

Guidelines and best practices for MSMEs to assure resiliency and progress towards a circular economy in sustainable resource management and critical raw material supply chain solutions



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Executive Summary

The report focusses on the opportunities and challenges for MSMEs involved in critical raw material supplies in response to COVID-19 pandemic and the post-pandemic economic recovery. The pandemic has placed critical raw material supply chains under severe pressure, yet opens opportunities which could be filled in by MSMEs. Many of the opportunities will also enable the MSMEs to make significant contributions in sustainable resource management, building resiliency and the progress towards the circular economy in the predicted economic recovery worldwide. However, the economic disruptions have also brought in new challenges, which require innovative solutions. Application of UNFC and UNRMS in sustainable resource management can be useful for MSMEs to build innovative business models and gain from the new avenues that are being opened. This report highlights key opportunities and challenges for MSMEs to build resiliency in critical raw material supply solutions, drawing from some key examples.

Key messages:

- ✚ The COVID-19 pandemic leads to the realisation that countries that have previously covered their demand for CRMs on the world market by purchasing them will increasingly have to provide for their own supply in the future.
- ✚ In order to protect their own companies, MSMEs should network more closely and join international organisations in order to participate in the international exchange of knowledge. The digitalisation of the enterprise is essential in this respect.
- ✚ MSMEs should provide early training to their staff to enable them to develop internal procedures to assess compliance risks and ensure compliance with legal requirements. Equally important is the company's knowledge of supply chains, international customs and national import regulations.
- ✚ National governments and international institutions can and should support MSMEs in networking and information gathering. An important task of national governments is to provide immediate financial support in the event of a crisis.
- ✚ In a post-COVID 19 world, stress testing in the supply chain will become a new standard. The distributed global business model, optimized for minimum cost, is complete. Tomorrow's model requires new priorities in optimization.
- ✚ COVID-19 has highlighted the weaknesses of a globalized manufacturing system, and to respond to them, we need to fundamentally rethink supply chains. Our medium-term goals should be to make them more regional, to modify the supply chain as a key factor in business success, and to put human capital back as the essential factor in the success of an agile company.
- ✚ The world has only experienced one well-documented pandemic in modern times - the so-called Spanish flu. Comparing the effects of the 1920 pandemic with the expected consequences of the COVID 19 pandemic, it can be assumed that the COVID 19 pandemic is likely to affect the world economy less severely than the Spanish flu.

Intended audience: Primarily entrepreneurs, business development managers, technical experts in existing and potential MSMEs, and financiers.

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List of acronyms

AoG	Aluminium of Greece
BREF	Best Available Techniques Reference documents
BEV	Battery electric vehicle
CCFL	Cold cathode fluorescent lamps
CEN/ CENELEC	European Committee for Standardization/the European Committee for Electrotechnical Standardization
CRIRSCO	Committee for Mineral Reserves International Reporting Standards
CSA	Coordination and support action
CRMs	Critical raw materials
DCED	Donor Committee for Enterprise Development
DCFTA	Deep and Comprehensive Free Trade Area
EC	European Commission
EIP	European Innovation Partnership on raw materials
EIP-SIP	Strategic Implementation Plan of the European Innovation Partnership on raw materials
EEE	Electric and electronic equipment
ELVs	End-of-life vehicles
EOL	End-of-life
EOL-RIR	End-of-life recycling input rate
EU	European Union
EURELCO	European Enhanced Landfill Mining Consortium
EURMKG	European Raw Materials Knowledge Gateway
EV	Electric vehicles
FAO	Food and Agriculture Organization
FDI	Foreign direct investments
HEV	Hybrid electric vehicles
HREEs	Heavy rare earth elements
IR	Infrared
IT	Information technology
JORC	Joint Ore Reserves Committee
JRC	Joint Research Centre
LCA	Life cycle assessment
LCD	Liquid crystal displays
LCO	Lithium-cobalt-oxide
LED	Light emitting diode
LFP	Lithium-iron-phosphate
LMO	Lithium-manganese-oxide
LREEs	Light rare earth elements

MSME, circular economy and critical raw material supply

LUCAS	Land use/ land cover area frame survey
MEErP	Methodology for the Eco-design of Energy-related Products
MFA	Material flow analyses
MSMBs	Mini, small and medium-size businesses
MSW	Municipal solid waste
NdFeB	Neodymium-iron-boron
NiMH	Nickel metal hydride
NCA	Lithium-nickel-cobalt aluminium-oxide
NMC	Lithium-nickel-manganese-cobalt
OECD	Organisation for Economic Co-operation and Development
OEMs	Original equipment manufacturers
PERC	Pan-European Reserves and Resources Reporting Committee
PGMs	Platinum group metals
PHEV	Plug-in hybrid electric vehicle
PMR	Primary mineral resources
PSD	Private sector development
PV	Photovoltaic
REEs	Rare earth elements
RMCs	Raw Material Commitments
RMI	Raw Materials Initiative
RMIS	Raw Materials Information System
SARB	South African Reserve Bank
SCM	Supply chain management
SEEA	System of Environmental-Economic Accounting
SIP	Strategic implementation plan
SMEs	Small and medium-sized enterprises
SMR	Secondary mineral resources
SRMs	Secondary raw materials
SDGs	Sustainable Development Goals
UNECE	United Nations Economic Commission for Europe
UNFC	United Nations Framework Classification for Resources
UNRMS	United Nations Resource Management System
UWWTP	Urban wastewater treatment plants
VET	Vocational education and training
WBES	World Bank Enterprise Survey
WEEE	Waste electric and electronic equipment
WSSTP	Water sanitation and supply technology platform
WWTPs	Wastewater treatment plants

Introduction

The COVID-19 pandemic (also known as coronavirus pandemic, corona pandemic, coronavirus crisis or corona crisis) is the worldwide outbreak of the new respiratory disease COVID-19. It first appeared in December 2019 in the Chinese megacity of Wuhan (Hubei Province), developed into an epidemic in China in January 2020 and then into a worldwide pandemic. The disease is caused by an infection with the previously unknown coronavirus SARS-CoV-2, which caused massive cuts in the public and private lives of many citizens in many countries around the world during the pandemic.

Micro, small, and medium enterprises (MSME) are the main drivers of economic development in almost all economies of the world and for various reasons are particularly severely affected by the pandemic. In most cases, MSMEs lack the financial means to bridge the delays in the supply of raw materials that result from the broken or interrupted supply chains. One of the main problems for these companies is to keep their qualified employees. Another problem is to compensate for payment defaults due to the delays and to fulfil longer-term supply contracts due to the non-delivery of raw materials.

The supply of critical raw materials (CRMs), which are usually only made available to the market by a few suppliers, is particularly problematic. However, these CRMs are needed for almost all innovative future technologies, such as e-mobility, renewable energies, communication technologies, defence technology, etc.

In the globalized world economy, the main threat during global crises is the interruption of supply chains. This interruption of the supply chains of important raw materials automatically leads to a stagnation in the development of those economies that do not have their own raw material reserves. The current pandemic shows the world this problem and demonstrates the importance of continuous supply chains to the governments of countries without their own raw material supply.

This study examines the supply chains of CRMs in the global economy and the impact of supply chain disruption on MSMEs. It proposes solutions and strategies that have been developed around the world to protect MSMEs from the effects of such crises and prepare these important companies for the future. It also presents strategies and projects that have been developed to ensure the supply of CRMs to the industry and to expand the supply of Critical Raw Materials through more developed resources and reserves to counteract the monopolization of the raw materials market.¹

¹ During the elaboration and source inspection, the consultant and contributors to this report have found many excellent sources already existing on the subject. Various experts describe scenarios that can be transferred to the CRM problem relatively quickly. Due to the limited time available, it has been decided to only marginally change these quotations; the source is always indicated. This reporting format is in compliance with UN regulations for consultant reporting.

Various definitions of MSMEs

Definition of MSMEs for the EU as given by the glossary of the OECD²

Small and medium-sized enterprises (SMEs) are non-subsidary, independent firms, which employ few employees. The exact number of SME employees varies across countries. The most frequent upper limit designating an SME is max. Two hundred fifty employees, as in the European Union, while some countries set the limit at 200 employees. The United States considers SMEs to include firms with less than 500 employees. Small firms are generally those with fewer than 50 employees, while micro-enterprises have at most 10, or in some cases 5 workers. Financial assets are also used to define SMEs. In the European Union, a new definition came into force on 1 January 2005 applying to all Community acts and funding programs as well as in the field of State aid, where SMEs can be granted higher intensity of national and regional aid than large companies. The new definition provides for an increase in the financial ceilings: the turnover of medium-sized enterprises (50-249 employees) should not exceed EUR 50 million; that of small enterprises (10-49 employees) should not exceed EUR 10 million while that of micro firms (less than 10 employees) should not exceed EUR 2 million. Alternatively, balance sheets for medium, small and micro enterprises should not exceed EUR 43 million, EUR 10 million and EUR 2 million, respectively (from OECD, 2005).

Following Eurostat (2019), during 2017, SMEs in the EU employed over 94 million people or approximately 66 per cent of the workforce. In Europe's biggest economy, Germany, SMEs employed 18.3 Million people, with over 6.7 million people employed by small-sized enterprises alone. Enterprises employing fewer than 250 persons make up over 99 per cent of all enterprises in all EU countries, Norway and Switzerland in 2015 (Table 1). They account for around two-thirds of total employment in the EU, ranging from 47 per cent in the United Kingdom to 85 per cent in Malta. Enterprises with fewer than 250 persons employed contribute about 56 per cent of the total turnover in the EU (Eurostat, 2019).

² Source: <https://stats.oecd.org/glossary/detail.asp?ID=3123>

Table 1: Number of enterprises, turnover and persons employed and the share of enterprises with fewer than 250 persons employed (Eurostat, 2019).

Number of enterprises, turnover and persons employed and the share of enterprises with fewer than 250 persons employed, 2015

	Enterprises		Turnover (m €)		Persons employed	
	total	< 250 persons employed %	total	< 250 persons employed %	total	< 250 persons employed %
EU-28	23 500 341	99.8	27 309 775	55.8	137 444 935	66.3
Belgium	602 153	99.9	989 197	65	2 769 085	69.3
Bulgaria	326 219	99.8	121 308	69.9	1 911 916	74.8
Czech Republic	1 001 048	99.8	444 231	56.9	3 591 896	67.6
Denmark	210 726	99.7	479 464	59.3	1 666 048	64.3
Germany	2 408 352	99.5	6 061 400	47.5	28 258 410	62.9
Estonia	68 124	99.7	50 820	77.5	414 763	78.2
Ireland	243 433	:	595 095	:	1 308 019	:
Greece	789 975	:	236 153	:	2 162 572	:
Spain	2 465 540	99.9	1 789 292	62.2	11 109 702	72.8
France	2 908 814	99.9	3 624 869	55.3	14 645 799	61.4
Croatia	146 637	99.7	77 670	60.9	989 598	69.5
Italy	3 683 127	99.9	2 887 615	68.8	14 225 278	78.7
Cyprus	48 329	99.9	25 573	79.9	215 716	83.9
Latvia	109 642	99.8	51 304	77.8	633 450	79.4
Lithuania	186 468	99.8	73 997	68.5	934 440	75.9
Luxembourg	31 926	99.5	151 365	70	255 869	68.3
Hungary	536 610	99.8	277 690	57.1	2 596 236	69.8
Malta	26 059	99.8	18 665	85.1	134 212	79.7
Netherlands	1 092 243	99.9	1 412 433	61.8	5 461 082	65.7
Austria	322 325	99.7	653 111	:	2 742 655	:
Poland	1 606 559	99.8	921 350	56	8 652 063	68.3
Portugal	807 183	99.9	314 227	:	3 007 264	:
Romania	458 122	99.6	263 366	59.1	3 898 199	65.5
Slovenia	134 727	99.8	83 628	68.3	591 340	73.7
Slovakia	429 524	99.9	180 476	56.7	1 502 912	71.8
Finland	229 096	99.7	365 782	56.1	1 454 614	65.6
Sweden	686 433	99.9	811 397	:	3 102 080	:
United Kingdom	1 940 947	99.7	4 348 297	47	19 209 717	53.5
Norway	293 403	99.8	546 504	:	1 610 874	68
Switzerland	142 775	99.2	1 929 684	:	2 737 720	67.1

: not available

Source: Eurostat (online data code: sbs_sc_sca_r2)



Definition of SMEs for the United States SMEs is given by JPMorgan (2020)

Following JPMorgan (2020), over 99 per cent of the United States' 28.7 million firms are small businesses. The vast majority (88 per cent) of employer firms have fewer than 20 employees, and nearly 40 per cent of all enterprises have under USD 100,000 in revenue. Twenty per cent of small businesses are employer businesses, and 80 per cent are non-employer businesses.

Definition of MSMEs by the Government of India

A practical definition is given by the Ministry of Micro, Small and Medium Enterprises of India/New Delhi dated 29 September 2006, published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (ii), vide S.O. 1642(E), dated 30 September 2006 except as respects things done or omitted to be done before such supersession, the Central Government, hereby notifies the following criteria for classification of micro-, small and medium enterprises:

- “... a micro-enterprise, where the investment in Plant and Machinery or Equipment does not exceed one crore rupees and turnover does not exceed five crore rupees;
- a small enterprise, where the investment in Plant and Machinery or Equipment does not exceed ten crore rupees and turnover does not exceed fifty crore rupees
- a medium enterprise, where the investment in Plant and Machinery or Equipment does not exceed fifty crore rupees and turnover does not exceed two hundred and fifty crore rupees.

This notification shall come into effect from 01.07.2020. ...”

Definition of crore: One crore rupees is equal to 10 million Indian Rupees. 10 million Indian Rupees are equal to EUR 117,718.19 or USD 133,358.04 on the 09.07.2020 11:00 UTC.

Definition of SMEs for China as given by Thomala (2019)

In China, private companies were limited in the past. This changed after the liberalization of the economy past 1988. “Each year, there are about five Million SMEs more in China, representing at least a ten per cent year-over-year growth rate. Since the economic reformation in China, SMEs have become one of the driving forces in the economy. In 2019, the number of SMEs was estimated to be over 38 Million. In Beijing alone, there were over 3,100 industrial SMEs generating more than 2.8 Billion U.S. dollars annual revenue in 2017. The classification of SMEs in China is quite complex, with specific criteria for different industries. According to the SME Promotion Law of China, SMEs are classified based on the number of employees, annual revenue and total assets. For example, a medium-sized agricultural enterprise is required to hire a minimum of five hundred people. A small-sized construction enterprise can have a maximum business revenue of 8.5 Million U.S. dollars. Compared to the SMEs in other economies, which often employ below 100 or 500 people, SMEs in China are relatively quite big. ...” (Thomala, 2019).

The COVID-19 pandemic is hitting SMEs particularly hard since most SMEs lack the financial means to bridge longer periods without orders. Since the strongest economies on earth are based on SMEs, it is necessary to protect and support these companies. The supply of critical raw materials is a pillar of this support.

Chapter 1

Background

1. Background

- ✚ The worldwide COVID-19 situation of MSMEs is highly variable. Thus, this chapter showcases the current COVID-19 status of selected UNECE and Non-UNECE countries.

a. COVID-19 and the impact on micro-, small and medium enterprises (MSMEs)

The situation in UNECE (United Nations Economic Commission for Europe) member States

European Union³

A view on the COVID impact on and support measures for SMEs

The first summary of data, which SMEunited has received from members about the impact of COVID on SMEs, the use of available measures and some forecasts for the macroeconomic impact is presented here.

1. COVID-19 impact on SMEs

COVID-19 hits small and medium enterprises all over Europe. On average, about 90 per cent of SMEs report to be economically affected. In particular, the most impacted sectors are services (60 per cent-70 per cent), construction and production. The food sector follows with an impact of 10 per cent-15 per cent. For instance, in France 90 per cent and in Spain 95 per cent of SMEs are affected. Moreover, 30 per cent of total SMEs report that their turnover is suffering at least an 80 per cent loss, with an EU average which is about 50 per cent loss. For instance, Belgium reports a decline in turnover for 72 per cent of SMEs and for 28 per cent of SMEs a loss of more than 75 per cent; Germany reports a decline of 50 per cent, France and Spain a decline of 80 per cent and 75 per cent in sectors confined. Besides, although a detailed forecast on employment is premature, SMEs expect an increase in the unemployment rate in a range between 3 per cent and 5 per cent points. In some countries, the impact is already harmful. For instance, in Spain and in Austria the workers who suffer a lay-off are respectively 760,000 and 200,000. In Germany and Finland, they are respectively 10,000 and 12,700. In contrast, Belgium reports a 32 per cent increase in unemployment in the private sector.

2. Available benefits

³ Adapted from: <https://smeunited.eu/admin/storage/smeunited/200417-covid19-impact1.pdf>

As regards liquidity measures: loan guarantees or subsidies are available in all countries responded. Postponement of Tax or Social Contribution payments is available in all countries but Portugal. For example, 20 per cent of taxes applied in Germany are postponed. Postponement of repayment of loans is available in some countries. There is still little information about the usage of these measures. Moreover, SMEs in all of the European countries have started to use the short-term unemployment scheme for protection. On average, at the time of this paper, a range between 10 per cent and 50 per cent of SMEs are applying this instrument. In terms of numbers, there are about 3.5 million workers and 200 thousand companies which are using the unemployment scheme. For instance, in Austria there are 53,646 applications, in Belgium, there are 1,075,000 temporaries unemployed, in Croatia 180,000, in Finland 260,000, in France 5 Million, in Netherland 300,000 and in Spain 270,430. In Germany, 36 per cent of all companies are asking for the protection scheme. Finally, EU countries are answering to the loss of income for self-employed through income subsidies. At the moment, the subsidy level is in a range between € 600 and € 2000 among EU members. For instance, in Ireland, it is € 1,517 per month, in Italy € 600 per month, in Spain 670 € per month (in Catalunya € 2,000 for self-employed). In Austria, there are 122,649 applications with € 105 Million transferred, in Belgium, there is 40 per cent request of all self-employed in March with a cost of € 419 Million and 50 per cent of all self-employed in April with a cost of € 523 Million. In France, there are € 1500 for 755,000 applications and €460 Million paid to 342.000 enterprises.

3. Macroeconomic forecast

GDP in EU nations may decrease by a range between 3 per cent and 6 per cent. The deficit may increase by a range between 3 per cent and 5 per cent points. There is still little info about the impact on the general unemployment. For instance:

- in Austria, GDP 2020: -2.5; employment: -1.1 per cent points; deficit: -5.5 per cent.
- In France, GDP 2020: -1 per cent, deficit: -9 per cent
- In Germany, GDP 2020: -2.8/-5.4 per cent
- In Italy, GDP 2020: -5/-8 per cent
- In Netherland, GDP 2020: -1.2/-5.0 per cent; unemployment: 4.1/4.3; deficit: -1.5 per cent/4.5 per cent.

Turkey⁴

In Turkey the pandemic is underway of a horizontal graphic on those days with approximately 1,000 people infection/day with some 20 people dead, unfortunately, after this critical increase from March to mid of May the situation is like this and looks promising. With the parallel of pandemic effects economy also has shown a decrease of approximately 30-35 per cent in my opinion according to the economic status of last year. But with the last week of May and beginning

⁴ Source: Enes Besir, Geophysicist, Assistant Manager DMT Turkey, Istanbul

of June, most of the sectors just turned back to their normal activities and also more aggressive than normal to recover lost time, which means the economy would recover in the near future.

With the decreasing demand of raw materials like coal, smaller mining companies also decreased their daily production amounts nearly to half on three months period (March-April-May) and their working hours, shifts as well (most of the smaller mining companies has worked only 1 shift/day on those 3 months period. But nowadays, with increasing demand and production, companies just started to have normal production rates with normal working hours. But mining has never stopped or decreased on those days by bigger actors of the mining sector, they have continued the activities with high-end precautions against to COVID-19.

During those pandemic days, the state has promoted the employees and employers with some supports. I can give some examples like; dismissal prohibition during Pandemic days, short-time working allowance, no tax liability for some months, credit packages for employees and employers with zero-interest and nonrecourse for 1 year and non-recourse credit and grant packages for employers.

USA⁵

The following section presents the situation faced by US small businesses. They continue to report uncertainty about the future as the coronavirus pandemic continues, although overall sentiment appears to be plateauing in recent weeks. Mini, small and medium-sized businesses (MSMBs) account for roughly 48 per cent of the US economy and provide employment to about 60 million people in the United States. As the COVID-19 pandemic continues to cause human suffering on a global scale, an increasing number of US SMBs fear that the economic impact will also lead to a reduction in revenues and are uncertain about the future.

The sustained impact from the COVID-19 pandemic has led to a continued decline in optimism for a rapid US economic recovery among SMBs. Businesses with less than \$20 Million in revenues and those that rely on retail foot traffic have been disproportionately affected. As the pandemic continues to unfold, we will track sentiment among SMBs to gauge how their views on economic activity, employment, and financial behaviour - as well as their expectations about financial institutions and public authorities - change as a result of ongoing public and private interventions.

⁵ Adapted from: <https://www.mckinsey.com/industries/financial-services/our-insights/tracking-us-small-and-medium-sized-business-sentiment-during-covid-19>

The majority of small and medium-size US businesses are concerned about their sustainability—some more than others.

Businesses extremely or very concerned about business sustainability since COVID-19, % of respondents¹

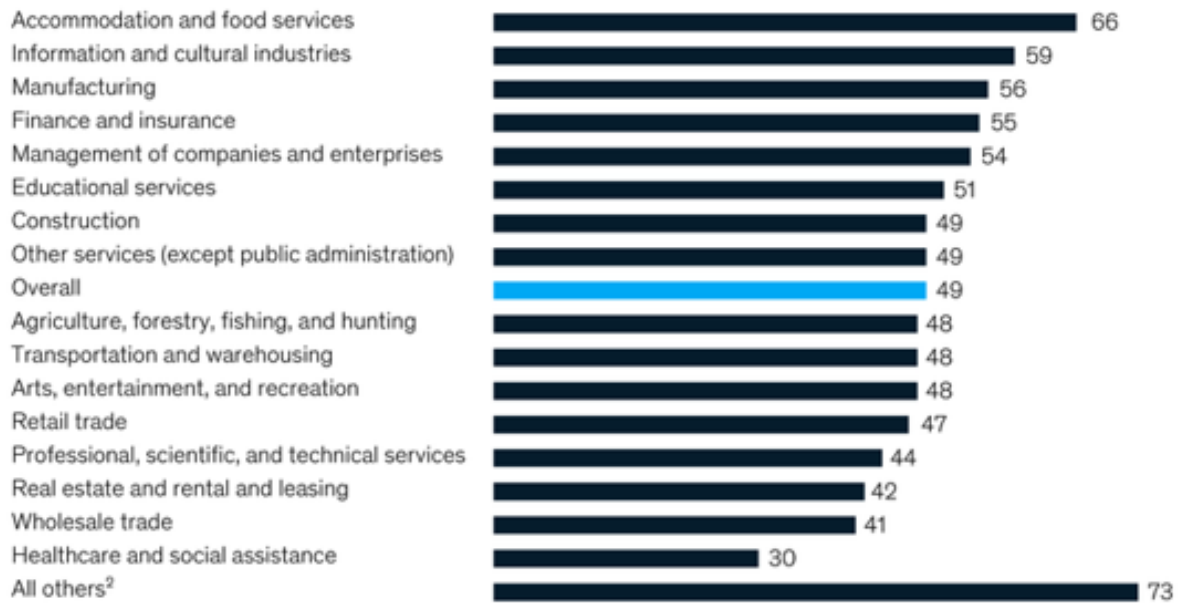


Figure 1: Business sustainability in the USA since COVID-19 (McKinsey & Company, 2020).

The situation in some Non-UNECE Member States

China⁶

The situation in China since the coronavirus outbreak began in January is briefly summarized here.

Chinese business activity has been severely slowed, affecting China’s position in the global industrial supply chain. The Enterprise Survey for Innovation and Entrepreneurship in China (ESIEC) launched a survey on the “condition of micro, small and medium-sized enterprises (SMEs) amidst the coronavirus outbreak.” The surveyors then conducted follow-up interviews with a representative sample of private entrepreneurs from a database maintained over the past three years, asking about the resumption of production as well the different challenges enterprises face. The findings include:

⁶ Adapted from: ESIEC/Center for Enterprise Research of Peking University; <https://www.cgdev.org/publication/impact-coronavirus-chinas-smes-findings-from-esiec>

- 80 per cent of surveyed firms had not resumed operations at the time of the survey, February 10, 2020, and 40 per cent could not determine a timeframe for resumption;
- 20 per cent of surveyed firms will be unable to last beyond a month on a cash flow basis, and 64 per cent beyond three months, presenting a dire picture for SME bankruptcies under an extended epidemic scenario;
- Barriers to business operations vary along the supply chain, with upstream firms mainly affected by labour shortages, while downstream firms face more severe challenges related to supply chains and consumer demand; and
- Policies aimed at work resumption should consider the characteristics of each industry and avoid a one-size-fits-all approach.

Based on the survey data, it is found that the impacts experienced by upstream and downstream firms were not identical under coronavirus conditions, reflecting their different positions in the industrial supply chain. While enterprises downstream in the industrial chain directly provide goods to consumers, upstream enterprises provide intermediate goods required by those downstream actors. In general, upstream enterprises enjoy the advantage of economies of scale. They can also rely on the capital structure to form large enterprises. In contrast, downstream enterprises consist mostly of labour-intensive, micro, small, and medium-sized firms.

As shown in Figure 2, as of February 10, 2020, an average of 80 per cent of enterprises still had not resumed operations, while the level of work resumption in business services was slightly higher at 30 per cent. A possible reason for this difference is the fact that the operations of the business services sector can be conducted online, and industries such as IT, logistics, and scientific research have become the foundation of social operations following the outbreak. Meanwhile, the heavy industry and residential services sectors are the most pessimistic about work resumption. Among those that have yet to resume work, 40 per cent currently cannot determine the timeframe for eventual resumption. Among those that can determine this timeframe, over 50 per cent of entrepreneurs feel that they will not resume work within two weeks (that is, late February 2020). Overall, the work resumption outlook is grim.

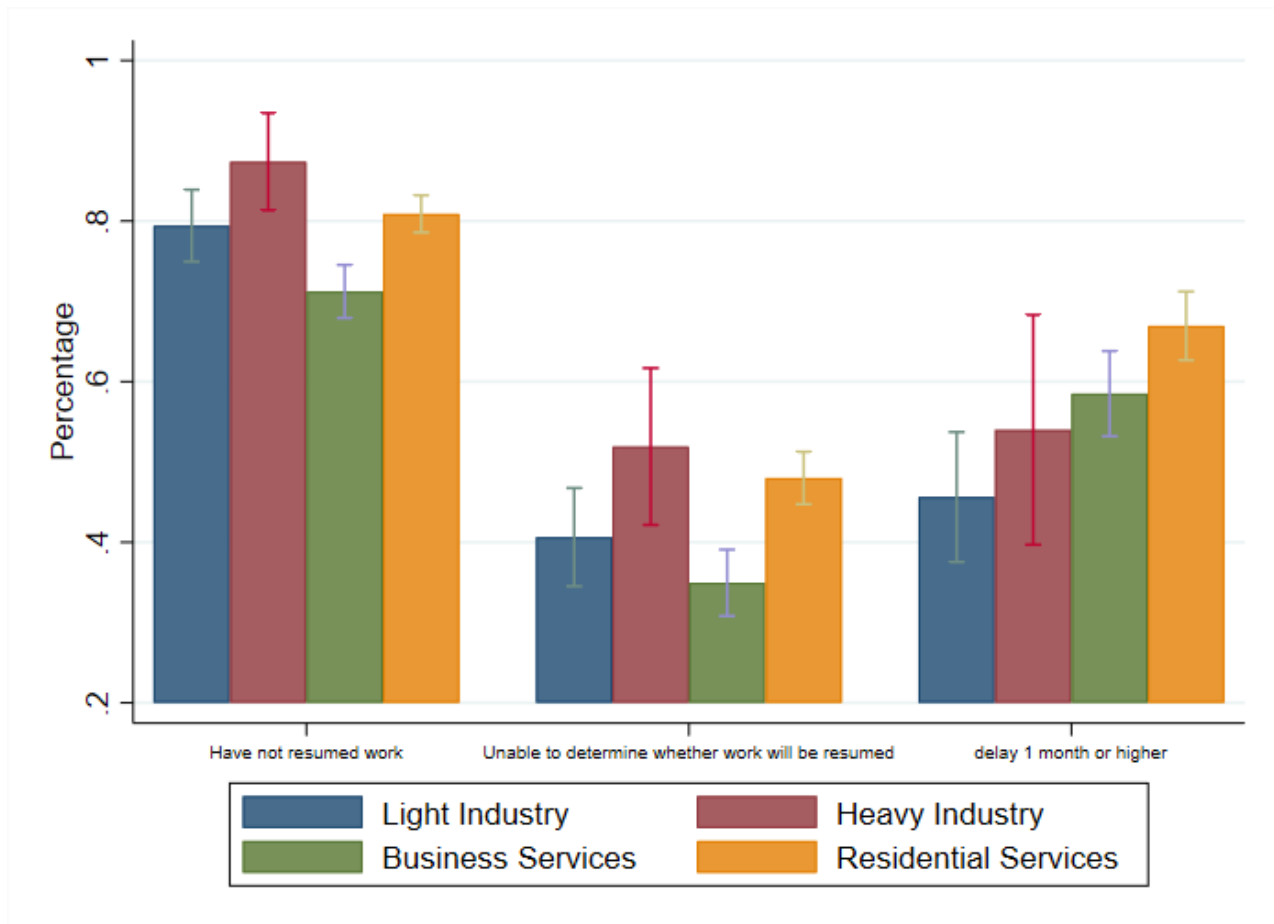


Figure 2: Work resumption situation by sector (ESIEC/Centre for Enterprise Research of Peking University)⁷

Note the authors' calculations are based on survey data. Vertical lines in the bar chart represent 95 per cent confidence intervals. If vertical lines in a bar chart do not match one another, this means that the average values of the two groups differ at the 95 per cent significance level.

