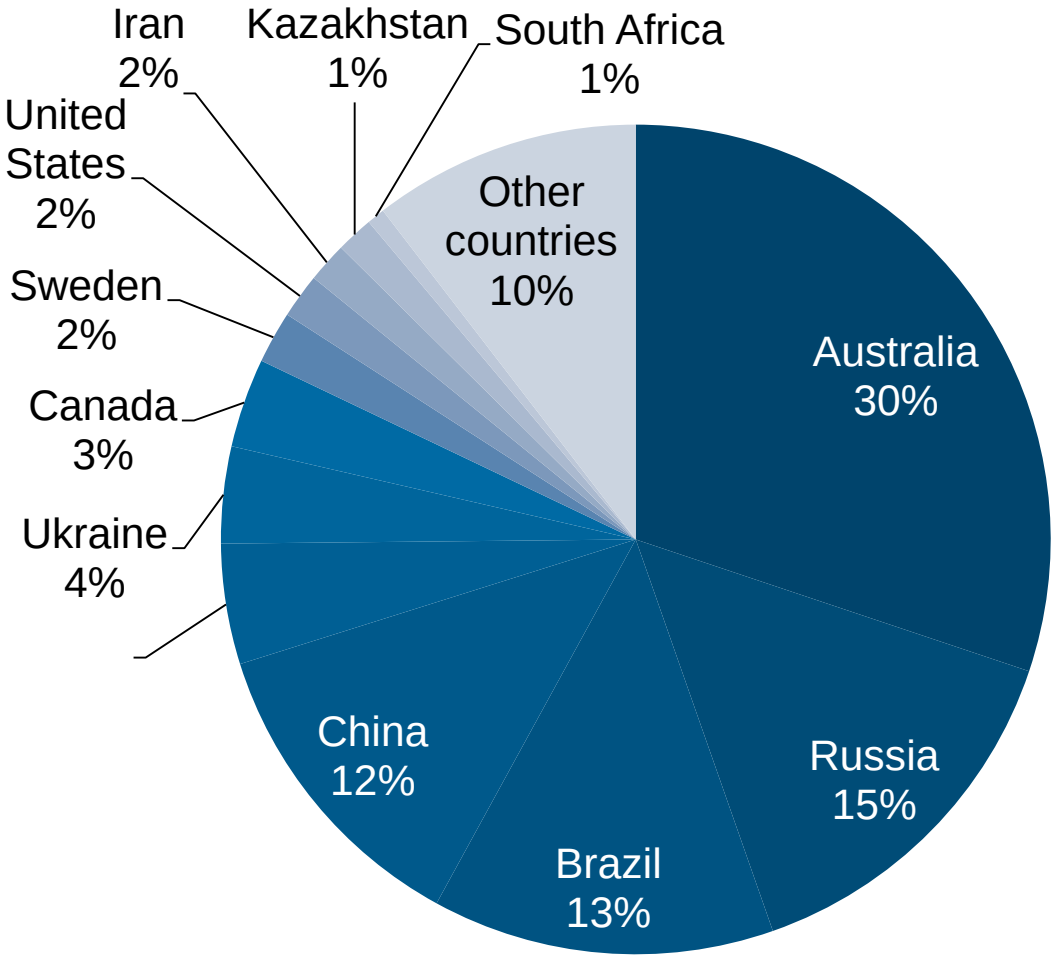
Reference

- USGS 2017

Global production and reserves

Primary production and reserves

Global reserves of crude iron ore



Global reserves of crude iron ore: Total 170,000 million metric tonnes

Reference

- USGS 2017

Global production and reserves

Primary production and reserves

Herfindahl-Hirschman index (HHI)

Herfindahl-Hirschman index (HHI)	
Index refers to	**Value**
Production	1
Reserves	0.3

The Herfindahl-Hirschman index (HHI) is a key figure for measuring concentrations. In this case the concentration of iron ore producing countries. 1 = high concentration of production

Used data: VDI standard 4800

Global production and reserves

Primary production and reserves

Largest iron ore producers in 2014

Corporation	ICMM member	Country	Capacity (Mt)	Capacity (%)
Vale Group	No	Brazil	451,7	17,17
Rio Tinto Group	Yes	UK	378,7	14,39
BHP Billiton	Yes	Australia	310,3	11,79
Fortescue Metals	No	Australia	81,5	3,10
Arcelor Mittal Group	No	UK	79,6	3,03
AnBenGroup	No	China	55,7	2,12
Anglo American Group	Yes	South Africa	50,8	1,93
Metalloinvest	No	Russia	46,8	1,78
Evrazholding Group	No	Russia	46,4	1,76
LKAB Group	No	Sweden	45,2	1,72
Metinvest Holding Group	No	Ukraine	44,7	1,70
Cliffs Natural Resources		USA	42,9	1,63

Reference

- Comtois C, Slack B. Dynamic Determinants in Global Iron Ore Supply Chain [Internet] [cited 2017 Mar 13]. Available from: https://www.cirrelt.ca/DocumentsTravail/CIRRELT-2016-06.pdf.

Global production and reserves

Ore as main-product / by-product

Iron ore is mainly mined as main-product.
Frequent by-products in iron ore mining are: TiO2, S, Ni, Cu, V
The principal iron-bearing minerals of commercial importance are hematite, magnetite, and goethite/limonite. Others include siderite, ilmenite, chamosite, and pyrite; in the case of ilmenite, Fe is recovered as a companion of TiO2, while pyrite is roasted to recover S with Fe oxide being recovered as a companion. Fe from ilmenite (and siderite) is used on a local basis, while pyrite and chamosite are virtually no longer important for iron production. Similarly, Fe may have previously been recovered from Ni-Cu deposits such as the Inco Sudbury deposit in Canada. Fe from magnetite was recovered as a co-product of V from the Mapoch mine and Cu from the Palabora mine, both in South Africa. Quantities of Fe produced as a companion are estimated to be a very small percentage of overall global production.

Reference

- Science Advances 2015 (www.advances.sciencemag.org/cgi/content/full/1/3/e1400180/DC1)

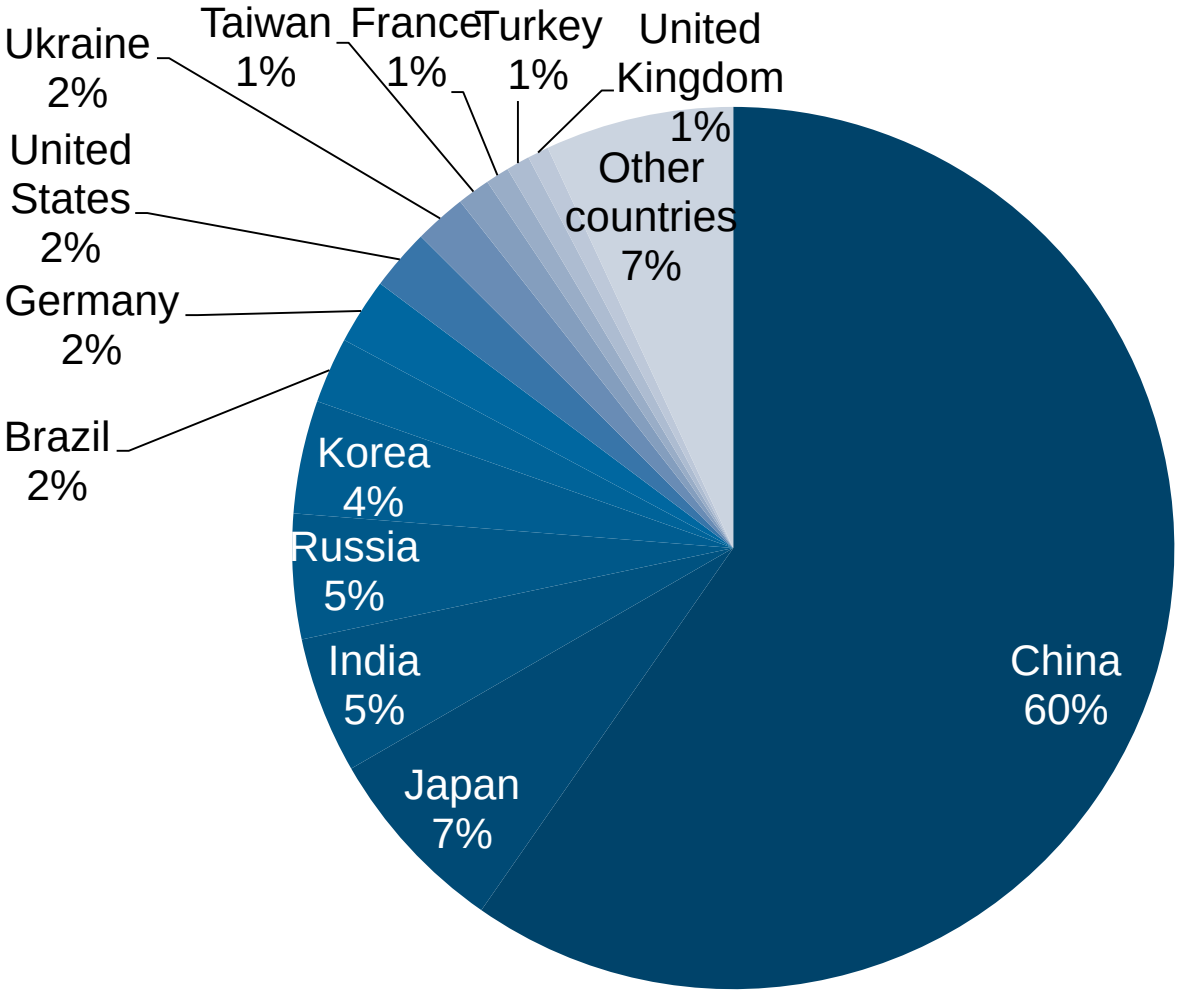
Further reading

- The Metal-Wheel by Reuter and van Schaik (http://eco3e.eu/wp-content/uploads/2011/01/29-metal_wheel.jpg)

Global production and reserves

Intermediate products production

Pig iron global production 2015



Pig iron global production 2015 (World total around 1,160 million metric tonnes of metal)

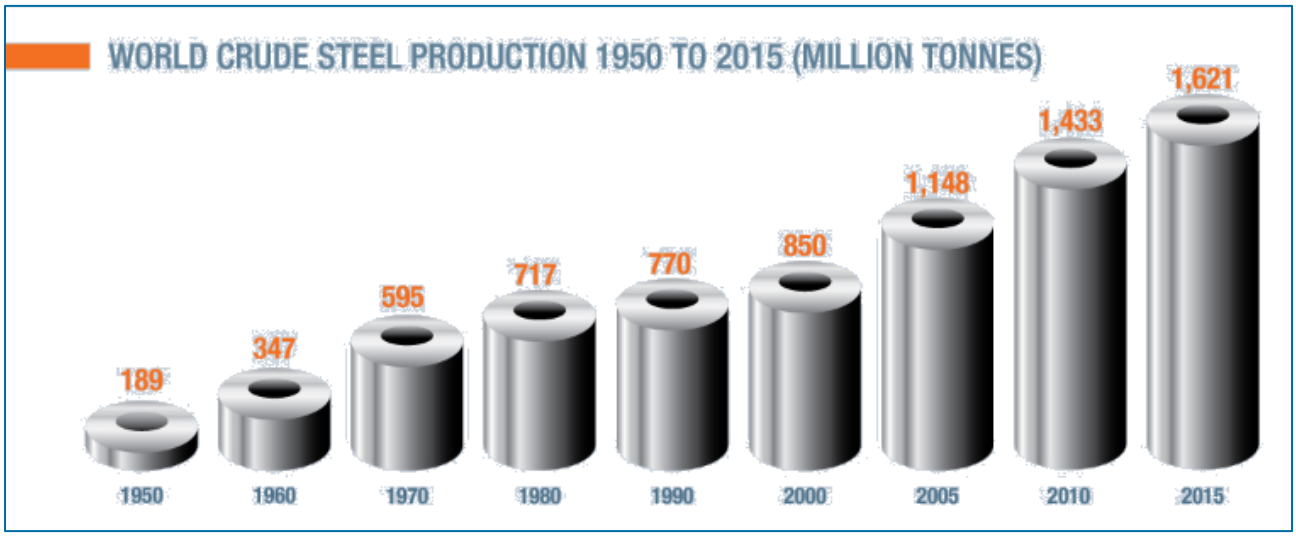
Reference

- USGS 2017

Global production and reserves

Intermediate products production

Historical development of worldwide crude steel production



Reference

- World Steel Association (https://www.worldsteel.org/en/dam/jcr:f9a336d7-8903-4bdf-9ed6-83b27d0ff807/WSiF+2016.pdf)

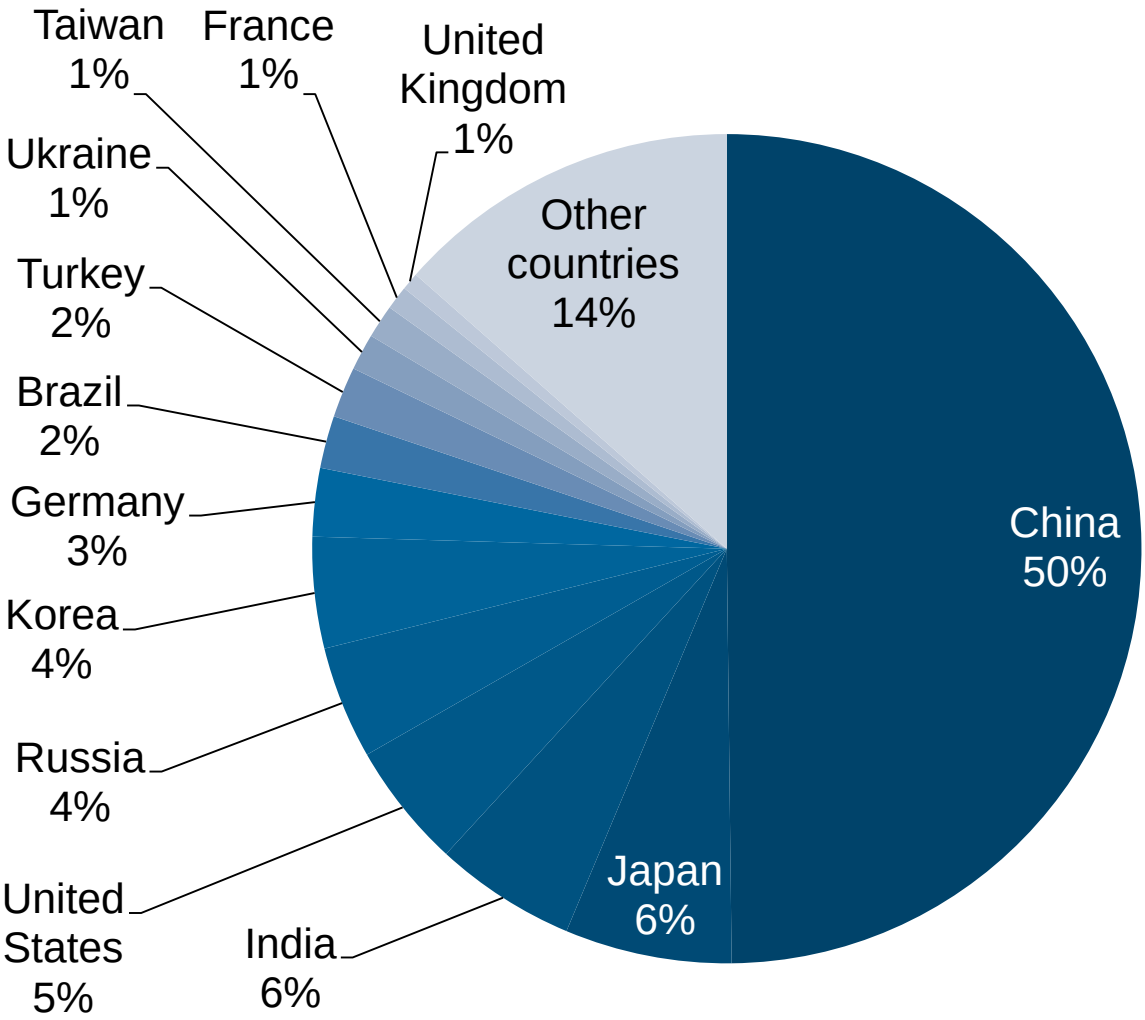
Further reading

- Eurofer (eurofer.eu)

Global production and reserves

Intermediate products production

Historical development of worldwide crude steel production



Crude steel producing countries 2015 (World total around 1,610 million metric tonnes of metal)

Reference

- USGS 2017

Global production and reserves

Intermediate products production

Summary

	EU28	Global
Pig Iron Production		
Crude Steel production (2016)	162 mio. t	1,628.5 mio. t [3]
Stainless Crude production (2015)	7,2 mio.t [2]	n.a.

