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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 in Ukraine

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LIST OF ACRONYMS

ANMPP Artemivsk Non-ferrous Metals Processing Plant
CHP Combined heat and power
CIS Commonwealth of Independent States
CRIRSCO Committee for Mineral Reserves International Reporting Standards
CRMs Critical raw materials
CSOs Civil Society Organisations
EBRD European Bank for Reconstruction and Development
EC European Commission
EDF Entrepreneurship Development Fund
EDS Electronic Digital Signature
EU European Union
GDP Gross Domestic Product
GEA Geological and Economic Assessment
GGF United Kingdom Good Governance Fund
GMP Good Manufacturing Practice
GSE Association of Geological Services for Europe
GUF German Ukrainian Fund
HREEs Heavy rare earth elements
IAEA International Atomic Energy Agency
IFC International Finance Corporation
IT Information technology
JORC Joint Ore Reserves Committee
KET Key Enabling Technologies
KPI Kyiv Polytechnic Institute
LED Light emitting diode
LLC Limited Liability Company
LREEs Light rare earth elements
MAP Mykolayiv Alumina Plant
MRMB Mineral raw material base
MSMEs Mini, small and medium-size enterprises
NADPU National Association of Extractive Industries of Ukraine
NBU National Bank of Ukraine

NPPs Nuclear Power Plants
OECD Organisation for Economic Co-operation and Development
OPEC Organization of the Petroleum Exporting Countries
PERC Pan-European Reserves and Resources Reporting Committee
PGMs Platinum group metals
PRMS Petroleum Resources Management System
REEs Rare earth elements
RPT Registrar of Payment Transactions
SCDO State Cadastre of Mineral Deposits and Occurrences
SCMR State Commission on Mineral Resources
SECO Switzerland's State Secretariat for Economic Affairs
SMEs Small and medium-sized enterprises
SDGs Sustainable Development Goals
SEZs Special economic zones
SPE Society of Petroleum Engineers
SSC Single social contribution
STCU Science and Technology Center of Ukraine
TPSs Thermal Power Stations
UNECE United Nations Economic Commission for Europe
UNFC United Nations Framework Classification for Resources
UN OCHA United Nations Office for the Coordination of Humanitarian Affairs
UNRMS United Nations Resource Management System
USF Ukrainian Startup Fund
UUE Union of Ukrainian Entrepreneurs
VAT Value Added Tax
ZPAP Zaporizhzhia Production Aluminium Plant
ZTMP Zaporizhzhia Titanium-Magnesium Plant

EXECUTIVE SUMMARY

The assignment is carried out in cooperation with the United Nations Economic Commission for Europe, one of the partners executing the UNDA project «Global Initiative towards the post-COVID-19 resurgence of the MSME sector».

The project's overall goal is to strengthen the capacity and resilience of micro-, small and medium enterprises (MSMEs) in developing countries and economies in transition to mitigate the economic and social impact of the global Covid-19 crisis. The project is intended to assist the MSMEs to assure resiliency and progress towards a circular economy in sustainable resource management and critical raw material (CRM) supply chain solutions.

Ukraine is one of the pilot countries for such customization that would consider the country's specific conditions.

Due to the COVID-19 pandemic, Ukraine may face the worst recession in decades, leaving more than 9 million people in poverty. UN OCHA in Ukraine reports that more than 80 per cent of households have lost income since the beginning of the pandemic. In more than 40 per cent of families, at least one family member has lost her/his job. Although there are no data on eastern Ukraine, the pandemic's socio-economic consequences in the conflict-affected region will be destructive¹.

The study on MSMEs was conducted in the specific context of Ukraine. Guidelines and best practices were developed based on the analysis of MSMEs' situation due to the COVID-19 crisis. This study highlights how opportunities and challenges in the area of critical raw materials supply chain and how MSMEs can contribute to building back the economy from the pandemic related crises in Ukraine.

The main findings of the study are:

1. Application of UNFC and UNRMS in sustainable resource management can help MSMEs build innovative business models and gain from the new avenues that are being opened.

2. It has been acknowledged that there are specific opportunities for the producing the vast majority of elements presented in the table of critical for the European Union positions (Study on the EU's list of Critical Raw Materials (2020) Final Report).

3. An additional opportunity for MSMEs to join the critical raw material supply sphere could be recycling waste or processing used products.

4. Ukraine's integration into European society expands existing and opens up new opportunities for MSMEs to participate in supply chains.

5. Disclosure of geological information in the "open data" format will be one of the incentives to increase investments in critical raw materials production.

6. Access to information on technologies that facilitate the extraction, enrichment and use of critical raw materials is essential for the development and growth of MSMEs.

7. Recommendations have been provided for MSMEs to minimize the risks associated with changes in consumer demand.

Guidelines have been developed considering the main principles of the UNFC and UNRMS for MSMEs and the Government of Ukraine to assure resiliency and progress

¹ Source: The COVID-19 Crisis in Ukraine. OECD (2020) Tackling coronavirus (COVID-19). Contributing to a global effort. <https://www.oecd.org/eurasia/competitiveness-programme/eastern-partners/COVID-19-CRISIS-IN-UKRAINE.pdf>

towards a circular economy in sustainable resource management and critical raw material supply chain solutions.

The customized Guidelines and Best Practices for Ukraine have become the basis for an on-line training course.

INTRODUCTION

On March 3, Ukraine announced the first confirmed coronavirus disease case in a man from Chernivtsi, who arrived from Italy to Romania by plane and then arrived in Ukraine by car.

On March 11, following Article 29 of the Law of Ukraine “On Protection of the Population from Infectious Diseases”, to prevent the spread of coronavirus COVID-19 in Ukraine and taking into account the decision of the State Commission on Technogenic and Environmental Safety and Emergencies of March 10, 2020, the Cabinet of Ministers of Ukraine published a decision on the introduction of quarantine.

As of 17 November, a total of 557 657 cases of COVID-19 had been confirmed in Ukraine, including 9 856 deaths and 250 983 fully recovered. In the past 24 hours, 11 968 new cases were confirmed. The seven-day moving average of newly-confirmed cases stood at 10 953 – its highest point since March. The case fatality rate is 1.8 per cent.

Micro, small and medium enterprises (MSMEs) constitute the majority (91 per cent) in the Union of Ukrainian Entrepreneurs’ structure, which entrepreneurs have established for entrepreneurs to create and develop a favourable business environment in Ukraine. It unites independent Ukrainian entrepreneurs, regardless of their activities’ scale, industry and geography, and stands for innovation and opening new markets for Ukrainian companies. These enterprises are the main drivers of economic development and are particularly severely affected in any scenario.

The central sphere of MSMEs activity is in retail and wholesale trade, as well as consulting, marketing and advertising services, non-banking financial services, production of equipment, furniture and mechanical engineering, services, HoReCa (**H**otel, **R**estaurant, **C**atering), construction and architecture, IT companies, providers of educational services, logistics, maintenance of the mining industry, etc.

In the globalized world economy, the main threat during global crises is the interruption of supply chains. This interruption of critical raw materials’ supply chains automatically leads to stagnation in developing those economies that do not have their raw material reserves.

This study examines opportunities and challenges for MSMEs in Ukraine involved in the supply of critical raw materials necessary in response to the COVID-19 pandemic and post-pandemic economic recovery. The pandemic has put the critical raw material supply chains under severe pressure in Ukraine and worldwide, but it opens opportunities that MSMEs could fill in. Ukraine was among the world’s leading producers of several types of critical raw materials, such as graphite, lithium, titanium, manganese and uranium. In Ukraine, many opportunities are emerging from the COVID-19 situation that will allow MSMEs to make a significant contribution to sustainable resource management, building resiliency and progress towards a circular economy. However, the economic disruptions have brought in new challenges, which will require innovative solutions. Application of UNFC and UNRMS in sustainable resource management can help MSMEs to build innovative business models and gain from the new avenues that are being opened. The report focuses on Guidelines and Best Practices for MSMEs to build resiliency in critical raw material supply solutions, drawing from crucial examples. The study is expected to assist entrepreneurs, business development managers, technical experts in

existing and potential MSMEs, financiers, Government officials, and policymakers in Ukraine understand the COVID-19 related issues, challenges and opportunities in critical raw material supply.

As a result of the conducted work, it has been acknowledged that COVID-19 became one of the main economic factors in Ukraine in 2020. Given that MSMEs provide about 64 per cent of added value, jobs for 81.5 per cent of employees and 37 per cent of tax revenues, and they are involved in the formation of raw material base and supply of critical raw materials in Ukraine, the introduction of restrictive measures has led to significant adverse consequences for MSMEs.

It could be concluded that defining parameters and critical raw material management system are the product of the implementation of legal, geological, economic and socio-political factors governing the geological study and use of the country's mineral base. Criticality should be determined by parameters that take into account the methodological principles of the UNFC and UNRMS. It is noted that basic principles of resource formation and management in Ukraine correspond to the UNFC and are implemented since 1997, and, since 2019, Ukraine has adopted a classification based on the principles of the UNFC at the state level.

Based on the analysis of the mineral reserve balance and existing occurrences in Ukraine, it has been acknowledged that there are certain opportunities for the production of the vast majority of elements presented in the table of critical for the European Union positions (Study on the EU's list of Critical Raw Materials (2020) Final Report), and they have been divided into three groups according to the level of supply risk:

- 1) low level of supply risk: gallium, hafnium, magnesium, natural graphite, scandium, silicon metal, titanium;
- 2) medium level of supply risk: barite, beryllium, bismuth, cobalt, coking coal, fluorspar, heavy and light rare earth elements, tantalum, niobium, phosphorite, phosphorus (apatite), lithium, strontium;
- 3) high level of supply risk: antimony, boron, germanium, platinum group metals, tungsten, vanadium, bauxites.

It has been mentioned that Ukraine has production capacities in several sectors that use raw materials, which, when processed, allow it to concentrate on some raw materials that are critical for the EU. An additional opportunity for MSMEs to join the sphere of critical raw material supply could be recycling waste or processing used products. The state's plans to restore primary industries, such as aerospace, mechanical engineering, shipbuilding, chemical, military and energy industry, and develop the country's infrastructure will stimulate domestic demand, including critical raw materials.

In 2019, Ukraine took second place according to the number of investments from the EBRD and first place – according to the number of signed projects. The total amount of new investments under all programs exceeded € 1.1 billion, which was used to support 51 projects. This will lead to introducing the latest technologies in the extraction and processing of raw materials to obtain more competitive commodity products.

COVID-19 will positively affect supply and demand for a long time to come. Some sectors will recover quickly, but the situation with industry and investment demand is much worse. 2020 changed the usual way of life. People have learned to live in conditions of pandemics and constraints. According to the results of 2020, the fall in Ukraine's GDP

is estimated at 4.2 per cent, which is lower than the previous forecast by 0.6 per cent. Both now and in the post-pandemic period, MSMEs have many perspectives in Ukraine, and they should seize opportunities and join or expand their participation in critical raw materials supply chains or related industries. Ukraine's integration into European society expands existing and opens up new opportunities for MSMEs to participate in supply chains.

Changes have been made in the work of the State Service of Geology and Subsoil of Ukraine to overcome corruption and restore confidence in the Service, improve the efficiency of subsoil use and attract industry investments. At the same time, it is emphasized that the industry potential remains unfulfilled, so only about 35 per cent of the more than 9,000 mineral deposits of commercial importance were developed in 2019. Disclosure of geological information in the "open data" format will be one of the incentives to increase investments in production.

It is emphasized that the MSMEs' success depends on continuous improvement of staff skills, and there are many opportunities for this now. For MSMEs to participate in the EU's sustainable critical raw materials supply chains, they have every opportunity to acquire professional knowledge and improve qualifications and skills in Ukraine. A necessary condition for the inflow of finance in MSMEs is the investment attractiveness of the company. Access to information on technologies that facilitate the extraction, enrichment and use of critical raw materials is essential for the development and growth of MSMEs.

The pandemic has shown that the virus can threaten the raw materials supply chain, which speaks in favour of increasing the supply of critical raw materials from Ukraine, located next to the European Union with a developed infrastructure and resources. Any crisis is an opportunity for business transformation and development. Business's response and actions during the crisis must be quick. Issues of safety and well-being of employees have become particularly important. It is essential to find a balance to support current operations in the new environment with minimal business losses.

Recommendations have been provided for MSMEs to minimize the risks associated with changes in consumer demand: it is necessary to monitor short-term liquidity, assess financial and operational risks and respond quickly, create a reserve fund that can keep the company afloat from several months to a year; track factors that may affect consumers, suppliers, contractors and partners, and continuously develop and improve skills of employees.

1. Background

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

Small and medium enterprises are the “backbone” of developed economies. For example, in the EU, MSMEs constitute more than 90 per cent of all enterprises and provide a significant number of people with jobs. They also provide the main impetus for a market economy due to their innovative aspirations. The share of small and medium-sized enterprises in Ukraine’s economy is also significant. MSMEs constitute about 99.98 per cent of all business entities in terms of their amount, 82 per cent – in terms of employment, and 65 per cent – in terms of sales of goods, works and services.

The criteria to define the concept of MSMEs vary depending on the country. In most cases, the upper limit designating MSMEs is a maximum of two hundred and fifty employees in the European Union, while some countries limit 200 employees. The United States considers SMEs to include firms with less than 500 employees. Small companies are generally those with fewer than 50 employees, while micro-enterprises have at most 10 or 5 workers. Financial assets are also used to define MSMEs.

According to the Law of Ukraine dated 5.10.2017 № 2164-VIII, amendments were made to Article 2 of the Law on Accounting, namely: the classification of enterprises was added (except for budgetary institutions) as given in Box 1.

Box1 Criteria for MSMEs in Ukraine

Micro-enterprises are firms indicators of which at the date of the annual financial statements for the year preceding the reporting year meet at least two of the following criteria:

- balance value of assets — up to 350 thousand euro;
- net income from sales of products (commodities, works, services) — up to 700 thousand euro;
- the average number of employees — up to 10 people.

Small are enterprises that do not meet the criteria for micro-enterprises and indicators of which at the date of the annual financial statements for the year preceding the reporting year meet at least two of the following criteria:

- balance value of assets — up to 4 million euro;
- net income from sales of products (commodities, works, services) — up to 8 million euro;
- the average number of employees — up to 50 people.

Medium are enterprises that do not meet the criteria for micro-enterprises and indicators of which at the date of the annual financial statements for the year preceding the reporting year meet at least two of the following criteria:

- balance value of assets — up to 20 million euro;
- net income from sales of products (commodities, works, services) — up to 40 million euro;
- the average number of employees — up to 250 people.

As of 2019, according to the State Statistics Service of Ukraine, the number of entities is 1,839,593 enterprises, including those categorized according to the structure, which is shown in Table 1:

Table 1. Indicators of structural statistics for entities with distribution by their size².

Years	Total	Including enterprises			
		large	medium	small	micro-enterprises
Number of entities, units					
2010	2183928	586	20983	357241	300445
2011	1701620	659	20753	354283	295815
2012	1600127	698	20189	344048	286461
2013	1722070	659	18859	373809	318477
2014	1932161	497	15906	324598	278922
2015	1974318	423	15203	327814	284241
2016	1865530	383	14832	291154	247695
2017	1805059	399	14937	322920	278102
2018	1839593	446	16057	339374	292772
Number of entities per 10 thousand people of the current population, units					
2010	477	0	5	78	66
2011	372	0	5	77	65
2012	351	0	4	76	63
2013	378	0	4	82	70
2014	450	0	4	76	65
2015	462	0	4	77	66
2016	437	0	4	68	58
2017	425	0	4	76	65
2018	435	0	4	80	69
Involved employees, thousand people					
2010	10772,7	2400,3	3393,3	2164,6	832,6
2011	10164,5	2449,0	3252,6	2091,5	788,9
2012	9957,6	2484,2	3144,2	2051,3	788,2
2013	9729,1	2383,7	3012,1	2010,7	795,3
2014	8796,7	1915,1	2696,5	1686,9	723,5
2015	8180,0	1708,6	2604,7	1576,4	691,4
2016	8108,3	1586,6	2622,8	1591,7	642,7
2017	8141,0	1560,9	2593,1	1658,9	714,6
2018	8532,5	1574,3	2744,2	1641,0	704,3
Hired employees, thousand people					
2010	8845,8	2400,3	3392,4	2043,7	762,0
2011	8757,9	2449,0	3251,6	2011,8	757,4
2012	8620,3	2484,1	3141,9	1951,6	736,5
2013	8279,4	2383,7	3010,1	1891,8	734,4
2014	7100,0	1915,1	2694,9	1583,0	626,6
2015	6437,6	1708,6	2603,2	1466,3	587,8
2016	6461,9	1586,6	2621,4	1505,9	565,2
2017	6575,9	1560,9	2591,3	1562,4	625,4
2018	6959,9	1574,3	2742,5	1553,8	623,0
Sold products (commodities, services), million UAH					
2010	3596646,4	1401596,8	1396364,3	568267,1	181903,1
2011	4202455,2	1775829,0	1607628,0	607782,4	189799,1
2012	4459818,8	1761086,0	1769430,2	672653,4	212651,2
2013	4334453,1	1717391,3	1662565,2	670258,5	216111,4
2014	4459702,2	1742507,9	1723151,5	705000,5	230729,3

² Information is given without taking into account the results of activities of banks and budgetary institutions and does not cover Crimea, the city of Sevastopol, and non-Government-controlled areas of Donetsk and Luhansk oblasts.

2015	5556540,4	2053189,5	2168764,8	937112,8	307450,0
2016	6726739,8	2391454,3	2668695,7	1177385,2	361784,0
2017	8312271,9	2929516,6	3296417,9	1482000,7	497777,1
2018	9966804,5	3515839,5	3924059,6	1766150,4	599625,6

In 2020, one of the main factors shaping MSMEs' economic development was the spread of the COVID-19 pandemic. In response to the COVID-19 pandemic, significant changes took place in the life of many countries around the world, including Ukraine. Thus, a state of emergency has been declared in countries or separate regions or areas; sanitary and epidemiological measures have been introduced in almost all countries (quarantine zones, temperature checks, cancellation of mass events, closure of educational, cultural and entertainment facilities); restrictions on departure/entry to countries and travelling within countries; the role of government regulation in emergency conditions has been strengthened; restrictions on labour activities have been applied; new distance forms of work and education have been introduced.

The International Monetary Fund has updated its forecast regarding the decline of the global economy, which is about to decrease from 3 per cent to 4.9 per cent in 2020 since the coronavirus pandemic had a more negative impact on economic activity in the first half of the year than it had been previously forecast. This is stated in the June World Economic Outlook Update from the IMF.

According to experts' forecasts, Ukraine will demonstrate a more profound decline than the global economy, which will be 6 per cent in 2020 (previously, the consensus forecast and the decline was 4.2 per cent).

One of the key strategic factors for the stable development of the economy of Ukraine and the achievement of the proper level and quality of life is the formation of modern civilized entrepreneurship. The main tasks of the state in the process of stimulation of the development of domestic entrepreneurship should be as follows: simplification of the business start-up procedure and creation of favourable conditions for effective and successful development of entrepreneurship in the future; formation of an adequate tax and legal framework for the development of entrepreneurship without bureaucratic barriers. Businesses need to realize their strategic resources and become one of the factors that would help our country overcome the economic crisis and make Ukraine an equal participant in the world's market relations. One of the positive factors of sustainable development is the participation of MSMEs in the raw material base and supply of critical raw materials.

b. Current status of MSMEs in critical raw material (CRM) value-chain in Ukraine

Interest in critical (strategic) minerals is becoming crucial in the global economy due to their natural limitations. The country's supply (or region) with raw materials is a factor of economic security, autonomy and a means of insurance against global crises.

Mineral raw materials are needed not only to produce a wide range of everyday goods and services, but also for the development of innovations, particularly for the development of more efficient and environmentally friendly technologies.

The acceleration of innovative technological cycles and rapid progress of developed countries has led to the increased global demand for prevalent metals and minerals. Ensuring access to a stable supply of many raw materials has become a major challenge for regional, national, and local economies with limited production, which depends on imports of many minerals, including critical mineral raw materials.

Public and private financial institutions have slightly different approaches to the definition of “critical raw materials”, but fundamental principles of the deficit of availability and complexity of supply logistics are decisive in characterizing this concept.

According to The American Geosciences Institute website, “critical minerals” are those that are essential to the economy and whose supply may be disrupted³. Experts of the European Union of Critical Raw Materials Alliance define “critical raw materials” as economically and strategically important raw materials for the European economy, which have a high-risk associated with their supply⁴. According to the definition of leading scientific geological organization under the Government of Australia (Geoscience Australia), critical minerals are metals and non-metals that are considered vital for the economic well-being of the world’s foremost and emerging economies, yet whose supply may be at risk due to geological scarcity, geopolitical issues, trade policy or other factors⁵. The main characteristic features of critical mineral raw materials (minerals) are their importance for the economy and deficit risk. Varieties of mineral raw materials with essential directions of use and face potential supply disruptions are crucial to a country or a region’s economic and national security⁶.

Some countries, such as members of the European Union, are developing a common strategy and approving joint lists of critical minerals. In particular, Canada and the United States have common interests in the sphere of critical raw material supply and ensuring the future competitiveness of the Canadian and American mining industries.