An important reason that enterprises cannot resume work is that employees are unable to return to work in a timely manner, a major impact. As shown in Figure 2, the percentage of employees unable to return to work in heavy industry enterprises is the highest, at nearly 30 per cent. At the same time, among entrepreneurs in both light and heavy industries, concern over temporary labour shortages is at its highest, at 60 per cent and 55 per cent, respectively. Light industry is often labour-intensive and relies heavily on its workforce. It also has a high proportion of foreign workers. For these industries, the most severe issue is the current labour shortage. Although the residential services sector has been directly hit by the coronavirus outbreak, only 30 per cent of entrepreneurs in this sector saw this shortage as an issue primarily because they are usually small or self-employed and feature a high proportion of local employees.

⁷ From: <https://www.cgdev.org/publication/impact-coronavirus-chinas-smes-findings-from-esiec>

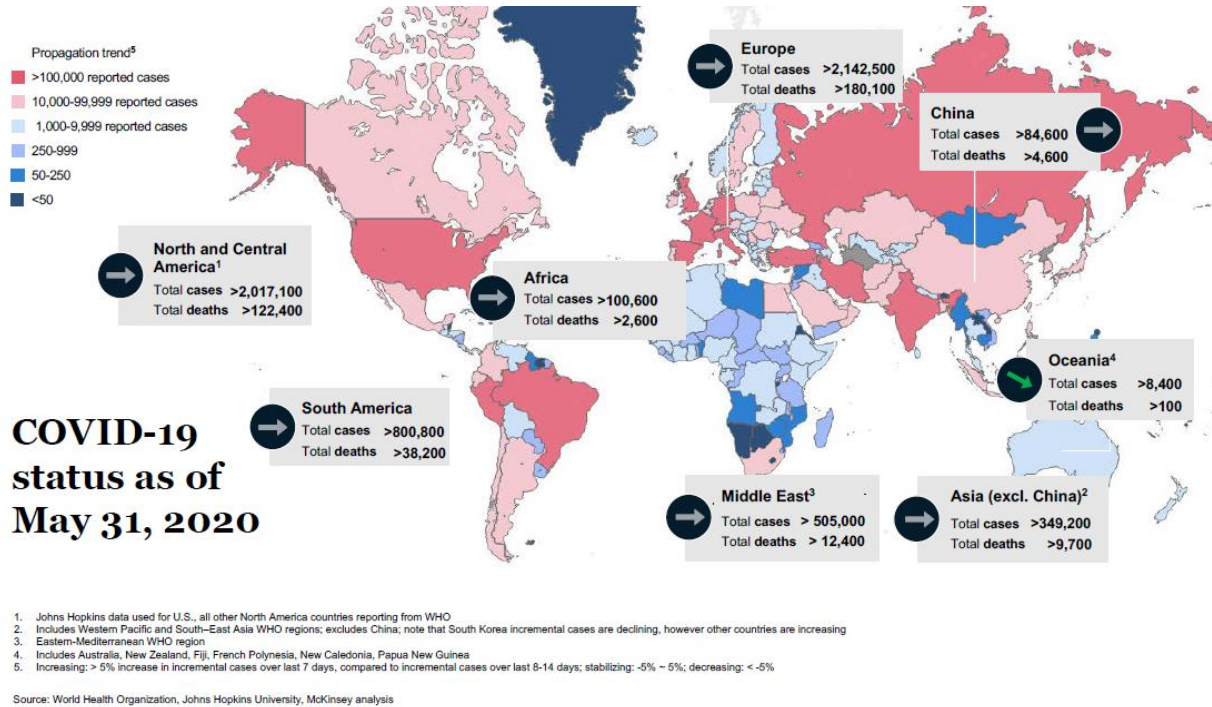


Figure 3: COVID-19 status as of May 31, 2020 (McKinsey, 2020)⁸.

India⁹

The situation in India is still developing, and the infected numbers are increasing steadily from a few 100s per day to 30 thousand per day. Cases in India have crossed a million marks. With India recording a spike of ~34,000 cases in a single day, the total tally now stands at 1,038,716. The death toll has climbed to 26,273, thereby making India becomes the third worst-hit country by COVID 19.

The economic impact of the coronaCOVID-19 virus pandemic in India has been largely disruptive. India's growth in the fourth quarter of the fiscal year 2020 went down to 3.1 per cent according to the Ministry of Statistics. Notably, India had also been witnessing a pre-pandemic slowdown, and according to the World Bank, the current pandemic has "magnified pre-existing risks to India's economic outlook". Up to 53 per cent of businesses in the country were projected to be significantly affected—Foreign Exchange Reserves USD 516.362 billion (As on 10th July 2020). On 12 May the Prime Minister announced an overall economic package worth US\$ 280 billion, 10 per cent of India's GDP, with emphasis on India as a self-reliant nation.

Indeed, mining and mineral sector impacted due to COVID-19 led slowdown. Mining companies, particularly smaller companies with more manual operations, are facing gradually increasing

⁸ From: <https://www.mckinsey.com/about-us/covid-response-center/home>

⁹ Source: Muhamad Danish, Marketing, Sales and Distribution manager DMT India, Kolkata

difficulties in maintaining production and retaining workforce. This is due to lower mineral offtake on account of lack of demand from end-use sectors and also non-availability of labour. In addition, mine developer operators and mineral operators are facing significant challenges due to delayed payments and unavailability of labour. Moreover, weak demand from key end-use segments like power, steel and cement beside the distressed condition of company financials.

The government intends to give a push to pan-India exploration projects and more and more of private sector participation into commercial mining. Recently the Government has opened 41 coal blocks for auction with a capital investment of around 4 Billion Euros in the next 5-6 years. CMPDIL has tendered 5 exploration blocks with the latest exploration techniques to fast track mineable resources. Auction of other mineral blocks is also ongoing. It is believed that demand and also stability in operations would return in a few months, and there could be a better outlook for the future.

- There is no significant financial support. However, ease in operations through policy reforms is being focused upon.
- There are Policy Reforms Introduction of Commercial Mining in Coal Sector, enabling any party to bid for a coal block and sell the products in the open market.
- Introduction of Commercial Mining in Coal Sector and auction of coal and other mineral concessions could see increased investment in the mining sector.
- Government is also likely to push acquisitions of assets of strategic minerals abroad such as battery minerals.
- Government is pushing for exploration projects in coal & other commodities.
- Investment and push in infrastructure projects are likely to result in increased demand for raw material and ease in logistics.

Indonesia¹⁰

The first two cases of COVID-19 announced by the Indonesian President on 2 March 2020. The government immediately takes action by tracking the source of infection and detecting people who are potentially infected. Those who were positive were immediately isolated in hospitals with the protocols recommended by WHO.

Because most of the case are found in Jakarta, on 10 April – 4 June 2020, the Government applied Large-scale social restriction in Jakarta, followed by some province. This policy affected various aspect, especially the economy. The government had stopped all flights, and train trips prohibit shopping centre from operating, requires employees to work from home. The case for termination of employment increased as lots of activity stopped.

During the restriction, the government provides assistance to affected communities by providing cash and basic food; the amount and type are different in each region. All medical expenses for

¹⁰ Source: Sonny Yudhistria, Geologist, Assistant Manager DMT Indonesia, Jakarta

patients who are positive are borne by the government. As per 25 June 2020, there are 49,009 cases of coronavirus positive in Indonesia, with the case of the death 2,573 people and recovered 19,658 people.

In mining sectors, Mining companies apply lockdowns at the mine site to prevent the spread of viruses in the mining area. Coal prices have also continued to decline since March until now. Most of the small mining companies are closing down their operation while big operation mining companies are dependent on their long-term contract to sell their commodities; thus, all mining sectors operation is slowing down. Mining companies tend to do savings in all of their operation aspects to reduce loss until the Pandemic goes (don't know when).

Mongolia¹¹

The Mongolian government has implemented robust measurement against the spread of COVID-19 in the early stage of the outbreak. These include the closure of air and land border crossing between China and Mongolia since 27 January 2020 and suspension of all international flights and passengers trains until 30 April which has been extended until 30 June (isee.mn, 2020). The face Mask duty and distance rules have also been executed. Until today, there is no registered local case, and totally 204 cases have been imported by bringing the citizens from the overseas whereby 139 cases have already been registered as recovered as 20 June 2020 (Consul.mn, 2020).

As of 15th of April 2020, Mongolian's total foreign trade turnover reached \$2.54 billion, a drop of 30.9 per cent YoY whereby exports accounted for \$1.18 billion and imports for \$1.36 billion, down 43.7 per cent and 13.7 per cent respectively. The main reason for the foreign trade deficit of \$175.9 Million was the dramatic decline in mineral exports. The main export goods are coal and copper followed by iron ore, gold and zinc. Mongolia exported 3.52 Million tons of coal, which is 62.4 per cent or 5.85 Million tons less YoY. Coal exports, which had been suspended since February 10 to prevent the spread of the coronavirus, resumed gradually or step by step in March. The export of copper concentrate reached 359,400 tons and earned about \$410 Million, whereby the corresponding loss amounts to \$184 Million. That's a 15 per cent drop in volume and 31 per cent drop in revenue. The corresponding loss from copper concentrate export has been \$184 Million. The copper prices have fallen by about 20 per cent since the beginning of the year, which has also impacted on the reduction of the revenue from copper export (Mongolian_Mining_Journal, 2020).

Regarding the situation of the smaller mining companies (MSMEs), no information is available.

The Government of Mongolia received several financial supports aimed at the fighting financial crisis due to COVID 19. These are listed below:

¹¹ Source: Margad Togtokhbayar, Business Manager Mongolia, DMT Germany, Essen

MSME, circular economy and critical raw material supply

- Asian Development Bank (ADB) has approved a \$100 million loan to the Government of Mongolia to mitigate the severe health and economic impacts of the novel coronavirus disease (COVID-19) pandemic (ADB, 2020).
- European Union provided a grant of EUR 50.8 Million to Mongolian government for the purpose of boosting employment and improving transparency in public finances.

Even the Mongolian government received financial support due to COVID-19 pandemic; the Mongolian government did not introduce any implementation plan.

Table 2: COVID-19 status in Mongolia as of June 2020 (Consul.mn, 2020).

MONGOLIA COVID-19 UPDATE /June 20, 2020/							consul.mn
	CONFIRMED CASES	LOCAL CASES	IMPORTED CASES	RECOVERED	ACTIVE CASES	DEATHS	IN QUARANTINE
JANUARY 31	0	0	0				39
FEBRUARY 29	0	0	0				275
MARCH 31	14	0	14	2	12	0	2310
APRIL 30	38 (+24)	0	38 (+24)	10 (+8)	28	0	466
MAY 31	179 (+141)	0	179 (+141)	44 (+34)	135	0	1891
JUNE 8	194 (+15)	0	194 (+15)	75 (+31)	119	0	1224
JUNE 9	194 (+0)	0	194 (+0)	85 (+10)	109	0	1509
JUNE 10	194 (+0)	0	194 (+0)	87 (+2)	107	0	1382
JUNE 11	194 (+0)	0	194 (+0)	89 (+2)	105	0	1638
JUNE 12	197 (+3)	0	197 (+3)	95 (+6)	102	0	1816
JUNE 13	197 (+0)	0	197 (+0)	95 (+0)	102	0	2057
JUNE 14	197 (+0)	0	197 (+0)	98 (+3)	99	0	2067
JUNE 15	197 (+0)	0	197 (+0)	108 (+10)	89	0	2061
JUNE 16	197 (+0)	0	197 (+0)	109 (+1)	88	0	2047
JUNE 17	197 (+0)	0	197 (+0)	111 (+2)	86	0	1891
JUNE 18	201 (+4)	0	201 (+4)	127 (+16)	74	0	1631
JUNE 19	204 (+3)	0	204 (+3)	132 (+5)	72	0	1719
JUNE 20	204 (+0)	0	204 (+0)	139 (+7)	65	0	1703
TOTAL	204 /Including 13 foreign nationals/	0	204	139	65 Medical condition: Mild: 57 Moderate: 8	0	9859 /Since January 9, 2020/

Table 3: Mongolian mineral exports 2020 (Mongolian_Mining_Journal, 2020).

Minerals exports (as of 15th of April, 2020)

Minerals product	Unit	Volume	Increase or Decrease 2020.04.15/ 2019.04.15 (%)	Revenue (US\$ million)	Increase or Decrease 2020.04.15/ 2019.04.15 (%)
Copper concentration	thou.tn	359.4	-14.5%	409.7	-31.1%
Coal	thou.tn	3521.8	-62.4%	284	-63.8%
Iron ore	thou.tn	2404.5	-3%	164.5	+22.7%
Gold	tonnes	1.6	-66.6%	80.4	-58.9%
Zinc ore and concentration	thou.tn	41.7	-11%	53.7	-20%
Fluorspar ore and concentration	thou.tn	168.3	+27.8%	42.5	-10.6%
Refined copper	thou.tn	3.6	+18.4%	19.7	+7.3%
Crude oil	thou.bbl	359.9	-80.6%	18.6	-82%
Molybdenum concentration	thou.tn	1.7	-0.27%	12.23	-17%

South Africa¹²

The national State of Disaster which was first announced on 15 March 2020 has been extended to 15 July 2020. A national lockdown was imposed for from 27 March 2020 until 30 April 2020 to contain the spread of the coronavirus. These national restrictions have since been eased based on a risk-adjusted strategy from 1 May 2020, becoming level 4 and from 1 June 2020, the restrictions were lowered to level 3.

The pandemic has affected the economy in a significant way, and the South African Reserve Bank (SARB) forecasts that the economy will decline by 6.1 per cent in 2020. Together with a significant drop in GDP, there is a probable recession with severe decline of the economy supplemented by great job losses and company closures. Currently, there is a strategic, phased reopening of the economy to help the economy to recover, i.e. more industries can operate under strict health measures.

When the lockdown was imposed in March 2020, most mines (mostly underground) were required to shut down or place their operations on care and maintenance apart from coal mines supplying

¹² Source: Mapadi Molepo, Geologist; DMT South Africa, Johannesburg

state power utility Eskom, which were only required to operate at reduced capacity. It was only from 1 June 2020 when all mining companies could fully reopen. The temporary closure and scaled-down operations have left a formidable dent on production and exports. Small miners do not have strong enough balance sheets, and only the strongest players are likely to survive.

The South African government has introduced various intervention measures to support Small, Medium and Micro Enterprise (SMMEs) in distress due to the pandemic. The scheme that small miners can benefit from is the SMME Relief Finance Facility, which provides soft-loan funding over a 6-month term from 1 April 2020 for existing businesses provided that they are 100 per cent South African owned, 70 per cent of their employees are South African, and they are registered and compliant with South African Revenue Services (SARS). In instances where SMMEs will require assistance longer than six months, the term may be extended dependent on their needs.

b. Current status of MSMEs in critical raw material (CRM) supply

Example situation inside the EU

SMEunited¹³

In Europe, SMEunited is a special organization that helps MSMEs to organize the supply with raw materials and to find a way through the “ocean” of information, institutions and organizations, which are available in the EU.

SMEunited was is formally known as UEAPME. It is the association of crafts and SMEs in Europe with around 70 member organizations from over 30 European countries. SMEunited is a recognized employers’ organization and European Social Partner. It acts on behalf of crafts and SMEs in the European Social Dialogue and discussions with the EU institutions.

SMEunited represents national cross-sectoral Craft and SME federations, European SME branch organizations and associate members. SMEunited speaks on behalf of the 24 Million SMEs in Europe which employ almost 95 million people. SMEunited is a non-profit seeking and non-partisan organization.

The 24 Million SMEs in Europe count for 99,8 per cent of all enterprises, 2/3 of employment and close to 60 per cent of the added value created in the European Union. These enterprises play a decisive role in Europe’s economy and society, are the driver of innovation and ensure social and regional stability.

SMEunited has three main tasks in giving SMEs a voice at European level:

- Representing the interest of SMEs towards the European Institutions, other stakeholders and in the Social Dialogue
- Networking and capacity building
- Projects.

SMEunited is operative in various sector activities, granting a direct connection to the specific needs and interests of business branches. These activities are managed by the following fora:

- Construction Forum
- Cosmetic Forum
- Food Forum
- Transport Forum
- Retail forum

SMEunited participates in various projects – as project leader or project team member. The up-to-date list of projects run with the participation of SMEunited can be found on the web-page of

¹³ Adapted from: <https://smeunited.eu/about-us>

SMEunited. SBS is a specific project of SMEunited (founding and leading partner) and is a European not-for-profit association established with the support of the European Commission to represent European SMEs in the standard making process at European and international levels. The SBS goal is to represent and defend SME interests in the standardization process at European and international level.

MSMEs supply in critical raw material (CRM)

Global markets are an essential source of growth for small and medium-sized enterprises (SMEs). However, only 600,000 SMEs employing roughly 6 Million people export goods outside the EU. The market for CRMs is international (Tab. 4) and small to medium-sized companies have little chance of directly contacting raw material sources. Furthermore, the acquisition of critical raw materials is, in most cases too costly for such companies. Increasing the internationalisation of SMEs and helping them access third markets is crucial for Europe's competitiveness, economic growth and innovation. This is the field of activity of the most various, mostly state-organized trade and networking organizations. The European Commission's priority is to ensure that enterprises can rely on a business-friendly environment and make the most out of growth markets outside the EU.

Table 4: Global supply of the CRMs – individual materials (EC, 2017b).

Material	Stage ¹³	Main global supplier	Share	Material	Stage	Main global supplier	Share
1 Antimony	P	China	87%	23 Natural graphite	E	China	69%
2 Baryte	E	China	44%	24 Natural Rubber	E	Thailand	32%
3 Beryllium	E	USA	90%	25 Neodymium	E	China	95%
4 Bismuth	P	China	82%	26 Niobium	P	Brazil	90%
5 Borate	E	Turkey	38%	27 Palladium	P	Russia	46%
6 Cerium	E	China	95%	28 Phosphate rock	E	China	44%
7 Cobalt	E	DRC	64%	29 Phosphorus	P	China	58%
8 Dysprosium	E	China	95%	30 Platinum	P	S. Africa	70%
9 Erbium	E	China	95%	31 Praseodymium	E	China	95%
10 Europium	E	China	95%	32 Rhodium	P	S. Africa	83%
11 Fluorspar	E	China	64%	33 Ruthenium	P	S. Africa	93%
12 Gadolinium	E	China	95%	34 Samarium	E	China	95%
13 Gallium*	P	China	73%	35 Scandium	P	China	66%
14 Germanium	P	China	67%	36 Silicon metal	P	China	61%
15 Hafnium	P	France	43%	37 Tantalum	E	Rwanda	31%
16 Helium	P	USA	73%	38 Terbium	E	China	95%
17 Holmium	E	China	95%	39 Thulium	E	China	95%
18 Indium	P	China	56%	40 Tungsten	E	China	84%
19 Iridium	P	S. Africa	85%	41 Vanadium	P	China	53%
20 Lanthanum	E	China	95%	42 Ytterbium	E	China	95%
21 Lutetium	E	China	95%	43 Yttrium	E	China	95%
22 Magnesium	P	China	87%				
Legend							
Stage	E = Extraction stage P = Processing stage						
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium						
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium						
PGMs	Iridium, palladium, platinum, rhodium, ruthenium						

*Global supply calculation based on production capacity.

In other countries outside the EU, similar organizations arrange the supply with international raw materials for their national customers. Such organizations are organized internationally and serve their members with networking and managing of trading opportunities.

Examples for global organizations are:

- World Customs Organization (WCO)
- World Trade Organization (WTO)
- International Chamber of Commerce: ICC
- Forum for East Asia and Latin American Cooperation (FEALAC)
- European Free Trade Association, EFTA
- Latin American and Caribbean regional organization/DFAT
- African Continental Free Trade Area (AfCFTA)
- Association of African Trade Promotion Organizations
- Asia-Pacific Economic Cooperation (APEC)

Hundreds of Bi-national chambers of commerce:

- Organized in the Federation of International Trade Associations

Examples for national organizations are:

- China Foreign Trade Centre (CFTC)
- U.S. Chamber of Commerce
- Germany Trade Associations - Association of German Chambers of Commerce and Industry
- German Mineral Resources Agency (DERA)

Bi-lateral agreements and contracts like (only examples):

- International Free trade Agreements (Fig. 4)
- EU-Mexico Trade Agreement
- EU-Vietnam Trade Agreement and Investment Protection Agreement
- CETA - International trade agreement between the EU and Canada
- JEFTA- International trade agreement between the EU and Japan

Organizations like these manage the international supply of raw materials. SMEs are supported to organize the supply with raw material and CRMs by the national Geological Surveys. In Germany, for example, the German Mineral Resources Agency (DERA) is part of the Federal Institute for Geosciences and Natural Resources of Germany (BGR). DERA collects information about all kinds of industrial minerals, metallic ore, fossil fuels, building materials, and any raw material, which is needed by the German industry worldwide. Published in annual publications, the availability, qualities of the material, amount of material and contact information are submitted to the public in general and specifically, to all kind of enterprises in need of such information.

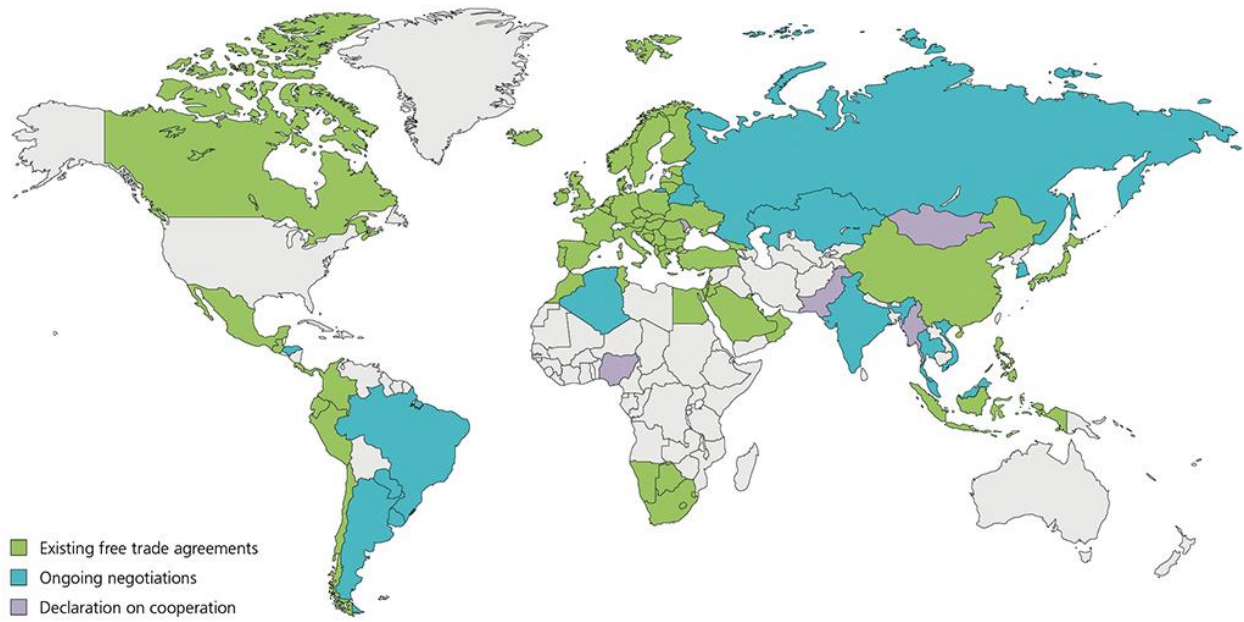


Figure 4: Free trade agreements worldwide.¹⁴

¹⁴ From: https://www.seco.admin.ch/seco/en/home/Aussenwirtschaftspolitik_Wirtschaftliche_Zusammenarbeit/Wirtschaftsbeziehungen/Freihandelsabkommen.html

C. Opportunities for CRM supply MSMEs in the post-pandemic world

To look at the economic situation in the post-pandemic period of COVID-19, it is necessary to compare the crisis to the economic consequences of previous pandemics. The only pandemic in the past, for which there are detailed economic analyses, is the Spanish Flu from February 1918 to April 1920 at the end of World War I.

Since the start of the COVID-19 outbreak, many businesses were uncertain about how this crisis will proceed. Will it last for weeks, months, years? At that point, many industry observers realised that the world had no experience in dealing with such a global scale health crisis for the past 100 years. The best reference point was the 1918 pandemic. In the industry, management experts were asked to understand the past experience, see how the Spanish Flu unfolded and re-learn the lessons. The most responsible companies in the world did have crash programmes to understand the impact of the 1918 pandemic and are applying the lessons learned in the current crisis management. With six months into the COVID-19 crisis, parallels are becoming more and more apparent. It is for this reason that the discussion was kept quite long, as we are still in the middle of the crisis and 1918 pandemic offers the best lessons to learn from (Correia et al., 2020).

The Spanish flu or 1918 influenza pandemic was an unusually deadly influenza pandemic caused by the H1N1 influenza A virus. Lasting about 15 months from spring 1918 (northern hemisphere) to early summer 1919, more than 500 million people were infected of a world population of around 1,6 Billion people. The death toll may have been anything from 17 Million to 50 Million, and possibly as high as 100 Million, making it one of the deadliest pandemics in human history. The pandemic cost more lives than the First World War, and the USA lost more soldiers to the flu than to the war. The rapid pace of the pandemic, which, for example, killed most of its victims in the US within less than nine months. The USA lost 500,000 to 850,000 people (0.48 to 0.81 per cent of the population).

For the USA, the Spanish Flu was the biggest pandemic in the history of the country. For US economists, the Spanish Flu is the most important pandemic event as a research project for economic consequences of a pandemic. Therefore, a lot of publication about the economic consequences of pandemic events are published in the US until today. The analyses of the economic consequences of the Spanish flu show striking parallels to the COVID-19 pandemic.

Following Garrett, Thomas A. (2007): "... most of the evidence indicates that the economic effects of the 1918 influenza pandemic were short-term. Many businesses, especially those in the service and entertainment industries, suffered double-digit losses in revenue. Other businesses that specialized in health care products experienced an increase in revenues. Some academic research suggests that the 1918 influenza pandemic caused a shortage of labour that resulted in higher wages (at least temporarily) for workers, though no reasonable argument can be made that this benefit outweighed the costs from the tremendous loss of life and overall economic activity. [...] The greatest disadvantage of studying the economic effects of the 1918 influenza is the lack of

economic data. There are some academic studies that have looked at the economic effects of the pandemic using available data, and these studies are reviewed later.”

Further, the report states that, given the general lack of economic data, however, a remaining source for information on (some) economic effects of the 1918 pandemic is print media. Newspapers in the Eighth Federal Reserve District cities of Little Rock and Memphis that were printed in the fall of 1918 were researched for information on the effects of the influenza pandemic in these cities. To close the gap of information and data Garrett analysed the headlines in two typical newspapers: The Arkansas Gazette (Little Rock) and The Commercial Appeal (Memphis) and assumed that piecing together anecdotal information from individual cities can provide a relatively good picture of the general effects of the pandemic.

Little Rock, Ark.

“How Influenza Affects Business.” The Arkansas Gazette, Oct. 19, 1918, page 4.