Reference

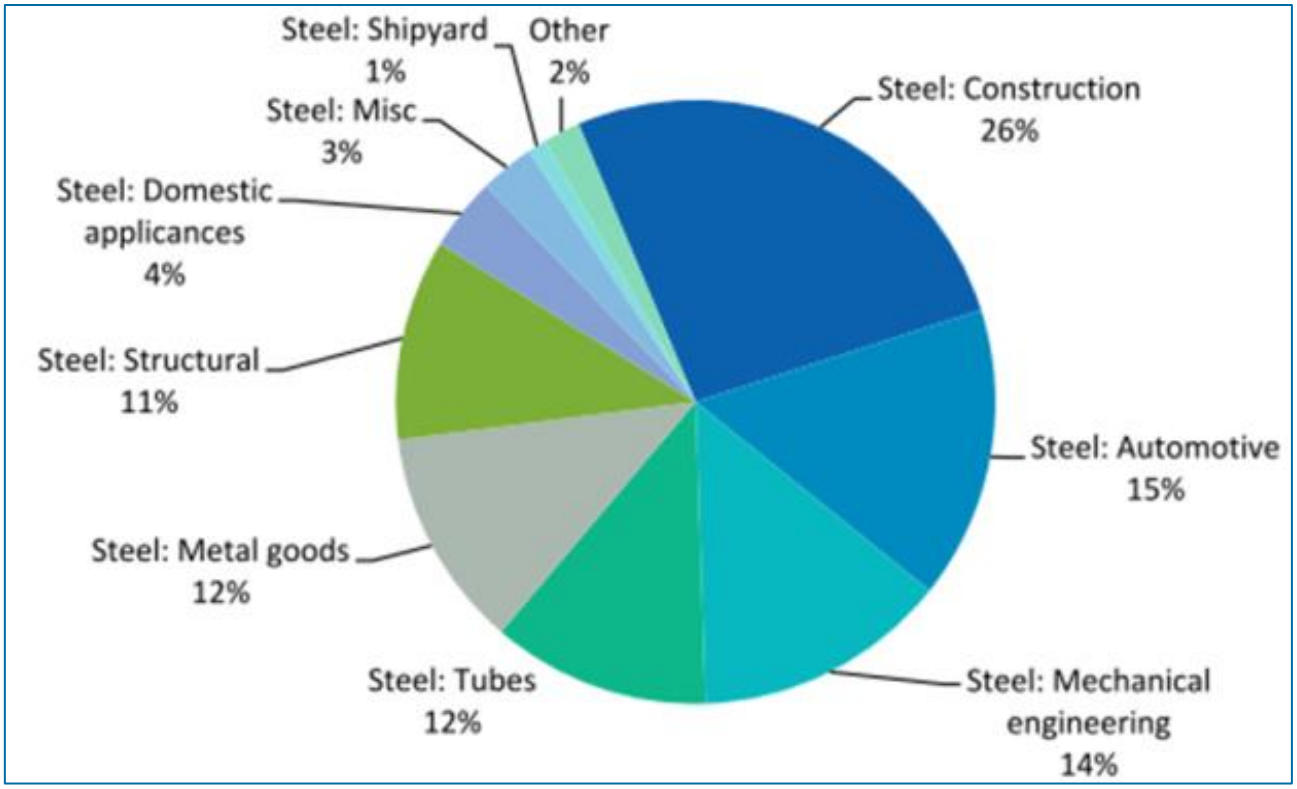
- Eurofer for EU28 crude steel production (http://www.eurofer.org/Facts%26Figures/Crude%20Steel%20Production/All%20Qualities.fhtml)
- Eurofer for EU28 stainless crude production (http://www.eurofer.org/Facts%26Figures/Crude%20Steel%20Production/Stainless.fhtml)
- World Steel Association for global crude steel production (https://www.worldsteel.org/media-centre/about-steel.html)

Global demand

Global demand

Application / end-use

End-use of iron ore in Europe in 2010



Reference

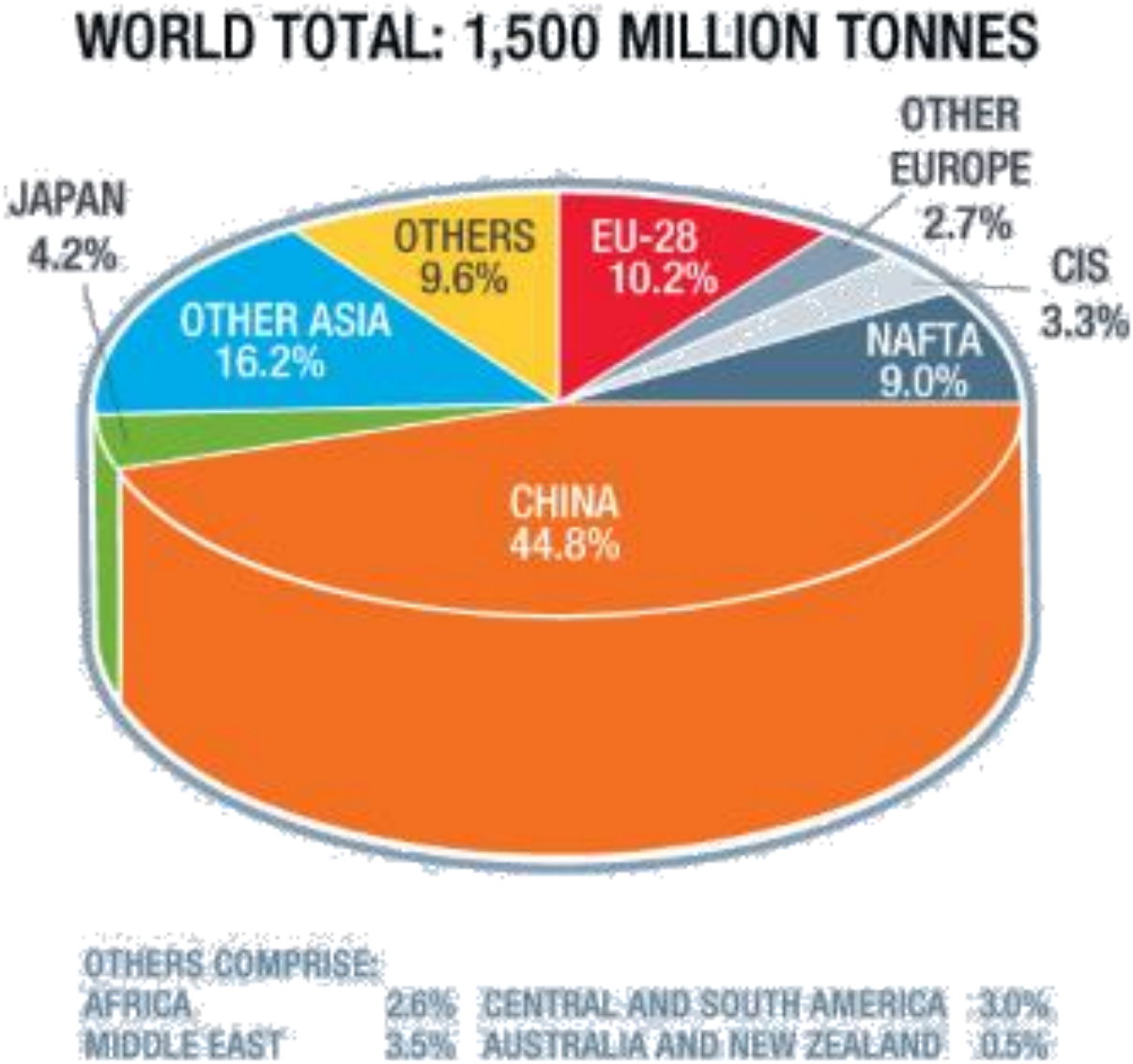
- European Commission 2014

Further reading

- World Steel Association (www.worldsteel.org)

Global demand

Global versus EU demand / consumption



Reference

- World Steel Association - World Steel in Figures 2016 (https://www.worldsteel.org/en/dam/jcr:f9a336d7-8903-4bdf-9ed6-83b27d0ff807/WSiF+2016.pdf)

Further reading

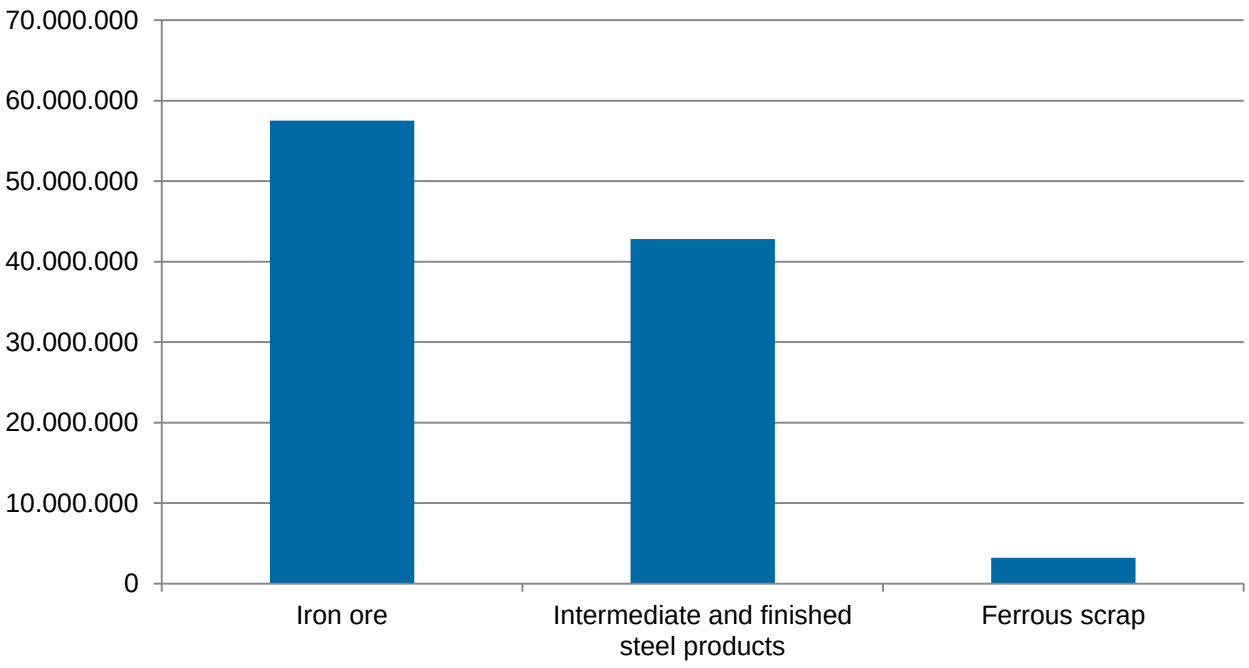
- Eurofer (www.eurofer.org)
- World Steel Association (www.worldsteel.org)

EU trade

EU trade

Extra-EU imports

Specific EU iron gross imports



Ores and intermediate products for EU processing industry; (rough estimation; intra-EU imports excluded; data refer to metal content)

Reference

- STRADE Policy Brief No. 02/2017 (http://stradeproject.eu/fileadmin/user_upload/pdf/STRADEPolBrf_02-2017_RawMaterialFlows_Mar2017_FINAL.pdf)
- COMTRADE (https://comtrade.un.org/data/)

Further reading

- Eurostat
- Comext
- WTO

EU trade

Extra-EU imports

EU28 import of iron ores and concentrates

(HS 2601) in 2015 (Official trade data; no metal content estimated)

Import iron ore from major countries	Million tonnes (in brackets share of total)	Million USD (in brackets share of total)
Brazil	54.5 (47%)	3.4 billion (48%)
Canada	19.0 (17%)	1.3 billion (17%)
Ukraine	16.3 (14%)	1.0 billion (14%)
Total	115.1 (100 %)	7.2 billion (100 %)

EU28 import of stainless steel in primary forms, semi-finished product

(HS 7218) in 2015 (Official trade data; no metal content estimated)

Major EU stainless steel imports (steel in primary forms, semi-finished product) from:	Tonnes (in brackets share of total)	
Russian Federation	13 844 (52%)	24 million (31%)
USA	4 387 (16%)	29 million (37%)
India	2 071 (8%)	5 million (7%)
Worldwide	26 795 (100 %)	79 million (100 %)

Reference

- COMTRADE (https://comtrade.un.org/data/)

Further reading

- Eurostat
- Comext

Further product groups ….

Scrap import is detailed in parameter recycling.

EU trade

Extra EU-exports

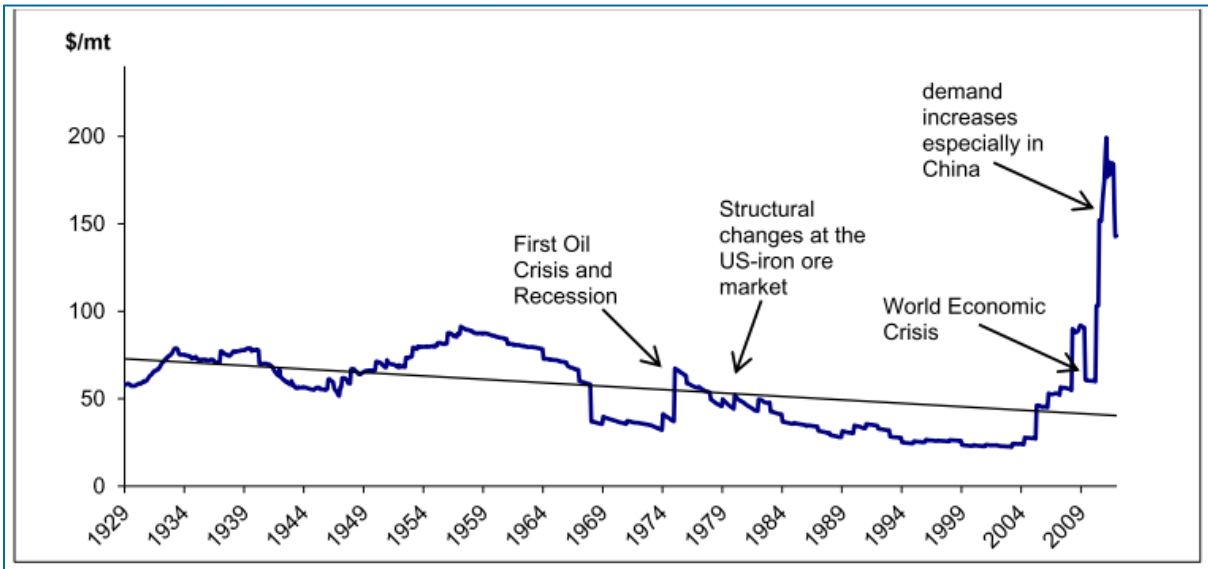
Note: The detailed concept for this section on extra EU exports should be elaborated in other projects / research; this issue is not in the STRADE focus.

Possible data sources are:

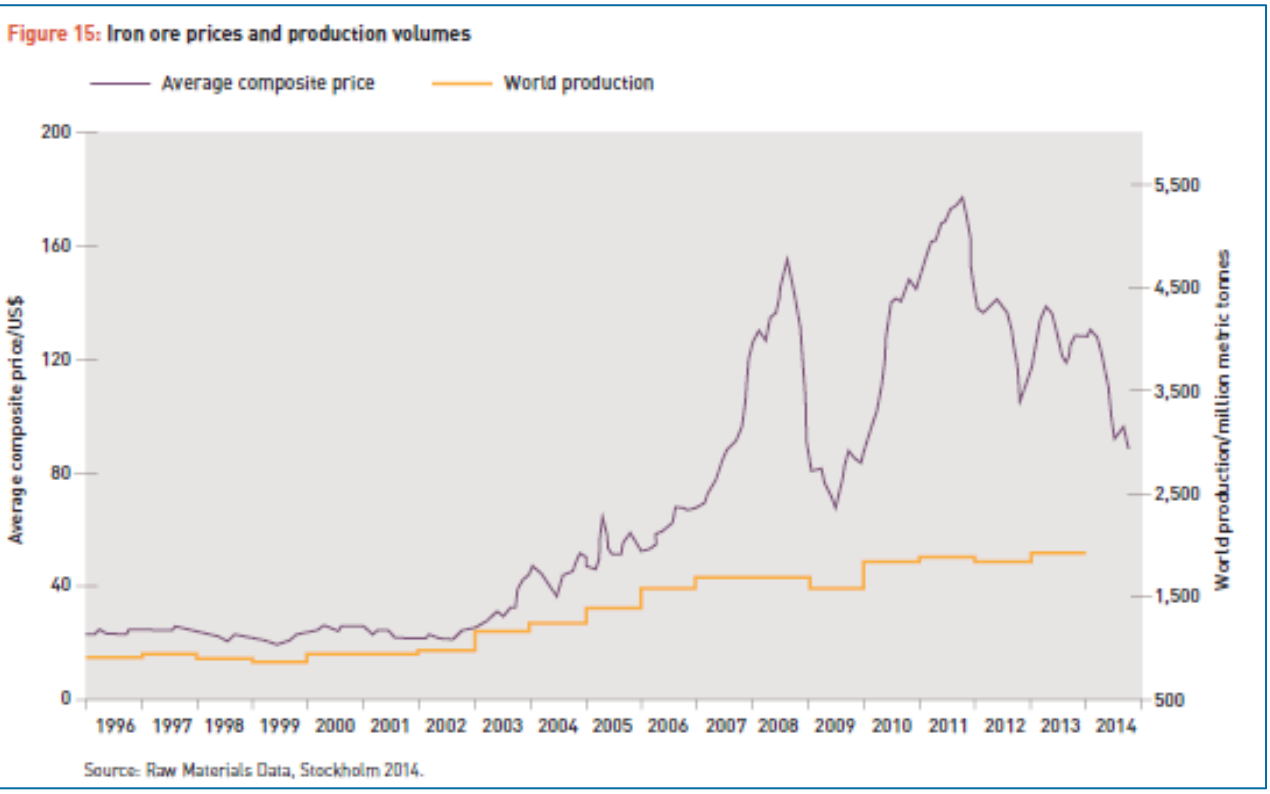
- COMTRADE
- Associations e.g.
- World Steel Association (https://www.worldsteel.org/en/dam/jcr:37ad1117-fefc-4df3-b84f-6295478ae460/Steel+Statistical+Yearbook+2016.pdf)

EU trade
Prices

Price history
Development of real iron ore prices (Prices are deflated, 2011 = 100)



Source: DERA, HWWI (2013) Ursachen von Preispeaks, -einbrüchen und –trends bei mineralischen Rohstoffen (Causes of price peaks, collapses and trends of mineral raw materials), Hamburg Institute of International Economics (HWWI) in contract for Deutsche Rohstoffagentur (DERA). April 2013, trend line and translation to English by Fraunhofer ISI



EU trade
Prices

Average ore price, Jan-Dec 2016	
Iron ore	93 USD / t

Marketindex 2017; Iron Ore Fines 62% FE spot (CFR Tianjin port), US dollars per metric ton

Reference

- Used data source for price history: EC 2014 (Report on Critical Raw Materials for the EU - Non-Critical Raw Materials Profiles) https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_de
- Used data source for price history: Raw Materials Group “The role of mining in national economies”, October 2014
- Used data source for average ore price: Marketindex (http://www.marketindex.com.au/iron-ore)

Further reading

- asianmetal.com
- metalpages.com
- UNCTADstat (http://unctad.org/en/Pages/statistics.aspx)
- IMF (imf.org)

Recycling / substitution / material efficiency

Recycling / substitution / material efficiency

Recycling

Note: The detailed concept for the section on recycling should be elaborated in other projects / research since the STRADE project focuses on primary production. Nevertheless some key data are proposed:

Iron: The end-of-life recycling rate (**EoL-RR**) of iron is between 52 % (USGS 2004) and 90 % (Steel Recycling Institute 2007) in UNEP 2011 and Bowyer et al 2015
Definition EoL RR: The EOL-RR is a measure of the extent to which ferrous metal contained in end - of - life steel products is actually recycled.