Thus, parameters (indicators) of criticality can be different: risk of deficit and economic importance, or supply risk (concentration of production), production growth (change in market size and geological resources) and market dynamics (price change). Sometimes different approaches are used to provide a more objective comparison between mineral raw materials and different markets. In this case, the overall economic significance is calculated by the ratio of gross value added to a country or region’s GDP.

Therefore, when defining “critical raw materials” it is necessary to comprehensively consider the chain of crucial criteria (parameters). At the end of which, a list of elements, raw materials that fall under this concept’s definition is formed.

During the *visualization* of the formation chain of the concept of “critical raw materials”, the authors consider three interdependent stages of definition: Mineral raw material base – Parameters of definition – List of critical raw materials.

³ Source: *Critical Minerals*//Official website of The American Geosciences Institute
<https://www.americangeosciences.org/critical-issues/critical-minerals>

⁴ What are Critical Raw Materials?//Official website of Critical Raw Materials Alliance. <http://criticalrawmaterials.org/critical-raw-materials/>

⁵ *Critical Minerals*//Geoscience Australia <https://www.ga.gov.au/about/projects/resources/critical-minerals>

⁶ Schulz K. J., DeYoung J. H., Seal R. R., Bradley D. C., eds., 2017, *Critical mineral resources of the United States – Economic and environmental geology and prospects for future supply*: U.S. Geological Survey Professional Paper 1802, 797 p.
https://pubs.usgs.gov/pp/1802/pp1802_entirebook.pdf

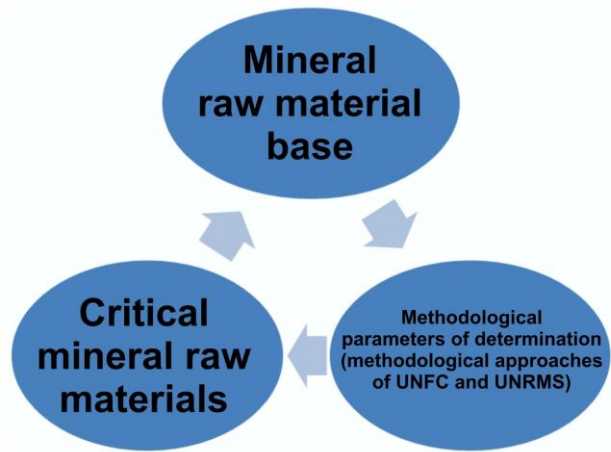


Fig.1. Process of defining the concept of “critical raw materials”.

Mineral raw material base (MRMB). MRMB is a set of detailed, pre- and initially estimated reserves (resources) of minerals and associated components in the subsoil and production waste, which can be used in the economic sectors. The economic benefits are at a level sufficient for expanded production.

The authors, at the current stage of the study, distinguished two groups of “sources of supply”:

A. *Deposits and manifestations of minerals that are accounted for following the established procedure:*

- combustible minerals (coal, peat, oil, gas);
- metallic minerals;
- non-metallic minerals;
- groundwater;
- surface water;
- other minerals.

B. *Production waste of mining enterprises:*

- waste heaps of coal mines and sections;
- dumps of mines and quarries of non-ferrous and ferrous metal ores;
- technogenic placers;
- slag dumps;
- sludge settlers and sludge tanks (tailings);
- ash dumps.

Parameters for defining Critical mineral raw materials.

The authors have analyzed many parameters of the “Criticality” of mineral raw materials using different works⁷⁸⁹. According to the research results, it has been

⁷ Minerals, Critical Minerals, and the U.S. Economy. Report in brief//The National Academies. – 2007. – 4 p. https://www.nap.edu/resource/12034/critical_minerals_inal.pdf

⁸ National Research Council, 2008. Minerals, Critical Minerals, and the U.S. Economy: Washington, D.C., National Academies Press, 264 p.; Report on Critical Raw Materials for the EU. Report of the Adhoc Working Group on dening critical raw materials//European Commission, May 2014. – 41 p. <https://ec.europa.eu/docsroom/documents/10-010/attachments/1/translations/en/renditions/pdf>

established that most of the parameters that determine the list of critical raw materials belong to a 2-coordinate system of concepts: economic importance and logistical parameters of supply.

However, this approach does not reflect the complexity of this issue and cannot be fully applied when determining the list of critical mineral raw materials at different levels of government and financial institutions.

Determining parameters and critical mineral raw materials management system constitute the implementation of a complex set of legal, geological, economic, and socio-political factors that regulate the geological study and use of the country's mineral base, region and world. Taking into account methodological principles of UNFC (United Nations Framework Classification for Resources) and UNRMS (United Nations Resource Management System), the list of critical mineral raw materials should be determined by the following parameters:

Socio-economic factors (E axis).

- increasing production quantities;
- expanding range of product types;
- supply quantities;
- concentration of production;
- impact of military-political conflicts.
- other factors (market dynamics, economic importance, ecology, etc.).

Technological factors (F axis).

- development of technologies of extraction, enrichment and production;
- change of the material component of the technological process;
- “environmental friendliness” of technologies.

Geological and commercial factors (G axis).

- availability of resource base;
- degree of knowledge and commercial development;
- availability of mining infrastructure and logistics.

Critical mineral raw materials. Lists of critical minerals (types of mineral raw materials) are part of developing the mineral raw material base of countries and regions. In Table 2, the results of comparing such lists for the USA, EU, Canada and Australia are given.

⁹ Study on the review of the list of Critical Raw Materials 2017. Criticality Assessments. Final Report. Written by Deloitte Sustainability, British Geological Survey, Bureau de Recherches Géologiques et Minières, Netherlands Organisation for Applied Scientific Research for European Commission. – June 2017. – 93 p. <https://op.europa.eu/en/publication-detail/-/publication>

Table 2. Lists of critical minerals of the USA, EU, Canada and Australia

Mineral	USA	EU	Canada	Australia
Aluminium				
Antimony				
Arsenic				
Barite				
Beryllium				
Bismuth				
Borate				
Cesium and rubidium				
Chromium				
Cobalt				
Fluorspar				
Gallium				
Germanium				
Graphite (natural)				
Hafnium				
Helium				
Indium				
Lithium				
Magnesium				
Manganese				
Molybdenum				
Nickel				
Niobium				
Phosphate rock				
Phosphorus				
Platinum Group Metals				
Potash				
Rare Earth Elements				
Rhenium				
Scandium				
Selenium				
Silicon metal				
Strontium				
Tantalum				
Tellurium				
Tin				
Titanium				
Tungsten				
Uranium				
Vanadium				
Zirconium				

The list of mineral raw materials may change over time.

Table 3. Comparison of lists of critical mineral raw materials of the EU in 2011, 2014 and 2017

2011	2014	2017
		Barite
Beryllium	Beryllium	Beryllium
	Borates	Borates
		Vanadium
		Bismuth
Tungsten	Tungsten	Tungsten
Gallium	Gallium	Gallium
		Hafnium
		Helium
Germanium	Germanium	Germanium
Graphite (natural)	Graphite (natural)	Graphite (natural)
Indium	Indium	Indium
		Natural rubber
Cobalt	Cobalt	Cobalt
	Coking coal	
	Silicon metal	Silicon metal
	Magnesite	
Magnesium	Magnesium	Magnesium
Niobium	Niobium	Niobium
Platinoids	Platinoids	Platinoids
REE (heavy)	REE (heavy)	REE (heavy)
REE (light)	REE (light)	REE (light)
Scandium		Scandium
Antimony	Antimony	Antimony
Tantalum		Tantalum
Fluorite	Fluorite	Fluorite
		Phosphorus
	Phosphorites	Phosphorites
	Chromium	

c. Opportunities for CRM supply MSMEs in economic recovery in Ukraine

Extraction of non-ferrous metal ore, polymetallic ore, as well as uranium and lithium ore.

Despite the existing resource base, the non-ferrous metal ore extraction segment of Ukraine is in a state of recession. Most deposits have been exploited since Soviet times. New deposits are developed based on geological exploration data of the same period, and new geological exploration works are almost not funded.

However, even old data indicates that Ukraine has significant reserves of the most popular non-ferrous metals in the world: titanium, lithium, uranium and zirconium. Reserves of these metals are the largest among European countries, and in some cases, Ukraine is among the top 10 countries in the world. As a result, we believe that non-ferrous metals have the most significant potential for developing the mining industry in Ukraine, particularly the uranium, titanium, lithium, and zirconium industry.

Raw material base, non-ferrous metal ores: Uranium consumption by Ukrainian enterprises is 2,500 tons per year, materials that lack are imported mainly from the Russian Federation. It should also be noted that the raw material base of aluminium and copper ore is absent in the country, and production facilities operate entirely on imported raw materials or process scrap metal. The nickel industry also operates on imported raw materials because of potential deposits. Although mentioned in studies by Soviet geologists, geological explorations that could confirm this information have not been conducted in recent years, so their development has not begun.

Table 4. Extraction of non-ferrous metal ore, polymetallic ore, as well as uranium and lithium ore

Minerals, thousand tonnes	Number of deposits		Reserves as of 01.01.2019, thousand tonnes		Extraction	
	Total	Under development	Balance, total, thousand tonnes	Balance, under development, thousand tonnes	thousand tonnes	million USD
Aluminium ore	1	0	18 885	–	–	–
Copper ore	1	1	20 488	20 488	–	–
Nickel ore	12	2	29 565	1 813.8	–	–
Lead and zinc ore	4	2	41 803	28 857	–	–
Lithium ore	3	2	*	*	–	–
Uranium ore	4	3	270–150	40	0.9	63
Titanium ore	40<	15	160000	48000	800	150

* According to the Order №440 of the Security Service of Ukraine dated August 12, 2005, the information is classified.

Aluminium industry.

Aluminium production in Ukraine consists of two enterprises: LLC Mykolayiv Alumina Plant (hereinafter MAP) and OJSC Zaporizhzhia Production Aluminium Plant (ZPAP).

MAP is the largest alumina producer (the primary raw material for aluminium production) in the CIS. In 2014 – 2018, alumina production amounted to 1.45 – 1.715 million tonnes, respectively¹⁰. “ZPAP” has a production capacity of 110 thousand tonnes of primary aluminium, its primary alloys and 265 thousand tonnes of alumina. In 2007, the company’s financial and economic profit amounted to 21 million USD, in 2014 – 2016, the plant was privatized due to non-fulfilment of investment obligations by previous owners, as a result of which the company’s profit initially fell, and in 2018 increased by 9 times and amounted to 11.9 million USD¹¹. Some companies produce finished products, collect and process non-ferrous scrap.

Copper industry

There are no explored copper deposits in Ukraine, although about 150 copper ore occurrences are known, and experts’ long-term forecasts are very high. So far, copper is extracted only as part of polymer ores and as a by-product.

¹⁰ Source: MAP has increased alumina production by 15% during the last 5 years. Article. News portal Nikvesti.

<https://nikvesti.com/news/politics/179170>

¹¹ Source: <https://www.althoughda.com.ua/rus/news/2018/06/25/638119>

The only manufacturer of flat and round rolled products made of copper and its alloys is the Artemivsk Non-ferrous Metals Processing Plant. The plant produces more than 1000 products from 100 brands of metals based on copper, nickel, zinc. The annual output of ANMPP is 50 thousand tons of finished products, which is the largest part of this subsector's total production. The domestic market of Ukraine consumes 80 – 85 per cent of products produced by the plant. Consumers of plant products: Ltd. Catech-Electro – a manufacturer of cable products in Ukraine, Ltd. JV Pancom-Yun – a manufacturer of cathode copper, Ltd. Zaporizhzhia plant of non-ferrous alloys, JSC Vtormet, JV Technoscrap, Ltd. Ecometan, Ltd. Bona.

Nickel industry

The Derzhgeonadra believes that sulfide-copper-nickel deposits promise for nickel extraction, mainly the Prutivka site, located in the Zhytomyr region. Reserves of nickel and cobalt in such deposits are estimated at thousands of tons, and, in February 2019, the Derzhgeonadra issued a permit to LLC Colormet Ukraine to develop the Prutivske ore occurrence. This company has expressed its interest in nickel extraction to meet the needs of aircraft construction and electric cars' production.

The only plant for processing ore, ferronickel and pure nickel is LLC “Pobuzhskiy ferronickel plant”, and according to UKRRUDPROM regarding the State Fiscal Service, it operates on imported raw materials from Guatemala and Indonesia. Its production capacity is 1.5 million tonnes per year, and it produces 75 – 90 thousand tonnes of ferronickel per year at 5 – 6 per cent* of the nickel content in ores and 16.5 – 19.8 thousand tonnes of nickel per year at 22 per cent* of the nickel content in the ferroalloy. *The norm for the subsector¹².

Lead and zinc industry (polymetallic ores)

In 2016, the international company Avellana Gold acquired the Carpathian Ore Company and inherited two licenses to extract polymetallic ores in the Muzhiyivske, Kvasivske, and Berehivske deposits of the Transcarpathian region of Ukraine.

By 2019, the first stage of the project was completed, including the refinement of dumps saturated with heavy metals: lead, zinc and cobalt. The second stage of the project includes the resumption of the polymetallic ore mining process. The production capacity of processing is 500 thousand tonnes of ore per year.

Zinc and Lead. In Ukraine, the technological process of metallurgical processing of lead-containing materials and production of lead, zinc and their alloys is carried out by the companies Ukrsplyv LLC, Ukrzinc, Megatex LLC.

Lithium industry

According to unofficial data, ore reserves with a lithium content of 1.1 – 1.25 per cent range from 500,000 to 5 million tonnes in Ukraine. In 2017 – 2018, special permits for lithium extraction were obtained by Petro-Consulting LLC and Regional Investment Technologies LLC (Ukrliityvydobuvannia), but no mining was conducted¹³.

Uranium industry

Explored estimated reserves of uranium ores in Ukraine are about 560 thousand tonnes, and proved reserves – 270 thousand tonnes. Two companies in Ukraine mine

¹² Source: Non-ferrous metallurgy of Ukraine (2007). State support of Ukrainian export.

<http://www.ukrexport.gov.ua/ukr/prom/ukr/13.html>

¹³ Source: <https://delo.ua/economyandpoliticsinukraine/ukraina-mozhet-stat-liderom-po-dobyche-cvetmetal-351523/>

uranium ore: the state-owned company VostokGOK and the private company Atomic Energy Systems of Ukraine, which received a license for extraction in 2016. According to government estimates, today, Ukraine imports about 60 per cent of the uranium consumed by domestic nuclear power plants¹⁴.

Domestic production of uranium concentrate amounted to about 836 tonnes in 2019; the potential of existing facilities allows to increase processing to meet the country's needs in the amount of 2.4 thousand tonnes per year.

The 2020 budget also provided UAH 140 million to increase domestic uranium ore production, namely, the construction of an enterprise with a capacity of 700 tonnes of uranium oxide concentrate per year. The critical issue is to find an investor and build new mines.

Ukraine has 12 endogenous uranium deposits explored in detail, with total reserves sufficient to meet the needs of existing NPPs of Ukraine for the next 100 years.

Main drivers of global growth in demand for non-ferrous metal ores include:

1. Demand for the metal, given the continued modernization of industrial production, which has not been completed in developing regions such as Asia, Africa and the CIS, these processes will gradually transit to Industry 4.0. In contrast, North America, Europe, Australia will transit to 5.0, which is essentially an upgrade of the previous version and, in fact, refers to version 4.5, which is a transitional stage.

2. Changing environmental requirements and switching to eco-friendly materials, in which case most metals are fully recyclable and can be a cheap alternative to plastic. The current development of recycling technologies allows restoring previously caused environmental damage in the shortest possible time. In total, these factors allow the development of non-ferrous metal ore extraction in Ukraine according to the following two scenarios (Fig. 2)¹⁵:

¹⁴ Source: Ukraine plans to spend UAH 140 million to increase uranium production. Article. Economy and politics in Ukraine. <https://delo.ua/economyandpoliticsinukraine/v-ukraine-na-uvlichenie-dobychi-urana-planiruju-360399/>

¹⁵ National Association of Extractive Industries of Ukraine (NADPU), Derzhkomstat, UEO calculations (with the same industry structure of the extractive industry of Ukraine)

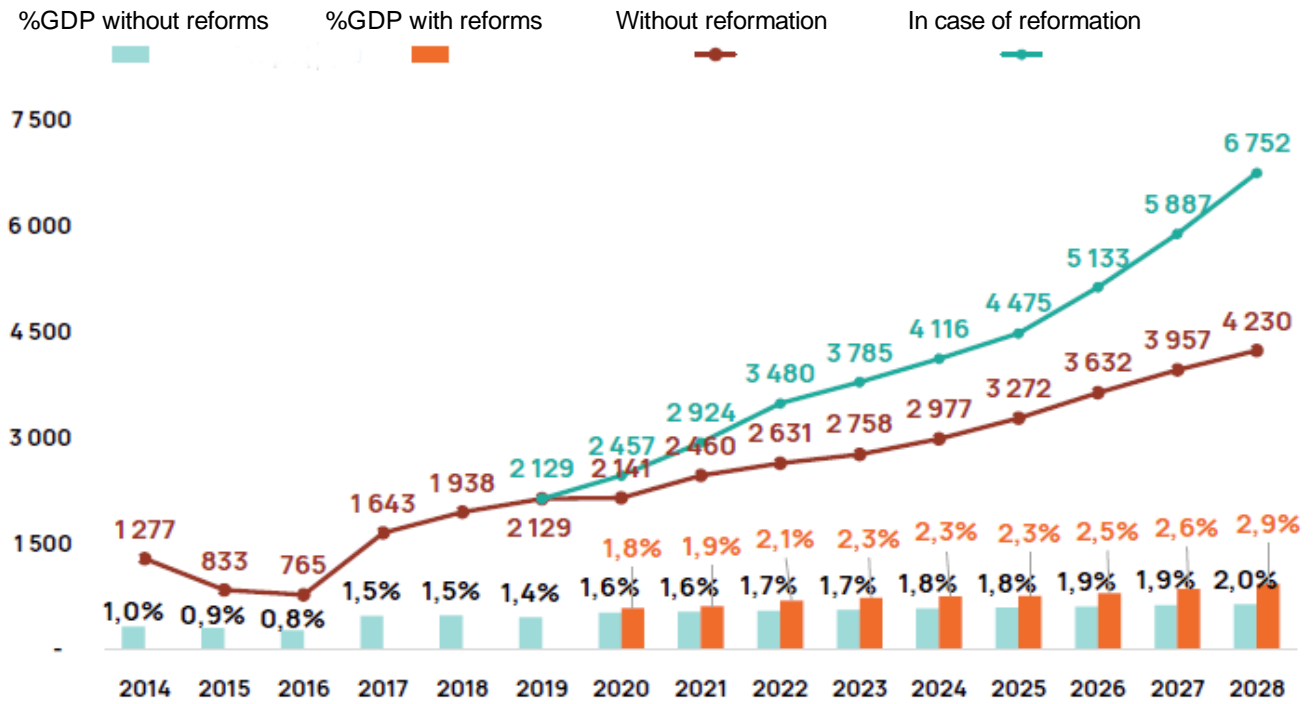


Fig. 2. Dynamics of GDP of Mining and Metallurgical plants (non-ferrous metals): scenario-based forecast, million USD

Today, in Ukraine, only the production of titanium, magnesium, silicon is based on its mineral raw materials. Imported raw materials or recycled materials are used to produce other non-ferrous metals (most of them). Ukraine has a mineral raw material base of non-ferrous metallurgy: lead and zinc ores (polymetallic ores), lithium, aluminium, copper, nickel, uranium ores.

Table 5. Raw material base, non-ferrous metal ores

Mineral	UOM	Ukraine				World	
		Number of deposits		Reserves as of 01.01.2019, thousand tonnes		Extraction, thousand tonnes	Reserves, billion tonnes
		Total	Under development	Balance, total, thousand tonnes	Balance under development, thousand tonnes		
Aluminium ore	Bauxite, thousand tonnes	1	0	18 885	-	350 000	55 - 75
	Metal, thousand tonnes						
Copper ore	Ore, thousand tonnes	1	1	20 488	20 488	21 000	2.1
	Metal, thousand tonnes			73	73		
Nickel ore	Ore, thousand tonnes	11	1	29 565	1 813.8	2 300	0.13
	Metal, thousand tonnes			217.2	16.46		
Lead and zinc ore	Ore, thousand tonnes	4	2	41 803	28 857		
	Lead, thousand tonnes			670	528	4 400	2
	Zinc, thousand tonnes			1 555	1 165	13 000	1.9
Lithium ore	Ore, thousand tonnes	3	2	*	*	85	0.08
	Metal, thousand tonnes			*	*		
Uranium ore	Ore, thousand tonnes	4	3	270 - 150		60	3 340
	Metal, thousand tonnes						

* According to the Order №440 of the Security Service of Ukraine dated 12.08.2005, the information is classified. Source: National Association of Extractive Industries of Ukraine (NADPU), <http://minerals-ua.info/stan-zapasiv.php>, U.S. Department of the Interior, U.S. Geological Survey, MINERAL COMMODITY, SUMMARIES 2019, Small Mining Encyclopedia. Volumes 1-3 - 2004, 2007, 2013, British Geological Survey, World Mineral Production 2013-17

Since the extraction of aluminium, copper, nickel, lead, zinc and lithium ore was not carried out in Ukraine, and enrichment, processing and casting plants are present in the industry of the country and operate on imported raw materials, let's assume that instead of imported raw materials Ukrainian producers could use domestic raw materials and on this assumption we will continue the analysis.