- Merchants in Little Rock say their business has declined 40 per cent. Others estimate the decrease to 70 per cent.
- The retail grocery business has been reduced by one-third.
- One department store, which has a business of \$15,000 daily (\$200,265 in 2006 dollars), is not doing more than half that.
- Bed rest is emphasized in the treatment of influenza. As a result, there has been an increase in demand for beds, mattresses and springs.
- Little Rock businesses are losing \$10,000 a day on average (\$133,500 in 2006 dollars). This is an actual loss, not a decrease in business that may be covered by an increase in sales when the quarantine order is over. Certain items cannot be sold later.
- The only business in Little Rock in which there has been an increase in activity is the drug stores.

Memphis, Tenn.

“Influenza Crippling Memphis Industries.” The Commercial Appeal, Oct. 5, 1918, page 7.

- Physicians report they are kept too busy combating the disease to report the number of their patients and have little time to devote to other matters.
- Industrial plants are running under a great handicap. Many of them were already short of help because of the draft.
- Out of a total of about 400 men used in the transportation department of the Memphis Street Railway, 124 men were incapacitated yesterday. This curtailed service.
- The Cumberland Telephone Co. reported more than a hundred operators absent from their posts. The telephone company asked that unnecessary calls be eliminated.

“Tennessee Mines May Shut Down.” The Commercial Appeal, Oct. 18, 1918, page 12.

- Fifty per cent decrease in production reported by coal mine operators.

- Mines throughout east Tennessee and southern Kentucky are on the verge of closing down owing to the epidemic that is raging through the mining camps.
- Coalfield, Tenn., with a population of 500, has “only 2 per cent of well people.

The following is adapted from the analysis of Garrett (2007):

One research paper examines the immediate (short-run) effect of influenza mortalities on manufacturing wages in U.S. cities and states for the period 1914 to 1919. The testable hypothesis of the paper is that influenza mortalities had a direct impact on wage rates in the manufacturing sector in U.S. cities and states during and immediately after the 1918 influenza. The hypothesis is based on a simple economic model of the labour market:

A decrease in the supply of manufacturing workers that resulted from influenza mortalities would have had the initial effect of reducing manufacturing labour supply, increasing the marginal product of labour and capital per worker, and thus increasing real wages. In the short term, labour immobility across cities and states is likely to have prevented wage equalization across the states, and substitution away from relatively more expensive labour to capital is unlikely to have occurred.

The empirical results support the hypothesis: Cities and states having more significant influenza mortalities experienced a tremendous increase in manufacturing wage growth over the period 1914 to 1919. Another study explored state income growth for the decade after the influenza pandemic using a similar methodology. In their unpublished manuscript, the authors argue that states that experienced larger numbers of influenza deaths per capita would have experienced higher rates of growth in per capita income after the pandemic. Essentially, states with higher influenza mortality rates would have had a more significant increase in capital per worker, and thus output per worker and higher incomes after the pandemic. Using state-level personal income estimates for 1919-1921 and 1930, the authors do find a positive and statistically significant relationship between state-wide influenza mortality rates and subsequent state per capita income growth.

A recent paper explored the longer-term effect of the 1918 influenza. The author questions whether in utero exposure to influenza had negative economic consequences for individuals later in their lives. The study came about after the author reviewed the evidence that suggested pregnant women who were exposed to influenza in 1918 gave birth to children who had greater medical problems later in life, such as schizophrenia, diabetes and stroke. The author’s hypothesis is that an individual’s health endowment is positively related to his human capital and productivity, and thus wages and income. Using 1960-1980 decennial census data, the author found that cohorts in utero during the 1918 pandemic had reduced educational attainment, higher rates of physical disability and lower-income. Specifically, “men and women show large and discontinuous reductions in educational attainment if they had been in utero during the pandemic. The children of infected mothers were up to 15 per cent less likely to graduate from high school. Wages of men were 5-9 per cent lower because of infection. Research also suggests that the 1918 influenza caused reductions in human capital for those individuals in utero during the pandemic, therefore has implications for economic activity occurring decades after the pandemic.

A recent study from March 2020 published by Colvin, Ch. and McLaughlin, E. compares the Spanish Flu and the upcoming COVID-19 pandemic:

Adapted from Colvin, Ch. and McLaughlin, E. (2020):

“... As news of the global spread of coronavirus disease (COVID-19) emerged, global financial markets reacted pessimistically and behaved in ways not seen since the 2008 financial crisis. But fully understanding the potential future economic impact of the virus, which leads to this disease remains difficult – because the spread of a disease on this scale is unprecedented in the modern world. The closest parallel is the 1918 influenza pandemic, popularly known as the Spanish flu (because it was first reported in Spanish newspapers). So, what are the lessons from this historical pandemic for policymakers today?” The report further mentions that:

The 1918 flu was the last truly global pandemic, its potency exacerbated in an era before the existence of international public health bodies such as the World Health Organization. About one-third of the world’s population caught this acute respiratory tract infection. Conservative estimates put the death toll at 20 Million, but it could have been more in the region of 50 Million. By comparison, nine Million people died in combat during the entirety of the First World War. Probably about 2-3 per cent of those who caught this RNA virus ended up dying, but much of the mortality was the result of complications – such as pneumonia – rather than the flu itself. There were several waves of flu, and most deaths occurred within a week of each outbreak. The last outbreaks, in 1919, took place a year after the disease was first identified.

The pandemic spread globally because of the particular set of circumstances in which it first arose. The First World War had just ended, and entire armies were being demobilized, returning home with the disease. Outbreaks spread along major transportation routes. Much of the world’s population was already weak and susceptible to disease because of wartime strains, especially in Germany. To make matters worse, there was an absence in transparency and little policy coordination. Wartime media censorship was still in force, and governments were preoccupied with planning for the peace. Those who perished were typically in the prime of their lives, between 15 and 40 years of age. Aside from these deaths, exposure to the flu had serious permanent long-term physical and mental health consequences on many survivors, especially the very young. There were also immediate and long-term consequences for the economy.

Urban populations proved particularly susceptible to this strain of flu, partly because of pollution. Researchers recently found that many more people died in the more polluted cities in 1918 relative to less polluted urban areas, suggesting a direct link between air pollution and influenza infection. The immediate economic consequences of 1918 stemmed from the panic surrounding the spread of the flu. Large US cities, including New York and Philadelphia, were essentially temporarily shut down as their populations became bedridden. As in Italy now, businesses were closed, sporting events cancelled and private gatherings – including funerals – banned to stem the spread of the disease.

The economic consequences of the pandemic included labour shortages and wage increases, but also the increased use of social security systems. Economic historians do not agree on a headline figure for lost GDP because the effects of the flu are hard to disentangle from the confounding impact of the First World War. The long-term consequences proved horrific. A surprisingly high proportion of adult health and cognitive ability is determined before we are even born. Research

has shown the flu-born cohort achieved lower educational attainment by adulthood, experienced increased rates of physical disability, enjoyed lower lifetime income and lower socioeconomic status than those born immediately before and after the flu pandemic.

The lessons from 1918 are stark. First, the public health response to the spread of the disease must focus on containment. The reason why the 1918 pandemic resulted in so many deaths was that so many people caught the disease in the first place. They were exposed because policymakers failed to stop the spread. Indeed, their actions helped spread the flu more widely. The repatriation of troops to their countries of origin was probably the main culprit. Communicable disease control policy works. Researchers found that US cities which implemented efforts to reduce infectious contact between people early in the 1918 outbreak had significantly lower peak death rates than cities that were later to adopt disease containment policies.

The second lesson is that useful information is the key to disease control. We cannot afford a media blackout or, worse, an active disinformation campaign. We can already see the terrible consequences of such policies in Iran. The truth always comes out eventually – there is nothing to be gained from hiding it. Indeed, governments stand to lose if censorship leads to social unrest. Political scientists are already speculating on the long-term political impact of media manipulation of coronavirus news in China.

The third lesson is that we must prepare for the economic and human consequences of the virus and act to minimize its impact. This pandemic is both a shock to demand and supply. Just as the disease is highly contagious, so too is the economic crisis it causes. The labour lost from implementing the recommended 14 days of self-isolation for suspected cases alone will have serious economic implications. Closing down entire regions or countries, as recently enacted in Italy, will no doubt cause a recession. The emergency lowering of interest rates in the US and the UK must be the first of many policies aimed at mitigating the economic impact of COVID-19. New fiscal policy measures must now also come into play. Individuals in low-paid precarious employment deserve targeted attention. Where medical care and sick leave are costly, this can force people to go to work even if they are still carrying the virus.

Just as in 1918, people in more polluted, urban, areas are likely to be particularly at risk. These are populations that are already more susceptible to respiratory illness due to environmental factors. Special measures to help these groups must be considered. And babies born to those affected by flu must be monitored closely and remedial interventions designed. We should not just focus on the headline mortality rates. We need to pay attention to those who survive this pandemic, and their offspring too. ...”

A recent study of Barro, R. J., Ursúa, J. F. and Weng, J. also compares the pandemic of the Spanish Flu and COVID-19 in their paper from April 2020. Barro et al. analysed data for 48 countries, 42 countries with data on real per capita GDP and 6 countries without GDP data. A table shows their estimates of excess mortality rates from the Great Influenza Pandemic (Spanish Flu). These rates are expressed relative to the total population for 48 countries for each year from 1918 to 1920. These 48 countries covered (42 of which have GDP data for the relevant timeframe) constitute 92 per cent of the estimated world population in 1918.

- The major result of the study reports that the major influenza pandemic is estimated to have reduced real GDP per capita in a typical country by 6.2 per cent.
- One of these events is the sharp US economic decline from 1918 to 1921 (12 per cent for GDP, 16 per cent for consumption)

From Barro, R. J., Ursúa, J. F. and Weng, J. (2020): Conclusions of the study:

The Great Influenza Pandemic of 1918-1920 represents a plausible worst-case scenario for disease outbreaks with a global reach like COVID-19. The flu death rate of 2.1 per cent out of the total population in 1918-1920 would translate into around 150 Million deaths worldwide when applied to the world's population of about 7.5 billion in 2020. Further, this death rate corresponds in our regression analysis to declines in the typical country by 6 per cent for GDP and 8 per cent for private consumption. These economic declines are comparable to those last seen during the global Great Recession of 2008-2009. Thus, the possibility exists not only for unprecedented numbers of deaths but also for a major global economic contraction. The results also show that the 1918-20 pandemic was accompanied by substantial short-term declines in realized real returns on stocks and short-term government bonds.

At this point, the probability that COVID-19 reaches anything close to the Great Influenza Pandemic seems remote, given advances in public-health care and measures that are being taken to mitigate propagation. In any event, the large potential losses in lives and economic activity justify the substantial expenditure of resources to attempt to limit the damage. In effect, countries have been pursuing a policy of lowering real GDP—particularly as it relates to travel and commerce—as a way of curbing the spread of the disease. There is clearly a difficult trade-off here concerning lives versus material goods, with the little ongoing discussion about how this trade-off should be assessed and acted upon.

Resumé and Opportunities for CRM supply MSMEs in the post-pandemic world

The summary of the results of the studies on the consequences of the Spanish Flu makes it possible to predict a future scenario about short-term and long-term consequences for the economy and the national economies:

- The pandemic of the Spanish Flu and COVID-19 are not possible to compare regarding the medical consequences - the outbreak intensity and mortality rates in the COVID-19 pandemic are lower than in the Spanish Flu until now. The Spanish Flu was much more dangerous.
- The economic consequences are possible to compare, scenarios and consequences for the economy during the Spanish Flu described in the papers could also be observed in the COVID-19 pandemic (positive medical consequences of shutdowns, negative economic consequences of shutdowns, short-term shortage of capital, infections at significant events, different infection rates in different social groups, etc.).
- The Spanish flu hit at the end of the first industrially led world war a world population whose resistance to the flu virus after 4 years of war was considerably reduced by malnutrition, stress and general exhaustion

- The virus surprised a health system weakened by the war in the industrialised countries that had hardly any resources left to stop the pandemic. The medical staff was tied to the fronts in the war and only reached civilian facilities again after the first wave of the pandemic at the end of 1918.

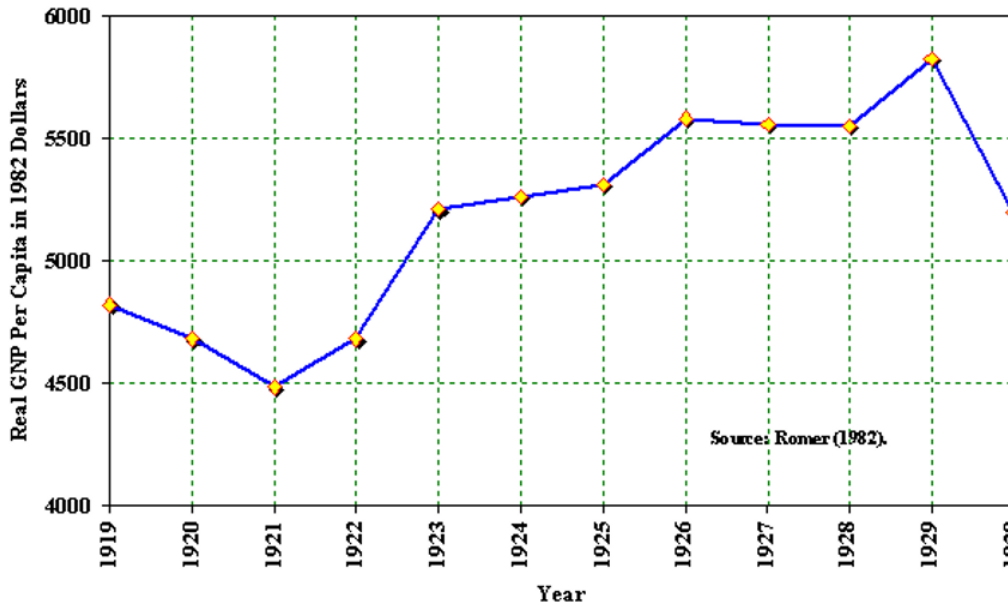


Figure 5: Real GDP per capita in the USA: In mid-1920 the American economy began to contract, and the 1920-1921 depression lasted about a year, but a rapid recovery re-established full-employment by 1923 (Smiley, 2004).

- This condition cannot be compared with the present time.
- Due to the slump in sales and lack of equity reserves, many MSMEs will go bankrupt and reappear in another form when the market generates demand again. CRM providers will also be unable to operate in line with market conditions for a while, which may lead to a temporary shortage of raw materials, which will have an impact on prices.
- After the First World War and the Spanish flu, the world economy recovered within about 2 years (Fig. 5) and the "Golden 20s" began. In the present situation, a rapid increase in demand in the post Corona period is also to be expected. In 1920, the development programs of the World Bank, the EU and similar institutions did not exist. Thus, after the pandemic, demand and thus the fields of activity for MSMEs should return relatively quickly to the level they were in before the pandemic.
- In the short term, the pandemic will affect supply; in the long term, this can be expected, that the consumption and the application possibilities for CRMs will increase, as the entry into electromobility has been decided in the West and other industries such as renewable energies, communication technology, etc. will also tend to expand their businesses after the pandemic in order to compensate for their financial losses.

As a summary of all studies, the current situation is considerably better than during the pandemic of 1918-1920, the so-called Spanish flu. However, MSMEs can be better prepared if the lessons learned from the past pandemics are imbibed. Most of the companies that perform well under crises like this always keep in consideration the best and the bad practices of the past. There will be waves of bankruptcy in the SME sector, but the world economy should recover faster than in 1920 after the Spanish flu.

d. Progress towards sustainable resource management and the circular economy - Application of UNFC and UNRMS

UNFC - United Nations Framework Classification for Resources

Definition¹⁵

The United Nations Framework Classification for Resources (UNFC) provides countries, companies, financial institutions and other stakeholders a futuristic tool for sustainable development of energy and mineral resource endowments. UNFC applies to energy resources including oil and gas; renewable energy; nuclear fuel resources; mineral resources; injection projects for the geological storage of CO₂; and the anthropogenic resources such as secondary resources recycled from residues and wastes. The emerging challenges in these sectors are the sustainable, environmental-friendly, carbon-neutral and efficient development, production of energy and raw materials required for a growing population. Innovations in production, consumption and transportation are fundamentally challenging how energy and material sectors function today. As a unique tool for harmonizing policy framework, government oversight, industry business process and efficient capital allocation, UNFC is capable managing the natural resources required for the present and future needs of the society and realizing the objectives on Sustainable Development Goals (SDGs).

UNFC, in its core principles, encompasses the holistic management of all socio-economical, technological and uncertainty aspects of energy and mineral projects. The project maturity and resource progression model of UNFC can de-risk projects from costly failures and thus protect the investments. UNFC fully integrates social and environmental considerations and technology readiness required to bring clean and affordable energy resource projects into the market. UNFC aims to provide clear and consistent specifications, guidelines and best practices for all energy and mineral sectors, which are of particular importance for the management of expanding demand of bioenergy, geothermal energy, solar energy, wind energy and hydropower resources.

To help the application of UNFC uniformly worldwide, guidelines on requirements for the competency of the personnel are included in the system. UNFC provides case studies and implementation examples, not only to improve the consistencies in the usage but also to enhance the system through innovative applications.

Benefits of using UNFC

- Structured framework of principles, rules and guidelines
- Aligned to major international and national classification systems
- Provides simplicity without sacrificing complete necessary flexibility
- Leverages global communications
- Numerical and language independent coding scheme

¹⁵ Source: <https://www.unece.org/energy/welcome/areas-of-work/unfc-and-resource-management/about-unfc-and-sustainable-resource-management.html>

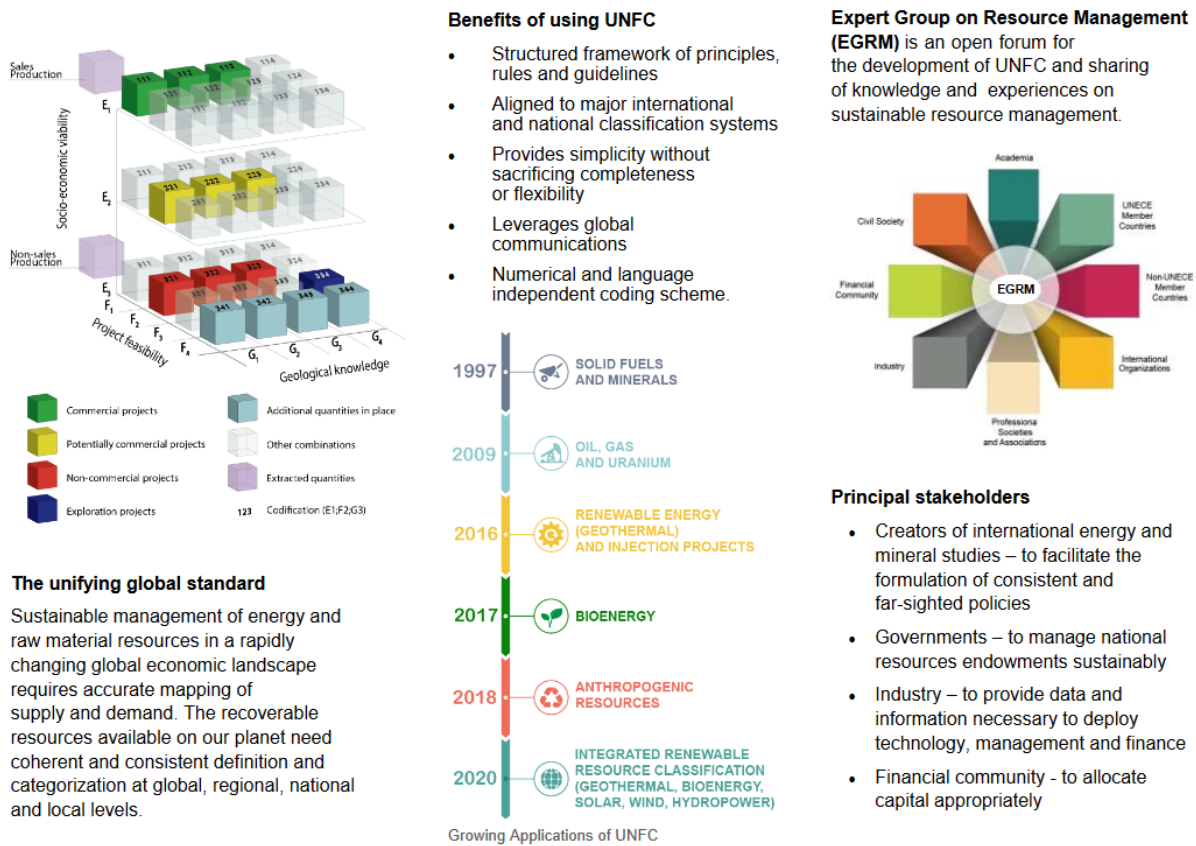


Figure 6: Short description of the UNFC.¹⁶

The UNFC classification is based on a generic, principle-based system, in which quantities are classified on the basis of the three fundamental criteria; economic and social viability (E), field project status and feasibility (F), and geological knowledge (G), using a numerical and language independent coding scheme. Combinations of these criteria create a three-dimensional system (Fig. 6).

The **E axis** shows the socio-economic sustainability and evaluates the favourability of social and economic conditions in establishing the commercial viability of the project, including consideration of market prices, legal, regulatory, environmental and contractual conditions.

The **F axis** shows the progress of the feasibility study for exploration or mine development, the maturity of studies and additional work required to implement mining plans or development projects. They range from early exploration through to advanced exploration, mine development, production and sales of the final product (i.e., gold, copper, etc.). The F axis reflects standard project stages and management principles.

The **G axis** is based on the confidence in the geological knowledge and potential recoverability of the quantities. The categories and sub-categories are the building blocks of the system, and are combined in the form of “classes”.

¹⁶ From: <https://www.unece.org/fileadmin/DAM/energy/unfc/home-page/UNFC-poster/download.pdf>

UNRMS - United Nations Resource Management System¹⁷

Definition

Resource management system – the core concepts

An ideal resource management system should be able to identify all developed and undeveloped projects and their maturity towards operation and production of the desired outputs (Tulsidas et al., 2019). It should be able to identify the key attributes of the social, environmental and economic viability of each project (Fig. 7).

Such a system should also be able to identify how the projects connect to the sustainable development programme, be it at a facility, company, national or regional levels. The system should make the linkage of a company vision, and the project attributes visible. The same is true for national or regional policies and priorities and nodes that connect to a large number of projects. The 2030 Agenda is a good example. How a project relates to the SDGs is not just restricted to a few measures such as fuel efficiency or emissions control but needs to be firmly linked to all the 169 targets.

The system should be capable of quantifying or describing the performance of the project for each of the key attributes qualitatively. It should provide standards and guidance to the project implementors on key aspects of good governance, such as:

- Core Competencies and capabilities
- Implementation (including local content)
- Innovation to overcome challenges
- Zero waste
- Zero harm
- Estimation of volumes and forecasts
- Documentation
- Analysis of results.

UNRMS looks to aid in replotting the economics of resource management in a balanced and equitable manner, grounded in the UN System of Environmental-Economic Accounting (SEEA) which is in turn firmly grounded in Nash's economic theory.

The SEEA Central Framework is an international statistical standard for measuring the environment and its relationship with the economy. The Central Framework covers measurement in three main areas:

¹⁷ See: United Nations Resource Management System Concept Note: Objectives, requirements, outline and way forward;
https://www.unece.org/fileadmin/DAM/energy/se/pdfs/egrm/egrm11_apr2020/ECE_ENERGY_GE.3_2020_4.pdf

- (a) ***Environmental flows.*** The flows of natural inputs, products and residuals between the environment and the economy, and within the economy, both in physical and monetary terms.
- (b) ***Stocks of environmental assets.*** The stocks of individual assets, such as water or energy assets, and how they change over an accounting period due to economic activity and natural processes, both in physical and monetary terms.
- (c) ***Economic activity related to the environment.*** Monetary flows associated with economic activities related to the environment, including spending on environmental protection and resource management, and the production of 'environmental goods and services.

The first step in the direction of integrating SEEA principles within UNRMS has been taken by UNFC itself through it not only classifying multiple resources but also secondary as well as primary resources. Once taken, that step leads naturally to managing these resources and resource combinations in a balanced and integrated matter within UNRMS. UNRMS, for example, can encompass polymetallic deposits such as those containing copper, gold, silver and uranium, but also whole energetic basins containing co-located solid, liquid and gaseous resources.

In summary, an ideal resource management system is all about project management, not an assessment of volumes or quantities, and discerning the links to the sustainable development programme.

United Nations Resource Management System



- Overarching SDG framework
- With reworked United Nations Framework Classification for Resources (UNFC) as the core
- Long-term policy making and planning
- Shorter-term actions - make resource projects competitive through innovative approaches
- Efficient financial capital allocation
- Reduce environmental burden, carbon foot-print
- Increase collaboration globally

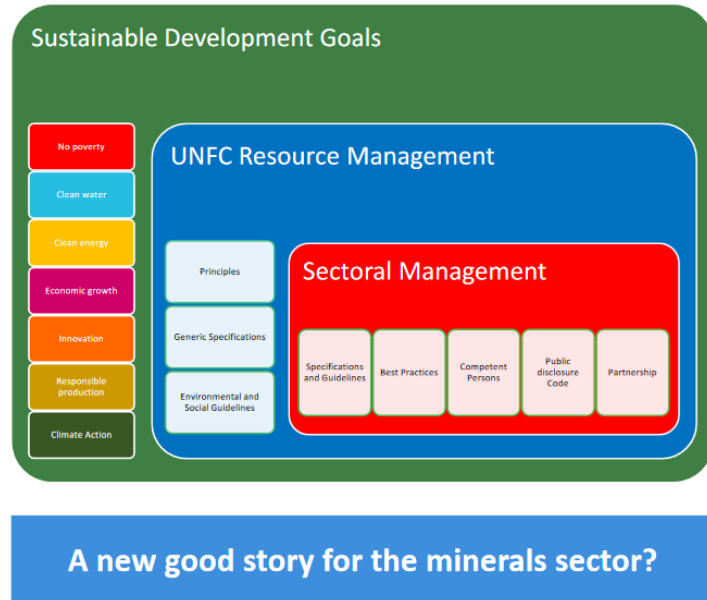


Figure 7: Short description of the UNRMS.¹⁸

Progress towards sustainable resource management and the circular economy

Mining projects can affect the well-being of the affected population and significantly reduce the quality of life. One example is the resettlement of entire villages for large open-cast mining projects. More and more frequently, affected residents are resisting mining in the immediate vicinity of their homes. The acceptance of mining projects has also decreased considerably due to the increase in environmental awareness. This increasing environmental awareness and the resulting non-acceptance to mining projects among parts of the population made it necessary to modify and expand the existing resource and reserve standards that have been used in industry until now. The world cannot stop mining raw materials, because - to express it bluntly - everybody wants to go back to nature, but nobody wants to walk. The world needs fuels, raw materials for cars, planes, ships etc. (traditional and electric), all raw materials for buildings and infrastructure, for communications and all other parts of our normal life. Since the world cannot do without mining, the changed views on environmental sustainability and consensus with the local population must be incorporated into the evaluation criteria of mining projects in order to continue to guarantee the world's supply of raw materials.

In contrast, the old GKZ standard of the socialist countries considered only the securing of the raw material supply of the socialist state economies without determining modifying factors. Economic

¹⁸ From: https://www.igfmining.org/wp-content/uploads/2018/11/Session-18_-_UN-tools_-_2.pdf

and social factors were not or hardly considered here. The only important factors were how much material is in the deposit and how much can be extracted.