Iron: The recycled content (**RC**) content of iron is > 25 – 50% (UNEP 2011)
Definition Recycled Content (RC): The RC indicates the extent to which end - of - life scrap is actually used in making new steel products.

Reference

- UNEP 2011 http://wedocs.unep.org/bitstream/handle/20.500.11822/8702/-Recycling%20rates%20of%20metals%3a%20A%20status%20report-2011Recycling_Rates.pdf?sequence=3&isAllowed=y
- Bowyer et al. 2015 http://www.dovetailinc.org/report_pdfs/2015/dovetailsteelrecycling0315.pdf

Further reading

- BIO by Deloitte. Study on Data for a Raw Material System Analysis: Roadmap and Test of the Fully Operational MSA for Raw Materials Final Report [Internet] [cited 2017 Feb 15]. Available from: http://c.ymcdn.com/sites/www.intlmag.org/resource/resmgr/docs/membership_central/newsletter/2016/February/MSA_Final_Report_02.pdf.

Recycling / substitution / material efficiency

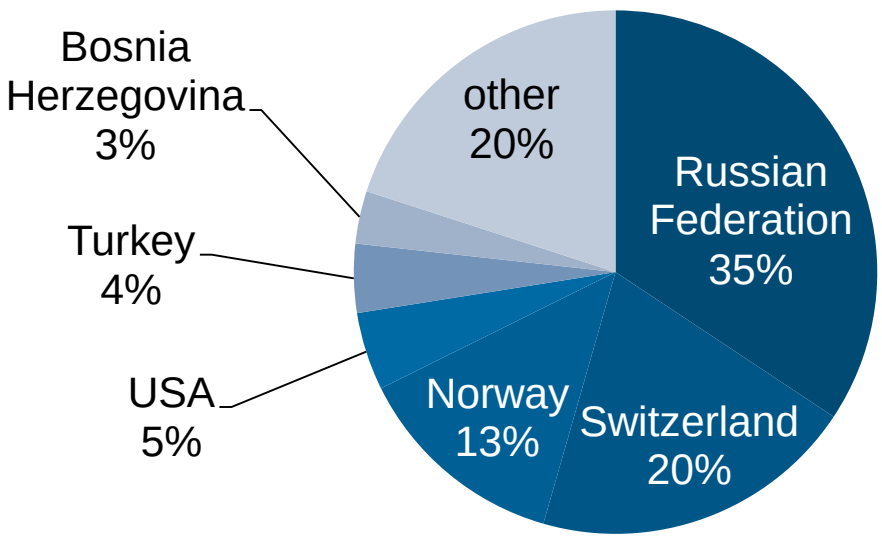
Recycling

EoL-RR and RC for selected product groups

Product Group	EU28		Global	
	EoL	RC	EoL	RC
Stainless steel	n.a.	n.a.	80-90%	60%
...				
...				

Ferrous scraps import to the EU-28 in 2014

main countries [in weight % iron]



Reference

- World Steel Association (http://www.worldstainless.org/Files/issf/Animations/Recycling/Flash.html)
- COMTRADE

Recycling / substitution / material efficiency

Substitutability

Substitutability scores for applications (1 = low substitutability)

Application	Substitutability score
Steel: Construction	1
Steel: Metal goods	1
Other	0.5
Steel: Automotive	0.7
Steel: Shipyard	1
Steel: Domestic appliances	0.7
Steel: Mechanical engineering	0.7
Steel: Structural	1
Steel: Tubes	0.7

Substitutability and effects of increased material efficiency are difficult to express in one indicator. With the above indicator estimation on substitutability is given. Specific research and expert estimation is necessary for substitutability in each application and in material efficiency potential.

Reference

- European Commission 2014

Further reading

- JRC 2016: Substitution of critical raw materials in low-carbon technologies: lighting, wind turbines and electric vehicles (available on https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/substitution-critical-raw-materials-low-carbon-technologies-lighting-wind-turbines-and)
- Graedel, T, Harper, E, Nassar, N, & Reck, B 2015, 'On the materials basis of modern society', Proceedings Of The National Academy Of Sciences Of The United States, 20, Academic OneFile, EBSCOhost, (http://www.pnas.org/content/112/20/6295)

Recycling / substitution / material efficiency

Material efficiency

Data sources / analysis are needed for material efficiency information

Mining & development

Economic contribution

Note: Detailed information on economic contribution of mining in the primary producing countries is elaborated in the countries profiles (Part II). See also Part II for further country-specific information and indicators (e.g. EITI-membership, control of corruption, political stability and absence of violence, job creation, revenues, etc.).

Artisanal and small scale mining (ASM)

ASM in iron ore mining	
Share of artisanal mining	> 4 %
Countries where artisanal mining is practiced	China, DRC

Reference

- Used source for share of artisanal mining: Dorner et al. 2012 (http://www.polinares.eu/docs/d2-1/polinares_wp2_chapter7.pdf)
- Used source for countries where artisanal mining is practiced: Gunson & Jian 2001 (http://pubs.iied.org/pdfs/G00719.pdf)

Further reading

- BGR https://www.bgr.bund.de/DE/Themen/Min_rohstoffe/Downloads/Studie_Zertifizierte_Handelsketten.pdf?__blob=publicationFile&v=2;
- BGR https://www.bgr.bund.de/EN/Themen/Min_rohstoffe/CTC/Concept_MC/ASM-great-lakes/ASM_node_en.html

Human rights

Human rights

Conflicts related to iron

Note: Detailed information on conflicts related to mining see Part II country profiles.

Child labour and forced labour

Note: See Part II country profiles for detailed information in child labour and forced labour in producing countries.

Case studies are provided in BGR study „Human Rights Risks in Mining“ (https://www.bgr.bund.de/DE/Themen/Zusammenarbeit/TechnZusammenarbeit/Downloads/human_rights_risks_in_mining.pdf?__blob=publicationFile&v=2)

Human rights

Child labour and forced labour

Note: See Part II country profiles for detailed information in child labour and forced labour in producing countries.

Case studies are provided in BGR study „Human Rights Risks in Mining“ (https://www.bgr.bund.de/DE/Themen/Zusammenarbeit/TechnZusammenarbeit/Downloads/human_rights_risks_in_mining.pdf?__blob=publicationFile&v=2)

Environmental issues

Environmental issues

LCA data

	Iron ore [iron ore 46%]	Iron	Steel [Steel]
Cumulative Energy Demand (CED)	63 (MJ/t)	21,1 (MJ/t)	25,6 (MJ/t)
Cumulative Raw Material demand (CRD)	1,0 (kg/t)	4,1 (kg/t)	10,0 (kg/t)

The consumption of energy resources is represented by the **cumulative energy demand (CED).** CED is a measure of the total amount of energy resources used to make a product or provide a service. It also includes the energy contained in the product itself. The CED identifies all non-renewable and renewable energy resources as primary energy values, with the higher heating value (HHV) of the various fuels used in the calculations. No characterization factors are used. This means that the consumption of energy resources is not an impact category based on different impact factors, but a life cycle inventory parameter.

The **cumulative raw material demand (CRD)** is defined as the sum of all used raw material – except of water and air – in weight unit.

Reference

- UBA 2012: Indikatoren / Kennzahlen für den Rohstoffverbrauch im Rahmen der Nachhaltigkeitsdiskussion (https://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/4237.pdf)

Further reading

- Ecoinvent (www.ecoinvent.ch)
- PROBAS (http://www.probas.umweltbundesamt.de/php/index.php)
- JRC (http://eplca.jrc.ec.europa.eu/)
- World Steel Association

Environmental issues

Association with radioactive substances

Category	Environmental hazard potential according to ÖkoRess methodology
Association with radioactive substances	medium

Data from Chinese iron ore deposits show average activity concentrations of 0.068 Bq/g for Thorium and 0.27 Bq/kg for Uranium (Hua 2011). According to the ÖkoRess methodology, this leads to a medium environmental hazard potential related to association with radioactive substances. (China produces 16 % of global primary mine production)

The risks varies highly between different mining sites and can be mitigated by various technological and management measures. The successful implementation highly depends on the local governance and mining companies' responsible mining practice.

Association heavy metals

Category	Environmental hazard potential according to ÖkoRess methodology
Association with heavy metals	medium

While iron is not a heavy metal itself, ores are commonly associated with elevated concentrations of heavy metals.

The risks varies highly between different mining sites and can be mitigated by various technological and management measures. The successful implementation highly depends on the local governance and mining companies' responsible mining practice.

Reference

- ÖkoRess Project Report (forthcoming): https://www.umweltbundesamt.de/umweltfragen-oekoress
- Hua, L. (2011): The Situation of NORM in Non-Uranium Mining in China. China National Nuclear safety Administration. (http://www.icrp.org/docs/Liu%20Hua%20NORM%20in%20Non-Uranium%20Mining%20in%20China.pdf).

Environmental issues

Acid Mine Drainage

Category	Environmental hazard potential according to ÖkoRess methodology
Acid Mine Drainage	medium

Iron ore is commonly mined from silica-rock deposits. While such formations usually contain sulfidic minerals, iron ore is mainly mined in oxidised form (iron oxides) and therefore from strata where sulfidic minerals have mostly been oxidised and depleted. According to the ÖkoRess methodology, this leads to a medium environmental hazard potential.

The risk varies highly between different mining sites can be mitigated by various technological and management measures. The successful implementation highly depends on the local governance and mining companies' responsible mining practice.

Chemical use

Category	Environmental hazard potential according to ÖkoRess methodology
Use of additives in extraction and benefication	Medium

Iron ores are commonly treated by flotation with the use of chemical additives.

Reference

- ÖkoRess Project Report (forthcoming): https://www.umweltbundesamt.de/umweltfragen-oekoress

Environmental issues

Open pit mining or underground mining

Category	Environmental hazard potential according to ÖkoRess methodology
Mining type	medium

Iron ore is commonly mined from open pits from solid rock formations.

Explanatory note: While underground mining has comparably little impacts in terms of land use and conversion of local ecosystems, open pit mining is much more relevant in this regard. Mining activities on loose material such as alluvial deposits (e.g. dredging in rivers) often has very high impacts on local environments.

Dam bursts / flooding

Incidents since 2000	EU-28	Global, without EU-28
Dam bursts / flooding	…	Bento Rodrigues (Brazil), 2015 Itabirito Regiao (Brazil), 2014 Shanxi (China), 2008 …

Reference

- ÖkoRess Project Report (forthcoming): https://www.umweltbundesamt.de/umweltfragen-oekoress
- http://www.wise-uranium.org/mdaf.html

Note: Further research necessary

Environmental issues

Mining waste

Average ore grade	10-50%
Submarine / riverine tailings disposal [if yes, include countries]	No

Sites-specific environmental risks

Site-specific environmental risk are detailed in the country profiles (water stress, protected areas, earth quake, mining accidents, Heavy rain/flooding)

Reference

- Priester, Dolega (2015): ÖkoRess – Teilbericht Bergbauliche Reststoffe (https://www.umweltbundesamt.de/sites/default/files/medien/376/dokumente/oekoress_-_teilbericht_bergbauliche_reststoffe.pdf)

Initiatives for responsible mining

Initiatives for responsible mining

Initiatives

Type of initiative	Iron ore / Steel
Specific iron and steel initiatives related to sustainable primary and secondary production	Responsible Steel Stewardship (Australia; global initiative under development)
Initiatives across the whole range of raw materials, including iron and steel:	ICMM (LSM) IRMA (draft) IFC TSM (Canada; Finland) GARD

Global market share of raw materials from different schemes

Initiative	Focus	Contribubtion of initiative to global production
Responsible Steel Stewardship	LSM (large scale mining)	n.a.%
Towards Sustainable Mining (TSM)	LSM	n.a.%
ICMM	LSM	3 of the 12 largest iron ore producers are ICMM members (see above)

Reference

- RSS = Responsible Steel Stewardship (http://steelstewardship.com/steel-stewardship-forum-update/) in Australia; as global initiative under development (http://www.responsiblesteel.org/)
- ICMM = International Council on Mining and Metals (https://www.icmm.com/)
- IRMA = Initiative for Responsible Mining Assurance (http://www.responsiblemining.net/)
- IFC = International Finance Corporation (http://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/about+ifc_new)
- TSM = Towards Sustainable Mining (http://mining.ca/towards-sustainable-mining); Finnish adoption see www.kaivosvastuu
- GARD = Global Acid Rock Drainage Guide (http://www.gardguide.com/images/5/5f/TheGlobalAcidRockDrainageGuide.pdf)

References

- European Commission (2014): Report on Critical Raw Materials for the EU - Non-Critical Raw Materials Profiles [Internet] [cited 2016 Nov 15]. Available from: http://ec.europa.eu/DocsRoom/documents/7422/attachments/1/translations/en/renditions/pdf.
- USGS 2017: US Geological Survey. Mineral Commodity Summaries 2017 https://minerals.usgs.gov/minerals/pubs/mcs/2017/mcs2017.pdf

Draft concept for a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues:

Part II
Draft concept of country profiles

(September 2017)

Öko-Institut e.V.

STRADE

Part II

Draft concept of country profiles

Content:

- **Economic contribution from mining**
- **Production**
- **Trade**
- **Governance**
- **Human rights and social issues**
- **Environmental issues**
- **Initiatives for responsible mining and development**

Preface

This document is Part II of the “Draft concept for a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues”. The Annex examines the necessity and feasibility of a data and knowledge information system on mineral mining and trade and related environmental and socio-economic issues.

The data is broadly structured into:

- Part I – Raw-material-specific information and
- Part II – Country-specific information.

Part II here presents a concrete example of compiling a country-specific profile and offers Brazil as the example. The data collection for these examples does not claim completeness but builds on easily available data to illustrate the underlying concept and serve as a basis for a general discussion of the structure of the information system. Further data collection will be necessary to elaborate comprehensive raw material and country profiles if the STRADE team and the requested stakeholders agreed upon their principal architecture.

Economic contribution from mining

Economic contribution from mining

Basic data on mineral's economic contribution

Mineral production

Parameter	Value	Reference
Production value, all minerals (ores, minerals, crude fertilizer, scrap, NF metals)	62 billion US$	ICMM (2014), data for 2012
Production value, all minerals as % of GDP (ores, minerals, crude fertilizer, scrap, NF metals)	2.9 %	ICMM (2014), data for 2012
Minerals of highest relevance	Iron, accounts for 17 % of global production and > 80 % of mineral exports (value)	IBRAM (2017e), data for 2012
Mineral exports, all minerals (ores, minerals, crude fertilizer, scrap, NF metals)	39 billion US $	IBRAM (2017e), data for 2012
Ores and NF-metals exports as % of merchandise exports (ores, minerals, crude fertilizer, scrap, NF metals)	19 % (in 2010) ⇨ 10.8 % (in 2015)	WorldBank (2017c),
Mineral rent[1] (% of GDP)	1.3 %	WorldBank (2017c), data for 2015
Oil rent[1] (% of GDP)	0.9 %	WorldBank (2017c), data for 2015
Coal rent[1] (% of GDP)	0.005 %	WorldBank (2017c), data for 2015
ICMM Mining Contribution Index[2]	75	ICMM (2014), data for 2012

[1] A rent is the difference between the value of production for a stock of minerals at world prices and their total costs of production.
[2] The country with highest MCI has 96 scores; country without contribution have 0 scores.

Economic contribution of iron and steel exports

Parameter	Value	
Iron and steel exports as % of merchandise exports	4.3 %	Workman (2017), data for 2016
Export share of steel production (steel export / domestic steel production)	44 %	Workman (2017), data for 2016

Economic contribution from mining

Government revenues from mining

Government revenues

Note: The data are preliminarily from 2012 and should be updated in the course of the project; R$ = Brazilian Real

Parameter	Value	Reference
Government revenues from mining (CFEM mining royalties only; no corporate taxes and VAT included)	1.8 billion R$	IBRAM (2017e), data for 2012
Additional government revenues from further taxes (e.g. corporate taxes; export taxes; VAT)	n.n.	
Total government tax revenues including social security funds	1500 billion R$	OECD.Stat (2017), data for 2012
Contribution of mining royalties to total government revenues including social security funds	0.1 %	Calculated, data for 2012
Contribution of all government revenues from mining to total government revenues including social security funds	n.n.	

Information on royalty and taxation regime

(status from 2012):
CFEM (Mining Royalty) is payable as consideration for the economic exploitation of mineral resources in their respective territories. They are distributed as follows:

- 12% to the Federal Government (DNPM 9.8%, IBAMA 0.2%, MCT/FNDCT 2%);
- 23% to the state where the mineral has been sourced;
- 65% to the producing municipality.