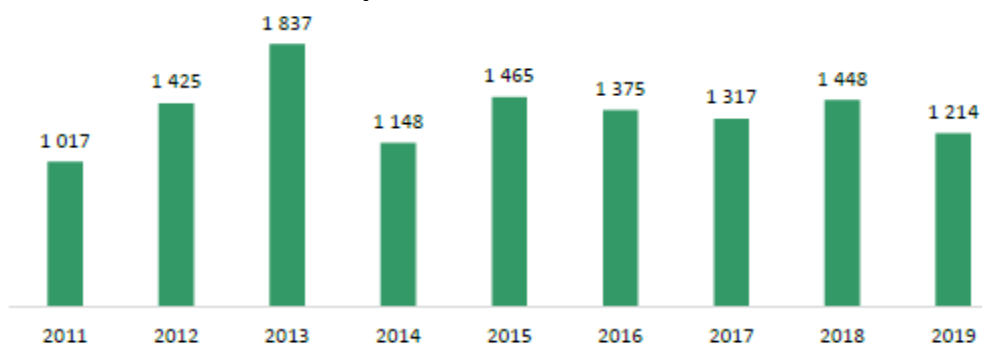


Fig. 3. Imports of ore and primary processing of nickel, thousand tonnes

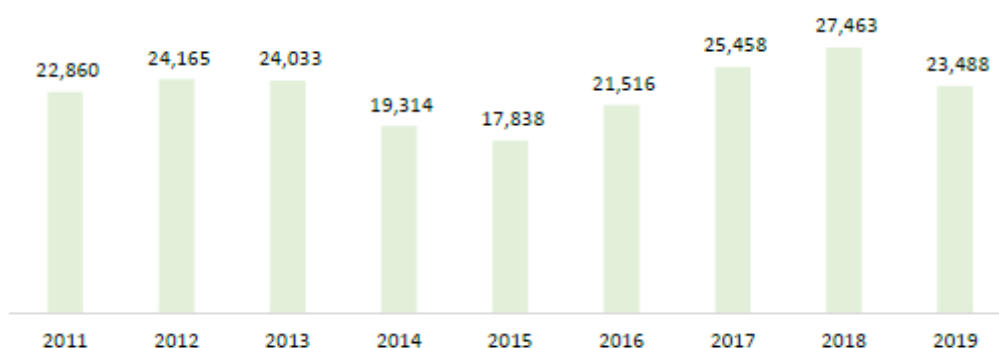


Fig. 4. Imports of ore and primary processing of zinc, thousand tonnes

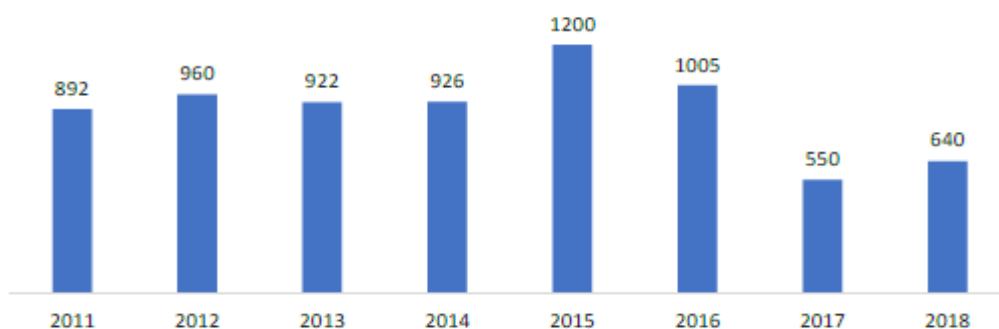


Fig. 5. Extraction of uranium ore, VostGOK, tonnes

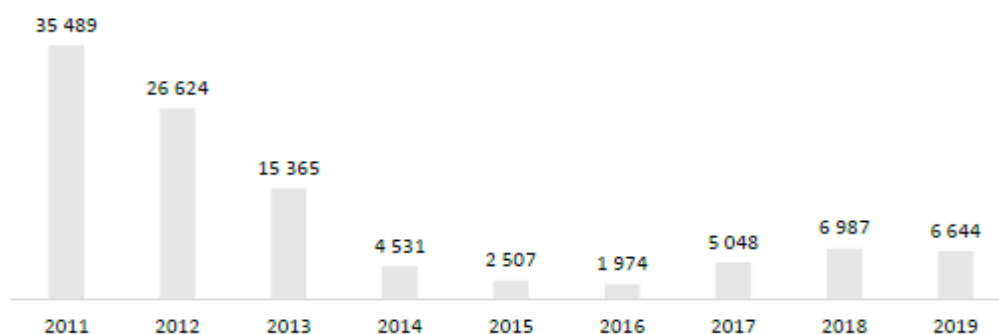


Fig. 6. Imports of ore and primary processing of lead, tonnes

d. Progress towards Sustainable Resource Management and Circular Economy: Application of UNFC and UNRMS in Ukraine

United Nations Framework Classification (UNFC) is the foundation for global geopolitical forecasts on energy and mineral raw materials. This Classification is designed to satisfy the needs of research on energy and mineral raw materials, resource management, corporate business processes, financial reporting standards. The UNFC is the universal system three-dimensional system.

Currently, over 75 countries use the UNFC as the main (China, India, Ukraine, Mexico, etc.) or have adapted (harmonized) documents with their national classifications.

Basic principles of resource formation and management in Ukraine are in line with the UNFC and have been implemented since 1997. But the work on improvement and harmonization of the classification is still ongoing; thus, on September 19, 2018, the Cabinet of Ministers of Ukraine adopted Resolution №764 “On Amendments to Paragraph 8 of the Classification of Mineral Reserves and Resources of the State Subsoil Fund”, which has amended the Classification of Mineral Reserves and Resources of the State Subsoil Fund, and which stipulates its adaptation (harmonization) to the provisions of the Framework Classification of Fossil Energy and Mineral Reserves and Resources (UNFC-2009), which are directed at the creation of a legal basis for attracting credit resources of international financial institutions during the extraction of mineral resources with the participation of foreign investors, which will positively affect the application of international standards of reserves evaluation and reporting that will improve investment attractiveness of subsoil mining projects and generally promote investment activities. Since 2019, Ukraine has adopted the Classification based on principles of the UNFC at the state level.

Classification of mineral reserves and resources of Ukraine establishes uniform principles of calculation, geological-economic assessment, state accounting and reporting on the use of mineral reserves and resources according to the level of their socio-economic significance (axis E), the degree of feasibility study and preparedness of mineral deposits for further use (axis F), as well as the degree of geological knowledge and validity (axis G) following the UNFC categories (Fig. 7).

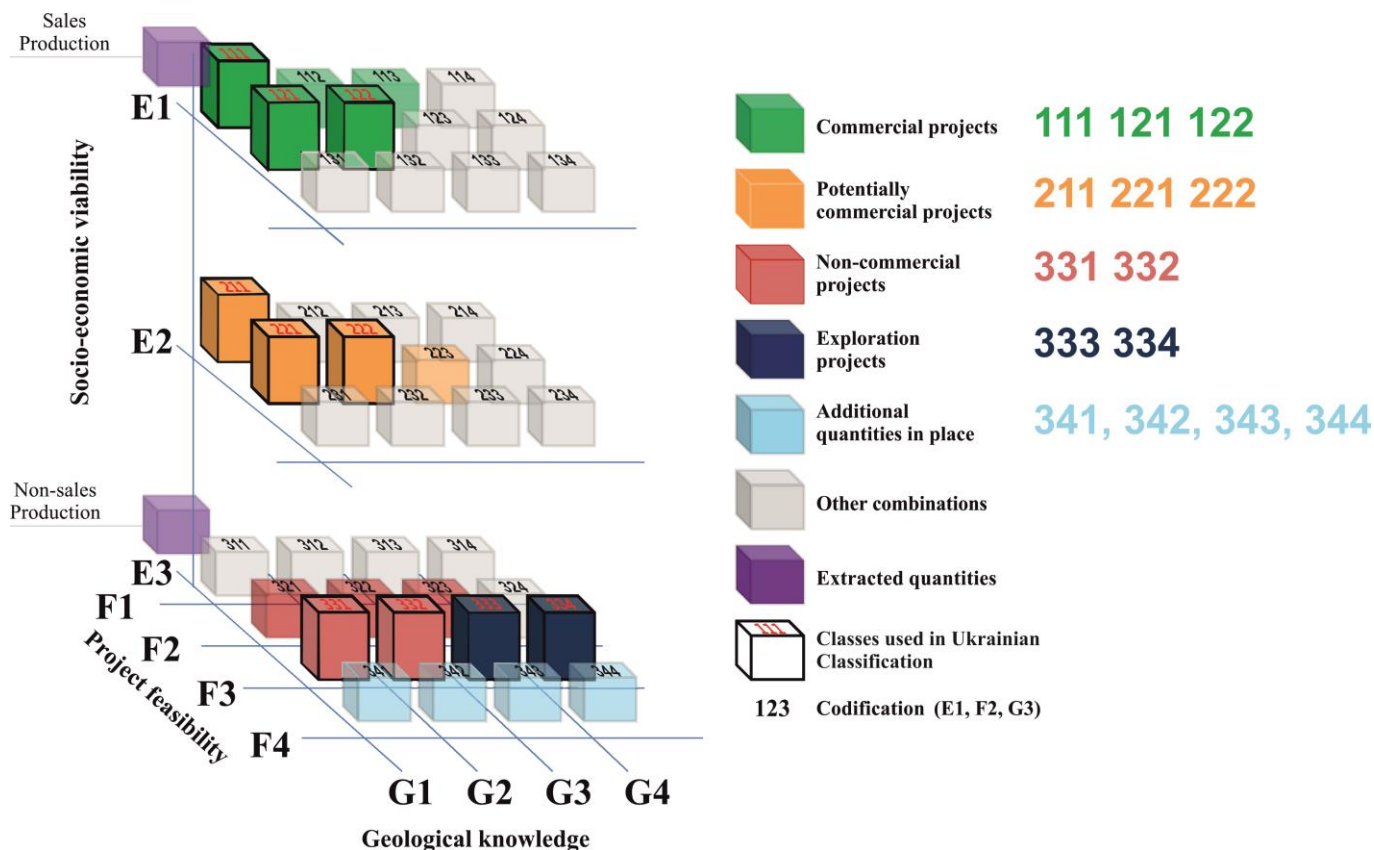


Fig. 7. Principles of allocation of mineral reserves and resources, adopted in the Classification of Ukraine, are harmonized with the International Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC)

In Ukraine, the UNFC has been tested for dozens of energy and mineral raw materials types, including groundwater resources, by the State Commission of Ukraine on Mineral Resources. Mechanisms of adaptation of the UNFC to projects related to renewable energy sources (bioenergy, geothermal energy, solar energy, wind energy and hydropower resources), burial projects (storage) of CO₂ in the geological environment, anthropogenic resources require further development.

The mineral resource management system determines the implementation of a complicated set of legal, geological, economic and socio-political factors.

In September 2015, as a part of the 70th session of the UN General Assembly in New York, the UN Summit on Sustainable Development and Adoption of the Agenda for Development after 2015 was held, where new development guidelines were approved. The Summit's final document "Transforming our world: The 2030 Agenda for sustainable development" determining goals for future international development, which replaced Millennium Development Goals that expired in 2015. SDGs have been adopted from 2015 to 2030 and include 17 global goals, within which 169 specific targets have been identified¹⁶.

¹⁶ Source: Sustainable Development Goals / Ukraine.

https://sustainabledevelopment.un.org/content/documents/26295VNR_2020_Ukraine_Report.pdf

The hierarchy of global mineral resource management is currently based on guiding documents of international organizations of various kinds (UNECE, IAEA); it aims to address some common issues or organization of projects. The 2020 – 2021 work plan of the Expert Group on Resource Management includes the development of principles, specifications, guidelines, application protocols, best practices and case studies to support the sustainable management of energy and raw materials within the UNFC and UNRMS (including mineral resources, oil and gas raw materials, renewable energy sources, nuclear fuel resources, injection projects, anthropogenic resources and groundwater resources).

The national level of mineral resource management has different features in different countries. The mechanism of mineral resource management is based on calculating mineral reserves and their sale on global stock exchanges. The following classifications dominate in this regard: for solid minerals – CRIRSCO group (JORC Australasia, NI 43-101 Canada, PERC Europe, SAMREC / SAMVAL South Africa, etc.), for hydrocarbons – SPE (PRMS).

The third level of the mineral resource management system is local. These are separate mineral deposits developed by public or private companies with mandatory compliance with current legislation.

The local resource management system covers local minerals used to satisfy infrastructure and local communities' social needs. Other resources can be addressed at the local level: wind and solar energy of small power plants, recycling, wastewater disposal, etc.

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

a. Primary and secondary resources of critical raw materials

According to the balance of mineral reserves and existing manifestations, which are presented in the Study on the EU's list of Critical Raw Materials (2020) Final Report, Ukraine has some opportunities to establish production of the vast majority of elements.

Antimony is used in the semiconductor industry; it is a component of lead alloys, used in plain bearings, added to metals for thin casting, used in refractory compounds, ceramic enamels, glass, paints and ceramics, as well as match heads. Occurrences of antimony are closely connected with Donbas' mercury deposits (Mykytivske ore field), where its reserves are estimated at 4.2 thousand tonnes, and estimated resources – 30 thousand tonnes, but the antimony content is low in ores (0.4 – 1 per cent). Antimony ended up in dumps along with the cinders of mercury production, and they have not been studied yet.

Barite is used in large quantities as a weighting agent for clay solutions during oil and gas wells drilling and as inert, heavy filler. Barite ore deposits are known in the Carpathian intermountain depression, and the junction of the Donetsk folded structure with the Ukrainian Shield. The complex Biganske deposit of sulfide-barite ores has been explored. Barite mineralization is developed in the upper horizons and near the Beregovo gold-polymetallic deposit. The State balance of mineral reserves of Ukraine “Barite” considers balance reserves of barite ores in the amount of 3 million tonnes, which the State Commission of the USSR on Mineral Resources has approved. The average content of barium sulfate is 38 per cent. Ukraine's needs for barite concentrate currently amount to 30 – 40 thousand tonnes per year.

Beryllium is used in metallurgy, aviation and aerospace industry, nuclear energy, X-ray technologies, electronics, optical devices, etc. The mineral raw material base is represented by one rather sizeable Perzhanske deposit of valuable genthelvin ores with good technological properties, characterized by the high quality of beryllium content and sound enrichment. Work is underway to put it into operation. There is also the beryllium mineralization associated with potassium feldspar alkaline rocks, granite pegmatites, complex rare-metal pegmatites of albite-spodumene type have been detected. Total reserves of beryllium oxide in Ukraine reach 66 thousand tonnes.

Bismuth has many commercial applications, for example, in pharmaceuticals, pigments and cosmetics, metallurgy. Ukraine does not have primary bismuth deposits. Bismuth mineralization is found here in minerals (native bismuth, bismuthinite, bismuth tellurides, maldonite) in gold ore occurrences of the Ukrainian Shield, bismuth can be extracted as an associated component in the future; in rare-metal occurrences. Increased bismuth content (up to 0.02 per cent) and bismuthinite were found in secondary quartzites behind ultrabasic rocks with sulfide cobalt-nickel mineralization.

Boron is used in the production of borosilicate glass and makes the glass durable and heat resistant. On the territory of Ukraine, there are about 60 occurrences of boron. Usually, the content of B_2O_3 is not commercial. Some boron occurrences are located in mud hills, waters of lakes and breccias of the Kerch Peninsula. The content of B_2O_3 in the rocks on separate mud hills ranges from 0.26 to 30 per cent. Reserves were calculated at

the end of the 1950s only at the Bulganatske (B_2O_3 – 53.7 thousand tonnes by category B + C1) and Tarkhankutske (B_2O_3 – 8.7 thousand tonnes by category B) deposits. Boron extraction from mud and bottom sediments of salt lakes does not exceed 60 per cent.

Cobalt is an essential component of alloys and special steels used in blue and light blue decorative glass and the manufacture of rhinestones. On the territory of Ukraine, balance reserves of cobalt are registered in eleven complex silicate-nickel deposits that contain it. Cobalt reserves constitute 9.85 thousand tonnes; off-balance reserves are available in the amount of 8 thousand tonnes. From 2001 to 2011, Pobuzhskiy Ferronickel Plant LLC developed 2 sections of the Lypovenkivske deposit. Cobalt was extracted from raw ore together with nickel in the form of ferronickel. Exploration and prospecting works for sulfide nickel and talc-magnesite were conducted, and reserves of associated nickel of weathering crust were estimated in 7296.5 thousand tonnes, cobalt – 477.7 thousand tonnes and iron – 142021.0 thousand tonnes. The established thickness of ore zones near Kryvyi Rih city has the following metal content: nickel – 0.44 per cent (maximum 3.9 per cent), copper – 0.35 per cent (maximum 2.46 per cent), associated cobalt – 0.053 per cent. Prognostic resources have been identified only on the intrusion part, where there are 27.7 thousand tonnes of nickel, 18.2 thousand tonnes of copper and 3.4 thousand tonnes of cobalt.

Coking coal is used mainly as a fuel and reducing agent in the metallurgical industry. 42 state-owned mines develop coking coal reserves with a total production capacity of 15.5 million tonnes/year and 21 non-state-owned mines with 25.6 million tonnes/year. Besides, 34 “small” mining enterprises in Donbas have special permits for the operation of coking coal via atypical mines with a total production capacity of 2.5 million tonnes/year. Simultaneously, 69.6 per cent of the total number of mines are located in the zone of anti-terrorist operation and in the territory where public authorities temporarily do not exercise their powers. In 2019, coking plants received 13.92 million tonnes of coal for coking, where: Ukrainian raw materials – 3.5 million tonnes, imported – 10.43 million tonnes.

Fluorspar (fluorite). Consumers are chemical and metallurgical industries, and it is also used in the electrolytic production of aluminium, electronics, medicine, reactive, laser devices, radio equipment, and other spheres. In Ukraine, deposits of fluorspar are known in the junction of the Ukrainian Shield with the Dnieper-Donets depression, in Podillia, the Sushchano-Perzhanska zone and the Kirovohrad zone, in the Pryazovia region. According to the State Balance of Mineral Reserves of Ukraine, total reserves of fluorspar (CaF_2) amount to 4076 thousand tonnes as of January 1, 2018, but domestic production of fluorite is not underway. The use of fluorspar in Ukraine does not exceed 60 thousand tonnes per year, 25 thousand tonnes used by the metallurgical industry; Ukraine’s needs for fluorite are met due to imports.

Gallium is one of the primary materials for the production of semiconductors; it is used in medicine and for the production of LEDs, solar panels, chips, in laser technology, for the production of mirrors. Since 2017, the Mykolayiv Alumina Plant, a leading enterprise in the aluminium industry of Ukraine and one of the largest in Europe in the field of non-ferrous metallurgy, belongs to the Swiss company Glencore. In March 2017, the plant reached a production capacity of 1.7 million tonnes of alumina per year after

some modernization. Specialists from this plant have mastered the technology of obtaining metallic gallium. Quantities of gallium production are over 12 tonnes annually.

Germanium is used in radio electronics and electrical technology as a semiconductor, in nuclear technology, instrumentation, mechanical engineering and metallurgy. On the territory of Ukraine, germanium is present in coal deposits of the Donetsk and Lviv-Volyn basins. The primary source of germanium in Ukraine is Donbas coal. Extraction of germanium from coal can be performed by using special equipment at coking plants. Coal has a germanium content of 1 g/t to 23 g/t. But there is no industrial extraction of germanium in Ukraine since 1991. It is possible to meet the need for germanium through the use of thermal coal ash. Balance reserves of germanium in the coal of Ukraine amount to 91.7 thousand tonnes as of January 1, 2018.

Hafnium – Reserves of hafnium (HfO_2) are determined based on zirconium reserves in a ratio of 1:50. In Ukraine, reserves of hafnium oxide in zircon are taken into account only in the Malyshevskiy complex placer zircon-rutile-ilmenite deposit, which is located in the Dnipropetrovsk region. As of January 1, 2018, reserves of hafnium oxide amount to 13.6 thousand tonnes, and their future increase is estimated at 100 thousand tons. The deposit has been in operation since 1961; opencast mining is applied. In 2017, the deposit produced 4164.7 thousand m^3 of sand with 349.7 tonnes of hafnium oxide. Ukraine produces 30 thousand tonnes/year of zircon concentrate. Quantities from these deposits meet all the needs of Ukraine in zirconium and hafnium, as well as allow to make significant exports. Extraction of hafnium and its processing in Ukraine is completed at the stage of obtaining pure metallic hafnium, but hafnium products manufacturing is absent in Ukraine.