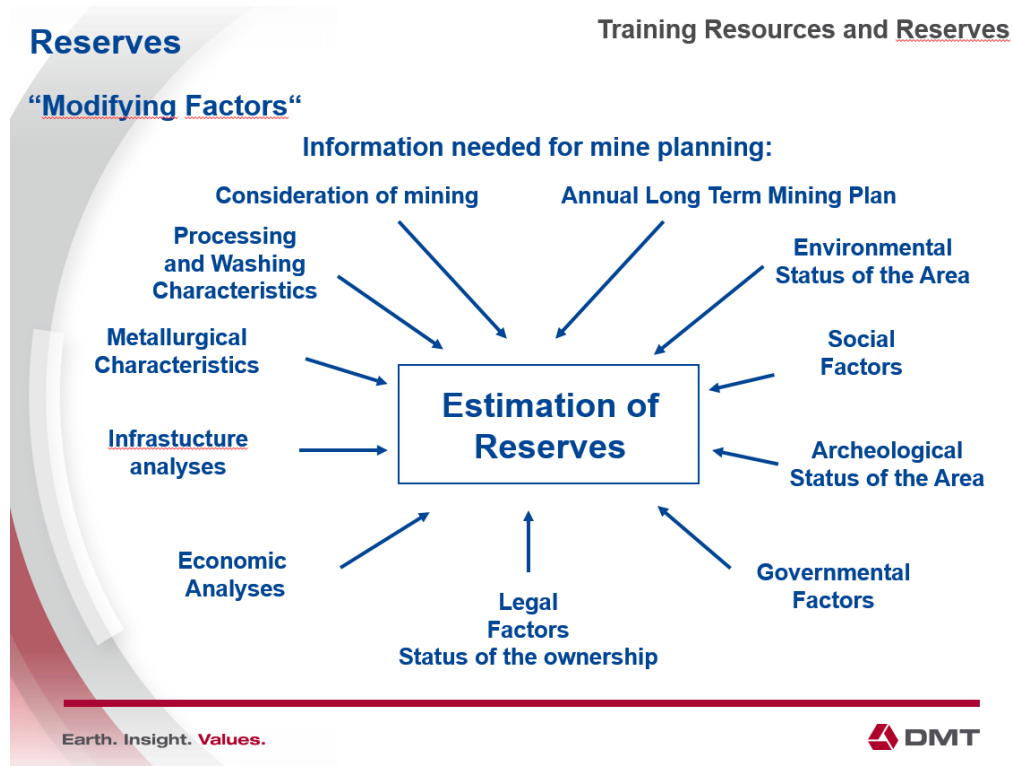


Figure 8: Modifying Factors that affect mining projects (DMT, 2018).

The standard procedures of raw material certification of the western world such as JORC, PERC, NI 43-101, etc. focus on geological and economic parameters to evaluate a raw material project. Other aspects are listed under the summary "modifying factors" and are considered when resources are converted to reserves. These "modifying factors" contain all factors which must be considered to make a mining project feasible and economically successful (Fig. 8). Here in the "modifying factors" environmental, social and legal factors were focused.

Raw materials are divided into Primary and Secondary Resources. Primary resources (Primary Mineral Resources – PMR) include all kinds of unused ores, concentrates, processed or refined materials which are produced from mines, processing plants, oil rigs etc. Secondary Resources (Secondary Mineral Resources – SMR) includes all kinds of recycled materials from recycling plants, waste dumps and landfills.

The UNFC standard started 1997 with same intentions to estimate resources and reserves of solid fuels and minerals. Over the last 23 years, the UNFC standard has been continuously developed and now covers almost every commodity in raw material extraction and energy production:

Growing applications of UNFC

1997 - solid fuels and minerals

2009 – oil, gas and uranium

2016 – renewable energy (geothermal) and injection projects

2017 – bioenergy

2018 – anthropogenic resources

2020 – integrated renewable resource classification (geothermal, bioenergy, solar, wind and hydropower).

The approach to develop a resource estimate for all types of raw material and energy supply was a significant step forward in the assessment of raw material reserves under consideration of environmental, social and socio-economic standards.

Example:

Certification of Raw Materials - CERA

Almost in parallel, a similar project has also been launched in the EU, which aims to combine the estimation of raw material resources and reserves with a proof of origin along the value chain - the Certification of Raw Material Project (CERA4in1).

The CERA4in1 project has been in development since 2015, initially within DMT GmbH & Co. KG, an international independent engineering and consulting company headquartered in Germany, before a formal project consortium was formed in 2017 comprising an interdisciplinary team and with the support of leading experts in sustainability and certification. This project is partly funded by EIT RawMaterials/EU and will be the first certification scheme that ensures an universal and standardized evaluation of environmental, social and economic sustainability of mineral raw materials and its specific conditions along the whole value chain from greenfield to consumer worldwide. Moreover, it guarantees the chain of custody of certified materials by using an appropriate combination of different traceability methods such as distributed ledger technology and analytical proof of origin. The CERA4in1 system consists of four consecutive standards, each of which focuses on different areas of the value chain and is thus optimised for each value chain actor. It guarantees maximum credibility through the independence of its developing consortium and public consultations during the development phase. Its governance body has a Not-for-profit structure and auditing processes as well as consultancy work within the CERA4in1 certification system are carried out by independent third parties. Interests and recommendations of stakeholders are taken into account to ensure a comprehensive and well-balanced set of standards criteria. CERA4in1 aims to integrate and accept established standards, allowing for synergies and harmonization within the existing standards world and reduced workload for organizations aiming for certification. Furthermore, it aims to be aligned with well-recognized regulations and standards in order to counteract the fragmentation of the standard market.

For more information see CERA website.¹⁹

¹⁹ CERA: <https://www.cera-standard.org/>

COVID-19 and certification of deposits

The COVID-19 pandemic will not have a major impact on the certification of deposits. It is to be expected that there will be delays, as in most countries site visits are not possible, which are required for certification according to standards like JORC, UNFC, PERC etc. Two weeks of quarantine should be mentioned here, which could await a returning colleague in his country after a site visit in regions at risk.

Until now, the global players like Volkswagen, Anglo-American, Bayer, Siemens etc. will not change their certification procedures to save money after the COVID-19 pandemic.

Chapter 2

Opportunities for MSMEs in CRM supply

2. A brief overview of opportunities for MSMEs in critical raw material supply

- ✚ The industry needs CRMs from primary deposits because recycling of many CRMs is only partially or not possible.
- ✚ The supply of CRMs from primary deposits is in the hands of a few countries, such as China.
- ✚ The further development of any future technology is not feasible without access to CRMs. Without access to CRMs, there will be no progress in the field of communication, the further development of electric vehicles, renewable energies and national defence.
- ✚ The pandemic will temporarily stop or reduce primary production in the supplier countries through country-specific look downs. Therefore, production in importing countries will be cut back for the same reasons. There will, therefore, be temporary reductions in both supply and demand.
- ✚ The pandemic has shown the world how vulnerable supply chains are in the globalised world. The pandemic will change these supply chains and their future organisation.

a. Primary and secondary resources of CRM

The following account modified after EC - (2018) provide the gist of EU's CRM strategy.

Raw materials are essential for the production of a wide range of everyday goods and applications. They are inextricably linked to all industries across all stages of the supply chain. They are crucial for a strong industrial base in the global economy, an essential building block for the growth and competitiveness of the industrialised countries. Accelerating technological innovation cycles and the rapid growth of emerging markets have led to a steady increase in demand for these sought-after metals and minerals. Future global resource consumption could double between 2010 and 2030.

In 2008, the EU Commission launched the European Raw Materials Initiative in response to the growing concern about securing valuable raw materials for the economy of the European Union. It is an integrated strategy that sets out tarred measures to secure and improve access to raw materials for the EU. One of the priority actions of the initiative was the establishment of a list of critical raw materials (CRMs) at EU level.

CRMs are particularly crucial for high-tech products, and emerging innovations - technological progress and quality of life depend on access to a growing number of raw materials. For example,

a smartphone can contain up to 50 different metals, all of which have different properties such as lightweight and user-friendly small size. CRMs are irreplaceable in solar panels, wind turbines, electric vehicles and energy-efficient lighting. Likewise, the defence capability of industrialised countries is directly dependent on access to CRM. Night vision devices, communication technology, stealth for aeroplanes, gyrocompasses for guided weapons etc. are directly dependent on access to REE and CRMs. The production of low-carbon technologies - necessary for the EU to meet its climate and energy objectives - is expected to increase demand for certain raw materials by a factor of 20 by 2035.

The list of CRMs includes raw materials that meet or exceed thresholds for both economic importance and supply risk. The EU - Commission established the first list in 2011 and committed itself to update it at least every three years to reflect market, production and technological developments. The first evaluation carried out in 2011, identified 14 CRMs out of the 41 evaluated non-energy, non-agricultural raw materials. In the 2014 evaluation, 20 raw materials out of the 54 evaluated materials were identified as critical.

In the 2017 re-evaluation, 27 CRMs were identified using a revised methodology for an evaluation of 61 raw materials (consisting of 58 individual and 3 group materials, a total of 78 individual materials) (Tab. 5). Considering the minimal supply of CRMs from secondary sources¹⁴ (see Figures 9 and 10), the need for access to primary sources is huge and crucial for the wealth – and even the survival – of European industries and their associated jobs and economic benefits.

The supply of PMR for the industry is essential as not all CRMs can be recovered as SMRs through recycling technologies. Several CRMs have a high technical and real economic recycling potential, and despite the encouragement from governments to move towards a circular economy, the recycling input rate (a measure of the share of secondary sources in raw material supply) of CRMs is generally low (see Fig. 10).

Table 5: List of critical raw materials to the EU 2017 (EC, 2017a). HREEs = heavy rare earth elements, LREEs = light rare earth elements, PGMs = platinum group metals.

Critical raw materials			
Antimony	Fluorspar	LREEs	Phosphorus
<u>Baryte</u>	Gallium	Magnesium	Scandium
Beryllium	Germanium	Natural graphite	Silicon metal
Bismuth	Hafnium	Natural rubber	Tantalum
Borate	Helium	Niobium	Tungsten
Cobalt	HREEs	PGMs	Vanadium
Coking coal	Indium	Phosphate rock	

This can be explained by several factors: sorting and recycling technologies for many CRMs are not available yet at competitive costs; the supply of many CRMs is currently locked up in long-life assets, hence implying delays between manufacturing and scrapping which negatively influences present recycling input rates; demand for many CRMs is growing in various sectors, and the contribution from recycling is largely insufficient to meet the demand.

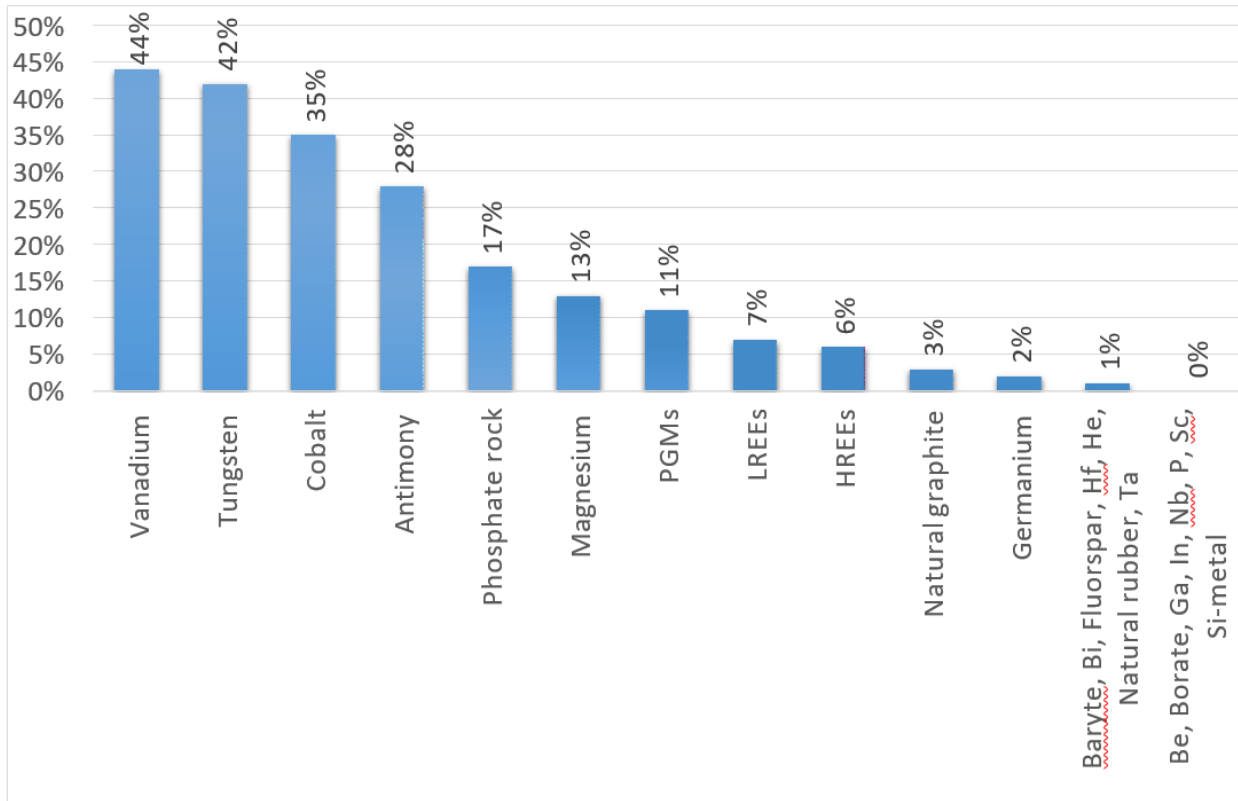
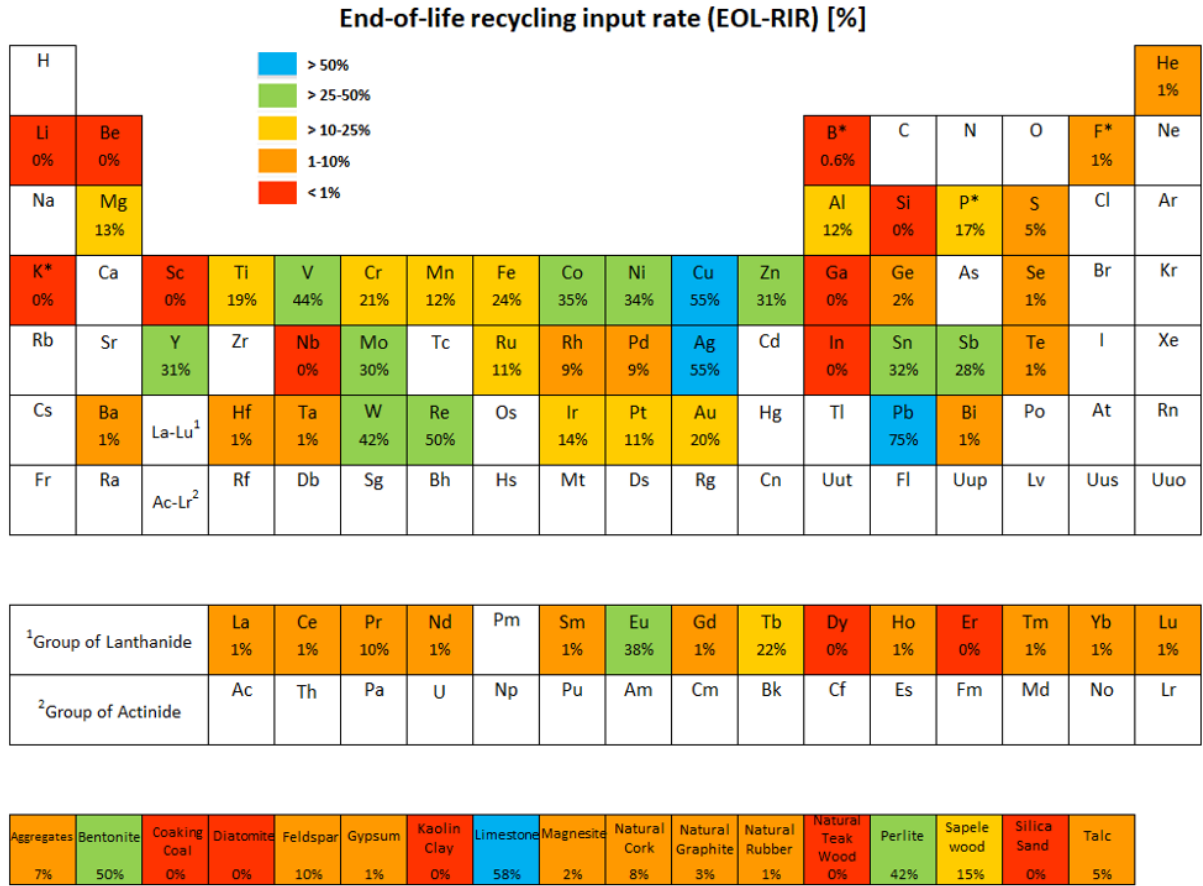


Figure 9: Current contribution of recycling to meet EU demand of CRMs: end-of-life recycling input rate (EOL-RIR). Source: JRC elaboration based on (Deloitte Sustainability, 2015) and (Deloitte Sustainability et al., 2017).

Fig. 9 presents the contribution of recycled materials to materials demand for a number of raw materials. It shows that even for materials for which overall recycling rates are relatively high, recycling's contribution to meeting materials demand is relatively low. This is because demand is higher than what can be met by recycling. In other cases, functional recycling is not economically feasible.

In summary, the circular use of CRM depends on many parameters. It should be noted that circularity is very much influenced by the sectors in which CRMs are used: The demand and the duration of the use of CRMs strictly depend on the products containing them, the recycling rates usually depend on the type of end-of-life products containing the CRMs. Critical is that the “rare” CRM like REE etc. is nearly not possible to win back from recycling procedures (Fig. 10). Thus, access to PMRs remains essential for the supply of the industry.



* F = Fluorspar; P = Phosphate rock; K = Potash, Si = Silicon metal, B=Borates.

Figure 10: Current contribution of recycling to meet EU demand of CRMs: end-of-life recycling input rate (EOL-RIR) – the periodic table. Source: JRC elaboration based on (Deloitte Sustainability, 2015) and (Deloitte Sustainability et al., 2017).

A further problem with the supply of PMR is the availability of primary resources in the industrialised countries (Fig. 11). The western industry is dominated by the manufacturing industry (i.e. the production of end products and applications) and also by the refining industry (metallurgy, etc.), compared to the extractive industry (mining and beams). The value chain of CRMs is not fully and homogeneously covered by European industry. There is a marked imbalance between the upstream stages (extraction/harvesting) and the downstream stages (production and use). Given the very limited supply of CRMs from secondary sources (see Figs. 9 and 10), the need for access to primary sources, including ores, concentrates, processed or refined materials, is enormous and crucial for the prosperity - and even survival - of Western and European industries and the jobs and economic benefits that go with it. Most of these primary raw materials are produced and supplied from non-European countries (EC, 2018).

Although China is also the main supplier of CRMs to the EU, the analysis highlights several other countries that account for important shares of EU supply of certain CRMs, such as the US (beryllium and helium), Russia (cobalt and scandium) and Mexico (fluorspar and tungsten). The

revised methodology takes into account the actual procurement in the EU and therefore provides a more realistic picture of the European raw material supply (EC, 2018).

For many CRMs, the upstream stages of the value chain are not present in the EU: Antimony, beryllium, borates, magnesium, niobium, PGMs, phosphorus, rare earths, scandium, tantalum and vanadium. This is due either to the absence of these materials in European soil or to economic and social factors which have a negative impact on exploration (for the discovery and characterization of deposits, the estimation of resources and reserves) or mining (closure of existing mines, reluctance to open new mines, etc.). In addition to abiotic raw materials, natural rubber is also grown and harvested entirely outside the EU (EC, 2018).

To gain access to these primary CRMs, the EU currently has no choice but to import the ores and concentrates or the refined materials from other countries to supply its industries and markets. Hafnium is the only CRM for which an EU Member State (France) is the primary producer worldwide. For hafnium and indium, Member States shall produce sufficient primary material to avoid significant imports from outside Europe.

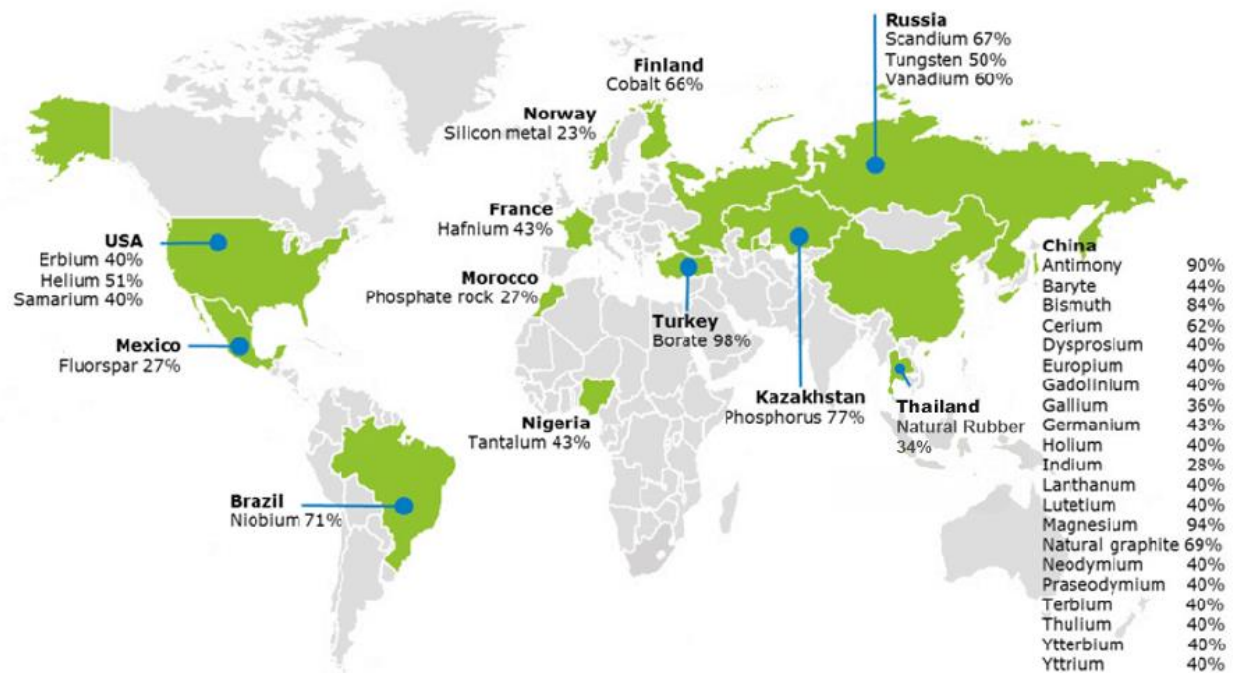


Figure 11: Contribution of primary global suppliers of critical raw materials, average from 2010-2014, modified from EC (2018).

Example situation inside the EU

Modified after EC (2018)

Mining Industry – Producer and Consumer of PMRs

Extractive industries provide mineral raw materials that are essential to the downstream industries and economic sectors. Extractive industries provide, first of all, primary (critical) raw materials. In addition, mining waste provides a (potential) source of secondary (critical) raw materials.

The inventory of the primary CRM deposits in the EU has been gradually built up in the Framework Program 7 projects Promin and Minerals4EU and also in the new Horizon 2020 ERA-NET GeoERA60 driven by European geological surveys. The production data of 63 mineral commodities from 168 countries are annually published by the Austrian Federal Ministry of Science, Research and Economy in the publication “World Mining Data” with quality of data indication.

As regards secondary CRMs extracted or extractable from mining waste, at present, there is no detailed database at EU or Member State level although recent EU-funded projects are addressing this lack of comprehensive data and information.

The mining industry is highly technical and consumes CRMs in the form of electrical and electronic control equipment, transport, support and mining machinery, electronic surveying equipment and health and safety equipment.

Example situation inside the EU searching for PMR's

EIT RawMaterials project of the EU²⁰

EIT RawMaterials project of the EU is summarized in this section.

EIT RawMaterials unites more than 120 core and associate partners and 180+ project partners from leading industry, universities and research institutions from more than 20 EU countries. Partners of EIT RawMaterials are active across the entire raw materials value chain; from exploration, mining and mineral processing to substitution, recycling and circular economy. They collaborate on finding new, innovative solutions to secure the supplies and improve the raw materials sector in Europe.

Exploration and Raw material resource assessment

A sustainable supply of raw materials is vital for Europe's future. However, Europe faces difficulties in securing raw materials due to a high reliance on imports, increasing demand and decreasing quality and decreasing availability of resources. Exploration activities are the initial step in the raw materials value chain. The industry faces an increasing number of challenges, such as the need for deeper exploration, the need for exploration undercover, the need to increase efficiency in terms of cost and resources, and the need for exploration in more challenging environments. At the same time, the industry needs access to highly-skilled, entrepreneurial

²⁰ Adapted from: <https://eitrawmaterials.eu/innovation-themes>

exploration professionals and must promote a better understanding and acceptance of the exploration industry within the broader society.

To meet these challenges, and to secure sustainable, efficient and successful exploration for the future, Europe needs new exploration technologies, innovative research and advances in education. EIT RawMaterials will facilitate all of this through bridging and synergies of knowledge from industry, research and education.

Mining in challenging environments

Throughout its existence, humanity has depended on the earth for its survival. The surface provides water, crops, fruits, grazing for livestock and more, but below the surface, there is a diverse quantity of raw materials that are vital for today's modern-day living and that we need to use sustainably without jeopardizing supplies for future generations. Europe faces significant challenges in securing raw materials in a sustainable way due to high reliance on imports, increasing consumption and decreasing quality and availability of resources.

Mining activities form the initial part of the raw material value-chain. Mining in Europe needs more generous support to secure and sustain this vital part of the value chain. The industry is facing surmounting challenges today, such as deeper mining, social license to operate, access to land, higher production rates, but at a lower cost and more challenging environments, both underground and on the surface. At the same time, the industry needs access to a new, highly skilled generation of entrepreneurial mining professionals and a better wider-society understanding and acceptance of the whole industry.

To meet these challenges, new innovative mining technologies, research and education are required through bridging of business, research and education, to enable a sustainable, efficient and prosperous mining industry now and in the future.

Europe is the birthplace of modern exploration technologies and mining. Through its vision 'To develop raw materials into a major strength for Europe', EIT RawMaterials aims to build up Europe's mineral extraction industry, providing opportunities through the development of innovative, smart and efficient technologies, specialist higher education with an added focus on entrepreneurship, and integration of the entire raw material value chain.

Increased resource efficiency in mineral and metallurgical processes

Processing of primary and secondary resources is a vital link in the raw materials value chain. Improving, innovating and rethinking the processes and technologies involved can open up new business opportunities which are more efficient and have less of an environmental impact. New processes and technologies in processing can potentially reshape the idea of what a resource is and secure supplies of raw materials for the future. When it comes to processing, European industries and research institutions have both long-standing experience and an extensive knowledge base.

They provide state-of-the-art solutions for processing resources — solutions that are utilized across the globe.

However, these modern-day solutions face a number of challenges — fluctuations in resource quality, the introduction of new resources, increased safety demands, environmental impact, and increasingly rapid changes in demands and markets. At the same time, it is crucial to ensure an efficient transfer of knowledge within the skilled processing workforce so that it can be retained by newer generations. EIT RawMaterials has set out to meet these challenges by supporting and facilitating the improvement and creation of innovative processing methods and technologies. In turn, these will catalyse new business opportunities for the processing of both primary and secondary resources. Within EIT RawMaterials' unique and comprehensive community covering the entire raw materials value chain, such developments can be matched with needs and demands — both upstream in the mining and mineral exploration sectors as well as downstream in the recycling, substitution and circular economy sectors.

Substitution of critical and toxic materials in products for optimised performance

A key element of human nature is the ability to exploit and design materials to fulfil specific purposes. In our modern age, cost and optimised performance have been the key drivers to find substitutes for existing solutions. Scientists and engineers have learned to make use of almost every element in the periodic table to create ever more complex materials for specific applications. In recent years, awareness of the substitution of toxic and resource critical materials has grown.

An increasing number of biological compatibility studies have raised concerns regarding the use of certain specific kinds of material. Investigations into the resource criticality of materials, i.e. their economic importance, supply risk, and environmental footprint, have shown that there may be bottlenecks in materials supply, both for the production of current key technologies as well as the breakthrough of emerging ones. The shift towards renewable energies, e-mobility, and Industry 4.0 are examples of extensive innovation processes that trigger the need for new kinds of advanced materials. Substitution is an intervention into an industrial ecosystem that brings the excellent potential for new businesses and economic growth.

Within this context, EIT RawMaterials has identified substitution as a pillar of its strategy to turn raw materials into a major strength for Europe. The substitution of resource critical, toxic and low performing materials is considered at elemental, material, process, and system levels. The network supports innovation and business creation offering solutions and added value, particularly in the fields of sustainable mobility, energy, machinery, and ICT. The current portfolio encompasses projects on topics including energy storage, magnetic materials, hard materials, lightweight design, and materials and systems modelling. Innovative new services and business models that enable optimised use of raw materials are also supported. These activities harmonize with education projects to encourage future experts in substitution-related fields and to raise awareness across broader society.

Recycling and material chain optimisation of end-of-life products

Across the globe, primary raw material sources are depleting, while the amounts of industrial waste and end-of-life-products are rapidly increasing. These waste streams contain valuable raw materials that can be extracted to meet the growing demands of global industrial production and consumption.

Recycling will have to evolve from a side stream to a major pillar of raw materials supply if we want to protect our planet and make business sustainable, considering the materials needs of an exponentially growing world population. Currently, recycling rates of some base metals are higher than 50 per cent. However, a large number of crucial elements are almost completely lost in the value chain. This is particularly the case for less noble speciality metals used in functional materials, where production from primary resources often comes with large environmental footprints.