Tax rates are applied onto the net revenue, and they vary according to the mineral involved:

- 3% for: aluminum ore, manganese, salt-gem, and potassium;
- 2% for: iron, fertilizer, coal and other substances;
- 0,2% for: precious stones, colored gemstones, carbonates and noble metals;
- 1% for: gold

Corporate tax: 34 % (Deloitte 2017)
VAT: standard rate, average 17 %
Export tariffs: 0 % (World Bank 2017d)

Further Reading:

- CFEM – Compensação Financeira pela Exploração de Recursos Minerais, http://blog.cfem.com.br/ (in portuguese, data on 2015 and 2016 royalties)
- Natural Resource Governance Institute, Brazil's Performance on the Resource Governance Index, http://www.resourcegovernance.org/our-work/country/brazil?page=1 (focus on oil revenues)
- Wold Bank (2006): Mining Royalties. A Global Study of Their Impact on Investors, Government, and Civil Society. Internet: http://siteresources.worldbank.org/INTOGMC/Resources/336099-1156955107170/miningroyaltiespublication.pdf (last visited 10.05.2017)

Economic contribution from mining

Employment

General data on employment

Parameter	value	Reference
Unemployment rate	11 %	ILOSTAT, data for 2016
Share of industry in total employment	21 %	ILOSTAT, data for 2016
Total employment	95 million workers	ILOSTAT, data for 2017
Informal economy rate in the non-agriculture sector	36.9 % 30.5 million workers	ILOSTAT, data for 2013

Employment in the mining sector

Parameter	value	Reference
Workforce in mining (formally employed)	175 000 workers	IBRAM 2017e, data for 2011
Informal workforce (estimates)	~ 300 000 – 500 000 workers, mainly in the extraction of gems, gold, diamond and mineral aggregates for the civil construction sector	IBRAM 2017e, data for 2011

Job multiplier in the extractive industries (UNCTAD 2015)

Country	Job Multiplier
Brazil	no data
Scotland	2.5
USA	5.0
Chile	7.0
Ghana	28.0

Reference:

- UNCTAD (2015): 17th Africa OilGasMine: Extractive Industries and Sustainable Job Creation. Internet: http://unctad.org/meetings/en/SessionalDocuments/suc_OilGasMine2015_bgNote_en.pdf (last visited 08.05.2017).
- IFC (2013): IFC Jobs Study Assessing Private Sector Contributions to Job Creation and Poverty Reduction. Internet: https://www.ifc.org/wps/wcm/connect/0fe6e2804e2c0a8f8d3bad7a9dd66321/IFC_FULL+JOB+STUDY+REPORT_JAN2013_FINAL.pdf?MOD=AJPERES (last visited 08.05.2017).

Economic contribution from mining

Resource endowment and reserves

Parameter	Global ranking
Fraser Institut: Best Practices Mineral Potential Index: This index is based on a survey and ranks the jurisdictions based on which region's geology "encourages exploration investment" or is "not a deterrent to investment", assuming their policies are based on "best practices" . (Rank 1 is the highest ranking. Rank 104 is the lowest ranking)	54/104
Further indexes giving information on the potential size of future mining projects, the country's mining experience and potential tier 1 assets: …	

Production and Reserves

Commodity	Annual production 2014 (USGS 2017, BGS 2017)		Reserves 2013 (USGS 2017)		Static lifetime
	[%] of global Production	[t]	[%] of global reserves	[t]	Years
Tantalum & Niobium	92.3	280,400	95	4,100,050	15
Bauxite	13.6	35,409,900	9	2,613,300,000	74
Iron ore	10.2	345,800,000	18	15,962,000,000	46
Talc	7.37	600,000	41	18,000,144	30
Tin	4.8	17,000	15	699,840	41
Manganese	4.6	2,498,220	10	54,150,000	22
Nickel	4.2	85,600	11	9,072,000	106
Natural graphite	3.7	78,460	36	39,999,540	510
Cobalt	2.7	3,500	1	84,521	24
Gold	2.7	80	4	2,382	30
Aluminium	1.8	962,000	9	569,699,400	592
Lithium	1.2	8,000	0.4	54,316	7
Magnesite	1.2	550,000	4	86,040,000	156

References:

- Fraser Institut (2017): Fraser Institute Annual Survey of Mining Companies 2016 https://www.fraserinstitute.org/sites/default/files/survey-of-mining-companies-2016.pdf (02.05.2017)

Note: The report and its rankings are based on 350 respondents from mining and exploration companies to the global survey.

Economic contribution from mining

Responsible Mining Index evaluation on mining companies' business socio-economic development engagement

company-specific but not mining-site specific

Company	Location of mine operation	Ore	RMI evaluation on companies' development engagement	Reference year	Details
The content and the structure of this table will be discussed in detail when first RMI data are published (scheduled in 2018). The current draft RMI methodology foresees a set of 5 indicators related to major mining companies' development engagement. These indicators are company-specific (overall, no country-specific distinction) and will only be derived for 30 major global mining companies. STRADE will discuss on the June 2017 workshop to which extent this perspective as part of a raw material information system. The list below shows the development engagement which will be included in the RMI (draft status May 2017).					

Company-level indicators:	Number of indicators
Subnational, National and Regional Socio-Economic Development Planning	1
Procurement	1
Institutional Capacity Building	2
Enhancing the Skills Base	1
TOTAL	5

Reference:
The Responsible Mining Foundation (2017): http://responsibleminingindex.org/ (last visited 29.05.2017).

Economic contribution from mining

Basic data on the economy

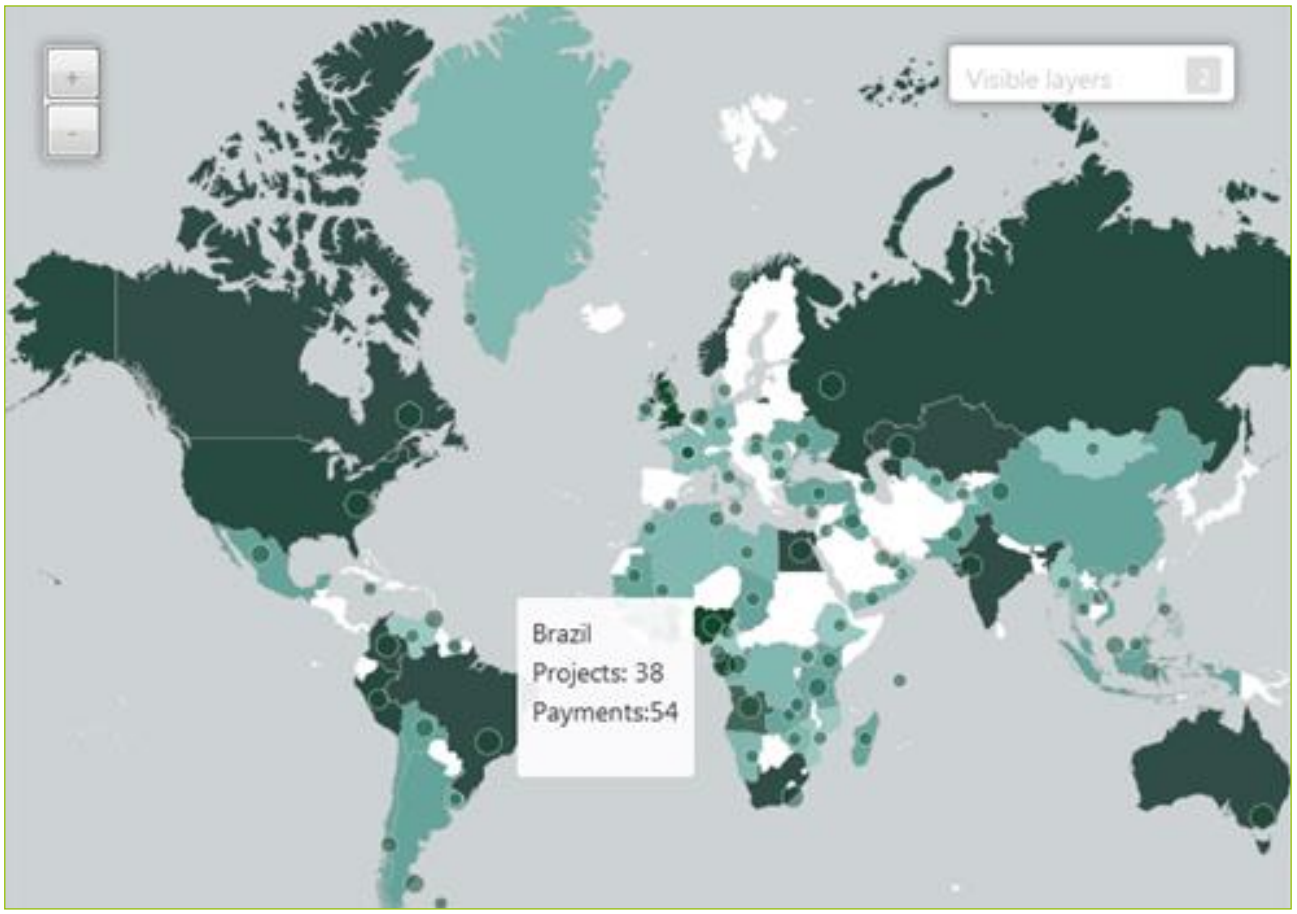
Parameter	Value	Reference
Population (Number of People)	*207,847,528*	World Bank (2017d)
Population density (People / km2)	*25*	World Bank (2017d)
GDP (Gross Domestic Product) (Million US$)	*1,774,725*	World Bank (2017d)
GDP per capita (US$)	*8,539*	World Bank (2017d)
Poverty rate (% of population with less than US$ 2 a day, PPP)	*7 %*	OECD (2015), data for 2013
Foreign direct investment, net inflows (including all sectors)	75 billion US$ 4.2% of GDP	World Bank 2017a World Bank 2017b

References:

- World Bank (2017d): World Development Indicators: http://data.worldbank.org/data-catalog/world-development-indicators (25.04.2017).
- EBRD (2017): EBRD: Annual Transition Reports and country fact sheets. Internet: http://2016.tr-ebrd.com/countries/ (last visited 08.05.2017)
- UN Statistics Division (2017): https://unstats.un.org/unsd/demographic/products/vitstats/ (last visited 18.04.2017)
- National statistic offices

Economic contribution from mining

project-by-project payments to governments



Payments by Project

Year	Paid By	Paid To	Project	Level	Payment Type	Currency	Value
2015	Norsk Hydro Asa	Brazil	Mineracao Paragominas SA, total	project	Royalties	NOK	79,686,000
2015	Norsk Hydro Asa	Brazil	Alunorte - Alumina do Norte do Brasil SA, total	project	Infrastructure	NOK	2,672,000
2015	Norsk Hydro Asa	Brazil	Mineracao Paragominas SA, total	project	Tax	NOK	222,476,000
2015	Norsk Hydro Asa	Brazil	Norsk Hydro Brasil	company	Fees	NOK	2,269,000

References:

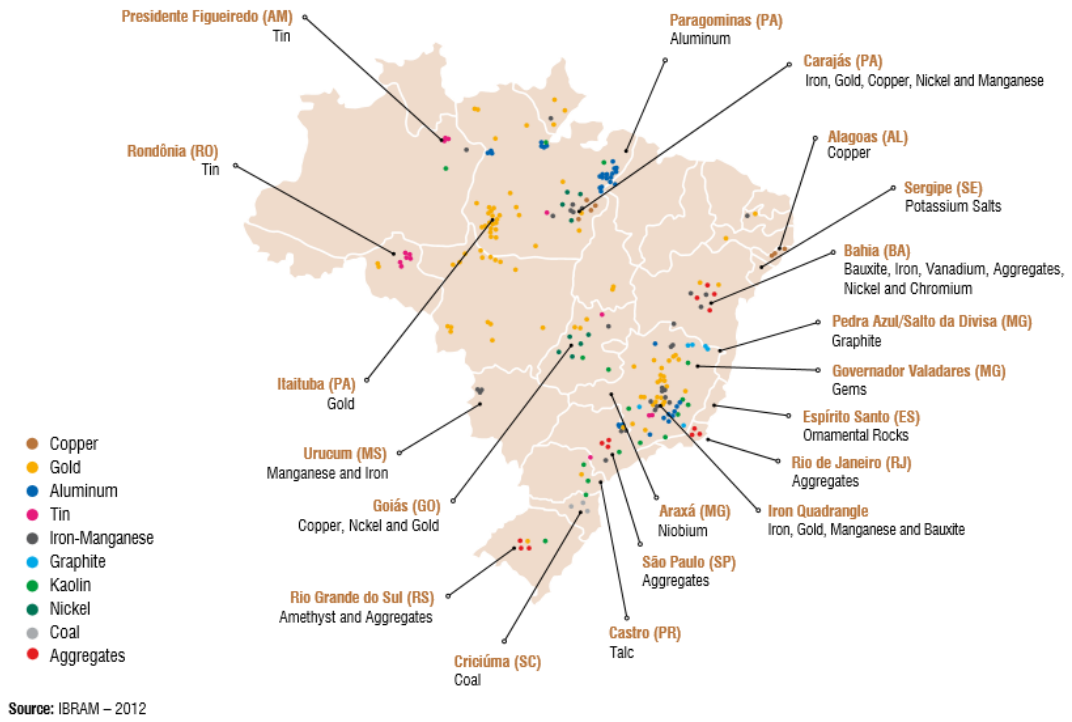
- National Resource Governance Institute NRGI (2016): Resource Projects Alpha. Internet: http://www.resourceprojects.org/ (05.07.2017).

Production

Production

Overview

MAJOR REGIONS WITH MINERAL DEPOSITS



Source: IBRAM – 2012

Reference:
- **IBRAM** (http://www.ibram.org.br/sites/1400/1457/00000364.pdf)

Mine production

	Unit	Fe	Cu	Ni	…
Production 2016	Mio. t/a	254	…	…	…
Production 2016	Mio. USD/a	28,296	…	…	…
Static lifetime*	a	47	…	…	…

*Static lifetime = Reserves / mine production in 2016
Brazil is the second largest iron ore producer

References:
- Mine Production in t / a (USGS 2017 Mineral Commodity Summaries); for Fe iron ore content is used Production in USD: SNL

Production

Mining sites and mining companies

Selected major mining sites

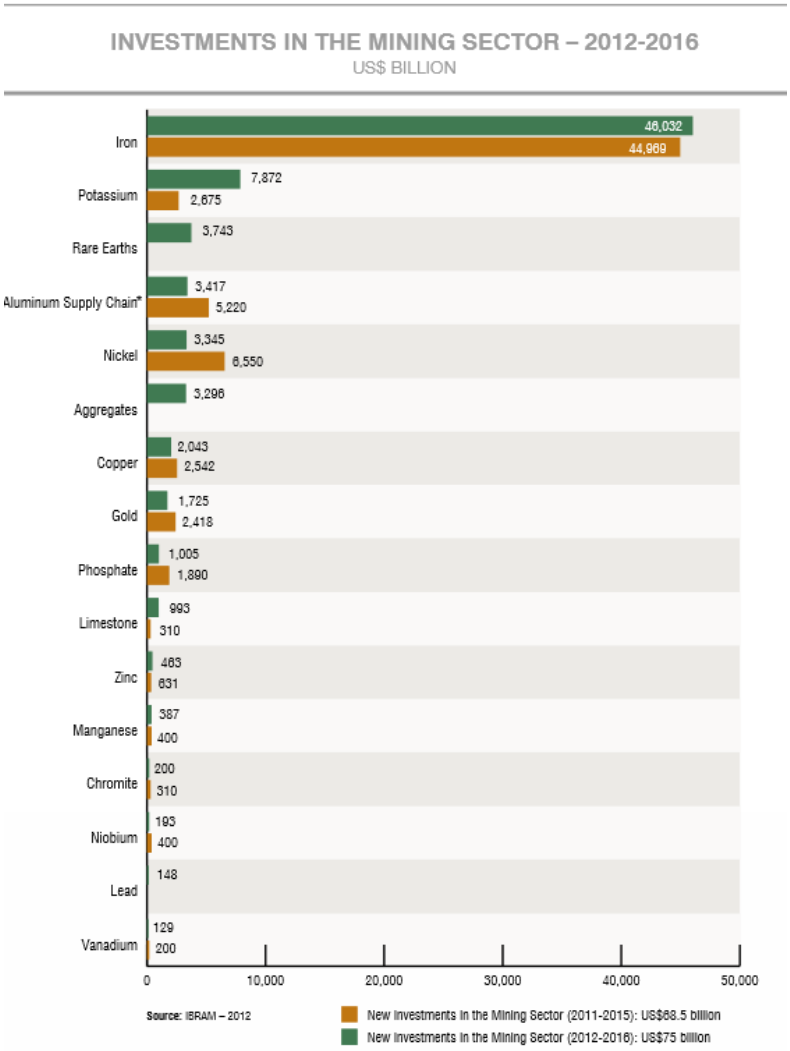
	Fe	Cu	Al
	Carajas, State of Para (3 mines)		
Company name	Vale SA		
Yearly mine production (t/a)	148 mio. t (2016)		
Domestic /foreign company	Domestic		
State-owned / private / enterprise	Privat		
Membership in reporting and responsible mining initiatives (e.g. IRMA, ASI, etc)	GRI, ISO,UN Global Compact		
Company information	http://www.vale.com/EN/investors/information-market/annual-reports/20f/20FDocs/Vale_20-F_FY2016_-_i.pdf http://www.vale.com/hotsite/Style%20Library/RelatorioSustentabilidade/Docs/Vale%20Sustainability%20Report%202016.pdf		

Additional remark:
Further Reading: Overview of State Ownership in the Global Minerals Industry (http://siteresources.worldbank.org/INTOGMC/Resources/GlobalMiningIndustry-Overview.pdf)

Production

Mining and exploration

Investment in mining



Source: IBRAM 2017e

Further reading:
New investment projects in crude steelmaking by economy are provided on http://www.oecd.org/sti/ind/steelcapacity.htm

Parameter	Value	Reference
Exploration spend relative to production value[1]	0,4 x	ICMM (2014)

[1] = country share of world exploration budget / country share of world production value; a value of 1 means that exploration and production are balanced according to global average exploration spendings and production values. The lower the value (less than 1) the less the share in global exploration than in global production.