Heavy and light rare earth elements (heavy – yttrium Y, gadolinium Gd, terbium Tb, dysprosium Dy, holmium Ho, erbium Er, thulium Tm, ytterbium Yb, lutetium Lu, europium Eu; light – cerium Ce, lanthanum La, neodymium Nd, praseodymium Pd, samarium Sm). They are used in technologies as alloying additives in various steels and alloys, in electronic devices, magnetic materials and incendiary mixtures, as catalysts, hydrogen batteries, in nuclear technologies, in glass and ceramics production, as well as in metallurgy. In geological complexes of Ukraine, several hundred objects of TR concentration (from deposits to ore occurrences) have been detected, which are currently being studied at various stages. Most of them are localized in the Ukrainian Shield and adjacent structures. The most important and studied one is the Azovske zirconium-rare earth industrial deposit. Ore bodies carry $\text{TR}_2\text{O}_3 = 0.02 - 9.92$ per cent, on average $0.088 - 1.822$ per cent with the content of $\text{ZrO} = 0.02 - 27.12$ per cent, containing elements of the cerium group $0.017 - 8.299$ per cent, and yttrium – $0.003 - 1.628$ per cent. Ores of phosphorus-rare metal Novopoltavske deposit and complex rare metal Mazurivske deposit can also be sources of concomitant supply of rare earth elements. However, concentrations of cerium elements prevail here over yttrium ones. There is the Yastrebitske fluorite-rare earth deposit in the northwest of the Ukrainian Shield, where there are inclusions and nests of zircon, tantalum-niobates, yttrifluorite, etc. The total content of rare earth elements reaches 0.3 per cent. The ratio of yttrium to cerium is 0.5: 0.7.

Magnesium is used for the production of light magnesium alloys, as well as for alloying aluminium alloys for various branches of mechanical engineering and instrumentation; it is used in ferrous metallurgy and for the production of Ti, V, Zr, U, Cr

in pyrotechnics, military equipment, medicine, automotive and aviation industry. The natural mineral bischofite is used in medicine. Magnesium consumption in Ukraine is a little more than 3 thousand tonnes per year. Zaporizhya Titanium-Magnesium Plant and CJSC Magnesium produced most quantities of magnesium. Bischofite-containing deposits are widespread in the Dnieper-Donets basin, where they are located in the potassium-bearing sub-formation. The Zaturynske, Skhidno-Poltavske deposits have been established within the Dnieper-Donets depression. The State Balance of Mineral Reserves of Ukraine considers two deposits – Zaturynske and Novopodilske, where total balance reserves of bischofite in solution amount to 1869 thousand tonnes as of January 1, 2018. Company Mineral Ltd. has been extracting and processing natural bischofite at the Zaturynske deposit since 1992. In 2017, crude bischofite ore was produced only in the Zaturynske deposit, and it amounted to 7.8 thousand tonnes. Reserves of crude bischofite ore in the Central part of the Central Section of the Novopodilske deposit, approbated by the SCMR of Ukraine, amount to 13386 thousand tonnes. LLC BSF is developing the site.

Natural graphite is used to produce aluminium by electrolysis; it is also used in electronics, in nuclear reactors, to produce refractory crucibles and lining plates, and as a lubricant. Crystalline graphite deposits form the Ukrainian graphite-bearing province, which includes four graphite-bearing regions. In total, about 100 deposits and occurrences of graphite have been discovered in the province. In Ukraine, as of January 1, 2018, 6 graphite deposits are accounted for, one is being developed. Accounted balance reserves of graphite amount to 17356.6 thousand tonnes. Graphite is flaky; its content in ores reaches 30 per cent. Graphite has been mined in Ukraine since 1931 in the Zavalivskiy graphite plant (Kirovohrad region). In recent years, the plant's capacity that exceeds 40 thousand tonnes of graphite per year is used only by 15 – 25 per cent. The plant consists of quarries for ore mining (graphite is distributed relatively evenly), an enrichment factory, workshops for chemical enrichment of graphite, colloidal graphite preparations, lubricating and cooling liquids, etc. Also, the Mariupol Graphite Plant in Ukraine (PJSC "Markograf") does not have its raw material base. Currently, work is being conducted to start developing the Balakhivske deposit in the Kirovohrad region and the Burtynske deposit in the Khmelnytskyi region.

Tantalum and niobium are used to produce heat-resistant steels for jet engine parts, rockets, gas turbines, chemical equipment, electronic devices, electric capacitors, and superconducting devices. On the Ukrainian territory, tantalum and niobium have been found in complex deposits and ore occurrences of the central, south-eastern and north-western part of the Ukrainian Shield. Reserves of tantalum pentoxide and niobium are accounted for by the State balance of mineral reserves of Ukraine in 2 complex deposits – placer zircon-rutile-ilmenite Malyshevske deposit, which is being developed (tantalum and niobium, contained in ilmenite and rutile, are not being extracted from concentrates given the existing technology and are entirely lost) and bedrock apatite-rare metal Novopoltavske deposit. Mass fractions of tantalum and niobium pentoxide in carbonatites are 0.002 – 0.003 and 0.06 – 0.3 per cent, respectively, with the amount of REE from 0.17 to 4.6 per cent. The Mazurivske deposit has quite significant tantalum and niobium reserves, rare metal mining and enrichment plant with a processing capacity of up to 15 million tonnes of ore per year can operate on its basis.

Platinum group metals are used mainly as catalysts in the electronics, automotive, and medical industries to manufacture chemical equipment and anti-corrosion coatings, in jewellery. Planned exploration work for platinum mineralization within Ukraine has practically not been conducted. There is currently no reliable analytical basis for determining the content of platinum group metals. According to sporadic analyses conducted in different years in various laboratories and based on analysis of geological signs of distribution of deposits of these metals globally, there are perspective geological objects, regarding the detection of platinum group metals in Ukraine. Increased concentrations of PGM have been found in several mafic-ultramafic massifs.

Phosphorite is used in ground form as fertilizer in agriculture. 5 deposits and 4 objects of accounting of phosphorite ores, with total balance reserves of P_2O_5 , as of January 1, 2018, of about 15 million tonnes, are accounted for by the State balance of mineral reserves of Ukraine. Total prognostic resources of all types of phosphorite deposits range from 2.0 to 4.0 billion tonnes. The Karpivske deposit and the Mylyatynske deposit are commercially developed.

Phosphorus (apatite) is the primary raw material for orthophosphoric acid; it is used in metallurgy as a deoxidizer and a component of some metal alloys, as a fertilizer (superphosphate), as a catalyst in organic synthesis, in medicine, in the production of matches, as a food additive (acidity regulator), it is also used to clean metal surfaces and create anti-corrosion coatings. Today, the raw material base of Ukraine is represented by five objects of accounting of ilmenite-apatite ores – Kropyvnianske, Stremyhorodske, Torchynske, Fedorivske, (Zhytomyr region), Nosachivske (Cherkasy region), where apatite is considered as a concomitant mineral; one apatite-rare metal ore deposit - Novopoltavske (Zaporizhia region), and Davydkivske deposit (Zhytomyr region) of apatite-ilmenite ores, where apatite has been studied as the main mineral. Total balance reserves of P_2O_5 in these deposits, as of January 1, 2018, amount to 96.2 million tonnes.

Scandium limits excessive growth of metal grains in the heating zone of aluminium alloys in the aerospace industry; it is used to produce high-intensity discharge lamps and as a marking agent in the refining industry. Scandium reserves have been estimated in four complex deposits. Significant scandium resources are concentrated in placer ilmenite and rutile-zircon-ilmenite deposits of Volyn and Right-Bank regions. Scandium can be extracted simultaneously from concentrates of ilmenite, titanomagnetite, zircon and rutile, containing scandium in the usual quantities for these minerals (0.1 – 0.4 per cent) at the existing enterprises of Ukraine. The technology of extracting scandium from ilmenites has been mastered in the metallurgical industry. The waste (ZTMP) contains more than 40 g/t of scandium; it can be removed. During the processing of bauxite at the MAP, about 1.4 million tonnes of red sludge are generated annually as waste, containing an average of 50 g/t of scandium. Available mining and processing facilities provide an opportunity to meet domestic needs in scandium fully and supply it for export.

Silicon metal is an alloying additive in the production of steels and alloys of non-ferrous metals; semiconductor silicon is used in electrical engineering and electronics. In Ukraine, quartzite, quartzite sandstone and quartz sand are used to produce refractories, ferroalloys and crystalline silicon. As of January 1, 2018, the State Balance of Mineral Reserves of Ukraine “Quartzite and Quartz for Refractories” includes 9 deposits: 5 deposits of quartzite, 2 – quartzite sandstone, 2 – quartz sand. Balance reserves of this raw

material are almost 170 million tonnes. Four deposits are being developed. Since 1968, products have been supplied to the Dnieper Aluminium Plant as raw materials for the crystalline silicon production.

Tungsten is mostly used for the production of materials based on tungsten carbide. Up to a quarter of tungsten is used to alloy steel, and the rest is used for products made of tungsten. No commercial tungsten deposits have been detected on the territory of Ukraine, and there are no commercial concentrations of tungsten in ores of other mineral deposits. In the frame of the Lypniazkiy granite dome on the area of 10 km², prognostic resources of tungsten on the area of distribution of ore-bearing rocks have been calculated (almost 96 thousand tonnes). The mineralogical analysis revealed scheelite. There are other promising ore occurrences.

Vanadium is used in metallurgy as an alloying additive, in the production of electronic devices, etc. On the Ukrainian territory, it has been found in commercial concentrations in ilmenites of apatite-ilmenite deposits, ilmenite placers and bedrock uranium-vanadium-scandium ores in the Ukrainian Shield. However, vanadium concentrates are not produced in Ukraine. The needs of the national economy are met due to imports. Reserves of vanadium (pentoxide) in twelve complex deposits are accounted for by the State Balance of Mineral Reserves of Ukraine. As of January 1, 2018, balance reserves of vanadium pentoxide amount to 333 thousand tonnes by different categories. As for secondary raw material sources of vanadium, wastes of Ukrainian oil refineries and titanium enterprises and ash from CHP and TPSs, especially those operating on fuel oils, deserve maximum attention. ZTMP waste contains 0.1 – 2.0 per cent of V₂O₅ and the plant has equipment for the extraction of vanadium and other components, with a capacity of up to 30 tonnes of V₂O₅ per year. Industrial solutions and “red sludge” from MAP that processes bauxites and from the Dnieper Aluminum Plant also contain V₂O₅. The Zaporizhia Aluminum Plant already has a workshop for processing aluminosilicate solutions with up to 100 tonnes of V₂O₅ per year.

Bauxites. Due to the alumina content of 48 – 60 per cent, it is the primary raw material for aluminium production. They are also used in the abrasive industry (alundum (electrocorundum), ferrous metallurgy (flux in open-hearth steel smelting), in the production of refractories, special types of cement. Ukraine does not have such high-quality raw materials, and plants operate exclusively on imported raw materials. The aluminium industry of Ukraine includes the Mykolayiv Alumina Plant (MAP), the Zaporizhia Aluminium Plant (ZALP), plants for secondary aluminium production, and the Brovary Aluminium Plant. As of January 1, 2018, reserves in the amount of 18.8 million tonnes are accounted for by the State Balance of Aluminium Ore. Another source of alumina is alunite, for example, from the Berehivske deposit, and in the 1990s, work was conducted to prepare a research and industrial workshop for the production of alum at the Transcarpathian Metallurgical Plant.

Lithium is one of the critical raw materials. It is used to produce ceramics and glass, chemical power sources, lubricants, continuity of steel casting, oxygen regeneration, polymers, aluminium metallurgy, and pharmaceuticals. According to the explored reserves and prognostic resources of lithium, Ukraine can be considered the wealthiest country in Europe. It can fully meet its own needs and the needs of the European market in lithium raw materials. There are pegmatite deposits that have been studied at different levels:

Shevchenkivske (spodumene ores), Polokhivske (petalite ores), Stankovatske (spodumene-pelitic ores), Balka Kruta (complex rare metal ores), as well as numerous ore occurrences of this type. Also, lithium forms large accumulations in the Donbas region in the composition of mica minerals with a lithium oxide content in the range of 0.2 – 0.6 per cent.

Titanium is used as a structural metal in aviation and missile technology, shipbuilding, power engineering, food, medical industry and non-ferrous metallurgy. Ukraine produces ilmenite and rutile concentrates, titanium dioxide, titanium sponge, metallic titanium and its products. In Ukraine, 26 titanium ore deposits have been explored with different levels of detail and another 48 deposits are off-balance, and titanium reserves and resources have been estimated only preliminary. Ilmenite and complex rutile-zircon-ilmenite placers are the main mineral base of titanium. Bedrock ores are associated with olivine gabbroid intrusions. The content of ilmenite reaches 25 per cent, apatite – 12 per cent. Ukraine has the largest Stremyhorodske bedrock deposit in Europe, complex and contains 131 million tonnes of ilmenite. Ukraine is one of the seven largest producers of ilmenite and rutile in the world. Production, labour and environmental resources in Ukraine, which are necessary for the titanium industry, remain quite competitive.

Strontium is used in industry as an alloying additive to alloys based on magnesium, aluminium, lead, nickel and copper, and pyrotechnics, as an emission coating, dielectric antennas, piezoelectric elements, small capacitors, in infrared sensors, and medicine. At the Novopoltavske apatite deposit, strontium is an accompanying element with isomorphic impurities in apatite and complex rare metal concentrates. The deposit is fully prepared for operation. During the development of the deposit, reserves of strontium and other accompanying elements belong to the recoverable ones; as of January 1, 2018, reserves of strontium (SrO) amount to 950 thousand tonnes.

Table 6. Supply risk of critical raw materials in Ukraine

Low risk	Medium risk	High risk
Gallium	Barite	Antimony
Hafnium	Beryllium	Boron
Magnesium	Bismuth	Germanium
Natural graphite	Cobalt	Platinum group metals
Scandium	Coking coal	Tungsten
Silicon metal	Fluorspar	Vanadium
Titanium	Heavy and light rare earth elements	Bauxites
	Tantalum	
	Niobium	
	Phosphorite	
	Phosphorus (apatite)	
	Lithium	
	Strontium	

b. Application in key sectors

As mentioned above, Ukraine has production capacities in a number of sectors that use raw materials, which, when processed, allow to concentrate some raw materials critical for the EU. An additional opportunity for MSMEs to join the sphere of critical raw material supply could be recycling waste accumulated during former production activities of enterprises or is currently generated at enterprises.

Furthermore, there are significant opportunities to process used products or those that can no longer be sold for many reasons (expiration date, consumer refusal, the prohibition to sell, etc.).

At the same time, when entering the supply chains of critical raw materials extracted from such sources, MSMEs should take into account that, for example, antimony, beryllium, cobalt, germanium, indium, platinum group metals, natural graphite, rare earth elements, silicon metal, tungsten, gallium are used in the production of electrical and electronic equipment. They are used to produce integrated circuits and LEDs, magnets, flat screens, optical fibers, and plastics. Antimony, cobalt, natural graphite, indium, lanthanum, cerium, and rare earth elements can be extracted from used batteries (portable, industrial and automotive).

c. Demand and supply

Even before the pandemic, production has been steadily declining in Ukraine since May 2019. According to the State Statistics Committee, industrial production fell by 5.1 per cent in January 2020. The decline is related to government protectionism in traditional countries for the export of Ukrainian metallurgy and the rapid decline in commodity prices of major industrial manufacturers. Thus, prices in the mining industry fell by 77 per cent during this period, oil refining and gas production have decreased as prices for energy carriers have significantly fallen, and there is a natural decline in demand for electricity, gas and coal to warm winters. Besides, the production of vehicle bodies, parts and electrical equipment have fallen. In 2019, car production decreased globally by 14.2 per cent. It also affected the Ukrainian mechanical engineering industry. Besides, the Russian market's closure for Ukrainian products is evident, while promoting other foreign markets is difficult due to high competition and unfavourable global conditions. The Russian Federation's continued hybrid aggression has a direct or indirect impact on macroeconomic indicators and destabilizes the situation in Ukraine. During the first nine months of 2019, capital investment in the extractive industry increased by 34 per cent, in electricity and gas supply – by 38 per cent, in metallurgy – by 34 per cent; the modernization creates the foundation for the future, but technological re-equipment has affected production volumes.

Similarly, industrial production fell by 3.6 per cent in the EU. China is one of the largest players in metals and ores, so it has shown a decline in demand and significantly pushed prices down. Transportation of goods by rail decreased by 1.9 per cent in 2019¹⁷.

¹⁷ Source: "Minus" for the eighth month in a row: Why Ukrainian industry is declining. Analytical article. News platform Economic truth. <https://www.epravda.com.ua/publications/2020/02/27/657430/>

As a result of the coronavirus pandemic and the introduction of quarantine measures, the fall in the GDP of Ukraine, according to the Ministry of Economic Development, Trade and Agriculture, amounted to 6.5 per cent in the first half of 2020. The coronavirus pandemic has a dual impact: as a disease and as the cause of the most significant economic crisis since 2008. Panic in markets and uncertainty in the future put much pressure on the business. In particular, company Apple states that the demand for smartphones and other equipment has declined worldwide due to the spread of coronavirus. The losses have also been reported by the Internet giants Google and Facebook; they explain it by the fall in advertising profitability, which is the largest source of income.

The coronavirus pandemic struck major automakers, Volkswagen and Fiat Chrysler announced the closure of their factories in Europe. The coronavirus caused significant damage to logistics. So, most airlines may not survive the crisis. Reduced demand for transport, the closure of air services and borders, and decreased energy consumption have led to reduced demand for oil, and, as a result, oil prices have dropped to record lows over the past 17 years. Decreased oil prices have caused significant damage to the energy sector and make its production unprofitable for some companies. The total value of all shares of the world's largest companies fell by trillions of dollars. Investors, brokers, dealers, and investment funds, banks and insurance companies that invest in securities are losing money. Investors are selling risky assets, including shares of companies and bonds in developing countries¹⁸. The inflow of foreign direct investment in Ukraine in March – April also stopped, and the net outflow of portfolio investment amounted to 0.85 billion dollars. The outflow of capital was caused by the investor's desire to increase investment in safe instruments and decreased prices for raw materials. Only some companies (manufacturers of disinfectants and some medical equipment, delivery services, etc.) have additional profits due to coronavirus.

The decline in world trade in 2020 will lead to a decline in global GDP. The resumption of trade in 2021 is uncertain. The biggest problem is that the share of raw materials in Ukrainian exports is 72.1 per cent, and the share of products using medium and high technology is only 15.4 per cent. In April, imports fell by more than a quarter compared to 2019. Almost all categories, except food, suffered equally. There was a rapid deterioration in the structure of exports in the mining and metallurgical sector. The decrease in exports of ferrous metals and their products occurs against the background of increased exports of ore. The ratio of exports of ferrous metals products and ores was 1 to 3.3 in March 2019, and this ratio reached 1 to 4.2 in March 2020. In the first half of 2020, a decline in all types of metallurgical products was recorded. The largest decline was recorded in the production of pipe products – by 29.4 per cent compared to the first half of 2019, steel – by 7.6 per cent, and rolled metal – by 4.7 per cent. 10 per cent of construction companies stopped working during the quarantine and still have not resumed their activities, 23 per cent of companies have stopped working for a while, 75 per cent of construction companies have announced the postponement of new projects, and more than 30 per cent of companies have announced staff reductions.

¹⁸ Source: Vynokurov Ya. Coronavirus economy: who loses and who earns on the epidemic? Article. News platform Hromadske. <https://hromadske.ua/posts/koronavirusna-ekonomika-hto-vtrachaye-a-hto-zaroblyaye-na-epidemiyi>

The recovery of the industry is slow. The impact of quarantine was more painful for some industries than for others. Most sectors experienced the most significant decline in April and recovered only slightly in May. Transportation suffered the most and, despite the weakening of quarantine, did not recover. In May, mechanical engineering showed only slightly higher results than in April, as did the fuel and metallurgical industries. Energy consumption in the food industry decreased a lot in May. The chemical and petrochemical industries, against the background of reduced prices for the primary raw materials – oil and gas, on the contrary, increased electricity consumption during April and May. Some external demand and an increase in budget expenditures for the purchase of certain machine-building and metallurgical products (including medical equipment, military products) led to a weakening of the decline in metallurgy, metal ore mining and machine building. However, there was a deep decline in equipment production for other industries (metallurgy, agriculture, and railways) and vehicles, indicating weak domestic demand. In the chemical industry, the decline resumed due to a decrease in fertilizers and cleaning agents' production. During several months of the quarantine period (from early April to early July), the number of unemployed increased by more than 48 per cent. According to the Chamber of Commerce and Industry of Ukraine, the unemployment rate is 13.7–15.4 per cent. This is the highest indicator for the last 15 years. Steel prices fell due to declining demand from consumer industries. Their recovery is supported by the return of demand from China and the restriction of production in some countries. The increase in prices for iron ore was facilitated by the reduction in supply from Brazil and Australia¹⁹.