EIT RawMaterials supports innovation projects and new businesses that scale up and introduce new technological solutions to the market. These are aimed at improving both the amount and quality of raw materials recovered from secondary sources, that is, end-of-life products, industrial residues, tailings, and urban and landfill mining.

World-leading universities in the raw materials sector run related Master and PhD courses and students are involved in many upscaling projects. For example, the current portfolio includes projects to develop cost-efficient dismantling technologies, optimise material supply logistics, and turn industrial waste into specified starting materials for industrial production.

Design of products and services for the circular economy

The EU is home to world leaders in manufacturing, game-changing innovative technologies and an entrepreneurial infrastructure that can boost the transition to a resource-efficient and sustainable society as envisioned in the EU 2020 agenda. A sustainable supply of raw materials is vital, but the EU is highly dependent on imports of raw materials that are crucial for both this transition and for Europe's industrial activity.

In particular, supplies of a range of ores, metals and rubber are vulnerable. A circular economy could increase the efficiency of primary resource consumption both across Europe and the world. By conserving materials embodied in high-value products, or returning waste to the economy as high-quality secondary raw materials, a circular economy would reduce the demand for primary raw materials. In turn, this would help to reduce Europe's dependence on imports, reducing pressure on the procurement chains for many industrial sectors from the price volatility of international commodity markets and supply uncertainty due to scarcity and/or geopolitical factors.

The challenge for EIT RawMaterials is thus to fully utilize the potential of industrial symbiosis by applying a systemic perspective and revitalizing the human capital in the raw materials sector through two strategic objectives:

DESIGNING SOLUTIONS: At the concept stage, many key decisions are made which have significant and lasting consequences from a raw materials perspective. In terms of system design in the future, a systemic approach to materials innovation, products, product-service systems, processes and wider systems across the whole lifecycle is essential. EIT RawMaterials will use powerful multi-scale modelling and decision-making support tools based on big data to offer new opportunities for designing smarter solutions.

CLOSING MATERIAL LOOPS: A radical shift is required: from linear to circular thinking. End-of-life products must be considered as resources for another cycle, while losses and stocks of unused materials must be minimized all along the value chain. In addition, interactions between materials must be taken into account in order to define the best circular solution from a systemic standpoint. Awareness of the benefits of closing material loops must be raised amongst students, industry and society.

Example: PMR Deposits

EURARE Project: Primary Mineral resources REE in the EU and associated Countries

The EURARE project was co-funded by the European Commission (EC) and researched the Primary Mineral Resources REE in the EU and associated Countries from 2013 until 2017.

CRMs like REE in any form are also available outside China. Looking at the Chinese deposits and the deposits in the EU and associated countries such as Greenland, it is clear where the search will be successful. Most occurrences of CRMS are linked to the old continental shields, in Europe the Scandinavian Shield and in associated with the EU in the Greenland Shield (Fig. 12).

These Precambrian shields exist all over the world. Therefore, it can be assumed that there should be similar occurrences of REE all over the world. Numerous research projects dealing with European deposits are carried out within the EIT RawMaterials - e.g. REEBAUX (REE from Bauxite red muds).

Location of REE occurrences and deposits in Europe



This map shows all the individual examples of REE mineralisation in Europe that were identified by the EURARE project. Zoom in on the map and click on the individual points to identify them. An indication of the scale of the deposit is given on the basis of the following definitions:

1. **Resource:** REE mineralisation that has a formal resource estimate which is compliant with JORC or a similar code
2. **Deposit:** REE mineralisation for which the available evidence suggests that an economic resource could be identified with further exploration
3. **Occurrence:** REE mineralisation that appears to be localised and is not considered to be of economic interest on the basis of current evidence
4. **By-product:** REE mineralisation that may be economic as a by-product of extraction of other minerals.

These classifications may be subject to change as new evidence is gathered.

Key

- : alkaline igneous rocks
- : carbonatite
- : vein and skarn (hydrothermal)
- : iron oxide-apatite
- : granite and pegmatite
- : bauxite
- : placer
- : other

Figure 12: REE mineralization identified by EURARE.

Example situation inside the EU searching for SMR's

The following example provides an example for landfills as a source of SMR, adapted from EC (2018)

Landfills – Source of SMR

Landfills are waste disposal sites for the deposit of the waste onto or into the land (Directive 1999/31/EC). Controlled landfills are divided into three categories: landfills for hazardous waste, landfills for non-hazardous waste and landfills for inert waste. The quantity and the composition of waste in landfills across the European countries reflect differences in the economic structure, the consumption patterns and the different waste policies of member states. The number of active landfills in the EU has decreased in the last decades from the numbers of the late 1970s. Similarly, the average size of the landfills has increased notably. However, there are overall between 150,000 and 500,000 landfills in the EU, the majority of which are not active anymore, which could potentially represent a significant source of secondary materials and energy. Other estimations indicated that the total amount of landfills in Europe is most likely even bigger, 90 per cent of those being non-sanitary landfills predating the Landfill Directive in 1999 and essentially containing municipal solid waste (MSW). Only 20 per cent are landfills containing more specific industrial waste and residues.

Eurostat provides yearly statistics about the flows of MSW disposed of in landfills. These statistics show a trend of reduction of waste landfilled, moving from 144 Million tons in 1995 to 61 Million tons (- 58 per cent) of waste landfilled in 2015 by the EU-27, even though more waste is being generated over these years.

Landfills were and are used for a wide variety of waste, representing nowadays an accumulation of a large amount of very different materials, including CRMs. However, no systematic collection of data specific to CRMs ending up in landfills is carried out and, subsequently, no precise statistics are currently available. Only rough estimates of the flows and amount of CRMs ending up in landfills are presently possible, such as the one provided by the MSA study (Deloitte Sustainability, 2015), a comprehensive data inventory of the material flows in industry and society in the EU-28, through two parameters:

- The ‘Annual addition to stock in landfill’ that quantifies the amount of element that is annually added to landfill (in the EU), including the processing waste, the manufacturing waste, the products at the end of life and the recycling waste that are sent for disposal; and
- The ‘Stock in landfill’ that quantifies the amount of element in landfill (in the EU). For the calculation of the stock, one considers the amount of material accumulated in landfill over the last 20 years as a maximum level.

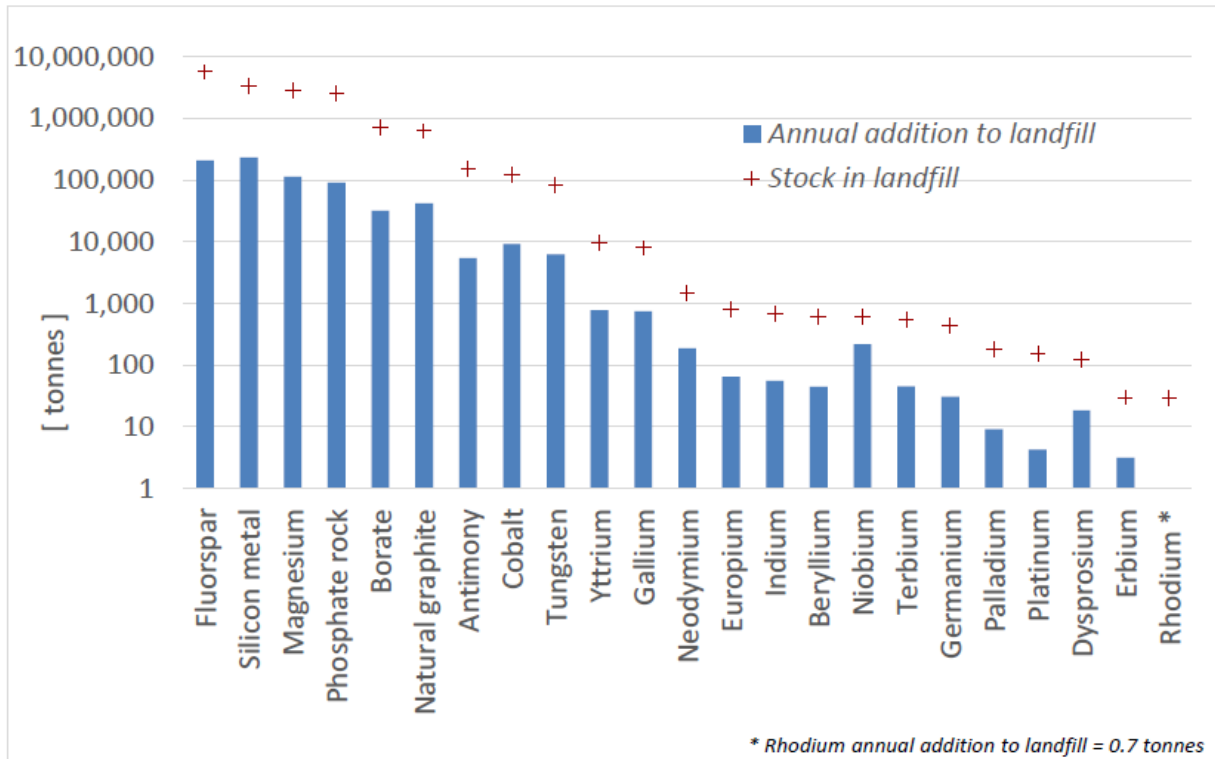


Figure 13: Amounts of some CRMs as 'Annual addition to stock in landfills in EU' and 'Stock in the landfill in EU'. Source: JRC elaboration based on 2015 MSA study (Deloitte Sustainability, 2015).

The estimated amounts of CRMs annually sent to landfills and the estimated accumulation in landfill over the last 20 years in the EU are plotted in Fig. 13. Quantities reported in Fig. 13 are indicative and are mostly derived from mass balances and expert assumptions. Moreover, CRMs accumulated in landfills have likely undergone chemical and physical changes for which their possible recovery must be carefully evaluated under several aspects.

The concentration of metal in mined ores is often less than 1 per cent, while in landfill their concentration can be as high as 20 per cent. It was estimated that 10 hectares MSW landfills might contain 188,000 t of steel and 10,000 t of aluminium (Cohen-Rosenthal, 2004). A recent study (Gutiérrez-Gutiérrez et al., 2015) provided a first estimate of the concentration of CRMs in British landfills operating between 1980 and 2011 and receiving MSW, commercial and industrial waste. This study also found that the concentration of overall CRMs in the landfills was about 380 mg/kg. If these concentrations were generalized to the EU-27 landfills between the years 1995-2014, the rough estimated total content of materials would be 470-520 thousand tons of REEs; and 340-370 thousand tons for other materials (Li, Ln, Sb, Co). More massive amounts could be available considering also the landfills operating before 1980, but no detailed data are available on their composition.

Example: SMR Deposits

REE from red mud

Rare Earth Elements (REE) are mined in many countries, but these raw materials are distributed very differently throughout the world. The de facto monopoly of the Chinese in REE production peaked in 2010 when China controlled more than 95 per cent of the world's REE production. In 2010, China produced 97 per cent of REE, India 2 per cent, Brazil 0.42 per cent and Malaysia 0.27 per cent. The remaining 0.31 per cent was produced by the rest of the world, i.e. the USA, Russia, the EU and others.

It has long been known that concentrations of REE are enriched in red mud produced by the Bayer process, in which the aluminium content is extracted from bauxite ore. Waste from the Bayer process (so-called red muds) is stored in tailings storage facilities, dumped into the sea or disposed of in some other way for decades. Now, these red muds can possibly be part of a solution to combat the Chinese monopoly. The Bayer process itself leads to a concentration of REE (Tab. 7). So far, it has been difficult to separate REE from red muds.

Table 6: Trace elements composition of karst bauxite of Greece, lateritic bauxite from Ghana and bauxite residue from AoG (Aluminium of Greece) from Vind (2018).

Element	Karst Bauxite Greece	Lateritic BauxiteGhana	Bauxite ResidueGreece, AoG
	ICP-MS (mg/kg)	INAA (mg/kg)	ICP-MS (mg/kg)
La	57 ± 7	19.1 ± 1.3	130 ± 1
Ce	206 ± 8	34 ± 1	480 ± 26
Pr	15 ± 1	n/a	29 ± 2
Nd	53 ± 6	13 ± 1	107 ± 0
Sm	9.8 ± 1.0	2.0 ± 0.2	19.4 ± 0.2
Eu	2.4 ± 0.9	0.8 ± 0.2	4.6 ± 1.1
Gd	10.6 ± 0.6	n/a	22.0 ± 0.3
Tb	2.3 ± 0.5	<0.5	3.3 ± 0.0
Dy	9.8 ± 0.3	n/a	20.1 ± 0.1
Ho	2.1 ± 0.1	n/a	4.1 ± 0.1
Er	7.2 ± 0.8	n/a	13.3 ± 0.3
Tm	<2	n/a	<2
Yb	7.0 ± 0.4	2.5 ± 0.3	13.8 ± 0.3
Lu	<2	0.4 ± 0.0	2.2 ± 0.0
Y	48 ± 2	n/a	108 ± 2
Nb	55 ± 9	n/a	100 ± 1
Th	51 ± 2	22.7 ± 2.3	105 ± 2
ΣLn ¹	382.3		854.4
ΣREE ²	430.6		962.5

¹ Sum of lanthanides; ² Sum of lanthanides and yttrium.

The latest research in Greece seems to have succeeded in this separation. The Laboratory of Metallurgy, School of Mining and Metallurgical Engineering of the National Technical University

of Athens (NTUA) published together with Aluminium of Greece the successful separation of REE from Greek Karst bauxite. Davris et al. (2018) describe in their publication “Developing New Process for Selective Extraction of Rare Earth Elements from Bauxite Residue Based on Functionalized Ionic Liquids” the processing of the REE from bauxite residues. According to information from the authors, the separation of the REE succeeded in the laboratory and a small test plant. An industrial test plant at the aluminium plant of the company MYTILINEOS Aluminium of Greece is in preparation.

Abstract from the paper Davris et al. (2018)

Ionic liquids (IL's) are versatile solvents consisting solely of ions and can be utilized to dissolve selectively rare earth elements (REE) from bauxite residues. The leaching process that developed is based on the hydrophobic ionic liquid betainium bis (trifluoro methylsulfonyl)imide [Hbet] [Tf₂N] and other similar ionic liquid derivatives. Leaching bauxite residue with HbetTf₂N selectively dissolves REE (>70 per cent) against Fe, Al, Ti and Si generating a solid residue to be utilized in cement or iron industry. Scandium appear to have different leaching behaviour from the rest REE with maximum 45 per cent recovery upon leaching, whereas Ca and Na almost totally dissolved.

The metals dissolve in HbetTf₂N leachate, are stripped with an aqueous acidic solution whereas hydrophobic HbetTf₂N is regenerated for reuse. During stripping and upon pH adjustment a preconcentrated Sc solution with less impurities is generated. The proposed IL process provides selectivity, recyclability of the leaching agent and more efficient acid input in the process.

b. Applications in key sectors

CRMs are used and needed in almost all industrial productions. In the context of this study, only the key sectors are presented here (Fig. 14).

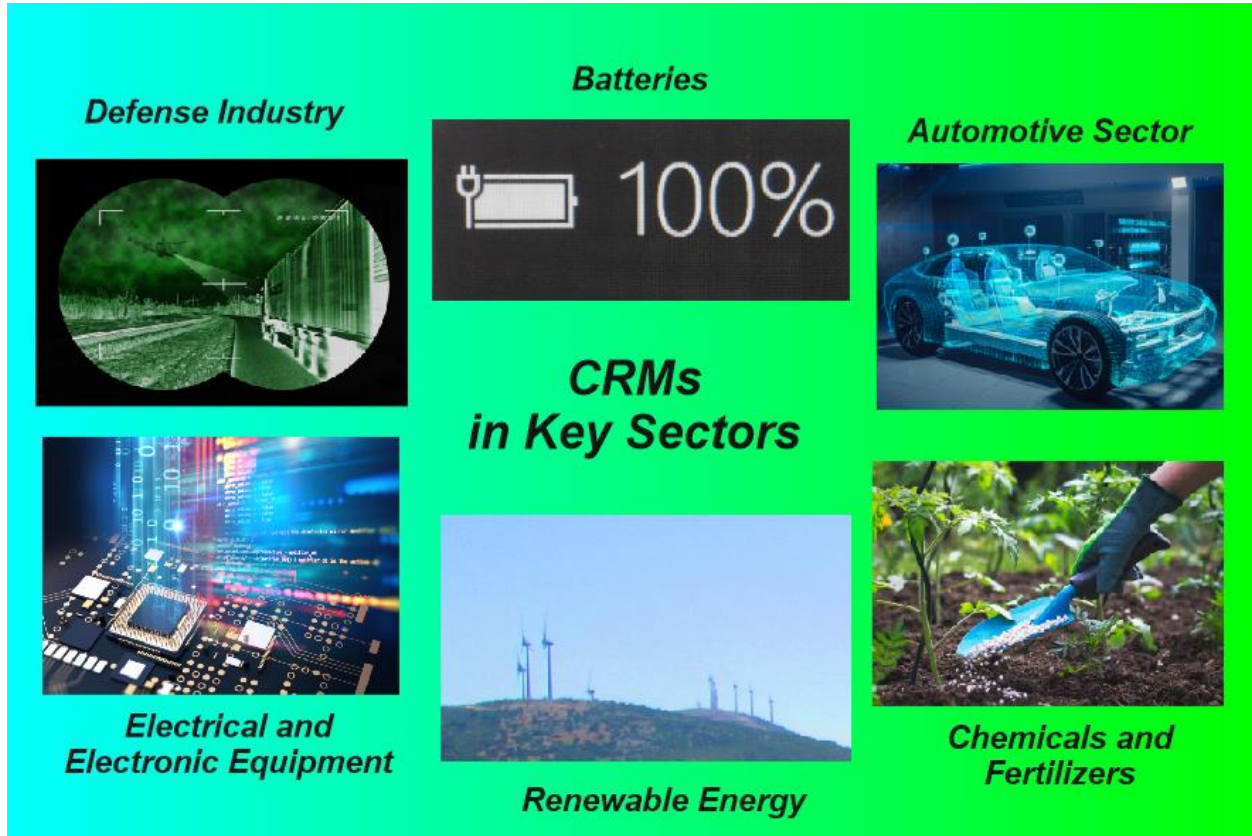


Figure 14: CRMs in key sectors.

The following sections, modified after EC (2018) provides an overview of the application of CRMs.

Electrical and Electronic Equipment

The electrical and electronic equipment (EEE) sector depends on a variety of CRMs including antimony, beryllium, cobalt, germanium, indium, platinum group metals (PGMs), natural graphite, rare earth elements (REEs), silicon metal, and tungsten.

For example, gallium finds widespread use in integrated circuits and light-emitting diodes (LEDs) for lighting. Other important product application associated with the EEE sector includes, e.g., magnets, flat-screen displays, and optical fibres. The EEE sectors are the major users of gallium (95 per cent of the element is used in the EEE sectors), germanium (87 per cent), indium (81 per cent), and several REEs (e.g., used in lighting applications).

Some flows of CRMs reach EEE indirectly, and these flows are not always captured by statistics. For example, 52 per cent of the overall flow of antimony is used to produce flame retardant for plastics, afterwards used to manufacture EEE. Additional information of these flows is necessary to capture the final uses of CRMs.

Batteries

This section also covers, to a certain extent battery used in the automotive sector.

There are three types of batteries: portable, industrial and automotive batteries. In the last decades, new battery chemistries have appeared on the market due to the development of new applications (e.g. electric vehicles, e-bikes). Depending on the battery chemistry, the main CRMs embedded in waste batteries are antimony, cobalt, natural graphite, indium and some rare earth elements. Antimony is mainly used for lead-acid batteries, and its use has declined due to new battery technologies. In contrast, in recent years, the battery market has seen a relative increase in the amount of cobalt: from 25 per cent of global end uses of cobalt in 2005 to 44 per cent in 2015. This is mainly related to specific Li-ion chemistries (e.g. Li-NMC suitable for new applications). Concerning natural graphite, almost 10 per cent of worldwide uses of graphite in 2010 was for the batteries sector. In fact, graphite is widely used in several rechargeables and non-rechargeable batteries (both portable and industrial) as an anode, for example in the quickly growing Li-ion battery market. From 2010 to 2017, alkaline batteries accounted for about 5 per cent of indium consumption. Finally, among rare earth elements, 10 per cent of the worldwide lanthanum and 6 per cent of cerium are used for NiMH batteries.

Actual collection rates of waste batteries depend on the battery technology/type (e.g. rechargeable/non-rechargeable batteries, Lithium/Ni-Cd batteries), on the lifetime of batteries, and on the end-user behaviour. For automotive lead-acid batteries, the collection and the recycling rates are much higher than for other batteries.

Automotive sector

In the automotive sector, including conventional (combustion engine vehicles), hybrid (HEVs) and electric vehicles (EVs), several vehicle components contain CRMs. Some examples are graphite (in brake linings, exhaust systems, motors, clutch materials, gaskets and batteries), cobalt (in lithium-ion batteries especially for EVs), Platinum Group Metals (palladium, platinum and rhodium in auto-catalysts and particulate filters), niobium (as an alloying agent in high-strength steel and nickel alloys used in the body structure, engine system and structural components¹⁴⁹) and Rare Earth Elements (in permanent magnets, auto-catalysts, filters and additives).

About 14 per cent of worldwide uses of graphite in 2011 refer to automotive parts. In 2012, the share of EU demand of palladium for petrol engines was 69 per cent, 70 per cent of platinum was used for light-duty diesel engines, and 80 per cent rhodium for 3-way catalytic converters used to reduce tailpipe emissions from vehicles. With respect to niobium, in 2012, 44 per cent of the EU demand was intended to the automotive sector. Among the REEs, neodymium, praseodymium and to a lesser extent dysprosium and terbium are used in large high-performance neodymium-iron-

boron magnets for HEVs and EVs electric motors. These are also used in small electric motors and electronic sensors for the standard automotive industry including starter motors, brake systems, seat adjusters and car stereo speakers. Moreover, lanthanum and cerium are embedded for an example, in nickel-metal hydride (NiMH) batteries used in HEVs designs. Cerium is additionally used in auto-catalysts, which accounted for 35 per cent of consumption in 2013.

Although the internal combustion engine is likely to remain dominant in the short and medium-term, the market for HEVs and EVs is expected to experience significant and rapid growth over the coming decades. The CRMs embedded in vehicles are expected to increase proportionally. Cobalt, graphite, and rare earth employed in Li-ion batteries and electric motors are among the most targeted by increasing EVs demand (Fig. 15).

Lithium-ion is the reference technology for EV batteries. Many different Li-ion chemistries are currently available and are being tested to improve the performance and lower the battery costs. For example, in recent years Li-ion chemistries have shifted in favour of lower cobalt compositions. Natural graphite, in turn, is the reference anode material. In comparison to available alternatives, natural graphite had a market share of 64 per cent in 2014.

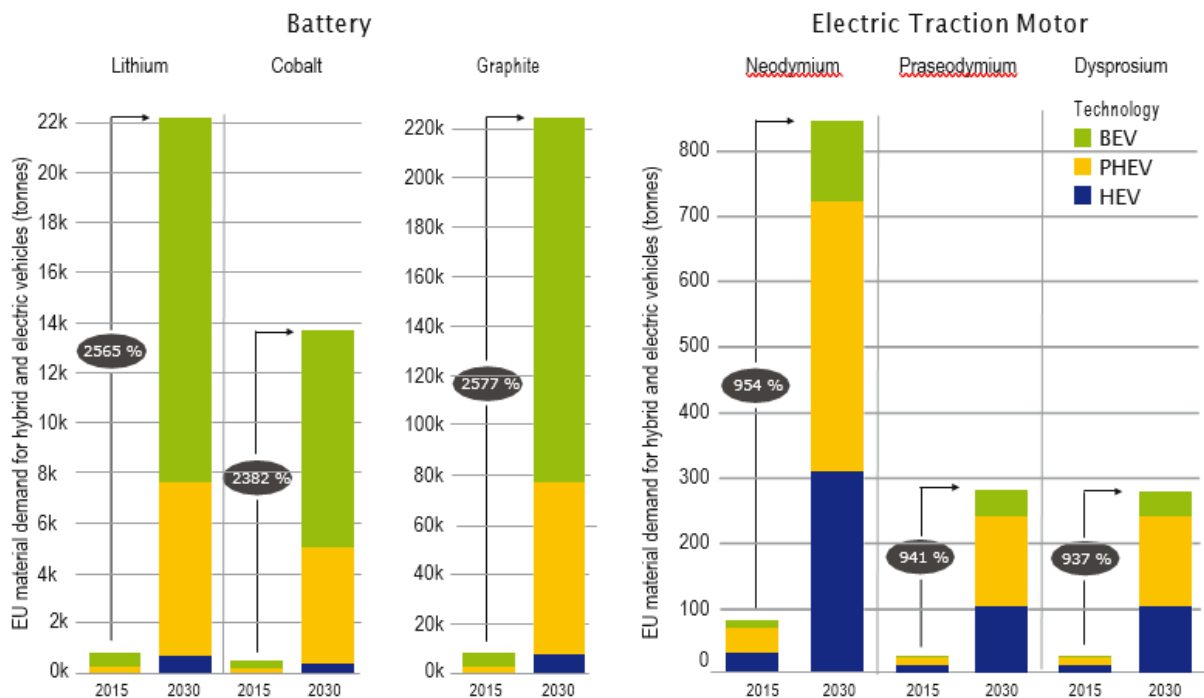


Figure 15: CRMs demand in the EU for the hybrid and electric vehicles segments (EC, 2018).

Levels attained by the EV market in the EU in 2015 created a demand for batteries of 510 t and 8330 t for cobalt and graphite, respectively. With regards to the rare earth for electric traction motors, in 2015, new EV's sold in the EU used about 50 t of neodymium, 16 t of praseodymium and 16 t of dysprosium while the demand for HEVs was around 33 t of neodymium, 11t of dysprosium and 11 t of praseodymium.

Given the recent introduction of EVs on the European market, and taking into account the average lifetime of EV components (estimated to be approximately 10 years), a significant number of EVs have not yet reached end-of-life. Large-scale recycling is not expected before 2020 and should only be more effective beyond 2025. Under current circumstances of low lithium and rare earth prices, high costs for technology largely untested at an industrial scale and the absence of substantial waste streams, the EU recycling infrastructure targeting EV batteries and electric motors is still weak.

Regarding the rare earth contained in electric traction motors, although the current level of recycling from permanent end-of-life magnets is still very limited¹⁶⁸, several studies estimate the potential level of recycling of REEs to be around 40 per cent in the next 20 years.

Renewable energy

Wind and PV energy technologies rely on a variety of materials including six CRMs, namely neodymium (Nd), praseodymium (Pr), dysprosium (Dy), indium (In), gallium (Ga), and silicon metal (Si). The EU demand for these materials will evolve in future depending on the deployment rates of wind and PV energy technologies and the technology mix. For instance, most of the wind turbines currently installed in the EU do not use permanent magnet generators and thus do not require rare earth. However, the situation can significantly change in the next 10-15 years due to sizing up of the wind energy: introduction of large and more efficient turbines, as well as more offshore wind power, may entail a higher use of permanent magnets. The projected evolution in the EU demand for the six CRMs. Big economies such as China and the USA have ambitious plans for clean energy deployment, even if they may not depend on the same extent as Europe on the offshore-based deployment of wind power using permanent magnets. EU manufacturers could thus face more competition for the same material supplies.

Several projects dedicated to permanent magnet recycling are either approved or underway in China. Currently, there is no recycling of these rare earth in the EU. Up to 2030, most of the wind turbines will still be in operation (assuming 30 years lifetime).

Recycling of Si, In, Ga from PV modules, alongside other raw materials such as glass, aluminium, copper and silver, has a high potential: more than 95 per cent is claimed as an economically feasible recycling rate. PV modules have a considerable lifetime - more than 25 years – meaning that this still young technology has generated little waste so far. Yet, the potential is enormous: between 2 and 8 Million tons of PV waste is estimated to be generated globally in 2030, increasing to 60-75 Million tons by 2050.

Defence industry

The defence industry depends on a variety of raw materials, which are necessary to build a large spectrum of key defence capabilities. Thirty-nine raw materials have been identified as “important” for production of high-performance processed and semi-finished materials (e.g. alloys, composites, etc.) needed for the manufacture of a large variety of defence-related components and subsystems.

The aeronautic and electronic defence sub-sectors are the primary users of CRM (and the most vulnerable to potential material supply constraints). Precise information on the type, composition and quantity of materials used in the European defence applications is limited mainly due to sensitivity reasons. Accurate information about the reuse of waste streams generated during the production of high-tech components for defence applications, management of the end-of-life military products and recycling of materials from these products is not readily available either. A short overview of CRMs in the US defence industry could be found in Table 6 (ClemSnide, 2019).