Production

Smelting & refining

Refining capacities and major smelters & refiners

Commodity	Membership in sustainable initiatives	Unit	Steel	…
Total refining capacity		mio. t	48.4	
Major smelters & refiners:				
Companhia Siderúrgica Nacional (CSN)	ISO	mio. t	5.6	
Gerdau S.A.	…	…	…	
Smelter x	…	…	…	
Smelter x	…	…	…	
Smelter x	…	…	…	

Additional remark / sources:
Total existing crude steel capacity: USGS 2016: Minerals Yearbook Brazil
https://minerals.usgs.gov/minerals/pubs/country/2013/myb3-2013-br.pdf
CSN: ttp://www.csn.com.br/conteudo_eni.asp?idioma=1&conta=46&tipo=59621
Gerdau: https://www.gerdau.com/br/en#

Metal & intermediate production

Commodity	Metal production
	t / a
Crude steel	33.3 mio.t / 2015
Refined copper	…
Refined nickel	…
…	

Reference:
Brazil Steel institute (http://www.acobrasil.org.br/site2015/eng/dados.asp)

Production

Business environment

“Ease to do business” – The Competitive Index

	Brazil
	Rank (1 = best ranking; 138 = worst ranking)
Institutions	120
Infrastructure	72
Macroeconomic environment	126
Health and primary education	99
Higher education and training	84
Goods market efficiency	128
Labor market efficiency	117
Financial market development	93
Technology readiness	59
Market size	8
Business sophistication	63
Innovation	100

Explanatory note:
The higher the rank (1) and value (e.g. 5.8), the better the competitiveness (e.g. Switzerland has the highest rank (1) and value (5.8) in innovation and sophistication factors; Mauretania is ranked lowest at 138 (value 1.9) in higher education and training)

Reference:

- World Economic Forum: The Global Competitiveness Report 2016-2017, 2016 (https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1)

Trade

Trade
Export

Brazilian ore exports

	Unit	Fe	Cu	…
Ore export (Brazil ⇨ global)	mio t/a	344		
Ore export (Brazil ⇨ global)	mio USD/a	25,800		
Ore export in EU (Brazil ⇨ EU)	mio t/a	54.7		
Ore export in EU (Brazil ⇨ EU)	mio USD /a	5,788		
Total ore export (t) / domestic ore production (t)	%	84		
Brazilian's contribution to EU iron ore imports from global suppliers:				
Ore export to EU (value) / total EU ore import (value)	%	48		
Relevance of Brazilian exports to EU for Brazil:				
Ore export to EU (t) / total ore export (t)	%	16		

Reference:
- COMTRADE (https://comtrade.un.org/data); HS 2601 (ore export) Eurostat Trade data (import EU 28) http://epp.eurostat.ec.europa.eu/newxtweb/mainxtnet.do Data for iron 2014

Additional remarks:

Trade
Export

Brazilian exports of selected intermediate products

	Fe		Cu		…
	t/a	Mio USD/a	t/a	USD/a	
Exports of semi-finished products of iron or non-alloyed steel:					
Export intermediate product (1) (global)	6.9 mio t	2.3 mio USD			
Export intermediate product (1) (to EU)	0.98 mio t	351 mio EUR			
Worldwide EU import intermediate product (1)	7.8 mio t	2.6 mio EUR			
Exports of …					
Export intermediate product (2) (global)	…	…			
Export intermediate product (2) (EU)	…	…			
Worldwide EU import intermediate product (2)	…	…			

Reference /sources:
(1): semi-finished products of iron or non-alloy steel - HS 7207: COMTRADE (https://comtrade.un.org/data); export to used data eurostat (import EU)

Additional remark:

Trade
Import

This issue should be elaborated within other projects. It is not a focus of the STRADE project.

Trade

Trade agreements & trade restrictions

Trade agreements

Free Trade Agreements:

- The EU is negotiating a free trade agreement with Brazil. This is part of the EU's Association Agreement negotiations with the Mercosur countries (which also includes Argentina, Uruguay and Paraguay). (EC 2017a)

Trade restrictions (not limited to mining)

	Brazil
Export tariffs on minerals	0 %
Export tariffs on intermediate products	0 %

Reference /sources:

- World Bank (2017): World Integrated Trade Solutions. Internet: http://wits.worldbank.org/ (31.05.2017).
- OECD Trade in raw materials (http://www.oecd.org/tad/benefitlib/export-restrictions-raw-materials.htm)

Trade

Secondary materials

This issue should be elaborated within other projects. It is not a focus of the STRADE project.

Governance

Governance

World Bank – Worldwide Governance Indicators

**not mining specific, refers to all sectors*

The WGI cover over 200 countries and territories, measuring six dimensions of governance starting in 1996: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. The aggregate indicators are based on several hundred individual underlying variables, taken from a wide variety of existing data sources. The data reflect the views on governance of survey respondents and public, private, and NGO sector experts worldwide. The WGI also explicitly report margins of error accompanying each country estimate. These reflect the inherent difficulties in measuring governance using any kind of data. Even after taking these margins of error into account, the WGI permit meaningful cross-country and over-time comparisons (Kaufmann et al. 2010).

Indicator	Governance score Highest performance: +2.5 Lowest performance: -2.5	Percentile rank Highest rank: 100 Lowest rank: 0	Number of used data sources
Voice and Accountability	0.38	60.10	14
Political Stability and Absence of Violence/Terrorism	-0.38	34.29	9
Government Effectiveness	-0.19	47.60	11
Regulatory Quality	-0.21	46.63	11
Rule of Law	-0.19	50.00	15
Control of Corruption	-0.43	41.35	12

Reference:
World Bank (2017): Worldwide Governance Indicators. Internet: http://info.worldbank.org/governance/wgi/#reports (last visited 08.05.2017).

Further Reading:
Kaufmann D., A. Kraay, and M. Mastruzzi (2010): The Worldwide Governance Indicators: Methodology and Analytical Issues. Internet: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1682130 (last visited 08.05.2017).

Governance

Transparency

EITI

The EITI is a standard by which information on the oil, gas and mining industries is published. The EITI is not a prescription for governance of the extractive sector, rather a tool that informs the way the sector is governed.(EITI 2017)

Membership	Since
No	-

BEPS (OECD 2013)

Base erosion and profit shifting (BEPS) refers to tax avoidance strategies that exploit gaps and mismatches in tax rules to artificially shift profits to low or no-tax locations. Over 100 countries and jurisdictions are collaborating to implement the BEPS measures. (OECD 2017b)

Action Brazil: Implementation of country-by-country-report (International Tax Review 2017)

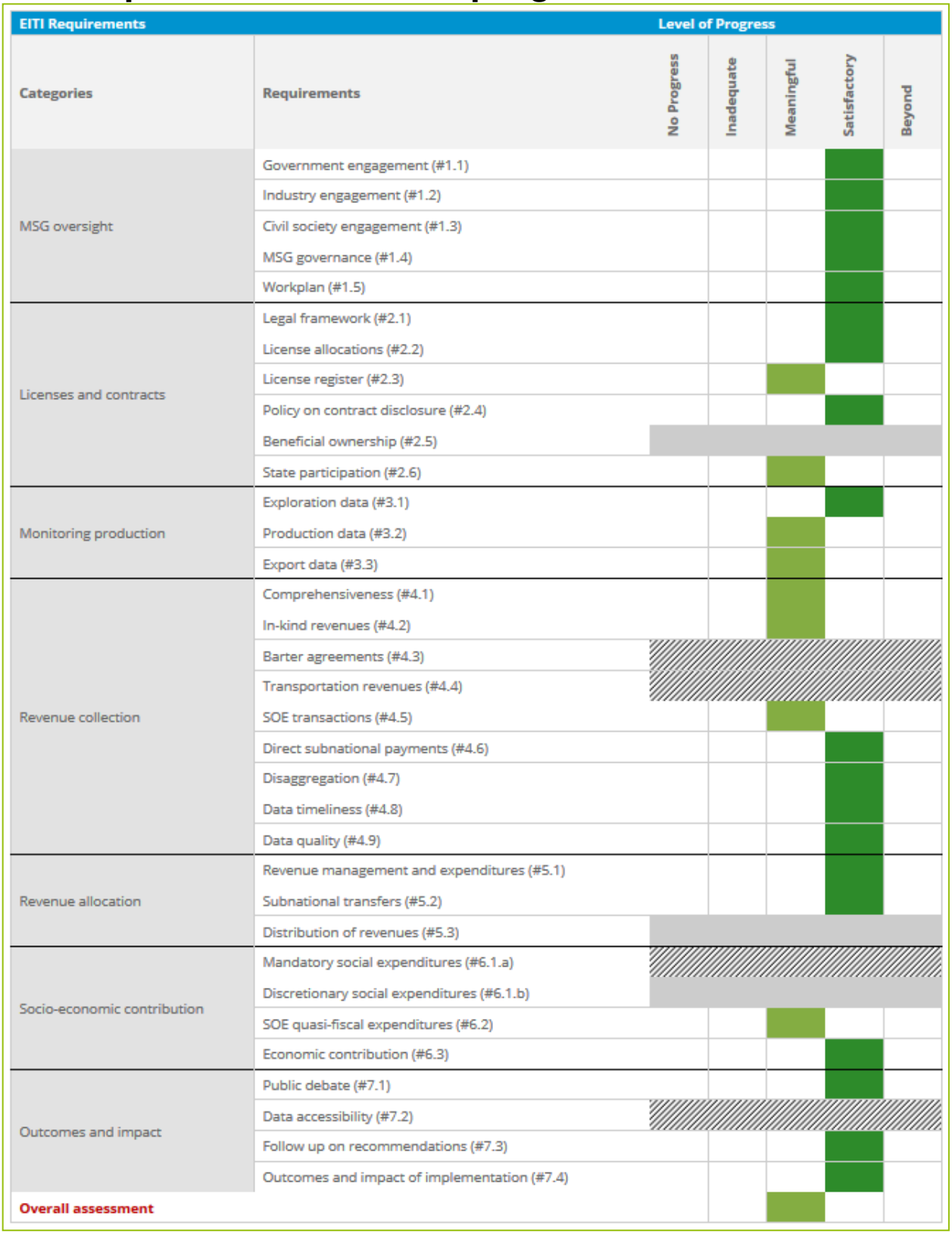
References:

- EITI (2017): EITI. Internet: https://eiti.org/ (last visited 08.05.2017).
- OECD (2013): Action Plan on Base Erosion and Profit Shifting, OECD Publishing. Internet: http://dx.doi.org/10.1787/9789264202719-en (last visited 08.05.2017).
- OECD (2017b): Base erosion and profit shifting. Internet: http://www.oecd.org/tax/beps/ (last visited 10.05.2017).
- Deloitte (2017): BEPS Actions implementation by country – Brazil. Internet: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-beps-actions-implementation-brazil.pdf (last visited 10.05.2017).
- International Tax Review 2017: Brazilian rules on country-by-country reporting. 2 May 2017 (http://www.internationaltaxreview.com/Article/3713934/Brazilian-rules-on-country-by-country-reporting.html)

Alternative transparency schemes: …

Governance

EITI requirements Ghana's progress



EITI (2017b): GHEITI Ghana Extractive Industires Transparency Initiatve. Internet: https://eiti.org/ghana#overview (last vsisted 10.05.2017).

Governance

Attractiveness from mining and exploration companies' perspective according to Fraser Institute's survey

Index	Global ranking Brazil
Policy Perception Index (PPI): The PPI is a composite index that measures the overall policy attractiveness of the 104 jurisdictions in the survey. The index is composed of survey responses to policy factors that affect investment decisions. Policy factors examined include uncertainty concerning the administration of current regulations, environmental regulations, regulatory duplication, the legal system and taxation regime, uncertainty concerning protected areas and disputed land claims, infrastructure, socioeconomic and community development conditions, trade barriers, political stability, labor regulations, quality of the geological database, security, and labor and skills availability. (Rank 1 is the highest ranking. Rank 104 is the lowest ranking)	64/104

References:

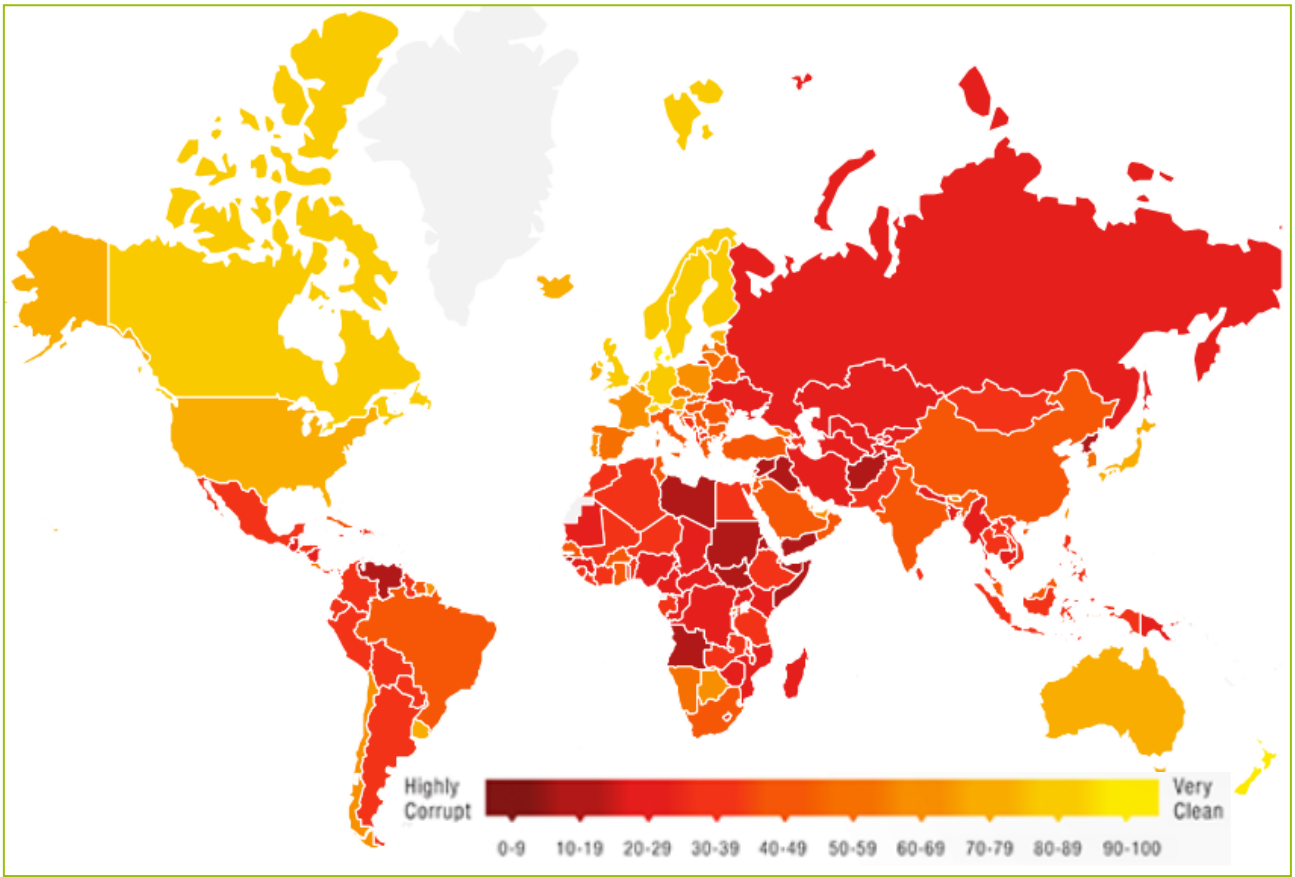
- Fraser Institut (2017): Fraser Institute Annual Survey of Mining Companies 2016 https://www.fraserinstitute.org/sites/default/files/survey-of-mining-companies-2016.pdf (02.05.2017)

Note: The report and its rankings are based on 350 respondents from mining and exploration companies to the global survey.

Governance

Transparency International's Corruption Perceptions Index 2016

The Corruption Perceptions Index aggregates data from a number of different sources that provide perceptions of business people and country experts of the level of corruption in the public sector. The CPI 2016 is calculated using 13 different data sources from 12 different institutions that capture perceptions of corruption within the past two years (Transparency International 2017).



Score	Rank
40/100	79/176

Reference:
Transparency International (2017): Corruption Perceptions Index 2016. Internet: http://www.transparency.org/news/feature/corruption_perceptions_index_2016 (last visited 08.05.2017).

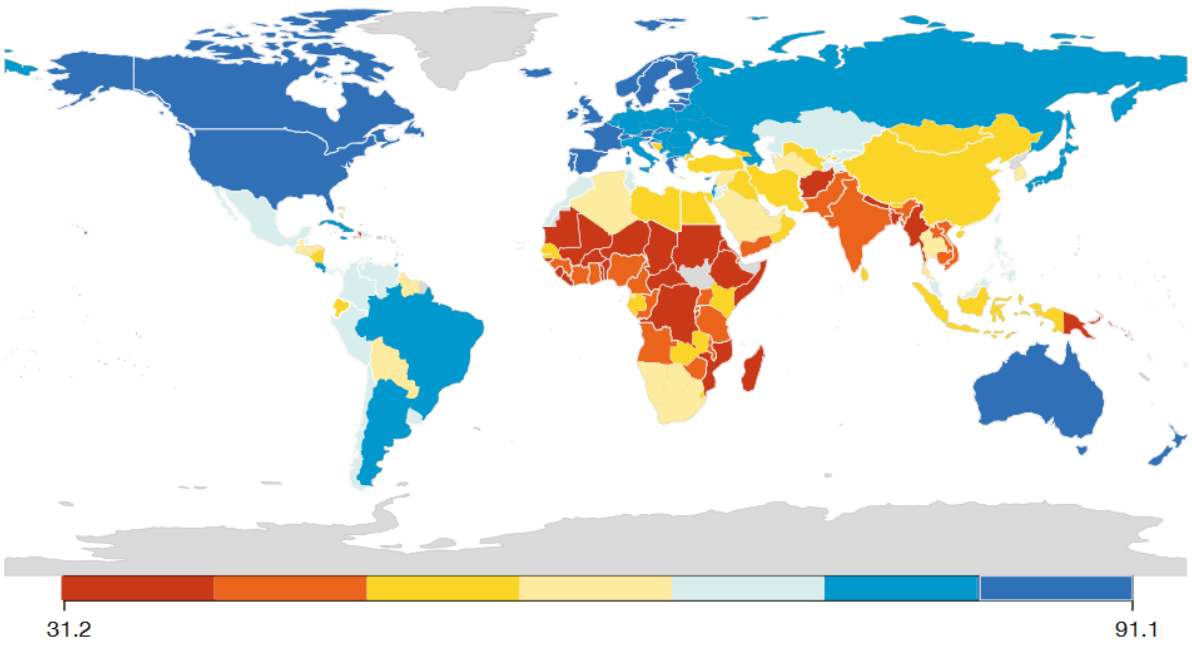
Parameter	Value	Reference
Bribery incidence (% of firms experiencing at least one bribe payment request)	-	World Bank 2017d

Governance

Environmental Performance Index

The Environmental Performance Index (EPI) ranks countries' performance on high-priority environmental issues in two areas: protection of human health and protection of ecosystems. Within these two policy objectives the EPI scores national performance in nine issue areas comprised of more than 20 indicators (see EPI Framework). EPI indicators measure country proximity to meeting internationally established targets or, in the absence of agreed targets, how nations compare to one another. (Yale University 2016)

Figure 24: Global 2016 EPI results range from a score of 31.2 to 91.1, with 100 being the best score and 0 the worst.