These data indicate a reduction of both demand and supply of raw materials, including critical raw materials determined by the EU due to the impact of COVID-19. But their gradual recovery is expected during the post-COVID-19 period. The growth of demand with uneven sectoral recovery will also be uneven, and, accordingly, supply, which is a reflection of demand, will also increase at different rates. In general, global trends defined before the COVID-19 pandemic are likely to be restored. Due to the preservation of the policy on further reducing CO₂ emissions, further development of the energy sector is expected due to renewable and small energy sources, energy storage technologies associated with the increased share of electric vehicles. Demand for cobalt, REE, PGM, and natural graphite is expected to increase in the coming decades, and silicon, indium, and gallium may become less critical due to more efficient use. The search for more efficient materials to replace existing ones, especially in terms of weight and reliability of use in extreme conditions (ceramics for jet engines, aluminium-based alloys for car bodies), will affect Ta, Mg, Nb demand. In telecommunications and electronics, the global expansion of digital networks and services will continue, increasing the demand for mobile equipment and fibre optics, so the demand for critical raw materials (REE, germanium) will grow in this sector. In agriculture, global population growth and actions aimed to improve the average standard of living will contribute to the development of needs for more efficient farming, thereby increasing dependence on phosphate rocks, but, at the same time, new precision agriculture technologies can reduce this demand.

¹⁹ Source: Konrad Adenauer Foundation. <https://www.kas.de/documents>

Ukraine has entered the current economic crisis with a balanced macroeconomic situation. The relatively low incidence of COVID-19 in most regions has made it possible to lift quarantine restrictions gradually. However, the decline in economic activity is significant in 2020, and the recovery may take longer than expected. The state's plans to restore primary industries, such as aerospace, mechanical engineering, shipbuilding, chemical, military and energy industry, and develop its infrastructure, will stimulate domestic demand, including critical raw materials. It will lead to introducing the latest technologies in the extraction and processing of raw materials to obtain more competitive products.

COVID-19 will affect supply and demand for a long time. Sectors, where quarantine restrictions are already weakening and related to consumer demand, will recover quickly (primarily retail and services). The situation is worse in the case of industry and investment demand. Demand and supply will decline in the short term due to the pandemic. The pandemic will temporarily stop or significantly reduce primary production in supplier countries due to certain blockades. Production in importing countries will be reduced for the same reasons. Thus, there will be a temporary reduction in both supply and demand. This state of affairs will continue depending on the course of the pandemic. It is difficult to estimate future demand for extended periods because technological innovations are unpredictable; they can completely change future needs. For example, a breakthrough in hydrogen and thermonuclear technologies, or successful nuclear fusion, can completely change future consumption and demand.

Supply of CRMs from secondary sources

The low rate of waste collection in Ukraine provides additional opportunities for MSMEs. Disposal of vehicles is another source of graphite, cobalt, platinum group metals, niobium and rare earth elements. Recycling photovoltaic modules to obtain Si, In, Ga, and glass, aluminium, copper, and silver has excellent potential. Sub-sectors of aviation and electronic defence produce waste streams generated during the production of high-tech components or the expiration of military products for defense applications, containing significant amounts of critical raw materials. Production of catalysts, fertilizers, polymers, pharmaceuticals and dyes requires antimony, barite, bismuth, borates, cobalt, fluorspar, hafnium, natural graphite, niobium, platinum group metals, phosphates, apatite, rare earth elements, metallic silicon, tantalum, tungsten, vanadium. These critical raw materials are lost due to dispersal in the environment or end up in landfills.

Processing dumps, settling tanks, tailings of mining and chemical, metallurgical, chemical and machine-building enterprises, organization of modern utilization and recycling of used products and landfills can become a reliable source of many critical raw materials and enable MSMEs to join EU supply chains.

d. Post COVID-19 outlook

The OECD states that the COVID-19 pandemic has caused the deepest economic recession in almost a century, which threatens health and disrupts economic activities and harms prosperity and jobs. Economic problems caused by the fight against the COVID-19 pandemic have exacerbated negative trends that have emerged amid the economic battle between the United States and China, which has divided the world into groups of influence on one side or another. And although victory in the fight against the virus is still far away,

it is safe to say that the world stands on the global economic crisis threshold. Simultaneously, even overcoming the virus will not stop the economic decline, as it will take a considerable amount of time to restore production and supply chains. This is related to purely technical difficulties and the lengthy legislative removal process of legal barriers created by states to protect domestic markets. The state also suffers economic and human losses associated with the struggle for a European future.

The modern globalized supply chain network is optimized to achieve the minimum delivery time at the lowest possible price. Global challenges have now revealed some shortcomings and weaknesses of this model. Previously hidden additional costs related to dependence on a single supply source and low flexibility of adaptation to shocks in real-time have been exposed. Today, a consumer tolerates higher prices for certain goods if there is no other option or the desire to get it is high.

As a result, the supply chain infrastructure will be reviewed over the next few years. After the current crisis, there will be a return to the formation of supplies primarily from nearby regions. Accordingly, new mining, processing and logistics centers will appear to collect individual components from small manufacturing plants, process cargo, and deliver them for further consumption. Ukraine has opportunities to increase the production of critical raw materials significantly; relatively low level of collection and processing of used products that contain useful components, relatively developed infrastructure and low wages of highly qualified personnel, proximity to European industrial centres give hope for the country to become a powerful EU partner in overcoming future crises. Changes began several years ago, after the signing of the association agreement with the EU. All spheres are being reformed while the country's legislation is being harmonized with European legislation.

Return to regional supply chains is a tough challenge. However, this challenge may be worth accepting in the world after COVID-19. Nowadays, the European industry imports up to 89 per cent of some critical minerals for further production; it is possible that soon we will observe a targeted transition to regional sources of search. Reliability and flexibility are becoming significant factors in terms of supply chain capacity. In the world after COVID-19, supply chain stress tests will become the new norm. Quantities are becoming more volatile, and supply chains need to become more adaptable to adapt quickly to situational changes and possible major catastrophic events. It requires a broader application of digital technologies. Having a strong group of experts in programming and IT technologies, Ukraine currently lags according to the digitalization of information and processes. Simultaneously, the Diia platform, which has been developed by the state and continues to expand, is recognized as one of the best in the world.

Profound and unexpected changes in quantities make statistical models useless. The human factor is critical. It has been proved that the principle of “autonomy” (automation with a human touch) of Toyota is the most adaptive. This involves automation of about 80 – 90 per cent of the system but leaves 10 – 20 per cent to the opportunity to apply human experience to improve system performance. Human is the most crucial asset of adaptation to unexpected challenges. COVID-19 has revealed weaknesses of the globalized production system. It is necessary to rearrange the supply chains fundamentally, to make them a key driving force of business and make human assets the most critical factor for business success.

Current OECD forecasts suggest that pandemic containment measures' initial impact could lead to a loss of 30 per cent of GDP. According to the International Monetary Fund, the fall in a global gross domestic product is expected to reach 3 per cent in 2020, which is higher than the decline of 2008 – 2009. Global markets for goods and services, capital and labour, are changing: new trade barriers are emerging, international investment and labour force migration are declining. In Ukraine, which has always been more vulnerable to crises, the gross domestic product's fall was expected to reach 4.8 per cent²⁰.

2020 changed the usual way of life. People have learned to live in conditions of pandemics and constraints. Ukraine's real gross domestic product was 1.2 trillion hryvnias in the third quarter of 2020; the fall of GDP was – 3.5 per cent compared to the third quarter of 2019. In the fourth quarter of 2020, Ukraine's real GDP decreased by 0.7 per cent compared to the corresponding period in 2019. According to the results of 2020, the fall in Ukraine's GDP is estimated at 4.2 per cent, which is lower than the previous forecast by 0.6 per cent. The Ministry of Economy predicts that the fall of GDP in the first quarter of 2021 may reach 3 per cent, but in the second quarter of 2021, the economic growth is expected by more than 7 per cent²¹.

Once the pandemic is under control, the top priority will be to address the crisis's economic impact to bring the economy back to normal as soon as possible. To address this issue, the OECD calls for adopting the "Global Marshall Plan" to support workers and individuals and keep businesses afloat. CSOs have to be key players in the medium-term perspective to rebuild the economy through public investment, social protection and business support. In the long term, when the economy begins to recover, it will be necessary to participate in the consolidation's national policy.

During the COVID-19 crisis, companies have used new technologies to fight, the speed and success of which are surprising. Digital capabilities are likely to be a significant driver of growth after COVID-19. The analysis of digital technologies' impact on labour productivity is convincing – the most digitized sectors are the most productive. Despite this, only a quarter of global sales and supply chains were digitized in 2019, and less than a third of operations were automated. In Ukraine, this indicator is much lower. According to the Ministry of Economy, the share of the digital economy in the gross domestic product of Ukraine was 4.36 per cent at the end of 2019, which was 0.86 per cent higher than in 2015. There is an exceptional potential in the digitization of supply chains, where this process is just beginning. An imagination, leadership and a bit of inspiration are required to create the right policy.

What we need now is a commitment to make changes and investments, which will lead us to a prosperous future.

²⁰ Main forecast macro indicators of economic and social development of Ukraine for 2020, approved by the Resolution of the Cabinet of Ministers of Ukraine dated May 15, 2019 № 555 (Official Bulletin of Ukraine, 2019, № 53, p.1832), Inflation report of the National Bank of Ukraine for April 2020, IMF World Economic Outlook (April 2020)

²¹ Source: *Economichna Pravda*. Ukraine's GDP in the last quarter of 2020. Article. News platform Economic truth. <https://www.epravda.com.ua/news/2021/02/15/671049/>

CRMs and related industry opportunities for MSMEs

Both now and in the post-pandemic period, MSMEs have many perspectives in Ukraine, and they should seize opportunities and join or expand their participation in critical raw materials supply chains or related industries. Ukraine's integration into European society expands existing and opens up new opportunities for MSMEs to participate in supply chains.

Thus, currently, the public sector of geological exploration of deposits, including critical minerals, has shrunk to a minimum over the past 30 years. With a reliable source of funding, MSMEs have the opportunity to provide exploration services at previously identified prospective areas (there are thousands of them in Ukraine). Such services can be complex and cover the entire geological exploration sector and narrowly focused; for example, they can focus on exploration for rare metal deposits, drilling or geophysical work.

When there is an interest in one or another critical raw material, MSMEs can perform work on analysing available information to offer prospective areas to the investor. The Subsoil Code, which is updated, will provide the free circulation of special subsoil use permits. It is necessary to involve experienced Ukrainian specialists, who are currently outside the production process, in such work types. Increasing the volume of exploration works provides an opportunity to develop related industries such as environmental, legal, accounting, financial, or laboratory-analytical with the appropriate sphere of specialization and certification level.

Increasing the extraction of critical minerals is impossible without the development of technologies, and MSMEs should use this opportunity. In this sector, Ukraine lags far behind developed countries. But at the same time, in some areas, Ukrainian scientists, inventors and developers occupy the first places in the world rankings. MSMEs can both import advanced technologies and participate in the development and implementation of domestic ones.

Given the total amount of waste accumulated within Ukraine, the development and distribution of technologies for their management provide new MSMEs opportunities. For example, in Ukraine, there is no infrastructure for collection and deep processing for further circular use of a wide range of used things, machines, devices and equipment that can become a source of raw materials, including critical ones.

Ukraine's integration into European society expands existing and opens up new opportunities for MSMEs to participate in supply chains. This may include the provision of special logistic services for the transportation of certain specific products, for example, by using waterways. The range of services related to cross-border transportation, such as logistics, customs clearance, certification, calibration, forwarding, etc., is also expanding.

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

a. Business facilitation and business registration

The most common organizational and legal forms are enterprise (legal entity) and individual entrepreneur. The most common enterprises are a private enterprise, a limited liability company, and a joint-stock company. Each of the forms of economic activity has characteristic features regarding the procedure of establishment, liquidation, reorganization, management, distribution of profits, property liability, etc. There are two systems of taxation in Ukraine: general and simplified (single tax). Simplified is better suited for those entrepreneurs who plan to provide services. When the form of business, company name, and taxation system have been determined, it is necessary to go through state registration. The law defines a certain package of documents to be submitted to the state registrar. In the case of registration of an individual entrepreneur, there are no difficulties in drawing up documents: it is enough to fill in the application for state registration of a natural person-entrepreneur²². An individual who wants to set up a business – a Ukrainian who has reached 18 years of age – can register as an individual entrepreneur. A Ukrainian at the age of 16 can also register, but parents or guardians' consent is required. Legal entity registration is a more complex process. Attention should be paid to the development of the constituent document. After the state registrar (or notary) has registered and entered information about the legal entity in the United State Register of Legal Entities, Individual Entrepreneurs and Public Organizations, a person is officially recognized as a businessman.

Several years ago, the registration of a company in Ukraine was accompanied by bureaucratic problems. In recent years, the following changes have occurred in the registration procedure for enterprises in Ukraine²³:

- In 2020, the use of the stamp was abolished during the registration of the company in Ukraine;
- Since 2020, there is no requirement for mandatory payment of the authorized capital upon registration of the LLC;
- Since 2020, all company documents are only in the state register. And this provides many advantages – owners do not have the originals, which they can suddenly lose. They can make copies of documents from the register at any time;
- Since 2020, it is not necessary to use the services of a notary. Bank cards, signature samples are certified by a bank employee, who also receives the necessary information about the company from the register when opening an account. It is no longer necessary to present notarized copies and records to perform these actions;
- Since summer 2020, it is possible to conduct online registration of the enterprise without notary participation. To do it, an individual must have a

²² Source: Ostoparchenko L. Starting your own business: the first legal steps. Interview with an expert. Legal Newspaper Online №21 (727). <https://yur-gazeta.com/dumka-eksperta/vidkrittya-vlasnogo-biznesu-pershi-yuridichni-kroki.html>

²³ Source: Online business registration: what will change in 2020. News platform Hromadskiy Prostir. <https://www.prostir.ua/?library=rejestratsiya-biznesu-onlajn-scho-zminytsya-v-2020-rotsi>

personal electronic digital signature (EDS) to sign registration forms and certify the constituent documentation.

EDS can be issued in special certification centres at various state structures and in some Ukraine banks (Fig. 8).




<i>HOW TO GET AN ELECTRONIC DIGITAL SIGNATURE</i>	
OPTION 1	Contact one of the qualified providers of electronic trust services (QPETS) List of all QPETS by the link: https://czo.gov.ua/ca-registry Further instructions are available on QPETS websites
	
OPTION 2	If you are a client of Privatbank - via Privat24:
	
	All services ➔ Business ➔ Download the certificate ➔ Further according to instructions Save the EDS to your hard drive or USB flash drive, come up with a password for it
OPTION 3	Pensioners can receive it together with the electronic pension card
	
	Electronic pension card combines functions of a pension card and a bank card, and contains electronic information about the owner and the EDS. In order to get it, contact the nearest territorial body of the PFU. It is made within 30 working days from the date of submission of the application and is issued in the chosen branch of the bank. EDS is created upon request together with an electronic pension card. The owner must remember the PIN code for the EDS app. ! Existing paper pension card can be replaced by the electronic one. At the same time, the transition to a new type of document is not mandatory, previously issued pension cards continue to be VALID.

Fig. 8. How to get an electronic digital signature

EDS can be used:

- to file income statement online;
- to order a record from state registers online;
- it is possible to order certificates from authorities in Ukraine online by using EDS;
- EDS is a necessary element for entrepreneurs to run their business with comfort; they can also use it to interact with the necessary state services;

Individual entrepreneurs and legal entities can use EDS to sign contracts online.

Registration of LLCs via the internet has recently entered into force in Ukraine. However, many citizens have already appreciated the advantages of such a service. An individual can register an LLC online through the website of the Ministry of Justice. This procedure is not very complicated; it allows us to create a personal account on the Ministry of Justice website. Registration on the website of the Ministry of Justice is relatively quick and easy. All documentation is certified by EDS. According to the Ministry's data, the registration of a limited liability company can be completed in 24 hours. The procedure may take 2 days maximum.

Registration of LLC as a VAT payer is performed when the company conducts business activities in different taxation systems. A legal entity in Ukraine can become a VAT payer at its request. The Verkhovna Rada of Ukraine registered a draft amendment to the Tax Code of Ukraine to simplify the registration of newly created entities as payers of the single tax and VAT (draft № 4244)²⁴.

²⁴ Source: Registration procedure will be simplified for entrepreneurs. Web-resource for businessmen, lawyers and accountants. https://biz.ligazakon.net/news/199170_pdprimtsyam-sprostyat-protseduru-restrats

Adopting bill № 4244²⁵ will solve the procedural problems of registration of legal entities and facilitate applying the simplified taxation system by registered individual entrepreneurs.

The launch of software registrars of payment transactions, so-called “RPT in a smartphone,” should simplify the relationship between business and regulatory authorities and register payment transactions. The Deputy Minister of Finance of Ukraine Svitlana Vorobey explained this matter during a round table on “Implementation of RPT software in a smartphone” in Ukrinform²⁶. Suppose the state and the business community are satisfied with “RPT in a smartphone” and are convinced that it will simplify the relationship between business and regulatory authorities, and simplify the procedures for registration of payment transactions and not be an additional burden for business. The third stage will begin on April 1, 2021, when RPT will be mandatory for all entrepreneurs. The implementation of the RPT software will be conducted in three stages. The first stage has already started on August 1; it introduces the possibility of using RPT software, including a free software product of the State Tax Service. As of the morning of August 3, almost 22.5 thousand RPTs were registered in the register of program registrars of payment transactions.

In November 2020, at the V Kyiv Oil and Gas Conference, the Head of the State Service of Geology and Subsoil of Ukraine, Roman Opimakh, presented its achievements in 2020²⁷. In his speech, he focused the attention of colleagues on priority tasks that were decisive in the work of the Service during the year:

- overcoming corruption and restoring the credibility of the Service,
- efficient use of subsoil,
- attracting investment in the sector.

During the year, the Service managed to change the regulator’s image, subsoil users began to trust it, and the market saw a fundamentally different approach: Derzhheonadra became open, transparent and honest mechanisms of work were chosen. Modernization of legislation on simplification of mining, the launch of the Subsoil User Investment Atlas and the Single Window, issuance of special permits at transparent online auctions permanently, liberalization of access to geological information, the update of the Methodology for calculating the initial cost of special permits, creation of a single Center for calculating the cost of special permits are the main achievements of Derzhheonadra. The State Service of Geology and Subsoil of Ukraine has proposed key areas to update legislation in the sphere of subsoil use. The modern approach is based on digitalization of regulation of the industry, transparent rules of access to the subsoil, support of small subsoil use and liberalization of circulation of special permits. The focus is still on the new

²⁵ Source: EXPLANATORY NOTE to draft of the Law of Ukraine “On Amendments to the Tax Code of Ukraine (on simplification of registration of newly created entities as single tax payers and value added tax payers)”. Web-resource for businessmen, layers and accountants. http://search.ligazakon.ua/l_doc2.nsf/link1/GI03466A.html

²⁶ Source: “RPT in a smartphone” should simplify the relationship between business and government. Article. Multimedia platform of foreign broadcasting of Ukraine. <https://www.ukrinform.ua/rubric-economy/3075064-rro-v-smartfoni-mae-sprostiti-vidnosini-biznesu-i-vladi-minfin.html>

²⁷ Source: V Kyiv Conference on Modern Methods of Drilling and Oil and Gas Production Increasing – DRILLING. INTENSIFICATION. HSE. – November 10, 2020 <https://www.youtube.com/watch?fbclid=IwAR2NPIVesx7jzqjh3kb1CPOIt0sKqeZP5ZVT52V5qvuhYrkWtYiXY6fYEpc&v=I9gp9ZAUw0g&app=desktop>

Subsoil Code. With major players in the mining sector and relevant Associations, key positions have been prepared, which should be included in the updated version of the document²⁸.

Discussion of the draft of the Law of Ukraine On Amendments to Certain Legislative Acts Concerning Simplification of Subsoil Use continues. There are currently two bills in the Verkhovna Rada (№ 4187, № 4187-1).

However, according to companies-members of the Health Care Committee of the European Business Association, the situation with confirming the requirements of good manufacturing practice (GMP) in Ukraine has recently deteriorated²⁹. While working on a new version of the Law of Ukraine “On Medicinal Products”, it is possible to simplify and improve the conditions for validating EU GMP certificates. Mutual recognition of GMP under the ACAA Agreement should also be considered strategic. Ukraine has already confirmed the absence of the necessity to perform “physical” inspections of production, given the generally accepted and confirmed the high level of national or supranational control in some countries.

b. Policy, legal and regulatory acts

In 2019, the mining industry’s share and quarrying was 5.6 per cent of the gross domestic product of Ukraine and provided jobs for more than 200,000 people. Simultaneously, the industry’s potential remains unrealized, so only about 35 per cent of more than 9,000 mineral deposits of commercial significance were developed in 2019.

The existing procedure of subsoil use is still complex and creates additional burdens for subsoil users. The path from initiating the auction to the actual use of the subsoil can take several years. The disadvantages of existing administrative processes cause it.

According to the information mentioned on the website of the State Service of Geology and Subsoil of Ukraine, during inspections of the state geological control, the compliance with almost one hundred legal and regulatory acts is inspected³⁰. Also, there are lists of the State Labour Service of Ukraine³¹, the State Environmental Inspectorate³², the State Fiscal Service³³, and other control and supervision bodies.