Overall, technological and economic barriers to recycle critical and scarce materials from defence industry could be expected. From an economic perspective, raw materials represent for some applications only a small fraction of the total value of the product (for example, the value of the materials contained in a jet engine may account for no more than up to 2 per cent of the engine cost). Even though an alloy which is recycled from the defence or civil applications contains valuable and high-priced CRMs, the separation into its constituents might not be cost-effective.

Table 7: Defence Use of REEs (ClemSnide, 2019).

Defense Uses of Rare Earth Elements	
Lanthanum	night-vision goggles
Neodymium	laser range-finders, guidance systems, communications
Europium	fluorescents and phosphors in lamps and monitors
Erbium	amplifiers in fiber-optic data transmission
Samarium	permanent magnets that are stable at high temperatures
Samarium	precision-guided weapons
Samarium	"white noise" production in stealth technology

Chemicals and fertilizers

The production of several chemicals and fertilizers relies on many CRMs, such as antimony; baryte; bismuth; borate; cobalt; fluorspar; hafnium; natural graphite; niobium; platinum-group metals (PGMs); phosphate rock; phosphorus; rare earth elements (REE); silicon metal; tantalum; tungsten; vanadium.

The main applications of CRMs in the chemical and fertilizers sectors include their use in the production of catalysts, fertilizers, polymers, pharmaceuticals and dyes. Examples include: 86 per cent of phosphate rock is used in the production of fertilizers; 90 per cent of white phosphorus is

used in the production of detergents and other chemicals; 60 per cent of bismuth is used in the manufacture of pharmaceuticals and other chemicals; and 54 per cent of silicon metal is used for making silicones and silicates (final applications in, e.g. shampoos, fixing materials and insulating materials).

Chemicals containing CRMs are produced for a broad variety of other sectors, e.g. 43 per cent of antimony is used in the production of flame-retardant chemicals, which are incorporated in polymers used mainly in the electric and electronic equipment sector.

According to the MSA study (2015), CRMs used in several chemical applications are lost to the environment due to dissipative use or to landfill. Examples of these losses include natural graphite used in lubricants, silicones used in different chemicals, tungsten used in the production of catalysts and a large percentage of borates and phosphates used in fertilizers.

For borates and phosphates, the sources of secondary materials are biogenic wastes (e.g. manure or other animal by-products, bio- and food wastes, wastewater), for which recycling is considered as functional because it replaces primary boron and phosphorus. The recycling of phosphorus-rich wastes can also help prevent water eutrophication.

C. Demand and supply

The study of Monnet and Ait Abderrahim (2018) analyses the needs of the entire CRM industry. MSMEs dealing with CRMs are part of this industry and therefore the analyses also apply to these companies.

Monnet and Ait Abderrahim (2018) analysed in their study the demand for the most important CRM for the future. Therefore, they also identify future supply. The study refers to four major points, and are summarized as follows:

- Analyse a series of applications covering the broadest part of future CRM requirements
- Identify a series of drivers affecting the future demand of CRMs in these applications
- Involve experts to validate these drivers and quantify the trends as much as possible
- Compile the drivers affecting the whole sector and highlight the most important.

They provide a synthesis of the trends per CRM for those involved in several applications. In the end, this study covered 12 applications involving 20 CRMs. 5 CRMs have been covered not for their primary applications (B, Ba, Hf, W, V) but because they are involved in the main application of other CRMs. As a result, the study covers a low share of their consumption. The coverage rate (percentage of current EU apparent consumption R1 covered in the study) for natural graphite is also low, but the reason is different: the applications involving this CRM are emerging and the future requirement for these applications are expected to exceed the total current consumption by 2035.

In the **energy sector**, the development of wind power (involving REE) and domestic energy storage (mainly cobalt and natural graphite) are expected to drive up the CRM requirements in the coming decades. On the contrary, the requirements related to the deployment of PV panels (mainly silicon, indium and gallium) should become less critical by 2035, mostly thanks to material efficiency. Important drivers to monitor in this sector include policies to reduce further CO₂ emissions, incentives for distributed power generation, power and storage requirements related to the deployment of EVs.

In the **transport sector**, the need to decarbonize mobility and reduce air pollution is closely tied to the emergence of hybrid and electric vehicles and the persistent dependence on autocatalysts for ICE vehicles. The deployment of EVs is expected to drive most of the growth of CRM requirements (mainly REE, cobalt and natural graphite) in this sector by 2035. The search for better performing materials to replace existing ones, especially in terms of weight and performance in extreme conditions (ceramics for jet engines, Al-based alloys for car bodies), should also impact the sector: Ta, Mg, Nb are the main CRMs concerned. Finally, the increasing demand for mobility, especially in emerging countries, and newer forms of mobility (MaaS), are not to be overlooked.

In the **sectors of telecoms and electronics**, the global expansion of digital networks and services implies that more people have access to the internet, thus fuelling the need for connected

equipment and fibre optics that Europe could produce and export. Therefore, the demand for CRMs in this sector should either level off (indium for screens) or keep increasing (REE, Ta, Pd for electronic devices & appliances, Ge for optic fibres). Important drivers to monitor in the future include miniaturisation of components, measures against planned obsolescence and restrictions on exports of e-waste. In addition, the search for better performing and cheaper materials or components of electronic appliances fosters substitution, making future demands more unpredictable in the sector.

In the **sector of agriculture**, the global population growth (moderate in Europe) will foster the need for more efficient agriculture, thus increasing reliance on fertilisers and potentially encouraging European exports. On the contrary, various sources of phosphorous are likely to be considered (animal manure, but also sewage sludge and food waste chain) to reduce dependence on phosphate rocks. At last, the emergence of precision agriculture, helped by new technologies, might improve the efficiency of the use of fertilisers, in a context where agriculture tries to reduce its environmental footprint.

Finally, some recommendations were made to provide guidance for further research. First, there is still a lack of information on the main application of some CRMs (not covered in this study). Besides, it could be wise to investigate secondary applications of some CRMs when existing studies reveal a quickly growing application (e.g. storage application for cobalt and natural graphite). In these cases, even secondary applications could exacerbate the upward trend of demand. Finally, in specific situations, a focus on some processing steps of the CRM value chain could bring valuable information since the criticality of some CRMs mainly depends on a specific form of a product like high-grade silicon used for PV panels and electronic components.

Influence of COVID-19 on demand and supply

Supply and demand will decline in the short term due to the pandemic. Firstly, the pandemic will temporarily stop or reduce primary production in the supplier countries through country-specific lockdowns. Secondly, production in importing countries will be cut back for the same reasons. There will, therefore, be temporary reductions in both supply and demand.

In most countries, the lockdowns are currently being loosened up again, which will lead to an increase in supply and demand. It remains to be seen whether this state of affairs will continue, depending on the course of the pandemic.

In general, it is challenging to estimate future needs for longer periods because technological innovations that cannot be predicted today can completely change future needs. For example, a breakthrough in hydrogen technology for automobiles or a successful nuclear fusion would completely change future consumption and demand.

d. Post COVID-19 outlook

Buatois & Cordon (2020) provides the following account:

As the COVID-19 virus wreaks economic turmoil around the world, modern supply chains face unprecedented stress. They are drawing an increased level of scrutiny.

For months before the COVID-19 crisis, trade tensions had been mounting due to the escalating tariff war between Washington and Beijing, and a broader populist streak was running through several other capital cities. This rise in protectionism, coupled with concrete costs and new financial barriers, fuelled broader challenges and concerns for logistics networks operating on the global level.

Today's globalized supply chain network has been optimised to identify minimum lead times at the lowest possible price. We want electronics made in China so that we can buy them cheap. However, rapid political developments, a shift towards consumers buying niche products and, now, global pandemics have revealed the weakness that lies at the heart of this model of manufacturing.

The hidden costs of single-source dependencies and low flexibility in adapting to real-time shocks have been laid bare. Today, we will tolerate higher prices for certain goods, if it means we get them faster and more in line with our aspirations.

As a result, the change that had already begun, towards more flexibility and multi-level sourcing, will accelerate tremendously. Over the next years, we can expect to see a broad overhaul of our supply chain infrastructure and a new order based on three key dimensions:

From globalization to regionalization

Logistics hubs will re-emerge at the regional level. To eliminate single-source dependencies, and to establish a flexible and adaptable supply chain, product integrators, sub-system suppliers and component suppliers will source, assemble and deliver from their backyards.

That change had been kicked off several years ago because of increasing Chinese labour costs. Once the major attraction for companies towards Asia, the labour cost differential has shrunk over the past few years. What continues to hold foreign attention, however, is the whole supply chain network of suppliers and sub-suppliers located in those Chinese hubs.

Today, sizeable electronic equipment manufacturers source about 40 per cent of their parts from China, including sub-assembly. Given the incredibly high number of parts required – each with different lead times – a return to regional supply chains presents an incredibly complex challenge. However, that challenge might be worth taking in the post-COVID world.

We have seen the impact of global sourcing in the pharmaceutical industry in Europe, which has imported 80 per cent of the active components for its drug supply from China and India. In the post-COVID future, it's entirely expected that European governments would ensure they could draw these supplies from their own region. Thus, we could soon see a purposeful shift to regional sourcing.

The supply chain: The new protagonist and the stress test

Since the 2008 financial meltdown, regulated financial institutions globally have been forced to stress test their balance sheets to assure preparedness for an economic shock. Governments wouldn't have it any other way.

Similarly, a series of large-scale cyber-attacks in the past ten years has forced technology companies to institute penetration tests to scrutinize their cyber-security mechanisms. Boards of directors won't have it any other way.

In a post-COVID-19 world, supply chain stress tests will become a new norm. The distributed global business model, optimised for minimum cost, is finished. Tomorrow's model demands new priorities in optimisation.

The supply chain has become the main protagonist everywhere; it has moved from playing a "behind the scenes" organizational role to being a prime driver of the company business.

In the past, volume stability enabled the supply chain to deliver with a high level of service while lowering costs at the accepted quality. However, supply chains and manufacturing plants allow minimal flexibility in terms of volume – as the struggle to fulfil ventilator demand has exposed.

As volumes become more variable, supply chains must become more adaptive, especially if, as forecasts suggest, large suppliers and logistics operators in the supply chain industry must prepare for major catastrophic events such as weather events (fires, flood, tsunami), lethal pandemic outbreaks, strikes, social unrest and associated disruptions.

To manoeuvre choppy waters, navigators need visibility. In specific industries, such as microprocessor development or consumer technologies, advanced electronics manufacturers have already produced comprehensive dashboards that layout the full status of production and shipment, down to the last detail. The dashboards refresh every 20 minutes to provide a real-time overview of the entire supply chain.

Such technology will inevitably emerge as the norm. Consider the pharmaceutical industry, for example, where there is currently no single database, either centralized or distributed, from which to map the critical components for drug manufacturing. For suppliers, and ultimately, end-users, the visibility on sourcing is critical and must be upgraded.

The human dimension is back: Manual steering and volume flexibility

The human dimension is back, and it will play a prime role in rebalancing the global supply chain during this crisis, and well beyond.

Big and unexpected changes in volume render statistical models useless. These assess events such as the pandemic as “outliers” and, therefore, discard them from the data. Although we need visibility for the people in the supply chain to be able to make decisions, most decisions should be made manually. Ergo, the human factor is critical.

The Toyota Principle of “autonomation” (automation with a human touch) has been proved to be the most adaptable. This involves automating around 80-90 per cent of the system but allowing a 10-20 per cent opportunity for human expertise to improve system operation.

And as unemployment rates rise across the world, healthcare and agriculture industries, as well as grocery stores, and another key “essential work” fields face labour shortages. Amazon announced 100,000 new roles in fulfilment centres and delivery networks, while, in China, the return of quarantined workers to production plants and factories generated relief in the West. Similarly, despite AI’s positive affect on efficient e-commerce, ‘the last mile’ of delivery – from distribution centre to doorstep still needs a human driver or drone operator.

Labour should be managed as a critical asset of adaptation that plays a fundamental part of a crisis response program. The shortage of N95 masks, for example, requires new manufacturing plants to meet demand, and given the dramatic price increases of up to 5x mark-ups in online retail outlets, increases in labour costs are both feasible and manageable. The opening of a new production line or the modification of an existing one requires a surge in human capital.

COVID-19 has revealed the weaknesses of a globalized manufacturing system, and in order to respond, we need to fundamentally rethink supply chains. Our goals in the medium term should be making them more regional, modifying the supply chain as a key business driver and putting back the human asset as the most important factor for an agile business to succeed. ...”

A lot of authors try to identify the risks and challenges of the time after the COVID-19 pandemic. A good selection of scenarios is presented by the OECD on their webpage according to fiscal, economic and general changes after the COVID–19 pandemic.²¹

The OECD starts with a precise analysis of the situation: The COVID-19 pandemic has triggered the most profound economic recession in nearly a century, threatening health, disrupting economic activity, and hurting well-being and jobs. Extraordinary policies are required to walk the tightrope towards recovery, which will shape the economic and social prospects of the coming decade. This

²¹ From <https://www.oecd.org/coronavirus/en/themes/global-economy>

page features the latest OECD data, recommendations and policy advice regarding the economic impact of COVID-19, as well as a curated collection of earlier OECD economic content.

Two major studies were presented:

- The first more general scenario presented in a short video an outlook what happens with GDP's, employment rates of younger people and adults worldwide in case the second wave of COVID-19 pandemic hits the world. The main message of the study is that if a second wave of the pandemic does not significantly change the development of gross domestic products, the loss of GDP in Europe would only increase from 9.1 per cent (single-hit scenario) to 11.5 per cent (double-hit scenario). The OECD forecasts similarly low GDP losses for the USA, Russia, Brazil and China. Only India would be hit harder by a second wave (-3.7 per cent: single-hit scenario; -7.3 per cent: double-hit scenario).
- The second study gives an outlook on what might happen in fighting the economic consequences of the pandemic. The OECD identified three phases of “normalisation” of the economy and the fiscal consolidation (OECD, 2020):
“... Today, all players (central and subnational governments, as well as the private sector) are taking emergency measures to save lives and protect employees and citizens. In this first moment (the “emergency phase”), coordination mechanisms are essential, as is delineating the activities properly to tackle the COVID-19 outbreak across levels of government and ensuring sufficient liquidity to avoid bankruptcies and pro-cyclical policies. Although some countries are already leaving this first phase, the possibility of a second wave should be carefully monitored, and extraordinary measures might have to be taken again in order to avoid it. Hopefully, lessons learnt from the first wave would help countries and SNGs cope better with a possible second wave.

As the pandemic gets under control, the critical priority will shift to addressing the economic impact of the crisis in order to bring the economy as fast as possible to normality (the “recovery phase”). Current OECD projections show that the initial impact of containment measures may result in losses of up to 30 per cent of GDP. To address this, the OECD is calling for a “Global Marshall Plan”, supporting workers and individuals, and keeping businesses afloat. The experience from the 2008-09 financial crisis shows that it is essential to ensure that SNGs are not forced to carry out pro-cyclical policies, which could worsen the economic crisis. SNGs are key actors for public investment and a large employer. They should therefore be key actors in the medium-term, to help rebuild our economies through the channels of public investment, social protection and business support, among others.

In the longer-term, as economies recover, fiscal deficits accumulated throughout the first two phases will be reflected in higher indebtedness that, at some moment, will have to be addressed in order for governments to remain fiscally sustainable. Therefore, SNGs will need to participate in national consolidation policies (the “fiscal consolidation phase”). Escape clauses which are justified in present circumstances will need to be replaced by

post-pandemic rules, when economic conditions allow, with a necessary correction within an adequately lengthy period.

Finally, keeping the lessons of the COVID-19 crisis in mind, inter-governmental fiscal relations can be permanently improved through the adoption of successful measures that were employed to tackle the outbreak, potentially leading to more resilient policies. “

Also, the webpage of McKinsey²² gives interesting and noteworthy views of the time beyond the pandemic:

Under the headline, “The Next Normal - How companies and leaders can reset for growth beyond coronavirus” McKinsey presented scenarios for the nearer future regarding urban development planning, the future of work organization after the crisis, the future of healthcare management and what it will mean for both patients and healthcare professionals.

The study “And now win the peace’: Ten lessons from history for the next normal” compares the initial conditions in different countries after WW II and compares them with the common situation after the COVID-19 pandemic. The authors explain in their summary (Sneader. K. & Singhal, S. 2020):

During the COVID-19 crisis, companies have used technology in new ways to cope, often with speed and success that surprised them. For example, retail stores cut down on the number of in-store cashiers but added more people to deal with online-enabled curbside pickup and delivery. On the whole, however, there are significant gaps between what is being done and what could be done. In 2017, MGI found that on average, industries were less than 40 per cent digitized; China, Europe, and the United States, other research found in 2019, had tapped into only 20 per cent of their digital potential. That matters, because just as technological diffusion powered postwar growth, digital capabilities will likely be a significant factor in fueling post-COVID-19 growth.

An analysis of the effect of digital on productivity is compelling—70 per cent of those identified as “digital superstars” achieve higher-than-average productivity, and the most digitized sectors are also the ones that are the most productive. Even so, only a quarter of global sales and supply-chain operations were digitized in 2019, less than a third of operations volume was digitally automated, and in 2018, only 12 per cent of companies had invested in AI in domains where the business case to do so was strong. There is particular potential in supply-chain digitization, where the process has barely started. Some companies are getting it right, by closely tying their digital and corporate strategies and creating a healthy organizational culture. But not nearly enough are doing so, meaning that the economy is not benefiting from these proven productivity technologies.

²² From <https://www.mckinsey.com/featured-insights/coronavirus-leading-through-the-crisis>

The good old days, in many ways, weren't all that good. People all over the world today are wealthier and healthier, with more access to information, culture, and education. From 2004 to 2018, more than 300 million people in India alone have lifted themselves out of poverty. Global life expectancy in 2016 was 72 years—up from 46 years in 1950 and higher than in any single country then. In Africa, life expectancy increased by almost a decade from 2000 to 2016 (to 62.1 years).

In one sense, however, the 1950s and '60s do look pretty good, as many economies enjoyed sustained and inclusive growth. COVID-19-riddled 2020 is not war-ravaged 1950. But history can still provide useful lessons. One is the need for international institutions and the public and private sectors to pull in the same direction. Another is the importance of health, education, and training.

There are also lessons in what not to do. Countries that cut themselves off from global flows of technology, trade, and information generally underperform. Controls on capital, wages, and prices suppress growth. The nationalizing industry is a productivity dud (with rare exceptions). Even with the right goals and the best of intentions, making the wrong choices can hurt productivity—as happened in postwar Britain—and thus make it less likely that the desired outcomes occur.

Imagination, leadership, and a dash of inspiration will be required to figure out the right policies for the 21st century. During the COVID-19 crisis, there have been many examples from the public, private, and social sectors to prove that these qualities are alive and well. What is needed now is the commitment to make the changes and investments that will create a future of broad prosperity.

Chapter 3

Guidelines and Best Practices for MSMEs

3. Guidelines and Best Practices for navigating challenges for MSMEs in the raw material supply business environment (with examples)

- ✚ National and International institutions are a big help for MSMEs business facilitation and business registration.
- ✚ In the short term during the pandemic, unbureaucratic aid measures such as simplifying import regulations can considerably simplify the situation of MSMEs.
- ✚ Simplification of laws and regulations can significantly improve the situation of MSMEs in the long term.
- ✚ Use the time of the pandemic to train your employees. National and international institutions and companies provide all kinds of training on the internet like entrepreneurship skill facilitation, market and business access, access to finance etc. (Fig. 16).



Figure 16: Challenges for MSMEs in raw material supply.

a. Business facilitation and business registration

Example: The Enterprise Europe Network²³

The Enterprise Europe Network helps small companies make the most out of business opportunities in the EU. It is a one-stop-shop for all business needs. It provides support on access to market information, overcoming legal obstacles, and identifying potential business partners across Europe.

The network offers a wide range of services to small and medium-sized enterprises (SMEs). It aims to:

- Help SMEs find international business, technology, and research partners in the EU, COSME participating countries, and other non-EU countries.
- Develop a service helping SMEs become active in the Single Market and beyond.
- Increase SME competitiveness through internationalisation and innovation support services.
- Involve SMEs in the policy-making process by transmitting feedback to the European Commission.
- Strengthen support to SMEs interested in participating in Horizon 2020 and corresponding calls for proposals, and encourage SMEs to participate in the SME Instrument.
- Enable SMEs to turn the resource efficiency challenge into opportunities that contribute to the future Climate Action and Green Action Plan.
- Improve SMEs' awareness of access to finance.
- Ensure visibility, recognition, and local awareness about the network.

The Enterprise Europe Network comprises about 600 partner organizations in more than 50 countries. It consists of around 3000 staff with expertise in business and innovation services for SMEs. The network is a two-way communication channel between the Commission and the SME community. It obtains opinions from SMEs about developing new legislation, taking into account initiatives set out in the Small Business Act and the Think Small First Principle. ...”

²³ Adapted from https://ec.europa.eu/growth/smes/support/networks_en

Supporting of MSMEs

What the EU does for SMEs²⁴

1. **Creates a business-friendly environment**

At the centre of the Commission's action is the Small Business Act for Europe (SBA) that provides a comprehensive SME policy for the EU and EU countries. The SBA promotes the 'Think Small First' principle and promotes entrepreneurial spirit among European citizens.

2. **Promotes entrepreneurship**

The Commission promotes entrepreneurship through the Entrepreneurship Action Plan, supports entrepreneurship education, and provides support tools for aspiring entrepreneurs.

3. **Improves access to new markets and internationalisation**

The Commission's priority is to ensure that enterprises can rely on a business-friendly environment and make the most out of cross border activities, both within the EU Single Market and outside the EU.

4. **Facilitates access to finance**

Access to finance is the most pressing issue for many small enterprises. The Commission works on improving the financing environment for SMEs and provides information on funding. The Late Payment Directive strengthens businesses' rights to prompt payment.

5. **Supports SME competitiveness and innovation**

Promoting competitiveness and innovation are critical aspects of EU policy in relation to industry and enterprise, in particular for SMEs.

6. **Provides critical support networks and information for SMEs**

- Your Europe Business Portal is a practical guide to doing business in Europe. It provides entrepreneurs with information and interactive services that help them expand their business abroad.
- The Enterprise Europe Network helps SMEs and entrepreneurs access market information, overcome legal obstacles, and find potential business partners across Europe.
- The SME Internationalisation support page provides information on foreign markets and helps European business internationalise their activities.
- The single portal on Access to Finance helps SMEs find finance supported by the EU.
- Supports start-ups and scale-ups in particular.

The Commission's 'Start-up and scale-up initiative' aims to give Europe's many innovative entrepreneurs every opportunity to become world-leading companies. It brings together all the possibilities that the EU already offers and adds a new focus on venture capital investment, insolvency law, taxation and more.²⁵

²⁴ Adapted from : https://ec.europa.eu/growth/smes_en

²⁵ For more information see: https://ec.europa.eu/growth/smes_en

b. Policy, legislation and regulations

The biggest problem with governmental and sovereign institutions that MSMEs have in international business is the collection of duties and taxes by governmental agencies in the exporting and in the importing countries. As each country has its own regulations and fees, it takes a lot of time and effort to complete the formalities for import and export. The smaller the company is, the more burdensome it is to handle imports of raw materials properly. For example, the average weighted import duty varies from country to country. The highest import duty worldwide has Bermuda with 20.85 per cent. In comparison, Hong Kong and Macao have an import duty of 0 per cent. In important economic areas in 2017 was the following percentage: People's Republic of China: 3.83 per cent, Japan: 2.51 per cent, European Union: 1.79 per cent and the United States: 1.66 per cent. The respective import duty does not apply to countries, with which free trade agreements have been concluded. Depending on how these processes are deregulated, the business of MSMEs is greatly simplified.

As adapted from White (2018), the following practices are recommended for business environment reforms that benefit the MSME sector:

- Give priority to levelling the playing field: ensure firms are not disadvantaged in the business environment based on their size or the sex of their owner (and recognize that while a law, regulation or procedure may appear neutral, it can have very different effects on firms of different sizes);
- Simplify, reduce costs and improve transparency: simplify the legal and regulatory regime, reduce the costs of compliance and improve the transparency of regulatory and administrative decisions for all firms;
- Invest in an objective assessment of the business environment: place more effort on proper diagnostics, improving the quality of data to guide policymaking, including an assessment of how the business environment affects MSMEs;
- Identify the causes and not just the symptoms: carefully analyses national circumstances and contexts and identify the root causes of poor MSME performance;
- Think small, aim for growth: understand how government policies, laws and regulations affect the MSME sector and its potential for growth;
- Avoid single, isolated reform measures: understand how the change in one part of the system may affect other parts;
- Go beyond business environment reform: recognize how the business environment relates to other factors affecting MSME competitiveness and growth;
- Ensure integrated solutions: use technical and financial cooperation to create suitable framework conditions and public-private dialogue, while improving legislation and regulation, administrative provisions and bureaucratic procedures;
- Improve representation and voice: promote dialogue between the private and the public sector and ensure the MSME sector can participate in these processes;

- Improve policy coordination and coherence: ensure the specific needs and opportunities of the MSME sector are addressed by the government, whether through specialized MSME development agencies or inter-ministerial mechanisms;
- Apply a gender lens to reform: ensure the sex of a business owner is not a determinant of success;
- Monitor and evaluate to stay on track: apply for regular reviews and establish robust feedback mechanisms;
- Invest in further research: fill the gaps in the knowledge on MSME development and the contribution of business environment reforms to improving MSME competitiveness and growth.

COVID-19 and policy, legislation and regulations

The impact of the pandemic on policies, laws and regulations is more likely to be medium to long-term, as only politicians can act immediately, and has also regained momentum in most countries around the world with protection and measures to contain the pandemic. However, the immediate measures imposed by governments will most likely not lead to long-term rules and regulations. They are immediate short-term measures in most countries. Yet, it can be assumed that in the longer term, laws and regulations will be adapted to prevent a similar pandemic based on current events.

C. Access to data, information and knowledge

The access to data, information and knowledge is the base for a successful MSME or start-up. Internationally, this task is mostly the responsibility of state institutions such as geological surveys, which guarantee the quality of the data and recommendations. The Chambers of Commerce can also provide access to data, information or knowledge. In many countries, in addition to purely governmental sources of information, there are also professional organizations such as the Professional Association of German Geoscientists (BDG) in Germany or the European Federation of Geologists (EFG) in the EU, which provide advice and transfer know-how through expert groups. Based on our research, one of the best existing systems is the EU Raw Materials Information System (RMIS). All data on a circular economy of critical raw materials are stored in this database.

Example for Access to data, information and knowledge

The EU Raw Materials Information System

The following account is modified after EC - (2018a).

Data sources

These sources of data can be permanent platforms (see the section on the RMIS), an analysis that is led regularly (see the section on MSA studies) or temporary initiatives in the form of projects (see ProSUM, Screen).

The EU Raw Materials Information System including the CRM factsheets

Securing the undistorted supply of raw materials and, in particular, of critical raw materials is crucial and requires a sound and continuously updated knowledge base, namely the European Raw Materials Knowledge Base (EURMKB), as highlighted and stressed in the EU Raw Materials Initiative (RMI) (EC, 2008). This need was further recognized by the Strategic Implementation Plan of the European Innovation Partnership on raw materials (EIP-SIP) of 2013, particularly in the Action area No II.8 (EC, 2017b). In this context, and responding to a specific action of the 2015 Circular Economy Communication, the DG JRC of the European Commission in close collaboration with DG GROW, is developing the EU Raw Materials Information System (RMIS). The Action Plan on Circular Economy (EC, 2015a) is explicitly calling for the ‘further development of the EU Raw Materials Information System’, in particular in the context of secondary raw materials.

The first version (RMIS 1.0) was launched in March 2015. The advanced RMIS (RMIS 2.0) to be launched at the end of 2017 (Fig. 17), intends to become a one-stop information gateway and knowledge service centre for non-energy, non-food primary and secondary raw materials. RMIS 2.0 ambition is (a) to support European Union (EU) policy with tailor-made applications like the periodical Raw Material Scoreboard (Vidal-Legaz et al., 2016) and Criticality

assessments, and (b) to help coordinate other EU-level data and information on raw materials (EUKBRM). This will be made available directly in the RMIS from different data sources. It will be facilitated by enhanced cooperation with the Member States, industry representatives, and other stakeholders. The other functionalities of RMIS 2.0 will also directly serve the implementation of the circular economy policy; examples include material flow analysis (MFA) including the EC material system analysis (MSA); the new trade policy application; information and data on Secondary Raw Materials; contents on sustainability issues and research & innovation.