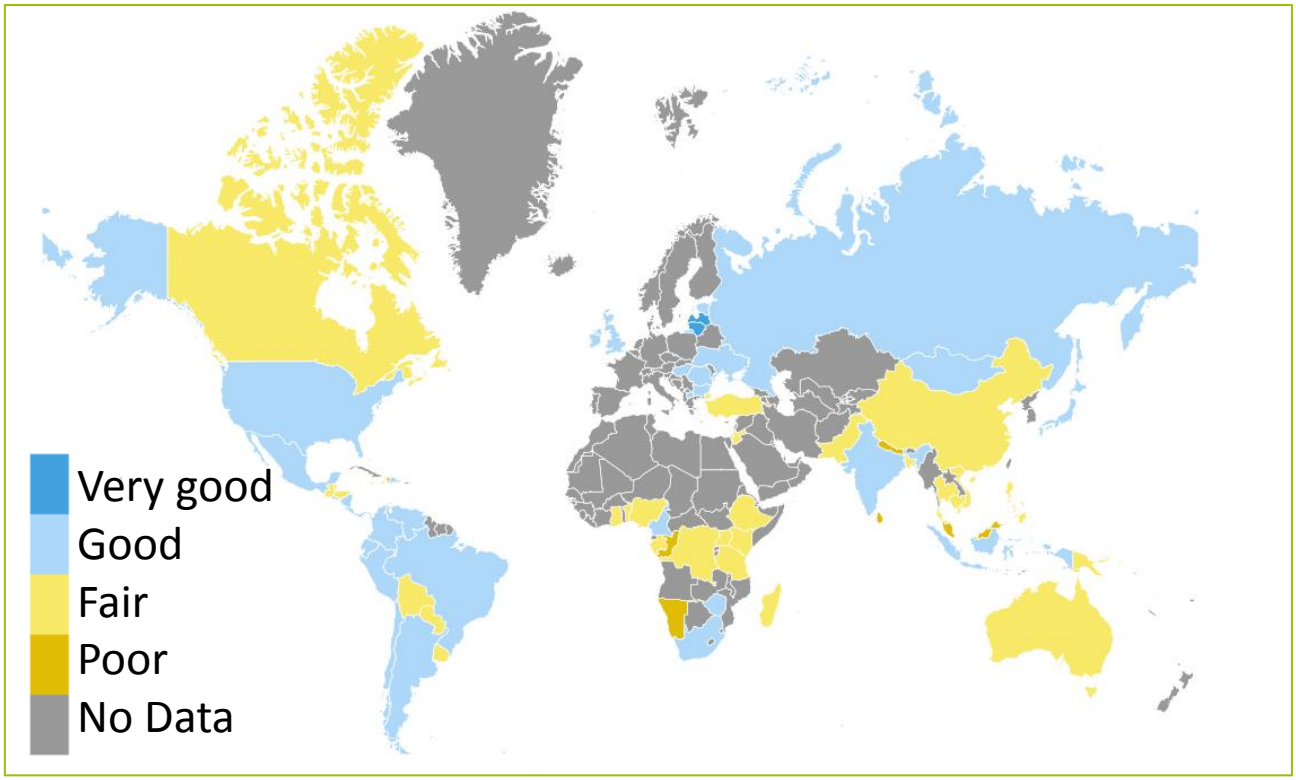


Reference:
Yale University (2016): Global Metrics For The Environment The Environmental Performance Index ranks countries' performance on high-priority environmental issues. http://epi.yale.edu/sites/default/files/2016EPI_Full_Report_opt.pdf (last visited 25.04.2017).

Governance

Environmental Democracy Index

"The Environmental Democracy Index was developed by The Access Initiative (TAI) and World Resources Institute (WRI) in collaboration with partners around the world. The index evaluates 70 countries, across 75 legal indicators, based on objective and internationally recognized standards established by the United Nations Environment Programme's (UNEP) Bali Guidelines. EDI also includes a supplemental set of 24 limited practice indicators that provide insight on a country's performance in implementation. The national laws and practices were assessed and scored by more than 140 lawyers around the world. Country assessments were conducted in 2014 and will be updated every two years. Scores are provisional until September 15th, 2015 as results are being shared with governments and civil society for feedback until July 15." (TAI & WRI 2017)



Reference:
The Access Initiative & World Resources Institute (2017): Environmental Democracy Index. Internet: http://www.environmentaldemocracyindex.org/ (last visited 25.04.2017).

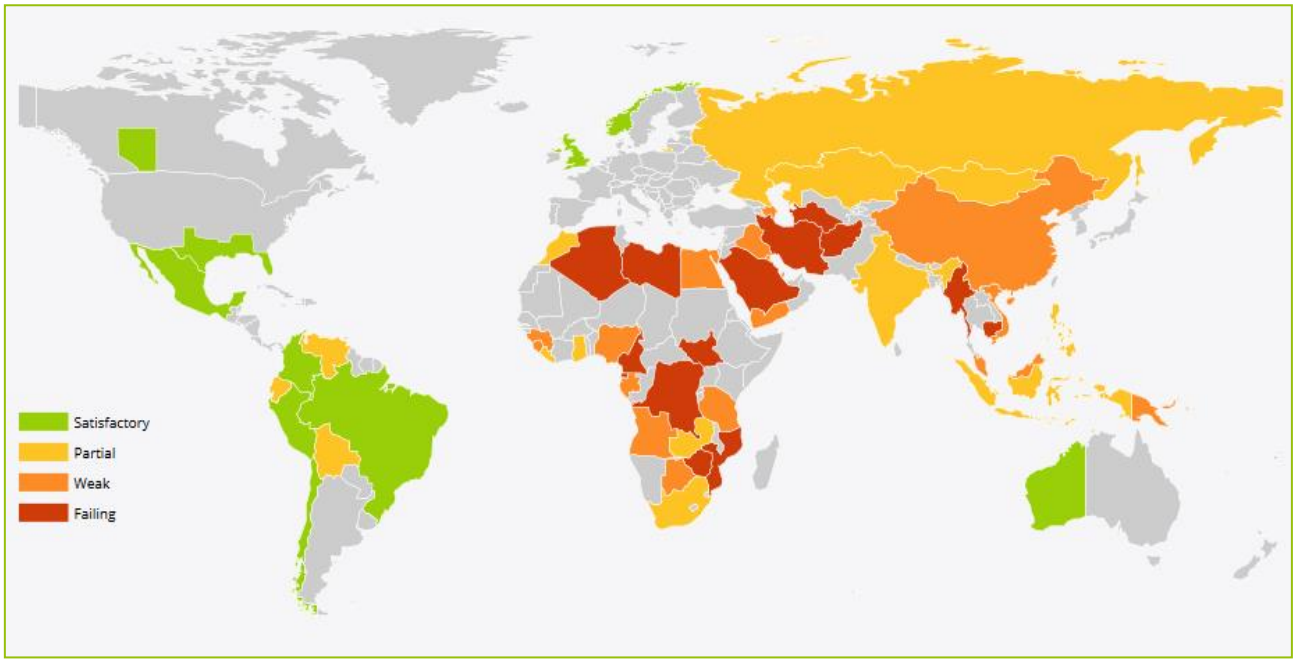
Access to information	Public participation	Access to justice	Country score
2.3	1.04	2.03	**1.8**
Note: 0 lowest score, 3 highest score			

Governance

Natural Resource Governance Index

"The RGI scores and ranks […] countries, relying on a detailed questionnaire completed by researchers with expertise in the extractive industries. The Index assesses the quality of four key governance components: Institutional and Legal Setting; Reporting Practices; Safeguards and Quality Controls; and Enabling Environment. It also includes information on three special mechanisms used commonly to govern oil, gas and minerals—state-owned companies, natural resource funds and subnational revenue transfers" (NRGI 2017).

NRGI Composite Score –Global Comparison (NRGI 2017)



Score Brazil (NRGI 2017b)

Rank out of (58)	Component	Score (out of 100)
8	Institutional & Legal Setting	81
9	Reporting Practices	78
2	Safeguards & Quality Controls	96
9	Enabling Enviornment	66
5	**Composite Score**	**80**

References:

- NRGI (2017): Resource Governance Index. Internet: http://www.resourcegovernance.org/resource-governance-index (10.05.2017).
- NRGI (2017b): Brazil's Performance on the Resource Governance Index Internet: http://www.resourcegovernance.org/our-work/country/brazil (last visited 10.05.2017).

Governance

Natural Resource Governance Index

NRGI Methodology (NRGI 2017c)

- **Institutional & Legal Setting:**

  10 indicators that assess whether the laws, regulations and institutional practices enable comprehensive disclosures, open and fair competition, and accountability.

- **Reporting Practices:**

  20 indicators that evaluate the actual disclosure of information and reporting practices by government agencies.

- **Safeguards and Quality Controls:**

  15 indicators that measure the checks and oversight mechanisms that guard against conflicts of interest and undue discretion, such as audits.

- **Enabling Environment:**

  5 indicators of the broader governance environment generated using over 30 external measures of accountability, government effectiveness, rule of law, corruption and democracy. The data reflect the extent to which the broader environment will help or hinder transparency and accountability efforts in the extractive sector. Box 1 below summarizes the discussion about including the enabling environment component in the Index.

References:

- NRGI (2017c):Resource Governance Index: Methodology. Internet: http://www.resourcegovernance.org/resource-governance-index/methodology (10.05.2017).

Governance

Responsible Mining Index evaluation on mining companies' business conduct

company-specific but not mining-site specific

Company	Location of mine operation	Ore	RMI evaluation on companies' business conduct	Reference year	Details
The content and the structure of this table will be discussed in detail when first RMI data are published (scheduled in 2018). The current draft RMI methodology foresees a set of 13 indicators related to major mining companies' business conduct. These indicators are company-specific (overall, no country-specific distinction) and will only be derived for 30 major global mining companies. STRADE will discuss on the June 2017 workshop to which extent this perspective which complements government's governance, can be integrated in country profiles as part of a raw material information system. The list below shows the business conduct topics which will be included in the RMI (draft status May 2017).					

Company-level indicators:	Number or indicators
Business Ethics	2
Board Level and Senior Management Accountability	2
Contracts Disclosure	1
Beneficial Ownership	2
Tax Transparency	2
Payments to Producing Countries	1
Bribery and Corruption	2
Responsible Contracting and Sourcing	1
TOTAL	13

Reference:
The Responsible Mining Foundation (2017): http://responsibleminingindex.org/ (last visited 29.05.2017).

Governance
Further reading

Further Reading:

- OECD (2017): OECD Corporate Governance Factbook 2017. Internet: http://www.oecd.org/daf/ca/Corporate-Governance-Factbook.pdf (last visited 08.05.2017)
- World Economic Forum (2016): The Global Competitiveness Report 2016–2017. Internet: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf (08.05.2017).
- Federal Ministry for Economic Cooperation and Development of Germany (): Natural Resource Contracts as a Tool for Managing the Mining Sector. Internet: http://ccsi.columbia.edu/files/2015/07/Natural-Resource-Contracts-as-a-Tool-for-Managing-the-Mining-Sector.pdf (last visited 10.05.2017).

Human rights and social issues

Human rights and social issues

Recognition of the Core Labour Standards of the ILO

(relevant for all sectors, not mining-specific)

Core labour standard	Ratified	In force
Freedom of Association and Protection of the Right to Organise Convention (No 87)		
Right to Organise and Collective Bargaining Convention (No 98)	X	X
Forced Labour Convention (No 29)	X	X
Abolition of Forced Labour Convention (No 105)	X	X
Minimum Age Convention (No 138)	X	X
Worst Forms of Child Labour Convention (No 182)	X	X
Equal Remuneration Convention (No 100)	X	X
Discrimination (Employment and Occupation) Convention (No 111)	X	X

Recognition of further ILO Standards

Core labour standard	Ratified	In force
Indigenous and Tribal Peoples Convention (No 169)	X	X
Safety and Health in Mines Convention (No 176)	X	X

Further reading:

- Max Planck Foundation (2016) Human Rights Risks in Mining – A Baseline Study (Commissioned by BGR) https://www.bmz.de/rue/includes/downloads/BGR_MPFPR__2016__Human_Rights_Risks_in_Mining.pdf (last visited 27.04.2017).

References:

- International Labour Organisation – Ratifications per country http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:102571 (last visited 28.04.2017)

Human rights and social issues

General human rights situation

Country reports *(not mining-specific)*

Information source	Weblink
Amnesty International	https://www.amnesty.org/en/countries/americas/brazil/report-brazil/
Human Rights Watch	https://www.hrw.org/world-report/2017/country-chapters/brazil
U.S. Department of State	https://www.state.gov/j/drl/rls/hrrpt/humanrightsreport/index.htm?year=2016&dlid=265568#wrapper

Results of the survey of violations of Trade Union Rights *(not mining-specific)*

The International Trade Union Confederation (ITUC) publishes an annual Global Rights Index that is based on 97 indicators and that takes recoded violations of workers' rights as defined in ILO conventions, as well as particularly vulnerable groups such as migrant workers or workers in the informal economy into account. Countries are rated on a scale from 1 to 5, with 5 being the worst grade with a large number of violations in the respective year.

Results	Weblink
4 (Systematic violations of rights)	http://survey.ituc-csi.org/Brazil.html?lang=en

Reference:

- Amnesty International (2017): The state of the world's human rights. Internet: https://www.amnesty.org/download/Documents/POL1048002017ENGLISH.PDF (last visited 26.05.2017).
- Human Rights Watch (2017): World Report 2017. Internet: https://www.hrw.org/sites/default/files/world_report_download/wr2017-web.pdf (last visited 26.05.2017).
- International Trade Union Confederation: Survey of violations of Trade Union Rights. Internet: http://survey.ituc-csi.org/?lang=en (last visited 26.05.2017).
- U.S. Department of State (2017): Human Rights Reports 2016. Internet: https://www.state.gov/j/drl/rls/hrrpt/index.htm (last visited 26.05.2017).

Human rights and social issues

Prevalence of child labour *(in all sectors, not mining-specific)*

The UNICEF Child labour database comprises existing data on the prevalence of child labour per country. Child labour is defined as the "Percentage of children 5–14 years old involved in child labour at the moment of the survey. A child is considered to be involved in child labour under the following conditions: (a) children 5–11 years old who, during the reference week, did at least one hour of economic activity or at least 28 hours of household chores, or (b) children 12–14 years old who, during the reference week, did at least 14 hours of economic activity or at least 28 hours of household chores." The data is based on Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS) and other nationally representative surveys.

Prevalence of child labor	Source
8 %	UNICEF

Prevalence of forced labour *(in all sectors, not mining-specific)*

The Global Slavery Index is published by the Walk Free Foundation and comprises a vulnerability model based on the four dimensions: civil and political protections; social health and economic rights; personal security and refugee populations and conflict. Each of the dimensions consist of further variables. Altogether the vulnerability model is based on the evaluation of 24 variables. A higher score indicates a higher level of vulnerability. The vulnerability model is the basis for an estimation of prevalence of forced labour [% of population] per country, which is also published in the report.

Civil and political protections	Social health and economic rights	Personal security	Refugee populations and conflict	Mean	Prevalence of forced labour [% of population]
38	20	46	31	34*	0.08 %

* Values range between 17 (Denmark) and 67 (Afghanistan)

Reference:

- UNICEF Child labour database https://data.unicef.org/topic/child-protection/child-labour/ (last visited 27.04.2017)
- Walk Free Foundation – The Global Slavery Index 2016 http://www.globalslaveryindex.org/download/ (last visited 27.04.2017)

Human rights and social issues

Recent violent conflicts with the involvement of the mining sector

The conflict barometer of the Heidelberg Institute for International Conflict Research maps and evaluates non-violent and violent conflicts world-wide. Violent conflicts are divided into violent crisis, limited war and war (with increasing intensity). The country profiles only include violent conflicts, which is based on the consideration that the analysis does a) not exhaustively cover all non-violent conflicts, and b) that non-violent conflicts can often be seen as part of normal societal process balancing the interests of different stakeholder groups.

Start year	Ore type	Location	Parent company	Intensity	Conflict parties	Conflict items
Note: in 2016, HIIK indicated no violent conflicts related to mining in Brazil. In order to illustrate the general approach of this table, the next row gives information on a non-mining conflict.						
1996	No mining specific conflict	São Paulo / Paraná state		Violent crisis	MST*, MTST** vs. government	Land use***

* MST: Landless Workers´ Movement

** MTST: Homeless Workers´ Movement

*** The conflict is mainly about land reforms and land rights in general. So far no mining sites / specific raw materials were addressed in the conflict.

Reference:

- Heidelberg Institut for International Conflict Research – Conflict Barometer 2016
http://hiik.de/de/konfliktbarometer/pdf/ConflictBarometer_2016.pdf
(last visited 27.04.2017)

Further reading:

- International Crisis Group – The monthly CrisisWatch provides a regular up-date on significant conflicts world-wide.
https://www.crisisgroup.org/fr (last visited 28.04.2017)

Further information on conflicts

There are manifold reports and data sources on conflicts available, which provide varying degrees of details on individual conflicts, their history, dynamics and drivers. Nevertheless, it is often difficult to evaluate the credibility and objectiveness of such sources. In many cases, reports on individual conflicts are biased and do not provide holistic analysis of issues and drivers.

The media presence of conflicts cannot be seen as meaningful indicator of the severity of the conflict because the media presence highly depends on the level of public awareness and the extent of public campaigns.