The situation with obtaining special permits has significantly improved with introducing the experimental procedure for holding an electronic auction in October 2018, but the existing procedure has several significant disadvantages. In particular, holding electronic auctions, defined deadlines for acceptance of an application and preparation for an auction, a deadline for holding an auction from the date of announcement of an auction,

²⁸ Source: New rules of the game in subsoil use. Official web-site of the State Service of Geology and Subsoil of Ukraine. <https://www.geo.gov.ua/novi-pravila-gri-u-nadrokoristuvanni/>

²⁹ Source: European Business Association. Business calls for a complex change in the approach to the GMP validation procedure in Ukraine. <https://eba.com.ua/biznes-zaklykaye-kompleksno-zminyty-pidhid-do-protsedury-pidtvverdzhennya-gmp-v-ukrayini/>

³⁰ Source: State Service of Geology and Subsoil of Ukraine. List of regulatory documents. <https://www.geo.gov.ua/npac/>

³¹ Source: State Service of Ukraine for Labor. Regulatory base. <https://dsp.gov.ua/category/diyalnist/normatyvna-baza/>

³² Source: State Ecological Inspectorate of Ukraine. List of regulatory-legal acts for business entities. <https://www.dei.gov.ua/posts/689>

³³ Source: State Tax Service of Ukraine. Legislation on business activities. <https://tax.gov.ua/diyalnist-zakonodavstvo-pro-diyalnis/>

but there is no time limit for the period between the preparation for an auction and the announcement of an auction. As a result, such preparation is delayed indefinitely without the possibility to challenge the inaction of the body organizing an auction effectively. Other bodies that provide approvals are involved in putting a subsoil area up for an auction. According to the State Service of Geology and Subsoil of Ukraine, 65 per cent of applications for an auction were returned with a refusal in 2019.

At the stage of preparation for extraction, a mining allotment is required, which duplicates permitting functions of a special permit, and documents provided for its registration are identical to those for obtaining a special subsoil use permit. Thus, the registration of a mining allotment, especially for an opencast extraction of minerals, is an unnecessary regulation tool and creates a burden for business.

Besides, a significant obstacle in attracting investment to the mining industry of Ukraine is the prohibition on selling the rights granted by a special permit. The purpose and task of the bill “On Amendments to Certain Legislative Acts of Ukraine to Support the Development of Domestic Subsoil Use Industries” proposed by a group of MPs (№ 4187 dated 05.10.2020) are to create a transparent, simple and clear system of subsoil use, reduce an excessive influence of the state on the industry, increase competition and legalize relations in the field of subsoil use³⁴. The bill introduces:

- Interactive map of Ukraine minerals – an information resource posted on the official website of the abovementioned body, which displays information about the State Fund of Subsoil of Ukraine.
- The geological study is replaced by a complex special permit, which allows combining the exploration of minerals with their extraction. The initial selling price at an electronic auction of such permit for subsoil areas where there are no duly approved mineral reserves is set at the level of 5 to 150 non-taxable minimum incomes per 1 hectare of relevant subsoil area for a year of use.

An exhaustive list of cases for granting a special permit without holding an auction is established. Peculiarities of the sale of a special subsoil use permit based on electronic auction results are determined. Submission of documents and reports in an electronic form through the electronic cabinet is anticipated. During expertise and assessment of mineral reserves and resources at the request of the subsoil user, the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC), the Classification of the Committee for Mineral Reserves International Reporting Standards (CRIRSCO), Petroleum Resources Management Systems (PRMS) and other international standards are allowed. An exhaustive list of cases when it is possible to suspend a subsoil use permit is established. The right of the holder of a special subsoil use permit to sell, use as collateral or otherwise alienate the rights granted to him by a special subsoil use permit to another legal entity or individual entrepreneur, including transferring them to the authorized capital of entities created with his participation, as well as contributing them to joint activities, with the transfer of rights and responsibilities to the new holder of the special permit.

The bill abolishes:

³⁴ Source: EXPLANATORY NOTE to draft of the Law of Ukraine “On Amendments to Certain Legislative Acts of Ukraine to Support the Development of Domestic Subsoil Use Industries”. Web-resource for businessmen, lawyers and accountants. http://search.ligazakon.ua/l_doc2.nsf/link1/GI03362A.html

Mining allotment for objects that are not developed by underground mining. The requirement to conduct an environmental impact assessment in areas of amber-bearing subsoil located on disturbed land plots following the list and coordinates determined by the Cabinet of Ministers of Ukraine. Approval of the use of local minerals by local communities. The list of documents in the package for granting a special permit for extraction without an auction is reduced. Approval of subsoil use for groundwater extraction and development of peat deposits by regional state administrations, the central executive body implementing state policy in the field of labour protection, and the central executive body implementing state policy in sanitary and epidemiological well-being of the population. Two types of special permits for subsoil use (for geological study and geological study with experimental and commercial development).

An alternative bill (N 4187-1 dated 21.10.2020) was developed by experts of the Executive Committee for Reforms of the National Reform Council of Ukraine³⁵. The bill proposes a more complete and comprehensive subsoil use reform compared to alternative bills, does not contain potentially corrupt provisions, does not increase administrative pressure on subsoil users and provides several stringent measures to ensure the energy security of Ukraine and address issues of the land use. Today, land use's problematic issues are one of the main obstacles to the implementation of legal rights of holders of special permits for subsoil use. Analysis of the current legislation of Ukraine and the practice of its implementation shows that the regulation of land transfer for subsoil use needs to be improved, in particular, to facilitate access of holders of special permits to land plots within limits set by the permit. Adoption of the bill will help to solve these problems in the sphere of subsoil use, secure the principle of direct distribution of income from subsoil use among Ukrainian citizens through the economic passport, improve the investment climate and attract additional investment in the extractive industry, stimulate the development of mineral deposits, which are of commercial importance. According to the bill, the public body authorized to issue a special permit is obliged to put up any subsoil area from the Interactive subsoil map for an auction within 20 days after receiving the application from subsoil users. Automatic reservation of state and communal lands, submitted for an auction, is introduced for a period of up to 1 year from the moment of receiving an official decision regarding its holding. The right to use subsoil will be suspended by the authority that issues permits only according to the court decision. The sale of crude oil, gas condensate of domestic production and liquefied gas by state enterprises will change. Instalment payment for special permits is anticipated for 25 million UAH. The land easement is supplemented by the right to build and place buildings/facilities related to subsoil use, and it is automatically recognized as a permit for the development of land management projects; it also simplifies the procedure for withdrawal of land plots. The bill repeals projects' approval to develop mineral deposits by the State Service of Geology and Subsoil of Ukraine and several other regulatory norms.

³⁵ Source: EXPLANATORY NOTE to draft of the Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine to Support the Development of Domestic Subsoil Use Industries". Web-resource for businessmen, lawyers and accountants. http://search.ligazakon.ua/l_doc2.nsf/link1/GI03461A.html

c. Access to data, information and knowledge

The existing procedure for the subsoil provision for use is still complex and creates additional burdens for subsoil users. Potential investors have difficulties at the stage of analysis of information about the object of investment because an online library of geological information is still in the process of formation and access to primary geological data is unregulated, the initial price of subsoil areas at auctions and the amount of government compensation for the conducted geological exploration works are calculated according to a complex and non-transparent method.

Geological study and subsoil use can be considered a social sphere of activity associated with the multilateral development of the general geological structure of the earth's crust, prospecting, assessment and exploration of mineral deposits. Its primary production process is formed of technologies for obtaining, registering, collecting and processing geological data. The result is information about geological objects, quantity and quality of natural resources in the subsoil, prepared following the established requirements. Procedure for management (provision for use and sale) of geological information on subsoil, obtained as a result of geological exploration, exploitation of mineral deposits or use of subsoil for other purposes, is determined by the Resolution of the Cabinet of Ministers of Ukraine dated 07.11.2019 № 939 "Procedure for management of geological information"³⁶. According to this document, geological information on various geological objects can be divided into two main categories: primary and secondary.

Primary geological information is information and data on physical carriers obtained during the use of subsoil as a result of the study of geological objects in their natural occurrence, samples, tests, and monitoring of the state, use and protection of subsoil.

Secondary (processed) geological information is information and data stored on physical carriers or displayed in electronic form, obtained during all types and stages of exploration, subsoil use, obtained from processing, interpretation and analysis of primary geological information.

Geological information is subject to mandatory storage by its owner and legal entities or individual entrepreneurs, who have been granted the right to use such information. Geological information is the subject of civil-law relations and can be used to contribute to the authorized capital of legal entities. Geological information created (purchased) at the expense of the state budget is state property. The manager of geological information, which belongs to the state, is Derzhgeonadra. Geological information created (purchased) at the expense of legal entities and individual entrepreneurs is their property. The geological information owner shall notify Derzhgeonadra of its creation, acquisition, transfer of ownership of geological information or the right to use it. Data on geological information, regardless of type and form of ownership, are subject to accounting in the catalogue of data on geological information maintained by the state scientific and production enterprise "State Information Geological Fund of Ukraine". Open (public) geological information is information, the publication of which in print media is possible in terms of state interests and does not violate a subsoil user's commercial interests. If it

³⁶ Source: Resolution of the Cabinet of Ministers of Ukraine "On disposal of geological information".
<https://zakon.rada.gov.ua/laws/show/939-2018-%D0%BF/print>

refers to geological information with limited access and falls under the Law of Ukraine “On State Secrets”, management of geological information is performed following the law.

Primary geological information, which is state property, is provided for use on a contractual basis. The state provides free access to such information only by providing it for inspection at storage on carriers on which it has been created.

The use of secondary (processed) geological information, state property, is free of charge. Such geological information is gradually placed in open online access on the Geoinform of Ukraine’s official website and provided in the form of copies (in electronic form). Payment for secondary (processed) geological information, which is state property, is collected from subsoil users only when issuing a special permit for subsoil use as compensation for state expenditures for geological exploration. The calculation of the value of secondary (processed) geological information, which is state property, is carried out following the Methodology for determining the value of geological information obtained at the expense of the state budget.

A legal entity or individual entrepreneur, who wants to acquire the right to use primary geological information that is state property, should send a registered letter of request to Derzhgeonadra. Derzhgeonadra prepares a draft agreement on providing services for determining the value of primary geological information and provides the right to use primary geological information after its signing and payment by the customer. Today, the value of the primary geological information is determined by direct calculation without considering factors that affect the quality of such information. This makes its acquisition unattractive and uncompetitive compared to obtaining such information directly by conducting the geological exploration. The new version introduces changes to the procedure for determining the value of primary geological information, which will make the mechanism for calculating the value of primary geological information as transparent as possible, and the cost itself will become more attractive for the acquisition and reimbursement of state expenses, taking into account all factors regarding quality and informativeness of primary geological information.

Geological information is exported following the legislation on foreign economic activity. Customs clearance of geological information is conducted following the requirements of the Customs Code of Ukraine.

Geological and economic assessment as a component of geological exploration and the whole subsoil development process is also characterized by phasing, which ensures the feasibility and rationality of each stage of subsoil development. Differences between stages of geological and economic assessment of mineral deposits consist of a gradual increase in the probability and detail of the assessment³⁷. The corresponding type characterizes each stage of geological study, volume and value of geological information. Geological information of the initial and preliminary stages (GEA-3, GEA-2) includes regional geological and geophysical surveys on a scale of 1: 1,000,000 (1: 500,000); regional geological surveys, geophysical and geological forecasting on a scale of 1: 200 000 (1: 100 000), geological surveys and geological forecasting on a scale of 1: 50 000 (1: 25 000), search and prospecting works on a scale of 1: 25 000 (1: 5000). At the initial

³⁷ Subsoil use in Ukraine/ Ed. by O.V.Kyryliuk, H.I.Rudko. – Chernivtsi: Bukrek, 2019.

stage, the degree of geological knowledge determines prognostic and prospective resources of minerals. Previously explored reserves are distinguished according to the degree of geological knowledge and confidence at the preliminary stage. Geological information of the detailed stage (GEA-1) meets the requirements of explored reserves.

Geological information is characterized by the following indicators, which, in turn, reveal its features:

- reliability and quality of information on geological study;
- availability of proper expert assessment of subsoil information;
- independence of information regarding its carrier;
- possibility of multiple uses of geological information without losing its volume and quality;
- commercial and public value;
- access limitation.

The State Cadastre of Mineral Deposits and Occurrences of Ukraine (SCDO) is an integral part of the accounting system of objects of the State Fund of Mineral Deposits and its reserve. SCDO is systematized information on the location, quantity and quality of essential and co-occurring minerals and their components, geological, hydrogeological, mining, geological-economic and other characteristics of accounting facilities of MRMB of the country. SCDO data is accumulated, periodically supplemented and updated in the SCDO (DB SCDO) automated database and submitted in the form of unified passports of objects of the SCDO accounting (passport) for a particular deposit and occurrence of minerals. Sources of information for compilation of passports of accounting objects and the formation of a computer database of the SCDO are stock geological materials stored in the SSPE “Geoinform Ukraine”. According to the legislation of Ukraine, all mineral reserves discovered in the subsoil and accompanying useful minerals available in them are subject to state accounting according to a single system. State accounting of mineral deposits is conducted in the manner determined by the Resolution of the Cabinet of Ministers of Ukraine dated 31.01.1995 № 75 “Procedure for state accounting of mineral deposits, reserves and occurrences”³⁸. The purpose of state accounting of mineral reserves and associated useful components is to obtain systematized information about their quantity, quality, degree of geological and technical-economic knowledge, level of commercial development, as well as information on production and losses.

State balances of mineral reserves are compiled annually on January 1 of each year. The formation of the State balance of reserves includes a wide range of participants: subsoil users, SCMR, the balance commission on reserves of Derzhgeonadra, SSPE “Geoinform of Ukraine”. Issues of the State Balance are prepared in several copies and handed over for storage to the archives of Geoinform of Ukraine, Derzhgeonadra, and state geological, mining enterprises and other interested agencies and organizations at their request.

The main problem that significantly complicates the use of available geological information is that most (almost 80 per cent) of this data is not digitized. Copying by modern means is impossible, so the processing is carried out in the reading room.

³⁸ Source: Resolution of the Cabinet of Ministers of Ukraine “On approval of the Procedure for the state accounting of deposits, reserves and occurrences of minerals”. <https://zakon.rada.gov.ua/laws/show/75-95-%D0%BF#Text>

Geological information is one of the aspects that investors analyze before they decide whether to invest in production or not. Accordingly, the availability of open, detailed and verified, i.e. high-quality geological data, simplifies investors' task. Thus, the disclosure of geological information in the "open data" format will be an incentive to increase investment in production.

The reform of Derzhgeonadra was discussed with representatives of relevant agencies in Europe and Canada³⁹. Foreign partners shared their experience and vision of the critical functions to be performed by the regulatory body. In particular, it was said that the state geological service should be a kind of one-stop-shop for the subsoil user, i.e. to perform the functions of a single permitting and regulatory body that can provide producers with a full package of services to ensure their activities. A single agency must provide all services, which will significantly simplify and accelerate the interaction between the investor and the state. Participants agreed that such a body should have all the geological information to manage this information, effectively and impartially assess the mineral resource base, ensure rational resource management, and conduct further geological exploration of the subsoil. Simultaneously, access to the results of geological surveys should be open to all subsoil users – online and offline. The parties agreed that their European and Canadian colleagues would provide consultations.

For a year now, Derzhgeonadra has been issuing special permits for subsoil areas only based on the results of online auctions, which can be monitored in real-time by anyone. Any company can select a proposal from the Subsoil User Investment Atlas, put it up for an auction, or nominate other areas if it is not in the Atlas. The participation of foreign companies in an auction has been simplified: now, there is no need to register a legal entity to compete for the right to develop a subsoil area⁴⁰. The launch of an electronic subsoil user's office and an interactive map of deposits is underway.

According to Derzhgeonadra, on November 12, 2020, an online calculator for calculating the approximate initial cost of special permits was launched on the "Geoinform" website⁴¹. This is a support tool for determining the economic feasibility of investment in the object, as it gives an idea about the initial sale price of a lot at an auction or the amount of fee for a special permit without an auction. To determine the approximate initial cost of the lot, it is necessary to fill in information about the object step by step: name of the site, type of subsoil use, number of commodities, its significance (local or national), commodity group, type, name, reserves and resources at the site by classes, the price for the unit of marketable products. All the information needs to be specified as calculation parameters contained in the site protocol and the Subsoil User Investment Atlas. The unit price of marketable products is published quarterly on the Service's website. The unit price of marketable hydrocarbons is determined by the Ministry of Economic Development and Trade and published on the website. The service will help

³⁹ Source: News report on working meeting with foreign geological regulators. State Service of Geology and Subsoil of Ukraine. <https://www.geo.gov.ua/proveli-robochu-naradu-iz-inozemnimi-geologichnimi-regulyatorami/>

⁴⁰ Source: News Report: Derzhgeonadra became a member of the CEEC Scout Group. State Service of Geology and Subsoil of Ukraine. <https://www.geo.gov.ua/derzhgeonadra-stali-chlenom-ceec-scout-group/>

⁴¹ Source: News report: An online calculator for calculating an initial price of a special permit has been launched. State Service of Geology and Subsoil of Ukraine. <https://www.geo.gov.ua/zapracuyuvav-onlajn-kalkulyator-obraxunku-pochatkovo%d1%97-cini-specdozvolu/>

subsoil users make investment decisions because the initial cost of a special permit can be used to calculate the economic feasibility of deposit development.

During the online meeting with the Secretary-General of the European Geological Survey, Slavko Solar, he expressed his sincere admiration for the changes initiated by Derzhgeonadra in geology and subsoil use in Ukraine over the last six months and confidence that Ukrainian and European experts can collaborate productively. He proposed continuing and deepening participation in a complex of projects to create a research environment for European geological services. The experience of European countries will be useful to develop an approach to creating a national geological data repository. Facilitation of access to geological information also requires a responsible approach to the protection of geological data. Therefore Ukrainian experts will study Europeans' work in the sphere of data management to anticipate possible risks and create a quality service on a national scale⁴².

d. Entrepreneurship skill facilitations

The Verkhovna Rada of Ukraine, the Cabinet of Ministers of Ukraine, specially authorized body in the field of small and medium business development, other central executive bodies, the Verkhovna Rada of the Autonomous Republic of Crimea and the Council of Ministers of the Autonomous Republic of Crimea, local state administrations, local self-governments ensure the development of small and medium enterprises. And it is determined by the Law of Ukraine “On Development and State Support of Small and Medium Enterprises in Ukraine”⁴³. In the modern world, each company's strategic goals become bolder, and the competition becomes more rigid. Sometimes it isn't easy to find the right skills to compete. Success requires continuous improvement of skills, and now there are many opportunities for this: online and offline training, educational series and institutions, business forums and seminars, open media and specialized reports, consultations with experts and practitioners, etc.

The implementation of educational programs in entrepreneurship at schools and higher education institutions, affordable (free) training for entrepreneurs by using the free online school for entrepreneurs “Diia. Business”, as well as information campaigns, local events and festivals “Buy local”, which stimulate the development of small and medium enterprises; implementation of programs “Big to small” (cooperation of big business with small and medium enterprises) will contribute to the promotion of entrepreneurship in regions. This norm is defined by the Cabinet of Ministers' Resolution dated August 5, 2020, № 695 “On approval of the State Strategy for Regional Development for 2021 – 2027”⁴⁴.

⁴² Source: News report: Roman Opimakh held a meeting with the European Geological Survey. State Service of Geology and Subsoil of Ukraine. <https://www.geo.gov.ua/roman-opimakh-proviv-naradu-iz-yevropejskoyu-geologichnoyu-sluzhboyu/>

⁴³ Law of Ukraine “On Development and State Support of Small and Medium Enterprises in Ukraine” (Vidomosti Verkhovnoi Rady Ukrainy (VVR), 2013, № 3, p.23) <https://zakon.rada.gov.ua/laws/show/4618-17#Text>

⁴⁴ Resolution of the Cabinet of Ministers dated August 5, 2020 № 695 “On approval of the State Strategy of Regional Development for 2021-2027” https://zakon.rada.gov.ua/laws/show/695-2020-%D0%BF?find=1&text=%D0%B1%D1%96%D0%B7%D0%BD%D0%B5%D1%81#w1_20

On July 31, 2020, the Ministry of Digital Transformation of Ukraine, in partnership with the International Finance Corporation (IFC), a member of the World Bank Group, presented the educational series “Financial Literacy for Entrepreneurs” on the platform Diia.Business. The educational series consists of 20 series and covers a wide range of topics. The better financial literacy an entrepreneur has, the better the results of his business. Businesses must communicate with financial institutions in one language. It is the language of financial reporting. But it is even more critical for a business to understand its financial efficiency. Therefore, understanding financial vocabulary is a necessary condition⁴⁵. The educational series will increase individuals’ financial literacy, small and medium businesses, and its task is to share the best world experience with Ukrainian entrepreneurs. Financial education is essential, and it is related to the development of the digital dimension. People who are sole proprietors do not have much time for education, and therefore, this course has been designed to make it easier for them to take it with a short series. The preparation of the educational series is possible due to the support of international partners within the four-year IFC project “Financial Inclusion for Economic Growth in Ukraine”, which is implemented in partnership with the Swiss State Secretariat for Economic Affairs (SECO) and the United Kingdom Good Governance Fund (GGF).