Figure 17: Front page of the EC's Raw Material Information System (RMIS 2.0) (EC, 2018).

Raw materials factsheets and RMIS 2.0

RMIS 2.0 is also intended to make easily available and further exploitable the huge amount of information and data collected during the criticality assessments, which represent the background of the lists of CRMs for the EU adopted in 2011, 2014 and 2017. Such information and data are compiled and systematically organized in raw materials factsheets that are a necessary complement to the list of CRMs and represent, under several aspects, an even more important piece of information.

A criticality is necessarily a screening tool mainly intended to highlight and easily communicate issues of concern, which can subsequently be followed up with more detailed studies and

assessments. The results of criticality assessments should, therefore, be considered a call for attention, not the final word, as it is very unlikely that all aspects that could influence the risk of supply and the consequences can be included in a screening methodology while keeping the calculation equations short, simple, and objective.

1. ANTIMONY

Key facts and figures

Material name and element symbol	Antimony, Sb	World / EU production (tonnes) ¹	42,833 / 0
Parent group	n.a.	EU import reliance ¹	100%
Life cycle stage /material assessed	Processing/ Sb metal	Substitution index for supply risk [SI(SR)] ¹	0.93
Economic importance (EI) (2017)	4.3	Substitution Index for economic importance [SI(EI)] ¹	0.91
Supply risk (SR) (2017)	4.3	End of life recycling input rate (EOL-RIR)	28%
Abiotic or biotic	Abiotic	Major global end uses in 2014	Flame retardants (43%) Lead-acid batteries (32%) Lead alloys (14%)
Main product, co-product or by-product	Main product or co or by product of Au, Pb, Zn	Major world producers ¹ (Sb metal production)	China (87%) Vietnam (11%)
Criticality results	2011	2014	2017
	Critical	Critical	Critical

¹ average for 2010-2014, unless otherwise stated.

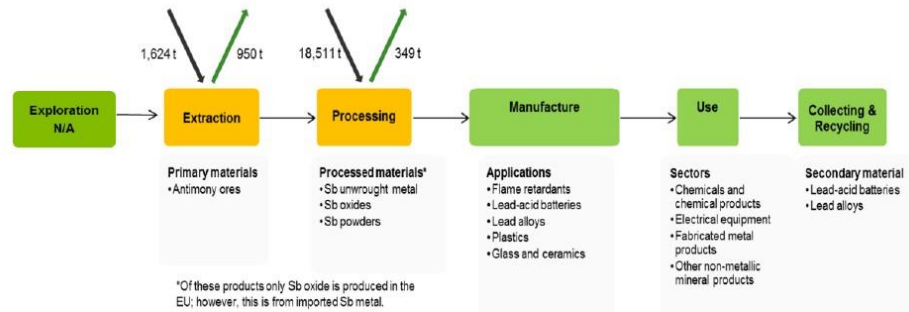


Figure 18: Example of a 2017 Raw Material Factsheet for Antimony (snapshot of the front page with key facts) to be soon inserted into the RMIS 2.0 (EC, 2017b).

Also, for these reasons, the EC has developed single raw materials factsheets, where the detailed information and data used in 2011, 2014 and 2017 CRMs lists are available in a structured and systematic form, available in RMIS 2.0 under the Criticality Raw Materials tile. Such factsheets include an element of analyses of supply from mining/harvesting, supply from recycling, trade, end-uses and related economic sectors, substitution, as well as supply chain analysis. They contain and explain the data used in the criticality assessment, as well as data not used in the definition of the supply risk and/or economic importance, but that are fundamental elements of information for a better understanding and subsequent decision processes. Key facts and figures are collected and summarized in the front page of each factsheet, as for example the one for Antimony shown in Fig. 18.

Raw materials factsheets equally bring together further information and data that third parties might want to use in their ad hoc criticality assessments, for example to more specifically targeting single sectors or smaller sets of key technologies. Additionally, RMIS 2.0 includes a section called ‘Raw material profiles’. These profiles are intended to be dynamic sources of information that will be regularly updated and that will serve multiple purposes, including the next revision of the critical raw materials list.

Material Systems Analysis 2015

The raw materials system analysis (MSA) (Deloitte Sustainability, 2015) was carried out in 2015 and investigates the flows and stocks of 28 raw materials from ‘cradle-to-grave’, that is, across the entire material life cycle from resource extraction to materials processing to manufacturing and fabrication to use and then to the collection, processing, and disposal/recycling (Fig. 19).

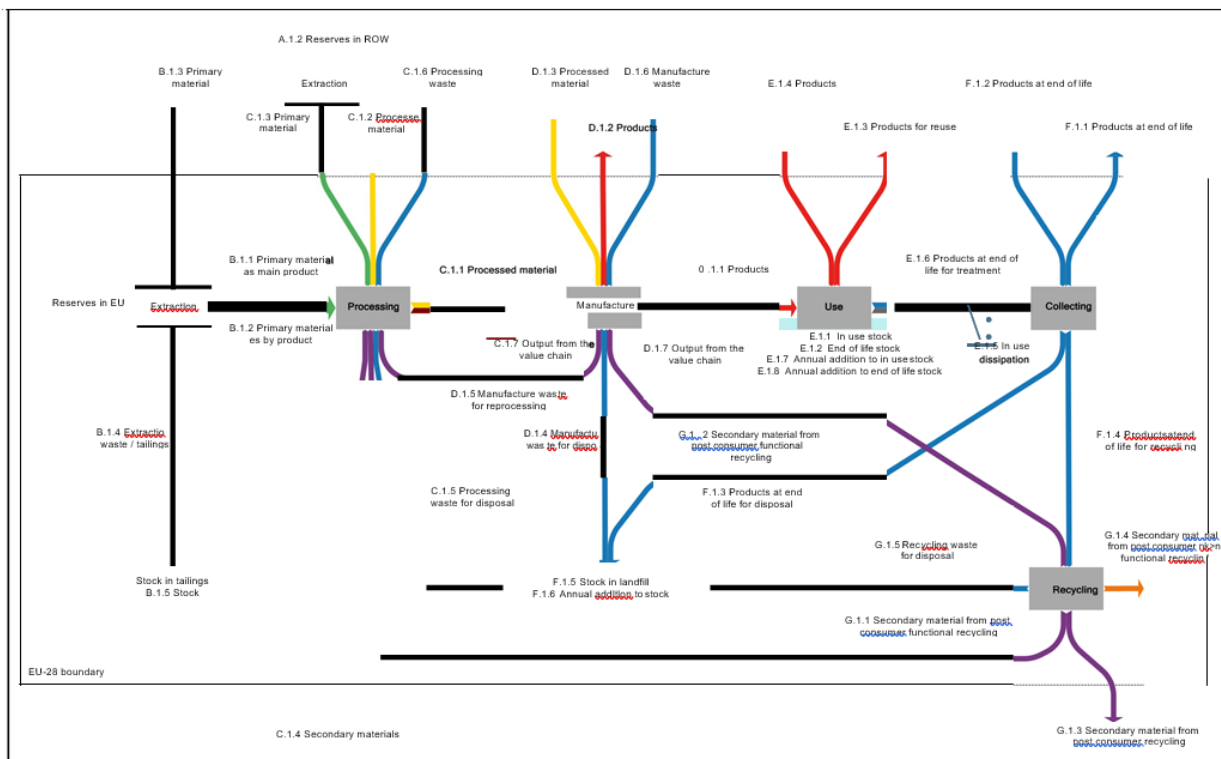


Figure 19: MSA framework and flows/stocks considered (Deloitte Sustainability, 2015).

The study has been carried out by DG GROW with the consultation of experts and stakeholders. It is a follow-up of the ‘Study on Data Needs for a Full Raw Materials Flow Analysis’, launched by the European Commission in 2012 within the context of the European Raw Materials Initiative’s strategy. This strategy, which is a part of the Europe 2020’s strategy for smart, sustainable, and inclusive growth, aims at securing and improving access to raw materials for the EU. The objective of the MSA study is to provide information on material stocks and flows and to assist the European Commission on the development of a full MSA for a selection of key raw materials used in the EU-28, some of them considered as critical.

By tracking materials throughout their full life cycle, MSAs can help to quantify potential primary and secondary source strengths, support monitoring of their ‘level of circularity’ in the EU-28, and manage metal use more wisely. This is particularly important for CRMs for which public information on their trade is sometimes unknown, their uses are not well understood, and their recovery and reuse once discarded is problematic. An accurate assessment of global and EU-wide mineral resources must include not only the resources available in the ground (reserves) but also those that are present as stocks within the technosphere and become available through recycling. The data resulting from the MSA study for CRMs provide an important base of background information from which future materials criticality can be better addressed, and sustainable development pathways, with an EU-wide scope, designed. A lot of this data will be presented in the sectoral chapters of this report.

Prosoma H2020 project

Prosoma (Prospecting Secondary raw materials in the Urban mine and Mining waste, Horizon 2020 research and innovation program, grant agreement No 641999, 2015- 2017)²⁶ is a Coordination and Support Action (CSA) establishing a European network of expertise on secondary sources of critical raw materials, vital to today’s high-tech society. The project aims at providing data about arisings, stocks, flows and treatment of various product groups, e.g. waste electrical and electronic equipment (WEEE), end-of-life vehicles (ELVs), batteries and mining wastes. Information concerning products placed on the market, products stocks, and waste flows of the EU countries derive from both measured data, coherent estimates based on statistical information, experts’ assumptions and extrapolation. Quality level, uncertainty and error propagation of the gathered information are harmonized in order to obtain high-quality data that will be available in a centralized Urban Mine Knowledge Data Platform. Moreover, the data structure eases the regular update and maintenance of the information.

Prosoma produced the EU Urban Mine Knowledge Data Platform (EU-UMKDP) providing user-friendly, seamless access to data and intelligence on secondary raw materials arising from various waste flows. This deliverable is key for the creation of a European raw materials knowledge base, and it is contributing to the above-mentioned EU Raw Material Information System.

This CSA is already contributing to policymaking activities in the field of circular economy and resource efficiency. Prosoma directly supports the European Innovation Partnership (EIP) on Raw Materials and its Strategic Implementation Plan (SIP). The project is complementary to a few other Horizon 2020, and FP7 actions focused on primary raw materials, and it is concurring on unlocking new possibilities for a sustainable supply of raw materials. It is contributing to the Raw Material Information System (RMIS) developed by JRC under DG GROW initiative.

European expert network on critical raw materials Screen

Screen (Solutions for Critical Raw materials — a European Expert Network) is a Coordination and Support Action aiming at gathering European initiatives, associations, clusters, and projects

²⁶ See: <http://www.prosumproject.eu>

working on CRMs into a long-lasting Expert Network on Critical Raw Materials, including stakeholders, public authorities and civil society representatives. This network will combine forces to address all the CRMs issues including mining, processing, recycling, substitution and final applications in relation to the cross-cutting aspects: policy/society, technology, standards and markets.

Screen will contribute to the CRM strategy in Europe by (i) mapping primary and secondary resources as well as substitutes of CRMs, (ii) estimating the expected demand of various CRMs in the future and identifying major trends, (iii) providing policy and technology recommendations for actions improving the production and the potential substitution of CRM, (iv) addressing specifically WEEE and other end-of-life (EOL) products issues related to their mapping and treatment standardisation and (vi) identifying the knowledge gained over the last years and easing the access to these data beyond the project. Screen has just published a report that reviews the use of CRMs in the European Union, considering the 2014 CRM list and underlying methodology. It takes an economy-wide approach (like the Material System Analysis and criticality studies) and complements it with a bottom-up perspective by addressing the material composition of products. The knowledge gathered within the Screen project will be collected and maintained in the Raw Materials Information System.

Impact of the COVID-19 pandemic on access to data, information and knowledge

Access to data, information and knowledge has become much more comfortable in the pandemic and only requires an Internet-capable computer system or a smartphone. Due to the fact that many scientists cannot attend conferences or symposia, the number of online conferences has increased considerably. In addition, travel expenses are eliminated, and thus such conferences are also accessible to MSMEs who would typically never be able to finance intercontinental travel for their staff. Since in many countries, employees are in the home office as a precautionary measure, there is enough time to participate in such web meetings.

In addition, international institutions and companies have been offering webinars on almost every topic since the beginning of the pandemic. Here, employees who are under-utilized or have more time to spare due to missed trips to customers or meetings can now receive training on almost any topic. Many of these webinars are free of charge or are considerably less expensive than large international congresses. It has never been so easy and inexpensive to have your employees trained by international experts.

d. Entrepreneurship skill facilitations

MSMEs are created by technicians, craftsmen, scientists or engineers, who develop a business idea and then put it into practice. This means that the emerging company is managed by someone who is in most cases a good technician or craftsman. This entrepreneur sees himself as the implementer of his idea or service and only then as a businessman. Most young companies and these are SMEs and MSMEs, fail if the technician does not understand that his company will not survive unless he develops into an entrepreneur with business skills. The problem what the prospective entrepreneur has, is that business management, tax law, marketing and business administration are neither part of the craft training nor part of the university studies. This assigns the entrepreneur a high level of responsibility; he is not only responsible for his further training, but must also delegate tasks and work which he cannot carry out himself to qualified personnel. He must also recognise that he and his staff must receive further regular training. These training courses must cover all areas that exist in the company. Training courses are offered by both governmental and private organisations such as chambers of crafts and chambers of industry and commerce. In developing countries, numerous NGOs and aid organisations offer training courses for every level of SMEs.

A very good overview and introduction to the needs of SMEs is provided by an Organisation for Economic Co-operation and Development OECD study on the situation of training in SMEs in Flanders, Belgium, and summarized here modified after OECD (2011).

The OECD Programme on Local Economic and Employment Development (LEED) listed a lot of useful and important training units for SMEs in their study of “Leveraging training skills development in SMEs – An analyse of East Flanders, Belgium” according to a survey among SMEs in Flanders on which training courses SMEs need most. A questionnaire was prepared by the OECD and has been translated by the commission of the Flemish government. As little as possible has been changed to the literal translation of the survey, in order to maintain international comparability. Occasionally, minor adaptations were made to improve comprehensibility. Only SMEs with less than fifty employees were invited to complete the questionnaire.

The results of the questionnaire for the tasks “Entrepreneurial and management skills” was (by 18 participating companies):

- business planning
- regulations and quality control
- human resources planning (recruitment, training and skills development) and
- allocation of resources
- strategic thinking
- self-confidence
- networking
- dealing with challenges and risks.

In the conclusions of their study, the authors address the particularities and barriers to employee training for employees of SMEs in Flanders:

“Managers of SMEs make an effort to participate in different networks, but there are still opportunities for more. Moreover, the networks are shattered over the region and the different industries. Small and large enterprises differ heavily in all aspects of an organisation. SMEs seem to attach as much importance to training activities as large enterprises do, but they differ in the extent to which they implement workforce development. Some of the SMEs have a clear strategy and philosophy concerning human resources, while others are only looking for training when skills needs occur. The main barriers to training for SMEs are practical feasibility and costs, even though different means of financial support by the government are already in place. Finally, all participants of the workshop agree that informal learning is an essential tool for learning, both for low skilled and high skilled workers. “

One possibility from the stateside to guarantee the education and further training of the founders and entrepreneurs of SMEs and thus to prevent rapid bankruptcies of too inexperienced entrepreneurs is the German system of master craftsmen and industrial master craftsmen, which has worked since the beginning of industrialisation. A similar system was also established in the German mining industry with the "Steigerschulen" (schools for mine foremen) before the First World War. In these schools, it was possible to bypass the "normal" school system and allow intelligent workers and craftsmen to move up into the management of a factory or mine without having a high school diploma.

Example:

The German school for Master Craftsmen “Meisterschule”

In Germany, the term "Meisterschule" refers to all further training institutions that prepare students for the advanced training to become a master craftsman. These are further training courses offered by private training institutions or professional chambers, less frequently by so-called technical schools. At these master schools finished craftsmen with professional experience learn accounting, tax law, management and the training of apprentices. In Germany, a craftsman's business, a garage or a specialist workshop may only be founded after successful completion of the master school. This binding training protects young craftsmen from bankruptcy and problems with the tax authorities. They are also allowed to train apprentices after successfully passing the master craftsman examination. Depending on the job description, the preparatory courses last between 3 and 24 months in full-time training; in part-time training up to 48 months. They cover training sections I to IV of the Master Craftsman Examination Regulations (MER).

Further training to become a master craftsman at a vocational school differs from pure preparatory courses, since here not only the MER is given priority, but also the underlying curriculum. Master schools thus serve to provide more in-depth and comprehensive continuing vocational training and promote general education. They are attended following vocational training and, as a rule, after sufficient practical work experience of several years. As a rule, further vocational school training lasts 12 to 24 months full-time. For part-time courses, correspondingly up to 48 months.

Impact of the COVID-19 pandemic on Entrepreneurship skill facilitations

The same applies to entrepreneurship skill facilitations as to topic impact of the COVID-19 pandemic on access to data, information and knowledge. A good opportunity to receive inexpensive training. In addition to state and public institutions, companies also offer the opportunity for further training for themselves and their employees. For example, Microsoft offers training in the field of Augmented Reality²⁷ or CoralDraw webinars²⁸ for the handling of their software.

²⁷ <https://www.microsoft.com/en-us/education/mixed-reality>

²⁸ <https://www.coreldraw.com/de/pages/webinars/coreldraw/>

e. Market access

Trade facilitation Implementation guide (UN): Trade facilitation and SMEs itinerary²⁹

Many factors affect the lower rate of participation of SMEs in international trade. There are internal constraints of higher vulnerability to market developments and high infrastructure costs, as well as lower productivity, including a lower level of digitization (OECD, 2017). In addition, SMEs are disproportionately affected by trade barriers and inefficiencies resulting from trade policy, namely standards and technical regulations, logistics processes and services, and customs and other administrative trade procedures. Trade and border procedures translate into direct and indirect costs for businesses and impact the firm's competitiveness. SMEs disproportionately bear the burden of these barriers.

Complying with regulatory requirements and adapting to regulatory variance across countries is more difficult and costly for SMEs compared to larger firms. They have comparatively higher regulatory compliance costs because of:

- Less in-house knowledge of applicable regulations and laws;
- Fewer dedicated resources for managing import/export processes;
- The lower level of digitalization of internal processes and documents;
- Less amount of capital available for investments in infrastructure and equipment;

As a result, screening, navigating and complying with different regulatory requirements is often too costly and time-consuming for SMEs, in particular when they operate in an opaque business environment where access to information is difficult and corruption ripe.

SMEs therefore, either do not engage in international trade or incur additional costs. They hire external advisors and contract international shipping or logistics companies that offer worldwide services and specific market knowledge and limit financial and logistics risks for the SMEs.

Hence, SME's ability to access international markets is more limited and vulnerable to framework conditions in which they operate. Trade facilitation may strengthen their capability to participate in international trade as it aims to bring down the cost and time to trade.

COVID-19 pandemic impacts on market access

As in the previous two chapters, the pandemic and the associated lockdown phases can be used to higher the in-house knowledge of applicable regulations and laws and of managing import/export processes. However, this requires a fast digitalization of the employees who should and can be trained. In most countries, there are subsidies for such digitization from the state or from development companies. Companies that have digitized their internal processes, documents and business processes and their employees early before the pandemic have a clear advantage. Access

²⁹ From: <http://tfig.unece.org/contents/market-access-challenges-SMEs.html>

to the international market is, like everything else, a matter of knowledge, and the lockdown period offers the opportunity to expand this knowledge and thus emerge stronger from the pandemic.

Example:

Trade Barriers for US SMEs

The US International Trade Commission investigated of trade barriers for SME in the EU market in 2014 (US ITC, 2014). The findings pointed at the following cross-cutting trade barriers:

- Standards related measures resulting in high compliance costs in particular for chemicals and cosmetics but also for machinery and technical equipment;
- High tariffs and quotas for agriculture products including corn, wheat, lamb and poultry.
- Difficulties involving trade secrets and patenting costs; and
- Logistics challenges including customs requirements.

Logistics challenges include difficulties with the Harmonized System (HS) classification because of difference in HS classification by EU MS and frequent incidences of delays due to re-classification. Other issues are the complexity and document and reporting requirements of the EU VAT system, and unreliable domestic distribution services. SMEs stated that these factors make it difficult for them to assess landed costs for the customers, increases their risks of additional costs, and reduces their competitiveness.

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³⁰ from Trade facilitation Implementation guide (UN): Trade facilitation and SMEs itinerary; <http://tfig.unece.org/contents/market-access-challenges-SMEs.html>

f. Access to finance

Muhammad Yunus and Grameen Bank were awarded the Nobel Peace Prize in 2006 for their work to "create economic and social development from below". Grameen Bank's objective since its establishment in 1983 has been to grant poor people small loans on easy terms - so-called micro-credit - and Yunus was the bank's founder.³¹

Microcredit is a common form of microfinance that involves an extremely small loan given to an individual to help them become self-employed or grow a small business. These borrowers tend to be low-income individuals, especially from less developed countries (LDCs). Not every MSME is helped by microcredit, but for thousands of micro-enterprises microcredit is the first step into a business activity. There are numerous examples from Asia and Africa of how microcredit has helped microentrepreneurs to escape unemployment and poverty. There is the case of the woman from Ghana documented by a German online Newspaper (SPIEGEL online – see Box on p. 73).

But not all economists believe in the effectiveness of microcredits. Milford Bateman, professor of economics at the University of Paula in Croatia, even considers microcredit to be anti-development. "Nowhere else in the world are there so many micro-enterprises as in Africa. The idea was for Africa to move away from this informal sector in order to develop and fight poverty," Bateman said in the DW interview.

Because workers in the informal sector often continue to work for starvation wages and remain poor. Bateman believes that poverty can only be fought by creating new businesses and well-paid jobs. Instead, donations and commercial funds would be pumped into a sector with no growth opportunities. ...³²

White (2018) provides a well-founded compilation of the problems and approaches to solving the issue of access to credit and financial services in his study 'Creating better business environments for micro and small enterprises':

The problems MSMEs face in accessing the finance and financial services (e.g., savings facilities, insurance) they require to compete effectively and expand are well documented. Thus, MSMEs often attract particular attention in this policy domain.

White, et al., (2017) reviews the evidence on the impact financial services have on SME growth and development and find that while improving access to finance generally enhances SME growth, the way this is achieved is more complex than simply focusing on the high cost of finance and the rigid eligibility requirements of commercial finance providers. Other factors affecting this dynamic are: poor business environments, inadequate infrastructure, corruption, and inexperienced

³¹ See www.nobelprize.org

³² Deutsche Welle; <https://www.dw.com/de/mikrokredite-kein-allheilmittel-gegen-armut/a-51123088>

business owners with poor management skills also inhibit growth. While there is evidence to show how stronger linkages between enterprises and financial institutions can improve access to financial services and induce growth, 'it is important not to isolate access to finance as a single constraint to growth, but to consider it as part of a more holistic approach'.

Schleifer and Nakagaki (2018) describe how, as entrepreneurs grow from micro to small and medium-sized enterprises, their financing needs are no longer met by microcredit, and they seek larger commercial bank loans. Indeed, in order to expand production, rent new facilities, employ workers, and enter export contracts, small firms are often required to move from the informal to the formal economy. They highlight the problems women, in particular, face in terms of dealing with regulatory and governance hurdles as well as social barriers and discrimination. These issues extend beyond the direct issues of access to finance.

Drawing from the WBES data from 70,000 enterprises across 107 countries, Aterido, et al. (2007) measure the effects of access to finance, business regulations, corruption, and infrastructure bottlenecks in explaining patterns of job creation at the firm level. MSMEs were found to have less access to formal finance, pay more in bribes than larger firms, and face greater interruptions in infrastructure services, while larger firms spend significantly more time dealing with officials and red tape. The authors argue that these results suggest that significant reforms to the business environment, including the finance sector, are needed to spur micro firms to grow.

Martinez, Peria and Singh (2014) also use WBES data from 63 countries in the period 2002-2013 to examine the effects of credit bureaus and find the likelihood that a firm has access to finance increases with the use of bureaus, while interest rates drop, maturity lengthens, and the share of working capital financed by banks increases.

Beck and Cull (2016) use WBES data to gauge access to financial services and the importance of financing constraints for African enterprises. They found that smaller firms were around 30 per cent less likely to have a formal loan than large firms, while medium-sized firms were 13 to 14 per cent less likely. In addition, firms organized as partnerships and sole proprietorships, the simplest organizational forms, are less likely to have a formal loan.

In Egypt, Loewe, et al. (2013) identifies the factors determining the upgrading of SMEs. They find the scarcity of medium-sized enterprises in Egypt is due to the challenge's firms face in remaining medium-sized or large. The business environment, notable problems in what they call 'state-business interactions', such as licensing, taxation, inspections, and competition control, was found to constrain SME survival and growth.

While the problems of MSMEs accessing finance are generally understood, less clear is the impact of MSME-targeted development programs that attempt to deal with these problems. McKenzie (2009) reviews a range of impact evaluations in finance and PSD to identify lessons learned and knowledge gaps. He finds that while evaluations have led reform efforts in areas such as

microfinance, microenterprises, insurance, and regulatory reform, there are, in fact, only a handful of rigorous studies. More evaluations are needed on a wider range of policies in a number of different institutional settings, to learn what works, where and why.

Poor access to finance is a problem that many women-owned and managed MSMEs struggle with. The World Bank (2014) finds that female-owned firms and agricultural firms face particular challenges in gaining access to finance. Women-owned firms tend to be smaller than firms owned by men and grow at a slower rate partly because women have less access to finance. Fafchamps, et al. (2013) finds women micro-entrepreneurs are less likely than men to realize business profits from increased cash grants, because they tend to be more susceptible to other demands on funds, including household demands. However, they benefit as much as male business owners when capital is increased.

De Mel, et al. (2009) finds that in households where women are empowered with more decision-making power and more cooperative husbands, they invest a larger share of the grant into working capital and have positive returns from investments of the larger grant. The DCED (2017a) presents evidence that suggests policies that create special lines of credit for women can increase their access to finance.

Spiegel online economy:

Microcredit in Africa Mrs. Adbena's small economic miracle



Then suddenly these men stood in their village. They gathered the women around them and told them about microcredits, guarantees, repayment instalments, interest rates and business plans. Words that were foreign to the village women five years ago. The visit was absolutely surprising: it was not the women who went to the bank, but the bank employees who came to the villages.

The financial professionals were trained beforehand by development aid workers. The women in the village also received training in money management afterwards: "We learned how to fill in forms, how to keep a household book and how to save a little money," says Sinina Adbena. Because putting a little money aside is one of the prerequisites for getting a loan. Since then, the women have vouched for each other in small groups. They control each other - if one of them does not want to pay, there is peer pressure. The faster the debts are paid off, the more money there is for the next loan. Here at Lake Volta, the principle also works. As with almost all microcredit projects, the repayment rate is close to 100 per cent, reports an employee of the supervising development aid organization Plan International. And that at the usual national interest rate of 25 per cent. Incidentally, this would be even higher without the help of the development aid workers, he says: "The banks would charge an interest rate of 50 per cent if we didn't drive the employees here to the villages. The project was preceded by long talks with the banks. Many decision makers had to be convinced.

For Sinina Adbena it was worth it: she took out 100 dollars on her first loan. Before that, the new entrepreneur had to work out a business plan and present it to the guarantee group and bank employees. "Every woman has to explain exactly what she needs the money for and prove before that she can handle it." The group decides together whether there will be a loan and how much.

With her starting capital, Sinina Adbena first bought shelves and built them on the wall of her little mud house. From the remaining money she bought the first articles in the nearby town. The shop was doing well. After only 16 weeks she had paid back her first loan. In view of her success, Adbena repaid the loan one year ago. She used her savings and another loan of 300 dollars to build a new house, which she had painted green. Like most of the village, the old shack was made of unplastered clay. Plastered houses, paint on the walls: a status symbol. One room was specially prepared for her shop. "It used to be a kiosk, now it's a real shop."

Adapted from Spiegel.³³

³³ Source: <https://www.spiegel.de/wirtschaft/mikrokredite-in-afrika-frau-adbenas-kleines-wirtschaftswunder-a-574570.html>

COVID-19 pandemic impacts on access to finance

Access to rapid financial sector assistance is a prerequisite for the survival of MSEs and SMEs in the pandemic. In many countries, there are emergency aid programs, such as emergency loans or bridging finance, some of which do not have to be repaid.

Here it is essentially a matter of convincing state institutions and the private financial sector not to drive the job machines and customers of tomorrow into insolvency today by failing to help them.