Human rights and social issues

Responsible Mining Index evaluation on socio-economic mine site performance

Company	Location	Ore	RMI evaluation on human rights and social performance	Reference year	Details
The content and the structure of this table will be discussed in detail when first RMI data are published (scheduled in 2018). The current draft RMI methodology foresees a set of 35 indicators related to human rights and social issues on company level and additional indicators on mine-site level. STRADE will discuss on the June workshop to which extent this high complexity can be integrated in country profiles as part of a raw material information system. The list below shows the social topics to be included in the RMI (draft status May 2017; further issues on employment and development are discuss within the section ‚Economic contribution').					

Company-level indicators	
Community Wellbeing	Number of indicators
Human rights	4
Community and Stakeholder Engagement	2
Economic and Social Viabilty	4
Community Health	1
Gender Equity	1
Indigenous Peoples	2
Free, Prior and Informed Consent	1
Land Use and Resettlement	3
Artisanal and Small-Scale mining	2
Security and Conflict-affected Areas	2
Grievance and Remedy	1
Working Conditions	
Living Wage	1
Occupational Health and Safety	3
Rights to Organise, Collective Bargaining and Freedom of Association	1
Worker Recourse	1
Non-discrimination and Equal Opportunity	1
Elimination of Forced Labour and child Labour	1
Further topics	
Post-Clusure Viability for Communities and Workers	4
TOTAL	35
Mine-site indicators	
Community grievance mechanism	
Workers grievance mechanism	

Reference:
The Responsible Mining Foundation (2017): http://responsibleminingindex.org/ (last visited 29.05.2017).

Human rights and social issues

Cases of human rights violations & social grievances (communities and workers) with links to mineral extraction, processing and refining

Date	Location	Description	References
Due to the sensitivity of such case specific listings, scope, method and type of presentation will have to be further elaborated on. The broad range of human rights and social issues illustrates the foregoing table on the Responsible Mining Index approach.			

Further important considerations on case specific reports
Reports on individual human rights abuses, social tension and grievance might partly can be subject to biases, incomplete situation analysis, political tendencies and views. Therefore, the integration of case specific information requires careful and neutral editing that allows the parallel presentation of differing views and standpoints.

Environmental issues

Environmental issues

Recent tailing dam failures and accidents

Year	Ore type	Location	Parent company	Type of incident	Release	Impacts
2015	Iron	Bento Rodrigues, Minas Gerais	Samarco	Tailings Dam Failure	32 million m^3	Flooded town; 17 persons killed; polluted rivers on a distance of 663 km

Reference:
- WISE – World Information Service on Energy: http://www.wise-uranium.org/mdaf.html
- ICOLD – International Commission on large dams: http://www.icold-cigb.net/

Recent pipeline spills and treatment failures

	Location	Company	Description	Impact	Reference
Pipeline Spills	Location 1				
	Location 2				
	Location 3				
Treatment Failures	Location 1				
	Location 2				
	Location 3				

Reference:
- Earthworks (2012) [USA specific]
- Schoproni et al. (2014) [Brazil specific]

Further reading:
- IFC (2014): Water, Mining And Communities: Creating Shared Value through Sustainable Water Management https://commdev.org/userfiles/IFC_140201_Water%20Mining%20Communities_0519c%20web.pdf (last visited 18.04.2017).

Environmental issues

Location specific risks / natural disaster risks

Methodologies to assess and classify natural disaster risks of mining sites are currently developed in the ÖkoRess Project financed by German Environment Agency. The methodologies use data on specific local risks for their risk classification. Relevant documents will soon be published under: https://www.umweltbundesamt.de/umweltfragen-oekoress

	Data source for local data	Fe			Cu		Al	
Selected major mines	USGS (2005)	Mine 1	Mine 2	…	Mine 1	…	Mine 1	….
Water Stress Index	Pfister et al. (2009)	Low/ medium/ high						
Mine within protected or close-by to Protected Areas	IUCN / UNEP-WCMC (2017) & Alliance for Zero Extinction (2010)	No/ Close-by / within						
Risk for earthquakes	Helmholtz-Zentrum Potsdam (2000)	Low/ medium/ high						
Risk for tropical storms	UNISDR (2015)	Low/ medium/ high						
Risk for floods	CIMA Foundation and UNEP-GRID	Low/ medium/ high						

Further reading:

- United Nations Office for Disaster Risk Reduction (2015): Global Assessment Report on Disaster Risk Reduction 2015. http://www.preventionweb.net/english/hyogo/gar/2015/en/home/data.php?iso=BRA (last visited 18.04.2017)
- OECD (2008): Key Environmental Indicators. Internet: https://www.oecd.org/env/indicators-modelling-outlooks/37551205.pdf (last visited 18.04.2017).

Environmental issues

Responsible Mining Index evaluation on environmental mine site performance

Company	Location	Ore	RMI evaluation on environmental performance	Reference year	Details
The content and the structure of this table will be discussed in detail when first RMI data are published (scheduled in 2018). The current draft RMI methodology foresees a set of around 17 indicators related to environmental responsibility on company level and additional indicators on mine-site level. STRADE will discuss on the June 2017 workshop to which extent these indicators might be integrated in country profiles as part of a raw material information system. The list below shows the environmental topics to be included in the RMI (draft status May 2017).					

Company-level indicators:	Number or indicators
Mine Lifecycle Management	2
Environmental Stewardship	2
Tailings Management	2
Air	1
Water	2
Noise and Vibration	1
Biodiversity	1
GHG Emissions and Energy Efficiency	2
Hazardous Materials Management	1
Emergency Preparedness	2
Security and Conflict-affected Areas	3
TOTAL	19
Mine-site indicators	
Local communities engagement in watermanagement decisions	
stakeholder engagement in emergy preparedness	

Reference:
The Responsible Mining Foundation (2017): http://responsibleminingindex.org/ (last visited 30.05.2017).

Environmental issues

Water and air emissions

The current draft proposal for the country profiles does not include quantitative data on water and air emissions due to the lack of meaningful data.
Existing aggregated data such as water use by sector or greenhouse gas emissions by sector, which are partly available on country basis, do not allow conclusions on the major environmental challenge: the level of ecological harm due to hazardous substances in the distinct environmental media (air, groundwater, soil, surface water etc.). These data are only punctually available for some mining sites.
The authors propose to focus in the first development stage of the country profiles on alternative approaches such as the occurrence of tailing dam and pipeline failures and the regional water stress (see previous tables).

Environmental issues

Further information

Further information on environmental issues are included in other sections of the country profiles or raw material profiles:

- Environmental Performance Index: see section on governance
- Association with radioactive substances: see raw material profiles
- Association with heavy metals: see raw material profiles
- Process chemicals use: see raw material profiles
- Potential for Acid Mine Drainage: see raw material profiles
- Mining type: see raw material profiles
- Mining method: see raw material profiles

List of weblinks and literature for further reading on recent other environmental hazards in the mining sector

The following list is meant to encourage further reading. The reader has to assess itself the quality and credibility of the information. Further, it does not claim completeness.

- Environmental Justice Map: https://ejatlas.org/
- …

Initiatives for responsible mining and development

Initiatives for responsible mining and development

Country-specific initiatives in the extractive sector – industry, government, CSO's, multi-stakeholder

Type Initiatives / Organisations	Name	Programs	Reference
Mining Associations	IBRAM – Brazilian Mining Association	Special Program for Safety and occupational Health – MinerAÇÃO	IBRAM 2017a
		Management of Water Resources	IBRAM 2017b
		Tailing Dams Safety Program	IBRAM 2017c
		CONIM – Committee for International Mining standardization	IBRAM 2017d
Governmental programs			
ASM-related initiatives; Multi-stakeholder initiatives			
CSO activities			
Mining companies with best practice according to the Responsible Mining Index evaluation (under development)			

Note: The table is meant to encourage further analysis. The reader has to assess itself the quality and credibility of the initiatives. Further, it does not claim completeness.

Further reading:

Initiatives for responsible mining and development

Official Development Assistance (ODA) and World Bank programmes for all sectors

ODA		
ODA, net	999 US$ million 4.8 US$/capita	OECD 2017, data for 2015

ODA per sector	US $ million	% of total ODA
Economic Infrastructure	620	55
Social Infrastructure	250	22
Multi-Sector	220	19
Production	25	2,2
Admin. Costs of Donors	8	0,7
Humanitarian Aid	4	0,35
Unspecified	2	0,17
Debt Relief	0	0
Refugees in Donor Countries	0	0

Reference: OECD (2017): Compare Your Country. Internet: http://www2.compareyourcountry.org/aid-statistics?cr=oecd&lg=en# (last visited 24.04.2017).

Worldbank projects	
IBRD lending in 2016: US$ 758 million, in 43 projects	World Bank 2017e

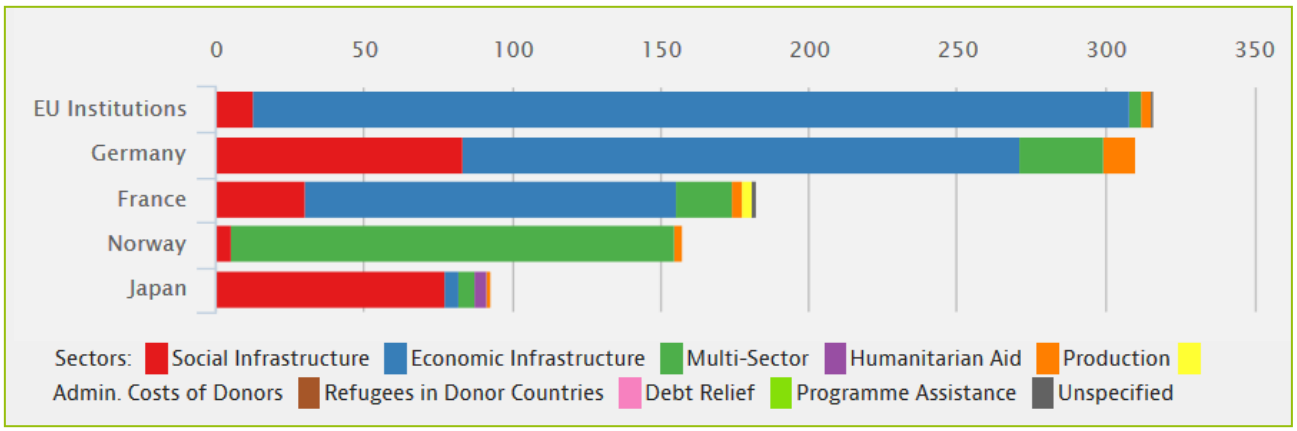
Further reading:

- OECD (2017):Geographical Distribution of Financial Flows to Developing Countries 2017. Disbursements, Commitments, Country Indicators. OECD Publishing. Paris

Initiatives for responsible mining and development

Official Development Assistance for all sectors

ODA by main donor countries and sector (OECD 2017)



Reference:

- OECD (2017): Compare Your Country. Internet: http://www2.compareyourcountry.org/aid-statistics?cr=oecd&lg=en# (last visited 24.04.2017).

Initiatives for responsible mining and development

Development assistance in the mining sector

Projects
2011-2015 Australian Government **30 million US$** *Material efficiency in raw-materials intensive production processes* The International Mining for Development Centre aims to strengthen the capacity of targeted developing partner countries to translate resource richness into significant and sustainable economic and social benefits. (OECD 2017b)
2011-2017 World Bank **50 million US$** *Energy and Mineral Sector Strengthening* The development objective of the Energy and Mineral Sector Strengthening Project for Brazil is to improve the contribution of energy and mining resources to accelerated national economic growth and increased social and environmental sustainability in a context of globalization and technological change (World Bank 2017c)

Reference:

- OECD (2017): Compare Your Country. Internet: http://www2.compareyourcountry.org/aid-statistics?cr=oecd&lg=en# (last visited 24.04.2017).
- OECD (2017b): OECD Stat – Creditor Reporting System. Internet: https://stats.oecd.org/Index.aspx?DataSetCode=CRS1 (last visited 24.04.2017).
- World Bank (2017c): Projects & Operations. Internet: http://projects.worldbank.org/ (last visited 25.04.2017).

Further reading:

- OECD (2017):Geographical Distribution of Financial Flows to Developing Countries 2017. Disbursements, Commitments, Country Indicators. OECD Publishing. Paris

Initiatives for responsible mining and development

EU and member states engagement in all sectors (not limited to mining)

Frameworks / Programmes
EU National / Regional / Multiannual Indicative Programmes: (EC 2017a): • Development Cooperation Instrument (DCI) 2014-2020: Multiannual Indicative Regional Programm for Latin America (EC 2017b)
Strategic Partner Dialogue: • EU-Brazil Strategic Partnership since 2007 (EEAS 2017) • Germany and Brazil conduct a strategic partnership
Free Trade Agreements: • The EU is negotiating a free trade agreement with Brazil. This is part of the EU's Association Agreement negotiations with the Mercosur countries (which also includes Argentina, Uruguay and Paraguay). (EC 2017a) • *For more information on trade issues see section on production & trade*
European Investment Bank (EIB) funding : • currently, EIB does not fund extractive industry projects (EIB 2017)
European Bank for Reconstruction and Development (EBRD) funding: • project list see (EBRD 2017); currently no projects in Brazil

Initiatives for responsible mining and development

Cross-country raw-material specific initiatives

Commodity	Name	Link to raw material profile	Website
Aluminum	Aluminium Stewardship Inititave (in development)	see raw material profile on alluminum	ASI 2017
Iron	Responsible steel scheme	See raw material profile on iron	Responsible steel 2017

Further reading:

Initiatives for responsible mining and development

Further reading

Global Reporting Initiative:
https://www.globalreporting.org/services/Analysis/Reports_List/Pages/default.aspx
……
……

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Annex 1: Background and basic considerations

1.1. Introduction

This paper contributes towards the development of a holistic raw material information system that combines global and EU mining and trade data with information on environmental and socio-economic aspects. The proposed concept used as a foundation companies' and policy makers' need for better knowledge on the relationship between issues addressing raw materials and responsible mining that will support their measures to mitigate negative impacts and to support socio-economic development in non-EU mining areas. Available data in this sector is fragmented and scattered, although some European and international institutions globally generate data and provide information. The current major challenge is consolidating the available data and filling in only selected missing information in this data set. With this objective, the authors suggest generating a raw material information system that broadly structures the data into:

- Raw-material-specific information and
- Country-specific information.

The proposed raw material information system has a global scope reflecting Europe's import dependency for many commodities and the global interrelationship of resource production and consumption. In the first stage, the proposed concept has a strong focus on non-EU raw material flows and non-EU mining countries in view of the fact that currently many parallel research projects, e.g. within the Horizon 2020 programme, already work on EU data collection and EU data harmonization. Their results are expected to importantly contribute to the suggested information system. In order not to duplicate other's work, the STRADE project, with its work packages on cooperation with resource-rich non-EU countries, focuses this draft concept on the global material flows, EU import flows and the related challenges in non-EU mining countries.

The analysis for developing this concept starts here in Annex 1 with chapter 1.2, which summarises drivers for raw-material-related data demand. Chapters 1.3 and 1.4 present initiatives and data sources that already create and publish data and information relevant for raw-material-related policy development. This analysis is completed in chapter 1.5, which summarises country-specific data that can be used to complete raw-material-related information on a country level. Based on this summary, chapter 1.6 provides general considerations for a data and knowledge platform on mineral mining and trade.

A proposal for compiling the identified raw material and country-specific information is presented in more detail in Part I (raw material profiles) and Part II (country profiles). This data architecture allows coupling general and global raw-material specific information with mining-country-specific data and indices.

1.2. Background

Raw–material-related policy development has always relied on sound data about geological reserves, mining and the uses of mineral commodities. While this information has traditionally been provided by national geological surveys such as BRGM, BGS, BGR and USGS, the focus of raw-material-related policies has widened over the last decade and increased the need for additional types of material-related information and analysis. This additional demand is mostly linked to the following developments:

- Sudden changes in demand and supply caused quite pronounced and unexpected price hikes for some commodities such as tantalum in 2000 and rare earth elements in 2010/11. This led to a widespread fear of comparable development for other commodities and stimulated political and scientific debates on *critical raw materials*. Subsequently, various research groups developed and

proposed methodologies to assess and compare supply risks of raw materials and the vulnerability of industries and economies to these risks [1–3].

- Mining can yield significant socio-economic benefits and is one of the few economic sectors with the potential to stimulate lasting economic growth in many regions. This is reflected in a number of policy processes and documents aiming to harness the sector for sustainable economic development and poverty alleviation [4,5]. However, many developing countries' experiences reflect poor economic development performance from mining revenues and their inability to meet high expectations. There is an urgent need to learn from past failures and successes and reengineer approaches that consider the interests of resource-rich and resource-consuming countries.

- The general increase in environmental awareness in the last decades has led to the development of life-cycle assessment methodologies (LCA), which assess the environmental impact of products and processes over their entire life cycle, from primary production to end-of-life. As all physical products and infrastructure require raw materials, this has created a demand for life-cycle inventory datasets on raw materials covering environmental impacts such as greenhouse gas emissions (GHG) and cumulative energy demand (CED) per defined unit of used raw material.

- A series of quite recent mining dam failures with disastrous consequences for ecosystems and local residents has increased the public's general awareness that mining is often associated with quite severe impacts on the environment that are not fully covered in existing life-cycle inventory datasets (see above about LCA). This also includes environmental impacts relate to land-use and ecosystem degradation, as well as various other impacts such as pollution caused by acid mine drainage (AMD), mobilisation of heavy metals and elevated levels of radioactive substances in ores and tailings [6].

- Starting with a series of reports addressing the role of mineral mining and trade in financing armed groups in the eastern DR Congo, international attention has shifted to human rights issues in mining within war- and post-war zones as well as in some other developing countries and emerging economies. Today, social issues in mining are widely seen as major challenges in international supply-chains [7,8].

While these developments have led to the creation of new assessment methodologies and raw-material and country-specific information systems, many of these initiatives mainly focus on their specific sphere of issues. As a consequence, there is now a wealth of high quality data and information tools on raw materials and mining available, but this knowledge is distributed over a rather broad variety of publications and datasets. For interested stakeholders from governments, industry, civil society and media, this diversity can be a major obstacle in finding the appropriate information, particularly information on responsible mining and human right issues.