The project “Increasing Business Competitiveness and Employment Opportunities for Vulnerable Population of Donetsk and Luhansk Regions” is implemented with the USAID Project “Economic Support for Eastern Ukraine”. The project provides training and consultations to start-up entrepreneurs and micro-business owners to improve the efficiency and competitiveness of business in modern conditions, particularly in conditions of quarantine restrictions. Separate training modules are also planned for high school students and undergraduate students of vocational education institutions. In each project’s location, a series of two two-day sessions of training, two one-day group consultations, individual face-to-face and online consultations are provided. During the training, entrepreneurs will improve business processes by reviewing business models and implementing improved financial planning, marketing, and human resource management strategies. An individual approach to education will help increase the profitability of each type of business and, as a result, will have a positive impact on the region’s economic development. The project is essential, especially in the negative impact of quarantine restrictions on micro, small and medium businesses⁴⁶.

Relations between government and business are essential for each party. A city needs money for the city budget and development to increase tourism, citizens’ comfort, and the MSME can provide it. At the same time, business needs adequate authorities to increase its competitiveness and create decent city conditions. To receive regular and significant contributions to the local budget in the future, the authorities should make every effort to create the best conditions for the growth of MSME. It is the city government’s responsibility to develop regulations considering the needs of the most vulnerable categories of entrepreneurs and the business environment, in general. Nowadays,

⁴⁵ Source: Educational series on financial literacy for entrepreneurs has appeared on Diia.Business. Article. Ministry and Committee of Digital Transformation of Ukraine. <https://thedigital.gov.ua/news/na-diyabiznes-zyavivsvya-osvitniy-serial-dlya-pidpriemtsiv-pro-finansovu-gramotnist>

⁴⁶ Source: Strykun H. Residents of eastern Ukraine will gain new skills. Article. National platform for small and medium business. <https://platforma-msb.org/44361-2/>

information plays an important role. Businesses need open data and information resources. City authorities should ensure transparent and equal access to dynamic information on communal property, land plots, and regulatory acts. The latter should help create necessary conditions and encourage business and define the responsibilities of entrepreneurs to improve the city's well-being. For example, according to the rules, the entrepreneur must clean and improve the area (15 meters) on each side of his / her plot, plant trees or pay for those that need to be removed for construction. In this way, the business makes the city cleaner and better. City authorities decide how and for how much the communal land can be sold. This resource is necessary for a business to rent a territory at the best price and develop it in the right place. Local authorities should regulate advertising.

Authorities can also influence communal markets – landscaping, sanitation, and development of shared infrastructure. One of the main problems is access to information on communal property and vacant land plots. Authorities should provide free access to up-to-date information on electronic form resources; for example, create a map of free areas or at least post a list of sites with their descriptions. Thus, the communal property will bring money to the budget instead of standing idle. The City Council should hold open land auctions, and this procedure is stipulated by law to ensure transparency. Authorities can also provide information on grants and business opportunities, thus encouraging enterprises to cooperate.

Local authorities can help with a water supply and heating, as “Teplomerezhi” and “Vodokanal” are cooperative enterprises. City authorities should adopt development strategies and programs and information about them. Thus, the city development plan is adopted by the city authorities every 5 years, and it should take into account the needs of the business. Continuous development and improvement of skills and knowledge are required in each sphere. City authorities can hold forums, training, seminars or create conditions for organizers to make such propositions. Also, the authorities can provide free opportunities to promote business, for example, at various forums, where business or community organizations can tell people about themselves and their activities to attract new customers⁴⁷.

As the executive director of the Union of Ukrainian Entrepreneurs (UUE), Kateryna Hlaskova reported on October 15, 2020, an authentic Ukrainian businessman's portrait was designed based on 1000 questionnaires. Thanks to the research, it was possible to determine the main reasons for setting up a business in Ukraine and the obstacles that hinder business development. According to the survey, the biggest stoppers are provoked by the state: an unstable situation, a constant change of “rules of the game”, a high tax burden, lack of available loans, etc. After analyzing the profile of business owners from different spheres, UUE has identified five criteria, according to which it is advisable to characterize Ukrainian entrepreneurs:

- Willingness to take risks in business;
- Innovation;
- Organizational skills of the manager;
- Honest and legal business;

⁴⁷ Source: Khorolska V. Small / medium business and what the Zaporizhzhia authorities can do to it. Zaporizhzhia Investigation Center. News report. <http://incentre.zp.ua/malij-serednij-biznes-i-shho-mozhe-zrobiti-z-nim-zaporizka-vlada/>

- Dependence of the business on external circumstances.

After analyzing the answers, five types of Ukrainian entrepreneurs have been distinguished:

- Working micro-owners (19 per cent, calmly run a business, beginners seeking to “put a business in order”);
- Agile innovators (22 per cent, they quickly detect existing problems, shortcomings and independently manage their correction, always seek to find new business opportunities);
- Ideological inspirers (19 per cent, active and inspired business owners, constantly generating creative ideas and considering new business directions);
- Business whales (21 per cent, large entrepreneurs, are fully responsible for their actions and their own business, do not rely on external circumstances, can adapt quickly);
- Detached owners (18 per cent, mostly owners of one micro-business in the sphere of wholesale and retail, often set unrealistic goals, less often than others use a democratic management style).

The main motives to start a business have also been clarified: self-fulfilment and the ability to implement ideas (75 per cent), financial security (74 per cent) and independence from the employer (65 per cent). Despite the imperfect business environment, Ukrainian entrepreneurs are optimistic about the country’s future in 5 years: economically developed, prosperous and self-sufficient country with a Western course of development (accession to the EU), without war, with an integrated territory and the rule of law⁴⁸.

Understanding the portrait of an entrepreneur allows preparing better regulatory documents and more effective training programs.

The EBRD helps SMEs attract highly qualified local consultants and experts-practitioners, who can transform businesses qualitatively by giving grants. Since 2010, the EBRD has implemented about 1,000 projects. Thanks to this assistance, more than 5,000 jobs have been created. About 60 per cent of enterprises have doubled their turnover. Another 19 per cent of clients who used local consultants’ services started exporting their goods and services. It is also essential that almost half of the enterprises have used consulting assistance again after implementing the first project. The program is implemented through business information support centres. There are already 15 such offices in different regions of Ukraine. There you can get a consultation, attend training and listen to webinars, which, incidentally, are free during the quarantine. In 2019, about € 1.3 million was mobilized within 160 consulting projects⁴⁹.

Regarding the participation of the MSMEs in the EU sustainable supply chains of critical raw materials, Ukraine can provide all the opportunities to acquire professional knowledge and improve entrepreneurs’ skills and abilities. A training system has been created and operating; it covers all stages of the production process and all industries involved in producing or supplying critical raw materials. Training is provided at state and private educational institutions and directly at the workplace. There are free and

⁴⁸ Source: Made in Ukraine. Catalog of Ukrainian companies and manufacturers. <http://madeinukraine.org/news/info/118>

⁴⁹ Source: Hrynkov D. Landscape for SMEs. Article. Business journal. <https://www.business.ua/uk/node/11207>

chargeable training courses. When information technologies are rapidly developing, opportunities to improve business skills are limited only by an individual's desire.

e. Market access

Many factors affect SMEs' access to the market of minerals and real opportunity to reach the level of international trade. There are internal constraints related to societal and state concerns about possible adverse effects on the environment and society. Significant expenditure of time and resources for preparing technical documentation that gives the right to operate legally obstructs market development. There are some restrictions associated with the legislation's requirements on state and trade secrets and regulations on the use of chemicals and ionizing radiation sources, and they need to be addressed before production begins. The cost of infrastructure construction complicates market access, given the low productivity of the initial period. The low level of digitization of SME workflows, especially during quarantine restrictions, is also one reason that significantly complicates the involvement of small companies in the market of critical raw materials. Besides, SMEs are less efficient than large businesses. Trade and customs procedures transform into direct and indirect costs for the business and affect the company's competitiveness. SMEs bear the burden of these barriers disproportionately. Compliance with regulatory requirements and adaptation to regulatory differences in different countries is more difficult and expensive for SMEs than for large enterprises. Entering the market is too expensive and time-consuming for SMEs, primarily when they operate in a non-transparent business environment where access to information is difficult and corruption exists. Thus, SMEs are either not engaged in international trade or forced to incur additional costs. They hire external consultants, sign contracts with international companies that offer services worldwide, have specific market knowledge, and limit SMEs' financial and logistical risks. Therefore, opportunities for SMEs to access international markets are more limited and vulnerable than domestic conditions in which they operate. Trade facilitation can enhance their ability to engage in international trade because it aims to reduce money and time on trade.

It is possible to use the time freed up due to the COVID-19 pandemic and related restrictions to raise awareness of current import/export management rules and laws. It requires access to the digital communication of employees. In most countries, subsidies are received for such digitization from the state or development companies.

Example: In 2014-2015, the Association of Geological Services for Europe (GSE) and representatives from the USA and Canada delegated 2 working groups to Ukraine, analyzed the work of the domestic Geological Survey and provided detailed conclusions-recommendations on reforming the Service following European standards⁵⁰. Only political will is needed for the implementation of these initiatives. The project regarding investors' attraction to the development of the Muzhiyevske polymetallic deposit was also launched in 2015 at the PDAC conference. But the problems of jurisdiction were reflected, as projects in Ukraine were considered quite risky. Problems of production in Ukraine are the

⁵⁰ Source: https://biz.censor.net/m3150549https://biz.censor.net/columns/3150549/nkel_kobalt_yake_znachennya_dlya_ukrani_ma_zrostannya_svtovogo_popitu_na_ts_metali

same as in the rest of the world. In 2015, when launching the project, investors did not know that they would face problems instead of “cooperation”⁵¹. At the end of 2018, there was no public source or expert opinion on the EBRD's Extractive Mining Industries Strategy for 2018-2022 in Ukraine⁵². Currently, the national geological industry has no subsoil use strategy and no methodology for allocating critical mineral raw materials. There is no legislative basis.

Natural resources are distributed very unevenly on the planet. In Ukraine, there are 117 types of minerals, and our industry is characterized by technological backwardness and low innovation activity of economic entities, the outdated structure of the manufacturing industry, increased technological dependence on other countries⁵³. Finding interested subsoil users should be addressed in parallel with the issue of attracting the latest technologies on international platforms. There are resources in Ukraine, but we need to learn to use them properly. Countries worldwide are no longer competing in the volume of deposits of certain minerals but rather in their processing technology. Large companies buy thick deposits of certain minerals and wait for years or even decades to enter the market with new technologies and conquer it⁵⁴. In autumn 2020, the Prime Minister of Ukraine Denys Shmyhal and the Vice-President of the European Commission for Interinstitutional Relations and Foresight Maroš Šefčovič agreed on cooperation in the sphere of critical raw materials, discussed ways to enhance cooperation and build a strategic partnership between Ukraine and the European Commission. The main goal of Ukraine in the field of economic cooperation with the EU is the further integration of Ukraine into the EU internal market, as enshrined in the provisions of the Association Agreement. Ukraine needs to initiate a joint project on minerals' geological study and prepare several deposits of those minerals included in the European Union's strategic list for an auction during 2021. A project on verification of mineral reserves in Ukraine is possible⁵⁵.

As in other sectors, there are some trade barriers for SMEs:

- measures related to standards that lead to high compliance costs, especially regarding chemicals and radiation sources, as well as machinery and technical equipment;
- difficulties related to state and commercial secrets and patent costs;
- challenges related to a significant amount of the minimum consignment of critical raw materials;
- logistics challenges, including customs requirements.

Despite the availability of finances and investors' desire, the development project of the Muzhiyevske polymetallic deposit has not reached the stage of a stable development yet.

⁵¹ Source: Smolin A. Investor's Diary: how to launch a gold mining project in Ukraine. <https://mind.ua/openmind/20186277-shchodennik-investora-yak-zapustiti-proekt-iz-vidobutku-zolota-v-ukrayini>

⁵² Source: Smolin A. Investor's Diary: analysis of the EBRD's mining strategy. <https://mind.ua/openmind/20187671-shchodennik-investora-analiz-strategiyi-ebrr-z-vidobutku-korisnih-kopalin>

⁵³ Source: Kashchuk D. Critical subsoil, or How we can affect the EU economy. Article. News platform Economic truth. <https://www.epravda.com.ua/rus/columns/2019/12/6/654540/>

⁵⁴ Source: https://biz.censor.net/m3150549https://biz.censor.net/columns/3150549/nkel_kobalt_yake_znachennya_dlya_ukrani_ma_zrostannya_svtovogo_popitu_na_ts_metali

⁵⁵ Source: Ukraine and the EU will deepen cooperation in the sphere of critical raw materials. Article. Multimedia platform of foreign broadcasting of Ukraine. <https://www.ukrinform.ua/rubric-economy/3135369-ukraina-ta-es-pogliblat-spivpracu-u-sferi-kriticnoi-sirovini.html>

f. Access to finance

Access to financial resources remains an essential factor for sustainable development and capacity building of MSMEs⁵⁶. Ukrainian Fund for Entrepreneurship Support was established in 1995. In December 2018, the Ukrainian Startup Fund (USF) was launched on the Cabinet of Ministers of Ukraine's initiative. In December 2019, the first call for applications was launched⁵⁷. Strategy for developing small and medium enterprises in Ukraine until 2020 was approved by the Cabinet of Ministers of Ukraine dated May 24, 2017, № 504-r. Expanding MSMEs' access to finance has been defined as an essential part of the MSME Strategy. The availability of external financing is determined by the requirements for borrowers, collateral and the size of real interest rates in the banking system. The state can facilitate targeted bank loans to MSMEs at the expense of budget funds and joint programs with donors and international financial institutions.

The Action Plan for the Implementation of the MSMEs' Strategy, approved by the Cabinet of Ministers in May 2018, contains four objectives that aim to improve financial access.

Neither the Strategy nor the Action Plan for its implementation contained measurable target results that would allow assessing the improvement of access to finance for MSMEs.

Since 2015, the number of operating banks decreased from 163 to 77, and during 2014-2018 the balance sheet decreased from 83.5 billion USD to 49.6 billion USD. The remaining banks operate exclusively as joint-stock companies. The absence of a legal definition of microfinance has limited opportunities for the development of microfinance institutions. The financial sector of Ukraine is burdened with a large number of problem loans.

Data published by the NBU and the Ministry of Economy shows that the amount of loans issued to MSMEs remains in absolute terms at the level of UAH 430 billion. According to a survey of entrepreneurs in six Ukrainian cities, more than 95 per cent of surveyed entrepreneurs have not even tried to obtain financial resources using financial instruments such as promissory notes, factoring and leasing.

According to NBU statistics, loans to MSME counterparties that are part of the business group amounted to 79.1 per cent at the end of October 2019. Interest rates on loans to counterparties that are related to business groups are usually lower. General statistics show the stagnation of MSME lending over the past three years, despite the growth of the economy of Ukraine. It indicates the absence of significant changes that could improve MSMEs' access to finance. The NBU survey results on bank lending conditions for the fourth quarter of 2019 show that the level of creditworthiness of MSMEs was considered low or average by more than 90 per cent of respondents. The low level of the debt burden of MSMEs indicates a significant potential for development using financial resources. Also, it is noteworthy that standards for approving MSME loan applications have been lowered, i.e. requirements for borrowers have been reduced in the third quarter of 2019 by the vast majority of banking institutions.

⁵⁶ Big problems of small business: assessment of the implementation of the strategy of small and medium business development in Ukraine until 2020 and further policy directions (www.boi.org.ua)

⁵⁷ Monitoring of implementation of the SME Development Strategy of Ukraine for 2017-2020 https://sme.gov.ua/wp-content/uploads/2020/09/Monitoring_the_Implementation_of_Ukraine-s_SME_Development_Strategy_uk.pdf

MSME representatives point to a lack of information on targeted programs to improve MSME access to finance. Simultaneously, there are currently up to 50 MSME support programs organized by international donors in partnership with Ukrainian banking institutions, investment funds and government agencies. A significant share of funds allocated by international lenders is not used due to stringent requirements for potential borrowers. The Ministry of Finance of Ukraine has currently reformatted the German Ukrainian Fund (GUF) into the Entrepreneurship Development Fund. Programs include MSME lending, targeted loans for social, energy-efficient, environmental projects, grants for the exchange of experience and the development of entrepreneurial competencies. The EU has an official portal, www.access2finance.eu, which contains detailed and up-to-date information on all European programs to improve MSMEs' access to finance at all levels and the financial institutions through which these programs are implemented. In Ukraine, a similar function of the official portal that would aggregate information on access to finance, grants and training programs for MSMEs can be performed by the Portal for Entrepreneurs of the Ministry of Economy www.sme.gov.ua. However, it still displays incomplete information. Significant limiting factors consist of insufficiently transparent activities of MSMEs, which complicate the assessment of loan applications by financial institutions, entrepreneurs' doubts about the ability to prepare convincing business plans, and many documents to obtain credit and duration of decision-making procedure. Simultaneously, the possibility to receive credit financing stimulates the transparency of running a business and facilitates a de-shadowing of MSMEs.

Entrepreneurship support programs have also been adopted at the municipal level. Currently, the city authorities can help with financial resources to support MSMEs; for example, they can reimburse interest rates on loans from the city budget, use opportunities of international programs to develop MSMEs and attract investors, promote MSME access to public procurement, i.e., create conditions for local firms to be able to get contracts on the site "Prozorro". Also, the city authorities can receive grants for business development and support and apply them as aid to entrepreneurs. For example, in 2019, the Lviv City Council launched a financial and credit support program for MSMEs. The Lviv City Council approved the reimbursement of some part of interest on loans to businesses in April 2019. However, despite attractive conditions, as of mid-December 2019, this offer was used only by one borrower under the GUF MSME support program.

Another example was the Entrepreneurship, Innovation and Startups Support Center opening on February 26, 2020, in Chernihiv, which was established with the State Fund for Regional Development's financial support. This project will promote the development of startups through acceleration and incubation programs and increase enterprises' competitiveness in the region⁵⁸.

The current share of problem loans is about half of all loans that have been issued. Ukraine is taking steps to restore its banking sector. In particular, the Credit Guarantee Fund was established for bank liquidation cases, and the NBU introduced new standards for regulating the banking sector following EU directives and practices. In October 2019, the parliament adopted the "Action Plan to Attract Private Investment in State-Owned

⁵⁸ Center for Entrepreneurship, Innovation and Startups – a new step towards improvement of the economic development of Chernihiv region <https://chor.gov.ua/nasha-diyalnist/novini/item/9129-tsentr-pidtrymky-pidpriemnytstva-innovatsii-ta-startapiv-zaprats>

Banks” and reduced the state's share in the banking sector by 20 per cent. Despite some improvements in lending conditions, the banking sector’s restructuring has become an obstacle to MSME financing. Interest rates for MSMEs remain high, reaching 20 per cent. Only a few companies have such a return on investment and use loans. At the same time, 90 per cent of the borrowed amount is used to pay for working capital and only 10 per cent– for investment.

Even under such circumstances, banks recorded a significant increase in demand for investment among MSMEs. There is also a significant demand for guarantees. On January 14, 2020, the Verkhovna Rada adopted the Law “On Amendments to the Law of Ukraine “On the State Budget of Ukraine for 2020” to Ensure the Entrepreneurship Development Fund’s Functioning”. This Law considers expenditures to finance the Entrepreneurship Development Fund (EDF) for UAH 2 billion by increasing the revenues of the State budget’s special fund from the early redemption of promissory notes of the Deposit Guarantee Fund. It is proposed to use UAH 1.5 billion for partial compensation of the interest rate and UAH 0.5 billion – to provide partial guarantees of the fulfilment of liabilities under loans of partner banks. In January 2020, the Cabinet of Ministers of Ukraine decided to launch program 579, under which companies would be provided with affordable loans at rates of 5 per cent, 7 per cent or 9 per cent per annum since February 1, 2020. Final rates for a borrower depending on the number of jobs created with the possibility of a quarterly reduction in interest rates.

The state MSME support program allows participants to receive affordable loans of up to UAH 1.5 million at rates of 5 per cent, 7 per cent or 9 per cent to start or expand their own business. In 2020, UAH 5 billion was allocated from the GUF budget for this program. As of the beginning of October, 3.81 thousand loans of more than UAH 9 billion have been provided since the start of the program in February. However, more than half of soft loans are issued to refinance existing loans. The Resolution of the Cabinet of Ministers states that refinance loans are issued for the period of quarantine and 90 days after its completion. Thus, 64 per cent of “affordable loans” (UAH 371 million) were issued to refinance previous loans within one week, 21 per cent (UAH 109 million) was allocated for capital investments, and 15 per cent (UAH 96 million) – to replenish working capital. At the beginning of October, loans were issued through 18 partner banks. There are already entrepreneurs who take loans for investment purposes. These are small amounts compared to the program’s total augmentation per week, which is on average 150 – 300 million UAH⁵⁹.

According to the Law of Ukraine “On Amendments to Certain Legislative Acts of Ukraine on the Improvement of Functions for State Regulation of Financial Service Markets”, the National Bank has been supervising institutions that are providing factoring and leasing services since July 2020. Along with the ProZorro system, the Small and Medium Enterprise Development Office is developing a product called “factoring for MSMEs in public procurement” that will allow underfunded MSMEs to participate in public procurement with the financial support of factoring firms (banks).

Almost all business associations and economic centres have sent their proposals to the government to save entrepreneurs during this challenging period of the corona crisis.