One of the first stimulus packages was the Coronavirus Aid, Relief; and Economic Security Act (CARES Act) in the United States, on 27 March 2020. The CARES Act is an economic stimulus package designed to help Americans affected by COVID-19. The CARES Act regulates the distribution of 2 trillion US dollars to different social groups in the USA:

- \$560 billion to individuals (full one-time payment of USD 1,200 (USD 2,400 for joint investment). In addition, these individuals are entitled to an additional payment of USD 500 per child)
- \$500 billion to large corporations
- \$377 billion to small businesses
- \$340 billion to state and local governments
- \$154 billion for public health
- \$44 billion for education and other causes

The European Parliament has agreed on a European stimulus package on 21 July 2020. For the first time in its history, the EU is jointly taking on debt to finance a €750 billion aid programme.

The agreement provides for a €750 billion recovery fund to help EU countries hit particularly hard by the pandemic back on their feet. €390 billion of this will be paid in grants, less than proposed by Germany, France and the EU Commission, €360 billion in loans.

g. Access to technology

Access to information about KETs (Key Enabling Technologies) is essential for the development and growth of MSMEs.

Definition: Key Enabling Technologies (nanotechnology, micro-/nano-electronics, photonics, advanced materials, industrial biotechnology, and advanced manufacturing technologies).³⁴

Due to the increasing differentiation and innovation in the field of technologies, it is hardly possible for MSMEs with only a few employees to keep track of state of the art. This is where supporting networks of public and industrial institutions have to intervene. Such a network exists in the EU with the KETs Technology Centres.

What are KETs Technology Centres?³⁵

KETs Technology Centres help SMEs across the 'Valley of Death' and go from lab to market to develop and produce new KETs-based products. They help companies reduce the time-to-market for new innovative ideas.

KETs Technology Centres are public or private organizations carrying out applied research and close-to-market innovation (Technology Readiness Levels TRL 3 to 8, not necessarily the whole range) in Key Enabling Technologies (KETs).

Technology Centres typically provide the following services to SMEs:

- Access to technical expertise and facilities for validation;
- Demonstration;
- Proof of concept/lab testing
- Prototype development and testing;
- Pilot production and demonstration/ pilot lines / pre-series
- Product validation / certification

What are the criteria for inclusion in the list of KETs Technology Centres?

Technology centres have to comply with 3 qualitative criteria:

- Provide services to industry and SMEs
- Be active in at least one Key Enabling Technology
- Be active in the higher Technology Readiness Levels (TRL) – have activities in TRL 5, TRL 6, TRL 7 or TRL 8

³⁴ From: <https://ec.europa.eu/growth/tools-databases/kets-tools/kets-tc/map>.

³⁵ From: <https://ec.europa.eu/growth/tools-databases/kets-tools/kets-tc/map>.

Technology Centres have to comply with at least two additional quantitative criteria among the following 4:

- More than ten projects with SMEs in the last two years.
- More than two major investments in equipment for close-to-market R&D activities with industry in the last three years. The Centre should provide a short description of these investments (type, functionality and investment amount)
- At least 15 per cent from industrial funding in the total annual funding of the Centre in the last two years.
- At least 7 per cent from projects with SMEs in the total turnover of the Centre in the last two years.

Technology Centres are responsible for the correctness and accuracy of the information provided.

There are more than 250 KETs technology centres in the EU that meet these criteria and are part of the EU-wide network. These KETs technology centres help MSMEs to develop, test and certify new products and services. They are spread all over the EU.

COVID-19 pandemic impacts on access to technology

As described above, access to new technologies also depends on access to information on new technologies. In times of a pandemic, the webinars and other online training courses of the KET Technology Centres are particularly useful for this purpose (Fig. 20).

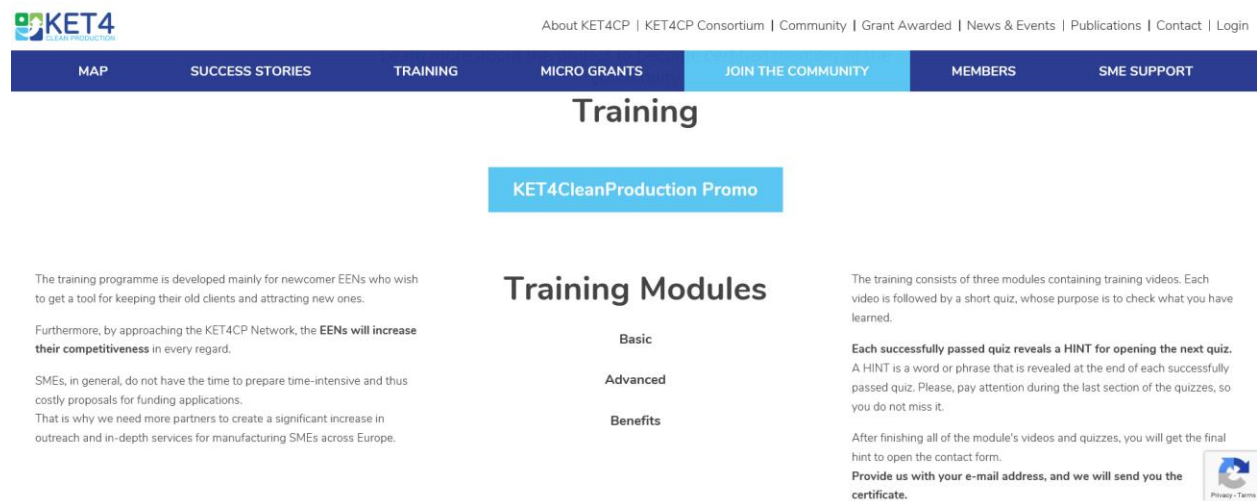


Figure 20: Training Course for SMEs by KET 4Clean Production.³⁶

³⁶ From: <https://www.ket4sme.eu/training>

h. Logistics and supply chains

MSMEs and SMEs should use supply chain management systems (SCM systems) to monitor and manage their supply chains. These programs make it easier for managers to keep track of the supply chains, on which the company depends so that they can intervene directly if problems arise. Thakkar, Jitesh J. & Deshmukh, S.G. (2009) describe in their study "Supply chain management for SMEs: A research introduction" the most critical points that should go into an SCMS:

Thakkar, Jitesh J. & Deshmukh, S.G. (2009) notes that a number of experts and practitioners from supply chain strategy recommends four metrics for executives' attention which incorporate all the dimensions of supply chain performance and respond to the factors that external stakeholders, analysts and venture capital firms take into consideration when evaluating a firm. This mainly includes:

- Total supply chain cost. The cost of fulfilment as a percentage of revenues or cost of fulfilment per case ordered.
- Service level. It includes fill rate (availability- the ratio of a number of items ordered by customers and number of items delivered to customers), operational performance (in terms of average order cycle time, consistency of order cycle time or on-time deliveries, and service reliability (deals with the accuracy of work in order entry, warehouse picking, and document preparation, etc.).
- Asset management. It focuses on the utilization of capital investments in facilities and equipment as well as working capital invested in inventory. Basically, two metrics are essential in this regard – capacity utilization and inventory turnover ratio (ratio of cost of goods sold during a time period to average unit inventory during the time period).
- Customer accommodation. It aims to capture measurement of perfect orders (an indicator of an organization's commitment to zero-defect logistics), absolute performance (provides a better indication of how a firm's logistical performance really impacts customers) and customer satisfaction.
- Cash-to-cash cycle time. It is the time required to convert a dollar spent on inventory into a dollar collected from sales revenue.
- Benchmarking. It makes the management aware of the state-of-the-art business practices. It may include internal benchmarking, competitor benchmarking and unrestricted benchmarking.

The importance of SCM systems is underestimated and sometimes misused by many MSMEs. Thus, Vuolle (2016) describes in his analysis "How SMEs can win with supply chain management systems" the main errors in the use of SCM systems:

Small and medium-sized enterprise owners need to understand that they have an untapped gold mine right in front of their eyes. It's their supply chain management system.

Even though SMEs can choose from among an abundance of such software, which supports the daily decision making of complex matters like what to buy, when, how much and from where, too few understand the true value of it. We have been living in the age of information technology for many decades. Still, many SME owners do not appreciate that IT systems, such as SCM systems, are only as good as the data entered into them. In my experience, many SMEs are not taking SCM systems seriously enough, and, as a result, they are losing market share and, ultimately, money.

Most of the SMEs had not been maintaining the most superficial data, such as product lead times or minimum stock levels, in their SCM systems. They left these fields empty or entered meaningless data. Instead of entering the correct data and letting the SCM system do the work, the SME owner did a lot of manual calculations while sitting in front of the computer.

As well, the most straightforward SCM processes were not in place or, if they did exist, were not followed. Often the SME owner talked about and planned to use an SCM system, but the good intentions ended up buried under the daily piles of work. This usually happened because the SME owner did not let employees run these SCM projects in a consistent way. Basically, the SCM strategy in many SMEs is non-existent. This has to change.

While daily business life is, even in SMEs, increasingly global, complex and fast-paced, with information flowing into a company from various directions, the human being can only handle a limited amount of data. Even a small company can have thousands of products and hundreds of customers and several suppliers that must be managed daily or weekly.

SCM systems offer huge process, customer satisfaction and direct cost reduction potential for SMEs. Without proper SCM strategy, action plan and processes, SMEs will lose business to competitors who have already implemented SCM.

Barriball et al. (2020) give some recommendation in their publication “Supply-chain recovery in coronavirus times - plan for now and the future” to generate plans of action to protect the companies, employees and supply chains from the worst consequences of the corona pandemic:

Actions taken now to mitigate impacts on supply chains from coronavirus can also build resilience against future shocks. Even as the immediate toll on human health from the spread of coronavirus (SARS-CoV-2), which causes the COVID-19 disease, mounts, the economic effects of the crisis—and the livelihoods at stake—are coming into sharp focus. Businesses must respond on multiple fronts at once: at the same time that they work to protect their workers’ safety, they must also safeguard their operational viability, now increasingly under strain from a historic supply-chain shock. Many businesses are able to mobilize rapidly and set up crisis-management mechanisms, ideally in the form of a nerve centre. The specific focus is naturally short term. How can supply-chain leaders also prepare for the medium and long terms—and build the resilience that will see them through the other side? What to do today?

In the current landscape, we see that a complete short-term response means tackling six sets of issues that require quick action across the end-to-end supply chain. These actions should be taken in parallel with steps to support the workforce and comply with the latest policy requirements:

- Create transparency on multitier supply chains, establishing a list of critical components, determining the origin of supply, and identifying alternative sources.
- Estimate available inventory along the value chain—including spare parts and after-sales stock—for use as a bridge to keep production running and enable delivery to customers.
- Assess realistic final-customer demand and respond to (or, where possible, contain) shortage-buying behaviour of customers.
- Optimise production and distribution capacity to ensure employee safety, such as by supplying personal protective equipment (PPE) and engaging with communication teams to share infection-risk levels and work-from-home options. These steps will enable leaders to understand current and projected capacity levels in both workforce and materials.
- Identify and secure logistics capacity, estimating capacity and accelerating, where possible, and being flexible on transportation mode, when required.
- Manage cash and net working capital by running stress tests to understand where supply-chain issues will start to cause a financial impact.

COVID-19 pandemic impacts on Logistics and supply chains

The supply chains are the main problem with the supply of CRMs in the COVID-19 pandemic. Considerable delays must be expected here. The path from mining to the final product is directly dependent on the availability of logistics and personnel. Within the supply chains all the problems of the pandemic can occur, the truck which is not allowed to pass a provincial border, the interposed customs office in the port, the merchant ship which has to be in quarantine for 3 weeks, the customs clearance in the port of destination which has no people to clear, etc. are problems which cannot be calculated in advance.

These problems can only be solved after loosening the lockdown criteria, and thus only after the pandemic.

Chapter 4

Summary and Conclusions

4. Summary of Guidelines and Best Practices and Conclusions

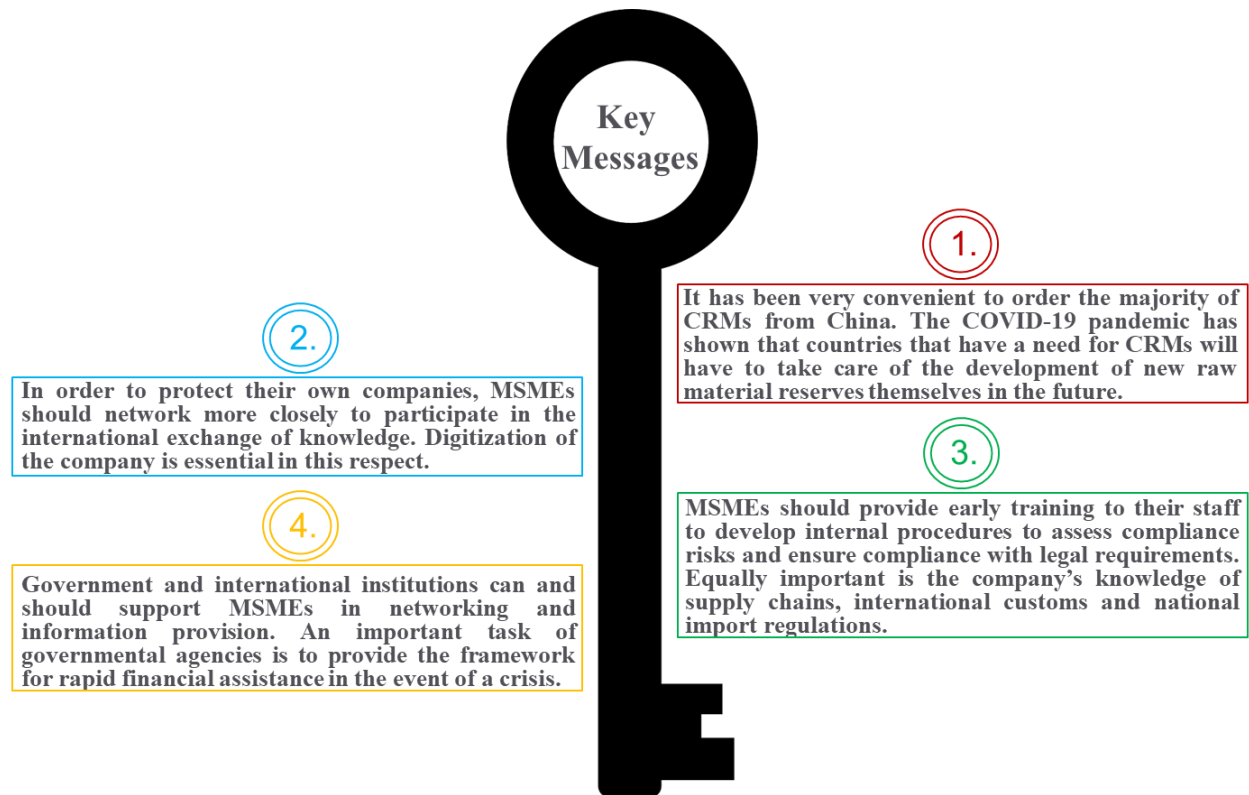


Figure 21: Key messages of this report.

Production and availability of CRMs must be increased to ensure supply of CRMs. This applies not only to MSMEs but to the entire industry. It was indeed very convenient to order required raw materials without discussions with mining opponents or environmentalists in China. But the current pandemic has shown that a virus can endanger the supply chain of raw materials. The market for CRM has so far, not shown any severe shortcomings of CRMs. The market for medicines looks very different. Especially in Europe and Germany, one often hears the sentence "is currently not available" in pharmacies. The reason for these supply shortfalls is that Europe has outsourced its supply of basic drugs to East Asia, just as the world has outsourced its supply of CRMs to China.

We do not know what effect a second wave of the pandemic would have in China. The security of raw material supply could suffer considerably if a second pandemic wave develops badly. Everything speaks in favour of decentralising the supply of CRM in the future and circumventing

the “quasi-existing” or de facto Chinese monopoly for a large proportion of CRMs. This means, however, that in return the industrialised countries and emerging markets will have to restart their exploration to explore new deposits of CRMs and that the mining of CRMs has to be restarted in countries, which are in need of CRMs for production (Fig. 21).

Politicians must be advised to keep their nerves during the pandemic. Almost all economies in the world are based on MSMEs and SMEs. Countries that leave their MSMEs and SMEs alone during the crisis and leave them defenceless and without support to governmental measures to contain the pandemic (lockdowns, etc.) and financial difficulties such as payment problems, repayment delays for loans etc., will be economically left behind after the crisis by countries that have not done so. As a result, the COVID-19 Pandemic will show how stable the political and economic conditions within the respective countries are.

Even now, during the crisis, it is becoming apparent which economies are resilient and which are not. Past mistakes cannot be quickly corrected in such a crisis, so the only recommendation for the future is to learn from the COVID-19 pandemic.

a. Recommendations for MSMEs

An excellent introduction to the subject of “What SMEs must do to comply with all rules and regulations and laws” and what are the obligations of SMEs to comply can be found on the website of the UNECE Trade Facilitation Implementation Guide:

What can SMEs do?³⁷

All economic operators may benefit from trade facilitation measures, such as simplified customs clearance, comprehensive guarantees or authorized trader programs. To benefit from these measures, operators and government engage in a partnership.

The trading community can do its part to become a trustworthy partner for government and benefit from such trade facilitation measures. They can change their conduct-of-business, namely their compliance management, actively engage in private-public consultation and stay informed of the legal and regulatory framework. This entails knowing and respecting legal obligations regarding financial solvency, record keeping, accounting standards, and duty of care.

This means that SMEs have to, at least:

- Put in place internal procedures to assess compliance risks and ensure compliance with a regulatory requirement, including, amongst others, requirements resulting from Customs law regarding classification, valuation, preferential origin certificates and anti-

³⁷ Adapted from the UNECE - Trade Facilitation Implementation Guide;
<http://tfig.unece.org/contents/what-can-SMEs-do.html>

dumping and countervailing duties, IP law, and trade law regarding export and import licenses, dual-use goods, and international sanctions.

- Put in place desk procedure to verify information submitted to government authorities and commercial partners, and review government decisions.
- Establish a reliable system for record-keeping, ideally integrated or cross-referenced with the internal accounting system that allows full tracking of goods and shipments.

SMEs that would like to join Authorized Trader or Authorized Economic Operator programs should inform itself of the detailed requirements of such programs, in particular in the area of security and safety requirements for infrastructure and staff, and professional qualification requirements for staff.

Record-keeping

This term describes the rules regarding retention of records, recordkeeping requirements and procedures governing the maintenance, production, inspection, and examination of records.

Requirements for record-keeping span across several government agencies and result from different bodies of law, including Customs and tax law. Generally, the rules define the required period (between 3-10 years), and the form in which the records must be stored (originals, paper and or electronic form), the obligations of third parties, such as clearing agents or freight forwarders to keep records on other operators' behalf, and the examination rights of the relevant government authorities.

Duty of care

Under Customs and commercial law, duty-of-care commonly requires adherence of the operator to a standard of reasonable care when performing import and export activities. This principle includes the duty to keep informed of applicable laws and regulations, to comply with regulatory requirements, to provide correct information and data to the government authorities, i.e. the obligation of 19 U.S. Code § 1484 to use "reasonable care" when making an entry with the US Bureau of Customs and Border Protection.

Duty-of-care is an important notion in case of an infringement of Customs law or other laws which can be treated as obvious negligence if it results from a lack of reasonable care. Operators need to apply particular care when classifying and determining the value of goods themselves, which commonly is not considered a minor error but an infringement and serious offenses and may lead to the imposition of penalties.

Integrated Services for MSMEs in International Trade (ISMIT)

SMEs can use the services of the integrated online platforms for accessing comprehensive services for participating in international trade. Currently, the UN/CEFACT is working on such a concept titled Integrated Services for MSMEs in International Trade (ISMIT). The ISMIT concept proposes an integrated, end-to-end eCommerce trade services platform for MSMEs to more effectively engage in cross-border trade. The services can include access to logistics service

providers, financing services, insurance services as well as regulatory services that can either be through connectivity to a Single Window or directly to Customs for export and import declarations and to other government administrations.³⁸

For further information MSMEs could contact:

EU AEO Guidelines

European Commission (2016) TAXUD/B2/047/2011 –Rev.6

US Bureau of Industry and Security Compliance guidelines: how to develop effective export management and compliance program and manual.

Here, the legal principle applies that ignorance does not protect against punishment.

Further recommendations

MSMEs should become members of professional or business associations, even if this costs dues. It is precisely these associations that make a decisive contribution to protecting MSMEs from harm and conflict with government agencies through advice and information. A fine for non-compliance is usually considerably more expensive than the annual fee of a professional or business association. Furthermore, MSMEs should attend training courses offered by chambers of commerce and industry or similar institutions. In general, training of the staff or parts of the staff is always recommended (Fig. 21).

An essential measure during the pandemic is for MSMEs to retain specialist staff. For companies that are now laying off staff that they will need urgently when the pandemic is over, this step could also mean the end of the business. After the pandemic, as the analysis of the Spanish flu from 1918 to 1920 has shown, the economy will try to compensate for the losses from the pandemic. Companies that do not have enough qualified personnel will have difficulty finding them on the labour market, as all companies are trying to hire new staff. Companies that fail here will go bankrupt.

Minimizing impairment of MSMEs by the COVID-19 pandemic³⁹

Businesses will bear the brunt of social distancing practices and disrupted supply chains caused by the outbreak of COVID-19.

While it is too soon to say what the impact of the pandemic will have on the local economy, many small to medium-sized enterprises (SMEs) will be most affected by changes in customer behaviour, labour shortages and late payments.

³⁸ The UN/CEFACT project can be followed here:

https://uncefact.unece.org/login.action?os_destination=%2Fpages%2Fviewpage.action%3FspaceKey%3Dthemepressdemo%26title%3DDISMIT%2B-%2BIntegrated%2BServices%2Bfor%2BMSMEs%2Bin%2BInternational%2BTrade&permissionViolation=true

³⁹ From Independent Online/South Africa;

<https://www.iol.co.za/business-report/companies/how-smes-can-prepare-for-impact-of-covid-19-45125716>

Given their size, lack of access to emergency capital and additional resources, small businesses are likely to be most affected by the declaration of the national state of disaster," says Daniel Goldberg, Chief Executive of Bridgement, a Fintech company offering digital invoice financing and credit facilities to SMEs.

"It's difficult to determine how long businesses will experience disruptions from COVID-19; it could be weeks or months. The best thing SMEs can do is to be as prepared as possible," said Goldberg, who highlights some key considerations for local SME owners to manage the impact of the outbreak:

1. Monitor customer behaviour: Small businesses may need to alter their activities to suit their customers change in behaviour. SMEs in the service industry is at risk due to restrictions on travel and fear around contamination, making it more difficult to make up cash flow losses.
2. Manage cash flow: Under extended pandemic scenarios, SMEs are at risk of running short on working capital. Labour and material shortages and lower demand from customers may result in less turnover.
3. Communicate with suppliers: While you may not have direct links of trade to China or any other affected regions, some of your suppliers might. Ask if they're facing delays in obtaining stock and whether or not they have additional materials on hand for you to purchase in advance.
4. Balance supply and demand: Consider whether production can be scaled back or amended to protect imported stock. If this is your business's offseason, look into slowing down on the production side of things to keep a steady cash flow available.
5. Consider a work from the home policy: If your industry, internal systems and processes allow for it, consider allowing employees to work from home. This can help maintain productivity and significantly reduce the chances of employees contracting COVID-19. Remote work is especially relevant for SMEs in professional services but is less applicable for SMEs in the manufacturing and retail/restaurant sectors.
6. Prepare for late payments: If your business fits into a larger supply chain, you may face late payments from customers who are experiencing a decline in sales as a result of the outbreak. It may be worth looking into accessing additional funding to manage this.

With the economy already feeling the pinch of the recession, the government is finalizing a package of interventions to offset the impact of COVID-19 on local businesses.

"SMEs will need financial support during this difficult economic time," concluded Goldberg.

b. Policy recommendations

A very good overview of recommendations to the policy for the promotion of MSMEs is provided by the study of the OECD “Recommendations for Georgia’s SME Development Strategy 2016-2020; March 2016; Project Report Working Group on SME Development Strategy”.⁴⁰

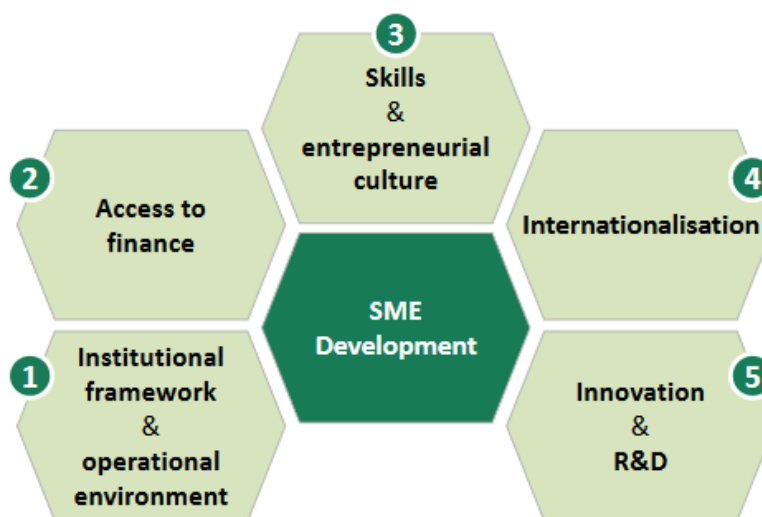


Figure 22: SME Development.⁴¹

The policy recommendations for SME development follow five strategic directions (Fig. 22): institutional framework and operational environment; access to finance; skills and entrepreneurial culture; internationalisation; innovation, and R&D. The study provides many examples and recommendations on how political institutions can facilitate the business of SMS and MSMEs:

1 Improve the institutional framework and operational environment

- create formal co-ordination mechanisms for SME policy amongst policy stakeholders;
- conduct regular SME-specific regulatory impact assessment;
- improve business closure and insolvency procedures;
- improve SME statistics collection and dissemination; and
- streamline the SME definition across statistics and policymaking

2 Ease access to finance for SMEs

- amend the legal framework on public grants;
- improve supply-side financial skills to leverage the regional presence of banks;
- promote demand-side financial education programs targeting SME entrepreneurs;

⁴⁰ Modified from: http://www.oecd.org/eurasia/competitiveness-programme/eastern-partners/Recommendations_for_Georgia_SME_strategy.pdf

⁴¹ From: http://www.oecd.org/eurasia/competitiveness-programme/eastern-partners/Recommendations_for_Georgia_SME_strategy.pdf

- consider establishing a credit guarantee scheme as a risk-sharing mechanism; and
- improve alternative non-bank and equity financing for SMEs

3 Promote skills development and entrepreneurial culture

- develop a country-wide labour market and training needs analysis;
- strengthen stakeholders' participation in developing and implementing VET policies;
- improve the quality and attractiveness of VET institutions;
- facilitate SME access to non-formal training;
- promote entrepreneurship through formal educational institutions; and
- support women's entrepreneurship

4 Support SMEs' internationalisation

- improve export promotion activities and export-related skills among SMEs;
- provide services to SMEs to adapt to DCFTA requirements;
- provide targeted financial support to exporting SMEs; and
- facilitate SME integration into global value chains through FDI-SME linkage programs

5 Facilitate SMEs' innovation and R&D

- amend the legal framework for innovation;
- foster collaboration between industry and academia; and
- consider providing financial support to SMEs for innovative activities.⁴²

MSME Raw Material Alliance for Circular Economy (MRM-ACE)

Establishment of an “MSME Raw Material Alliance for Circular Economy (MRM-ACE)” is recommended.

MRM-ACE could be a platform to bring together MSMEs, Policymakers and Financial Institutions to support raw material supply chains in the UNECE region. Such a platform could be a starting point for MSMEs. They want to develop into the international market for CRMs and other goods. It could act as an interface between the individual company and the large international institutions and help small and medium-sized entrepreneurs to obtain information and assistance more quickly and effectively.

MRM-ACE could be a platform for sharing knowledge on the raw material and circular economy. The targeted and effective use of raw materials requires special knowledge and know-how that a start-up company or MSME cannot provide for lack of specialised personnel. For similar reasons, MSMEs, the continually evolving circular economy with minimization of resource use and waste generation, pollution prevention and avoidance of carbon emissions, can neither technically nor organizationally keep an eye on this. A link between the circular economy and companies would be essential and helpful here.

The task of such an institution would be:

⁴² Further detailed information: [http://www.oecd.org/eurasia/competitiveness-programme/eastern-partners/Recommendations_for_Georgia_SME_strategy .pdf](http://www.oecd.org/eurasia/competitiveness-programme/eastern-partners/Recommendations_for_Georgia_SME_strategy.pdf)

- Discuss collaborative efforts
 - Social and environmental challenges and opportunities
 - Business models
 - Skills development
 - Investment channelling
- Provide best practices and guidelines.

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