To overcome this problem, establishing a common data and knowledge information system where data and information from the various existing sources are hosted in a structured and easy accessible manner is considered and presented. This paper lays out initial considerations for such an information system and aims to stimulate related networking and developments.

1.3. Review of current activities in collection and provision of raw-material-related data

The following table provides an initial summary of European and global institutions and their activities in the field of data collection and provision with the focus on global and EU raw material flows and responsible mining issues.

Table 1: Selected institutions' activities related to data on global and EU raw material flows and responsible mining issues

Institution	Type of activity	Name
Eurostat	International trade and production statistics	COMEXT, PRODCOM [9] [10]
Eurostat	Raw material indicators related to EU raw material consumption and material flows along the supply chain based on environmental-economic accounting	Indicators DMC and DMI (domestic material consumption and input) Indicators RMC and RME (raw material consumption and equivalents [11]
European Innovation Partnership on Raw Materials (EIP)	24 indicators on EU raw materials (5 related to imports)	Raw materials score board [12]
European Innovation Partnership on Raw Materials (EIP)	Provision of EU-level data and information on raw materials from different sources in a harmonised and standardised way	European Union Raw Materials Knowledge Base (EURMKB) [13]
European Commission	Criticality analysis of raw materials	Critical material list and background reports [2,14,15]
Joint Research Centre	Raw material information systems (advanced RMIS 2.0 under development);	RMIS [16]
UN	Database on global trade	COMTRADE [17]
OECD	Information on human rights issues for companies' due diligence activities (under development)	Minerals Risk Handbook
UNEP	Platform and information for stakeholders in the extractives sector (under development)	MAP-X [18]
Responsible Mining Foundation	Independent ranking of large mining companies in responsible mining practice (under development)	Responsible Mining Index (RMI) [19]

Institution	Type of activity	Name
Mining companies	Sustainability reporting	Sustainability reports
World Bank	Evaluation of countries' governance (cross-sectoral) and provision of economic data	World Governance Indicators (WGI) [20]
Natural Resource Governance Institute	Evaluation of countries' resource governance	Resource Governance Index (RGI) [21] [22]
Civil Society and Research (e.g. Environmental Justice Atlas)	Mapping of mining conflicts	Web based information on environmental and social conflicts, e.g. [23]
International Council on Mining & Metals (ICMM)	Evaluation of mining countries' contribution to national economies	Mining Contribution Index (MCI) [24]
Ilostat (ILO labour statistics)	Country-specific data on labour issues	Data on mining employment and working conditions

Source: Oeko-Institut compilation

The large number of institutions already working on specific aspects of data compilation (see Table 1) is discussed in more depth in the next two chapters within the context of raw-material and country-specific subject areas.

1.4. Review of raw-material-specific data sources

1.4.1. Data on primary production, trade and use

Information on primary production volumes and trends are compiled by various national geological surveys, with the most widely used data regularly published and updated by USGS [25,26] and BGS [27]. Data on commodity trade can be retrieved from WTO or from statistical data agencies such as Eurostat and the UN Statistic Commission (with a temporal offset of several months). Data on commodity prices are available from UNCTADstat [28], IMF [30] (base metals only) or from service providers (e.g. Metal pages [29] or Asian Metal [31]). Stock exchanges that trade raw materials publish information on current price developments [32].

While data on raw material use per sector are partly included in USGS publications, the data is mostly limited to the US economy. Comprehensive data on iron ore are available from UNCTAD [28]. Further information on sector- and application-specific uses can often be found in publications from industry associations and raw-material-related research groups such as the International Copper Study Group (ICSG), the International Lead and Zinc Study Group (ILZSG), the International Aluminium Institute, the World Steel Association, the International Molybdenum Association and the World Gold Council.

1.4.2. Data on recycling and substitution

Data on global and country-specific recycling rates, volumes and recycling content are not available in a uniform and regularly updated format. European data are provided by Eurostat, and further individual data are sometimes provided by industry associations and raw material related research groups (see section 1.4.1), UNEP Resource Panel published global average data on end-of-life recycling rates and recycled-content rates [33].

There is little systematic information on the substitutability of raw materials. Nevertheless, some studies have attempted to assess the substitutability of raw materials using simplified clusters such as low, medium and high [2,34–36]. These studies have mostly been conducted in relation to criticality assessments (see section 1.4.3).

1.4.3. Methods and data on raw material supply risks

In the last decade, price hikes for some technology metals have stimulated a broad debate on the *criticality* of raw materials. To support this debate and to facilitate political and economic decision-making, various European and international research groups have developed related assessment methodologies [2,3,35,37–41]. Raw material criticality is commonly determined by two dimensions: supply risks and vulnerability. While vulnerability entirely depends on the level to which an economy, an industry or a company relies on a certain material, supply risk assessments follow a more universal approach and mostly use indicators and data such as country and company concentration of production, the political and regulatory situation in producing reserve-holding countries, recycling and substitutability.

While most studies yield a comparative assessment of raw material criticality, individual indicator values are also available and can be of interest to decision-makers.

1.4.4. Life-cycle inventory (LCI) datasets

To support life-cycle assessments (LCA), a variety of life-cycle inventory databases such as ProBas (German Environment Agency), EcoInvent (Swiss not-for-profit association) and EPLCA (European Platform on Life Cycle Assessment) have been established; various industry associations also provide LCA data. These databases contain quantitative data on environmental impacts such as greenhouse gas emissions (GHG), cumulative energy demand (CED), acidification potential (AP) and water use for industrial processes and can also be used quantify such impacts for a defined unit of raw material (e.g. 1 metric tonne). Although such assessments have been carried-out to compare various types of commodities [42], data gaps have been found to be significant [43]; LCA-based assessments of raw material related environmental impacts are currently only reliable for greenhouse gas emissions (GHG) and cumulative energy demand (CED).

1.4.5. Methods and data on environmental issues beyond LCI data

Since life-cycle inventory (LCI) data is currently still insufficient to cover all aspects of environmental impacts from mining, additional types of information can help to sharpen the view on potential environmental consequences of mining and benefication. In the ongoing ÖkoRess project led by the German Umweltbundesamt, a team of scientists is currently developing a methodology to assess the environmental hazard potential of mineral resources [44]. While the methodology uses many of the data sources listed in sections 1.4.4 and 1.5.4, it also considers characteristic geochemical properties of deposits and ores (associated heavy metals, radioactive substances, potential for acid mine drainage), commonly applied extraction (open pit or underground mining) and benefication practices (use of process chemicals). Once the

level of raw materials is evaluated, the results can be used to complement criticality assessments (see section 1.4.3) with an environmental dimension.

1.5. Review of country specific data sources

1.5.1. Economic indicators

Economic indicators and a wealth of other important socio-economic data are provided by the World Bank [45] and UNDP [46]. Both organisations use statistics from various sources, including government statistics and data from other UN bodies; both sources are the major entry point for country-based economic and socio-economic data.

Further evaluations of the role that mining plays in national economies are published by the International Council on Mining & Metals (ICMM) [47].

1.5.2. Governance indicators

The quality of governance has far reaching influence on mining-related issues, including understanding how mineral wealth is used to stimulate socio-economic development and growth. The organisation Revenue Watch created and published the Resource Governance Index for 58 countries in 2013 [48], which will be updated by the Natural Resource Governance Institute in the near future. Although not specifically tailored to natural-resource-related governance, the World Bank provides comparative data on various country governance aspects [49]. Further data sources for governance on a national level include the Corruption Perception Index by Transparency International [50], as well as the EITI process that, amongst others, requires member countries to report on financial flows from the mining sector to government bodies.

1.5.3. Data on production and trade

In addition to the data available on an international level (see section 1.4.1), national statistics often provide more detailed country-specific data that frequently contain information on individual production sites, activities of mining and trading companies, as well as trends over time.

1.5.4. Methods and data on country and site-specific environmental risks

One major type of environmental impact is related to tailing dam bursts [6], for which some datasets allow an analysis of past incidents, including their location and the type of mineral being mined [51,52]. To assess potential future disaster risks, geospatial information on risks for strong storms, floods and earthquakes can be used. Geospatial information is available from national geological surveys or data sources with global scope [53,54]. This data can either be displayed in country maps to give a graphical orientation of areas where mining might be subject to extreme events or it can be combined with the geographic coordinates of mining sites to assess whether or not an individual mine is located within a high-risk area. The overall geological comparable approaches can also be taken for water stress, protected areas, land-cover and land-use.

In 2018, the Responsible Mining Index is expected to publish environment indicators on the performance of approximately 150 mining operations from 30 of the world's largest mining companies, with regular biennial updates. The indicators deal with the topics environmental stewardship, tailings management, air, water, noise and vibration, biodiversity, GHG emissions, energy efficiency, hazardous materials management, emergency preparedness and lifecycle management.

1.5.5. Methods and data on human rights risks and social issues in mining areas

With the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas [55], as well as the UN Guiding Principles on Business and Human Rights [56], upstream and downstream companies in mineral supply chains are increasingly requested to conduct human rights due diligence, including an assessment of potential human rights risks in mining areas. Originally it was seen that supply-chain-related activities were widely related to tin, tantalum, tungsten and gold from the African Great Lakes Region; however, the OECD Guidance subsequently recommends addressing human rights issues in the supply chains of *all* minerals sourced from any conflict-affected and high-risk area [55]. To implement these recommendations, companies are now challenged with conducting human-rights-related risk assessments of their various mineral supply-chains. While there are no perfect information sources to provide a full insight into the realities of mining areas on the ground, various sources exist that allow first risk screenings and prioritisations. This includes country rankings related to child labour [57] and forced labour [58], as well as evaluations of ongoing conflicts [59,60]. In addition, information on human rights situations on a country level can be taken from the country profiles compiled by Amnesty International [61], Human Rights Watch [62] and the U.S. Secretary of State [63].

Another means to assess potential human rights issues of mining is the evaluation of artisanal and small-scale mining (ASM) activities. Although artisanal mining is not necessarily related to human rights abuses, ASM activities are often carried out in areas with weak government control. In addition, many artisanal mining activities are carried out with little or no health and safety measures, making severe health impacts and fatal accidents significantly more common than in most regular mining projects. There are various studies on the challenges and opportunities of artisanal mining in certain economies and for individual minerals [64–66]. A recent project by the World Bank and the non-profit international development organization PACT aims at further improving data on artisanal mining [67].

Country data on labour standards are compiled in the ILO Information System on International Labour Standards NORMLEX [68], while the International Trade Union Confederation provides a country-based overview on violations of trade union rights [69]. Detailed information and country indicators on various social and human development aspects are annually published in the UNDP Human Development Report [46]. Further development-related indicators are provided by the World Bank [45].

While reports on individual human rights abuses and social tensions on a community-level can also be integrated into such an information system, awareness is needed that such types of information require highly careful and neutral editing for presenting the differing views and standpoints. Political views or biases might otherwise influence the reporting, showing a one-sided image and questioning the credibility of the information system.

The current draft Responsible Mining Index methodology foresees detailed data collection on company and mine-site levels as data foundation for a set of 35 indicators related to human rights and social issues (first publically available ranking is scheduled in 2018). In workshops in June 2017, STRADE will discuss to which extent these extensive indicators might be integrated in country profiles as part of a raw material information system. In any case, the proposed information system might benefit substantially from RMI's futures experiences in their challenging data collection process.

1.6. Considerations for a data and knowledge information system on minerals and related socio-economic and environmental issues

The analysis in the previous chapters yielded a plethora of raw-material and country-specific data sources and information systems. While some of this data is quite closely linked to raw material production and trade, others (such as country indicators on various socio-economic aspects) were originally designed for multiple purposes but can also be utilised to gain insights into relevant framework conditions affecting the mining sector. STRADE suggests that such information systems have the following characteristics and target groups:

- The proposed raw material information system is supposed to be implemented in several stages. It is suggested to begin implementation with those minerals having good data availability (e.g. copper, zinc, nickel, lead, iron ore, gold). In the next step, minerals and metals with less data availability, such as bauxite, molybdenum, and rare-earths, can be addressed. Those minerals where the demand for information is high, e.g. conflict minerals, should be particularly emphasized. The data depth should also increase stepwise, with data gaps being closed gradually.

- The information system should offer a wide range of reliable data, information and data-sources on raw material production, trade and related socio-economic and environmental issues. This should also encompass topics and data around development perspectives from mining, as well as existing initiatives aiming for environmentally and socially responsible development of the minerals sector. Although the approach slightly defers from this proposed information system for mineral and metals, the FAO database FAOSTAT on agricultural, forestry and fishery resources can be used as a good example of how such data integration can occur [70].

- Due to the wealth of existing data sources, the information system should mainly strive for integrating existing data into one information system. Development of new indicators and data-sets might partly be relevant for socio-economic and environmental issues where existing data sources are still fragmentary.

- The Joint Research Center (JRC) of the European Commission is currently developing its RMIS 2.0, a raw material information system including economic, socio-economic and environmental dimensions. The STRADE concept is a proposal how to integrate particularly the socio-economic and environmental dimensions in RMIS 2.0 or a similar data platform.

- The use of the system should be free of charge and target use by policy-makers, analysts and decision-makers from industry (upstream and downstream companies), civil society organizations and academia.

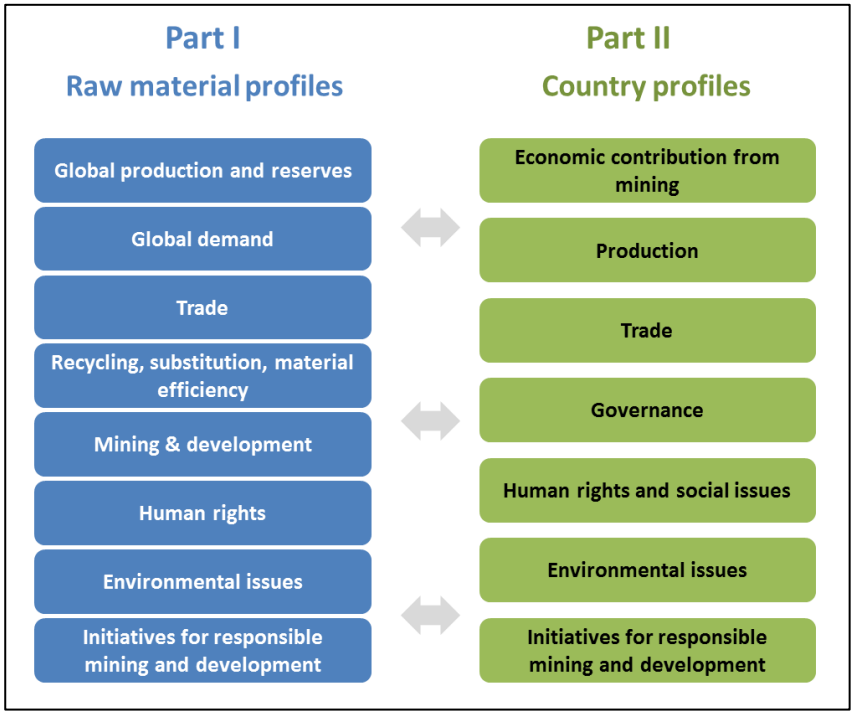
- Due to the different data types and information references, data can be grouped into two major levels: Raw-material-specific information and country-specific information. Country-specific information can then be attributed to raw material information by using either global production distribution (raw material a is mined in countries u, v, w) or trade data (raw material a is imported into the EU from country x, y or z).

- The information system has to be updated regularly and should also consider new developments in data availability. Thus, hosting such a knowledge platform requires stable financing and institutional set-up. For a European knowledge platform, JRC appears most suitable taking over these tasks.

- The amount of work to be done to implement and maintain the information system will surely be high and would require contribution from many experts. However, the poorer alternative to one central information tool is the widely scattered and duplicated research from a large number of stakeholders. Currently, an increasing number of upstream and downstream companies and private and public institutions make great efforts to collect the proposed data individually. Societies' and companies' rising interest in supply chain due diligence for a wide range of raw materials will reinforce the related information demand in the coming years. The overall working load would be significantly reduced if one information tool could provide basic information to a wide range of users. Consequently, the information system also supports EU companies' competitiveness by assisting them to gain basic knowledge of all three sustainability dimensions related to global raw material flows.

Figure 1 illustrates the proposed structure for complementary raw-material-specific and country-specific information in a joint information system and lists the major topics to be covered. It underlines the strong overlaps between raw-material-specific and country-specific topics.

Figure 1 Concept and structure of raw material profiles and country profiles



Part I presents a more detailed structure for the raw-material-specific information (raw material profiles). It uses iron ore as an example and provides draft concepts on how the existing data can be compiled and grouped.

Part II provides a draft concept on how the existing country-specific data can be compiled and grouped (country profiles), with Brazil as the example.

The data collection for these examples in Part I and II does not claim completeness but builds on easily available data to illustrate the underlying concept and serve as a basis for a general discussion of the structure of the information system. Further data collection will be necessary to elaborate comprehensive raw material and country profiles if the STRADE team and the requested stakeholders agreed upon their principal architecture.

1.7. List of Abbreviations

Abbreviation	Description
AMD	Acid mine drainage
ASM	Artisanal and small-scale mining
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources Germany)
BGS	British Geological Survey
BRGM	Bureau de Recherches Géologiques et Minières
CED	Cumulative energy demand
COMEXT	Community External Trade Statistics (EU database on external TRADE)
DMC	Domestic material consumption
DMI	Direct material input
EIP	European Innovation Partnership on Raw Materials
EITI	Extractive Industries Transparency Initiative
EU	European Union
EURMKB	European Union Raw Materials Knowledge Base
GHG	Greenhouse gas emissions
ICMM	International Council on Mining and Metals
ILO	International Labour Organization
ILZSG	International Lead and Zinc Study Group
JRC	Joint Research Centre
LCA	Life-cycle assessment
LCI	Life-cycle inventory
MCI	Mining Contribution Index
OECD	Organisation for Economic Co-operation and Development
PRODCOM	Production Communautaire (EU database on production)
RGI	Resource Governance Index
RMC	Raw material consumption
RME	Raw material equivalents
RMI	Responsible Mining Index
RMIS	Raw Material Information System
UNDP	United Nations Development Programme
USGS	United States Geological Survey
WGI	World Governance Indicators

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