⁵⁹ Landscape for SMEs <https://www.business.ua/uk/node/11207>

Donors and business are ready to help. The Ministry of Digital Transformation of Ukraine has summarized all the inquiries and main categories of problems and specific solutions to them, which individual business associations and communities offer, specific proposals and a specific action plan. Given the global financial crisis's tendencies, this product can help MSMEs continue to operate during and after quarantine⁶⁰.

The mining and metallurgical industry of Ukraine has accelerated its decline since 2015. It was caused not only by the annexation of some part of the territory but also by the weak demand for products. The conflict continues to affect the level of interest of entrepreneurs in the mining sector and industry. For example, the EBRD supports projects aimed at improving transparency, health and safety standards or the energy efficiency of the mining sector. There is a joint program of the EBRD and the EU – “EU4Business: Support for Small and Medium Enterprises in Ukraine”. It provides grants for innovative projects on MSME development, job creation and business development at the local community level, and economic policy improvement in this sphere following international best practices. The program was launched in 2017, and initial funding was received from the EU. This institution remains the primary donor of the project. In 2019, Ukrainian MSMEs received direct funding for almost € 23 million under the EU4Business program. This summer, a new financing agreement for € 20 million was approved. The EBRD is one of the largest donors of financial resources for Ukraine.

In 2019, Ukraine took second place according to the number of investments from the EBRD and first place – according to the number of signed projects. The total amount of new investments under all programs exceeded € 1.1 billion, which was used to support 51 projects. Last year, one of the bank's priority activities in Ukraine was agribusiness. The EBRD is a leading institutional investor in Ukraine, which has already committed to providing more than € 14.54 billion (over 460 projects). Support for small and medium-sized enterprises is also a priority for other international financial organizations. For example, in partnership with Switzerland's State Secretariat for Economic Affairs (SECO), IFC has developed crop receipts to allow farmers to use them as collateral for payment. Many small and medium-sized agricultural enterprises could not receive financing in any other way due to the lack of collateral.

The purpose of creating the online platform “Factoring Hub” is to expand the market for small business products through public procurement participation and develop alternative financing methods and automated online platforms. The vast majority of micro and small enterprises do not consider public procurement as a market at this point due to unacceptable payment terms (60+ days) and the inability to lend to a customer due to limited access to working capital loans. This is especially noticeable now during the crisis caused by the COVID-19 pandemic. Trade finance and factoring are specific solutions for access to working capital financing within the framework of trade operations. Factoring is most useful for small enterprises experiencing financial difficulties due to late repayment of debts by customers and limited available sources of financing. The share of factoring in Ukraine's GDP is approximately 0.3 per cent. The non-recourse factoring, which is promoted within the project, allows a supplier to sell customer's account receivables to the

⁶⁰ Source: Ionan V. Business has to be heard during a crisis, but the government does not do it. This is a big mistake. Article. NV Journal. <https://nv.ua/ukr/biz/experts/yak-vryatuvati-ukrajinskih-pidpriyemciv-vlada-ne-chuye-biznes-shcho-robiti-50079612.html>

bank and receive payment for supplies in just a few days in a way and amount more attractive compared to a bank loan. The online platform allows an entrepreneur (supplier) to apply for public procurement participation and receive offers of non-recourse factoring from a bank. MSMEs reserve the right to accept or reject the terms of non-recourse factoring offered by the bank. Due to information on customer payment discipline and the integration of the Prozorro system's open data, the bank spends a minimum of resources to assess customer's credit risk. Bank's offer consists of non-recourse factoring provision when the bank assumes risks of non-payment by the customer and provides financing – up to 98 per cent of the transaction amount without additional collateral and 100 per cent in case of using the online service. Participation in the platform is free for MSMEs and customers. Further steps also include the regulation of factoring and other possible changes in legislation and the further scaling alternative financing in Ukraine⁶¹.

Tax exemptions during the quarantine period concerned only micro-enterprises, namely individual entrepreneurs. In particular, they were exempted from paying a single social contribution (SSC) for three months. So, they were able to save more than 3 thousand UAH. Also, some individual entrepreneurs were able to receive state assistance in the form of child benefits for the entire quarantine period plus one month after its completion. However, such payments stopped in September.

As a possible participant in the supply chain of critical raw materials to the EU, MSMEs have access to finance characterized by some peculiarities. As in other sectors, a necessary condition for the inflow of finance is the company's investment attractiveness. This concept is a rather abstract, subjective category. Nowadays, there is no single approach to defining the essence of this economic category. A significant source of investment attractiveness of mining companies is reserves and resources of minerals, which play a dominant role in shaping the company's market value, so, first of all, a modern and reliable assessment of the quantity and quality of reserves is needed⁶².

Financing of MSMEs at the stage of geological exploration is carried out in the vast majority of projects by large non-state companies planning to conduct mining activities or expand the existing raw material base of their own mining companies. There are no non-state junior companies among MSMEs in Ukraine because a special subsoil use permit is not transferable to another company. The exploration industry is associated with high risks and finances that a junior can be attracted other non-exchange instruments (primarily since the exchange does not function in Ukraine) cannot ensure the company's activities. The issue of rational use of funds during the geological study of subsoil requires streamlining and modernization of the entire production cycle – from the justification of the required amount of funding to the analysis of investments' economic efficiency, including adaptation to EU standards. Analysis of international standards' content has shown that most of their provisions are contained in domestic regulatory-technical and other documents. Competitiveness in terms of the modern global market environment is determined by the compliance of products (services) with international quality standards. In countries with developed market economies, compliance of business structures with these standards is the concern of their owners, and in countries with emerging market

⁶¹ The Ministry of Economy strengthens support for small and medium business

https://biz.ligazakon.net/news/197195_mnekonomki-posilyu-pdtrimku-malogo--serednogo-bznesu

⁶² Subsoil use in Ukraine / Ed. by O.V. Kyrlyuk, H.I. Rudko. – Chernivtsi: Bukrek, 2019. – 688 p.

economies, the issue of standardization and certification is a matter of public policy. Unfortunately, this issue is still not recognized at the state level in Ukraine, so enterprises, including MSMEs, do not know their immediate future. If MSMEs can receive financing in most sectors of the economy, these opportunities are quite limited in the exploration and mining sectors.

g. Access to technology

Access to information on technologies that facilitate the extraction, enrichment and use of critical raw materials is essential for the development and growth of MSMEs. First of all, these are technologies such as bio-, micro-, nano- (nanoelectronics, photonics, advanced materials, industrial biotechnology and other advanced production technologies). Due to enhanced differentiation and innovations in technology, it is challenging for MSMEs to track technological advancements with only a few employees and little financial resources. The support provided by the network of government and industrial institutions is significant.

Such a network exists in the EU with Key Enabling Technologies. Such public or private technology centres help SMEs proceed from the laboratory to the market, develop and manufacture new products based on crucial connectivity technologies. They help companies to reduce the time for new innovative ideas to enter the market. Technology centres are responsible for the correctness and accuracy of the information provided. More than 250 KET technology centres in the EU meet strict criteria and are part of a pan-European network. These KET technology centres help MSMEs to develop, test and certify new products and services. They are widespread throughout the EU.

The Science and Technology Center in Ukraine, STCU, is an international intergovernmental organization established to prevent disseminating knowledge and experience related to weapons of mass destruction. To achieve this goal, STCU engages former defence professionals, scientists and researchers. STCU projects enable professionals to direct their activities in a peaceful direction. STCU began its activities on December 14 – 15, 1995. Today, the STCU headquarters is located in Kyiv and has regional offices in Baku, Chisinau and Tbilisi, and Kharkiv and Lviv. The centre has 178 partner organizations. STCU promotes and develops professional connections of scientists and institutes with leading experts and institutes of the EU, Canada and the USA and conducts training in the following areas: patent law, strategic planning, business administration and commercialization, and technology transfer.

Technoparks of Ukraine⁶³ is an association of leading academic research institutes, universities, scientific-technological and industrial enterprises with high innovative potential and competitive products on global markets. The first Ukrainian technology parks appeared in 2000 after adopting of the Law of Ukraine on Technology Parks. Projects implemented by their participants cover the most important spheres of science, technology and production for the economy of Ukraine. Technoparks of Ukraine can be divided into three categories:

⁶³ Source: Taurian State Agrotechnological University named after Dmytro Motorny. Lecture on Innovation and technological centers. <http://www.tsatu.edu.ua/tstt/wp-content/uploads/sites/6/lekcija-9-innovacijno-tehnolohichni-centry-z-dyscypliny-nk.pdf>

- those that have been created based on extensive research centres or universities, which have powerful research units that fall under the Law of Ukraine № 991 - XIV dated July 16, 1999 “On the special regime of investment and innovation activities of technology parks,” and have special privileges.
- those operating in special economic zones (SEZs) with the same tax benefits as other enterprises in these zones;
- those created at higher educational institutions, research institutes without any state support and do not have any benefits.

Small enterprises and firms are created to organize production. Due to minimal financial, technical, human, and other resources, these firms merge and have a standard economic, legal and technical maintenance system and a common system of investment and innovation management. This ensures a high survival rate of small university companies of science-intensive production, creating favourable conditions for their development.

The primary purpose of technology parks is a complex organization of science-intensive production by facilitating the creation and introduction of new technologies and stimulating the development of specialists’ creative potential. By concentrating scientific, production and financial resources, technology parks ensure the reproduction of the full life cycle of innovations: research – development – implementation – mass industrial production of science-intensive high-tech competitive products on world markets. Technoparks are zones of economic activity that combine the potential of universities, research structures, industrial enterprises and subjects of innovation infrastructure at regional, national and international levels. A technology park is an innovative structure that can most effectively use the resources⁶⁴.

Mechanisms of indirect development and implementation of innovations at the state level are tax, financial and credit, depreciation, and other influences on implementing innovations. The mechanisms of direct action include the following: administrative and departmental (natural state subsidized funding of research); implementation of state target programs of various levels by allocating funds based on contracts concluded with winners of competitions and the creation of innovative structures by the state or with the participation of the state, namely: technopolises, technoparks, business incubators, engineering centres, etc. According to the Ministry of Education and Science, there are 34 technology parks in Ukraine.

For example, KPI and Science Park will create an innovation infrastructure that will consist of several prototyping laboratories and an innovation workshop. As a result, KPI scientists, graduate students and students will be able to conduct all necessary experiments aimed at bringing the project to the pre-commercial stage and to create prototypes of their innovative products within a few days, which will be developed by Science Park, business incubator, several ventures and investment funds, other elements of innovation ecosystems Sikorsky Challenge⁶⁵. Priority activities include new technologies for the production of

⁶⁴ Source: Technological parks. Ministry of Education and Science of Ukraine. <https://mon.gov.ua/ua/nauka/innovacijna-diyalnist-ta-transfer-tehnologij/tehnologichni-parki>

⁶⁵ Source: Science Park “Kyivska Polytechnika”. <http://spark.kpi.ua/>

materials, their processing and aggregation, the creation of the industry of nanomaterials and nanotechnologies, widespread application of technologies for cleaner production and environmental protection.

The survey “Activities of higher education institutions and research institutions on technology transfer and academic entrepreneurship”⁶⁶ provides the following information

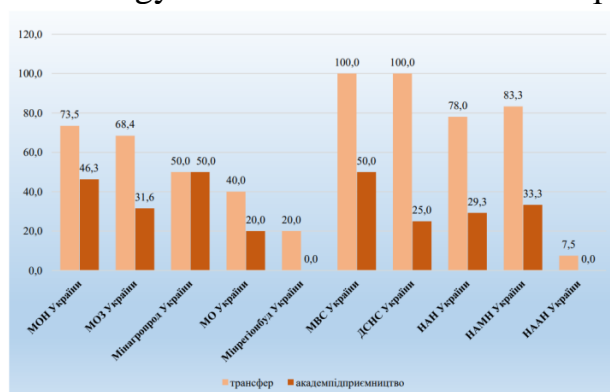


Fig. 9. Share of structural subdivisions on technology transfer and subdivisions engaged in academic entrepreneurship, per cent

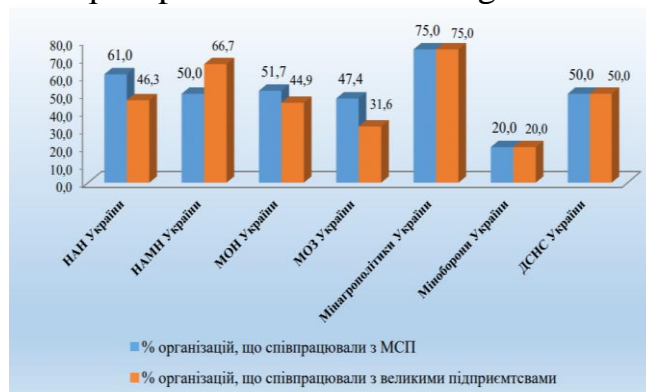


Fig. 10. Share of organizations that have collaborated with small and medium enterprises (SMEs) and large enterprises, per cent

However, it should be noted that a tiny share of SMEs currently uses services of technology centres, as these enterprises mainly provide standard consumer services.

The impact of the COVID-19 pandemic on access to technology is undeniably harmful. The vast majority of research institutions and industrial enterprises have faced quarantine restrictions. As has been described above, access to new technologies also depends on access to information about new technologies. Webinars and other online training courses on technology centres’ key technologies are beneficial during the pandemic.

h. Logistics and supply chains

Supply chain management is the central concept of supply management in a modern economy. Supply chain management is more than just logistics. Supply chain management is a consistent business concept that combines advanced organizational principles and modern information technology capabilities. Supply chain management is closely connected with business strategy. The scale of development of supply chain management is such that experts are already talking about the shift of competition between enterprises towards the competition between supply chains. Effective supply chain management is a crucial factor in maintaining and increasing revenues and competitiveness in current and future markets.

⁶⁶ Source: Activities of higher education institutions and research institutions on technology transfer and academic entrepreneurship. Ministry of Education and Science of Ukraine. <https://mon.gov.ua/storage/app/media/innovatsii-transfer-tehnologiy/diyalnosti-ofisiv-z-transferu-tehnologiy-shchodo-perspektiv-zastosuvannya-rezultativ-ikh-diyalnosti-subektami-malogo-i-serednogo-pidpriemnitstva.pdf>

International companies pay special attention to building productive relationships with suppliers and the formation of sustainable supply chains. As for domestic enterprises, the implementation of such a concept is a new area, but a small number of them have already taken effective practical steps in this direction.

Some factors can both accelerate and constrain processes of sustainable development of enterprises in supply chain management. In particular, the following factors accelerate these processes: cost reduction; introduction of risk management systems; improvement of quality; obtaining ISO 14000 certification; improving staff working conditions; the level of corporate culture; pressure from investors; consumer demand, practical cooperation with suppliers and integration of supply chains. On the other hand, the research analysis allows us to identify factors that constrain the abovementioned processes: regulatory framework, government regulatory instruments; public pressure; competition challenges; conditions of activity at different levels (regional, global, etc.).

Ukrainian companies highlight the following positive aspects of their sustainable development in their analytical reporting: ensuring the dynamic development of the company, productive collaboration to meet customer needs; continuous improvement of activity; quick reaction to changes in the market situation and new customer needs; balanced and fast decision-making and further implementation of the results; active use of modern management methods and tools; creating values for customers and society, improving the quality of life; concern for the environment, compliance with the highest safety standards, etc.

The risks (constraints) of sustainable development include reduced exports to the Russian Federation, which occupied a leading position in the structure of Ukrainian exports until 2014; “fluidity” of the regulatory framework; the difficult socio-economic situation of Ukraine in recent years; loss of traditional sales regions due to the unstable situation in eastern Ukraine and loss of the Autonomous Republic of Crimea.

A separate challenge for logistics was quarantine, which was introduced in March 2020 due to COVID-19. COVID-19 has led to unprecedented disruptions in supply chains worldwide and to extreme delays in the delivery of essential goods and the accumulation of stocks of non-critical products that do not meet current needs. To improve supply chains’ efficiency, supply chain managers need to know what is happening and where, including current and projected threats related to COVID-19 and as weather and road conditions.

Supply disruptions are unavoidable, and during the crisis caused by COVID-19, threats to current activities become even more significant. Enterprises need to fully understand their network and flow of goods through all channels as never before. They need to respond to current changes and ensure that resources are appropriately allocated to support business activities.

In times of crisis, understanding current and future logistics capacities and associated compromises will be even more critical than ever, as it will prioritize logistics needs based on capacity requirements and sensitivity to product delivery time. Therefore, even if companies expect to increase productivity and make up for a time in their value chains, they must reserve logistics capacities in advance to minimize the impact on

potential cost growth. Working with partners can be an effective strategy to prioritize and increase capacities on more favourable terms.

In case of immediate identification of risk in supply chains, managers must ensure chains' flexibility in the future.

4. Summary of Guidelines and Best Practices in Critical Raw Material Supply for MSMEs and Conclusions

The production and availability of critical raw materials must be increased to ensure their supply. This applies not only to MSMEs but to the industry in general. Indeed, it was very convenient to order necessary raw materials without any local discussions from China. But the pandemic has shown that the virus can threaten the raw materials supply chain. The cause of shortcomings in the supply of medicines is that Europe has transferred its essential medicines to East Asia and transferred critical raw materials to China. The security of the supply of critical raw materials can also be significantly affected if the pandemic continues. Everything favours decentralization of the supply of critical raw materials in the future and bypassing the Chinese monopoly on a significant share of critical raw materials. However, this means that industrialized and developing countries will have to restart their explorations to explore new deposits of critical raw materials and establish the extraction of critical raw materials to meet production needs.

a. Recommendations for MSMEs in Ukraine

In a few months, COVID-19 has become a global problem worldwide. Its consequences are dire not only to health but also to the economy, which inevitably affects millions of people's quality of life. Small and medium enterprises provide the foundation of economic stability in most developed countries. They suffer the most at this point. At the same time, global changes create new opportunities for the Ukrainian economy, namely: increased demand for food while the supply is reduced; relocation of industrial production from Asia to Europe, closer to markets; an increase of export of high-tech industrial products by using the potential of Ukraine in information technologies, etc. That is why Ukrainian companies, including MSMEs, need to develop their effective program to help overcome the adverse effects of the COVID-19 pandemic with minimal losses and take advantage of new opportunities to ensure long-term sustainable economic growth.

After a thorough analysis of the European and US governments' actions, the Ukrainian government has eased external pressure on business by providing some benefits and discounts and minimum wage compensation for employers. However, it will not be enough to support small and medium enterprises in Ukraine⁶⁷. All these measures should slightly reduce the burden on Ukrainian business, but, in our opinion, it will not significantly affect the overall decline in business activity. It will not compensate for the significant loss of profits.

Small and medium enterprises play a crucial role in Ukraine's economy, providing about 64 per cent of value-added, 81.5 per cent of jobs and 37 per cent of tax revenues. The introduction of restrictive measures has led to significant negative consequences for business due to the partial or complete cessation of enterprises' operation, complicated logistics, reduced demand and the destruction of supply chains. Small and medium-sized companies include enterprises that do not exceed the established limit in employee turnover and income. Small and medium enterprises are considered to be extremely dynamic because they can respond quickly to market needs. Simultaneously, the

⁶⁷ Vahner I.M., Demko I.I. (2020). The impact of COVID-19 on the economic development of small and medium-sized businesses in Ukraine. *Bulletin of the University of Banking*, (1 (37)), P. 59-66.

development of small and medium businesses is strongly influenced by the country's general business climate.

It should be noted that any crisis is an opportunity for business transformation and development. Consumer preferences and demand will change during the crisis; new niches for business will appear. It is essential not to miss such opportunities for Ukrainian entrepreneurs. Therefore, the reaction and actions of business during the crisis must be quick. Any plans and strategies should be reviewed continuously depending on changes in the situation. Such actions must be coordinated through the leadership of owners or company executives.

Ukrainian entrepreneurs offer their recovery strategy and “survival” tactics for small and medium enterprises, which include the following steps:

1. Safety of employees and the continuous operation of the business. Issues of safety and well-being of employees have become particularly important. They are waiting for instructions from employers, public and political figures. An open and transparent dialogue will help reduce overall tension, increase cohesion, and ensure the business's proper functioning.

Companies can adopt several measures, such as introducing or extending a flexible work schedule and finding other opportunities to allow employees to work from home and be safe. They can try to reshape teams, reallocate resources, and develop measures to protect staff and create safe working conditions. Also, regular newsletters can be arranged to keep employees informed of government and health authorities' current situation and decisions. This will help staff and organizations survive the crisis.

It is essential to find a balance to maintain current operations in new conditions with minimal business losses. Suppose the nature of work does not allow staff to work from home or have a flexible schedule due to the necessity to remain in the workplace or interact with customers. In that case, measures should be taken to prevent the spread of the virus.

2. Development of new strategies to preserve business continuity. Many enterprises will not avoid significant disruptions during the COVID-19 epidemic, which will affect business efficiency. Export companies were the first to feel the crisis's blow – they began to experience severe logistics problems. They faced disruptions related to changes in consumer demand.

To minimize these risks, small and medium enterprises need:

- To monitor short-term liquidity, implement a procedure for monitoring short-term cash flows to predict their reduction promptly and take measures; increase working capital management efficiency, especially in collecting receivables and inventory control. Besides, it is essential to look for non-standard solutions and reduce the working capital cycle. Particular attention should be paid to regular interaction with suppliers to identify potential risks on time.

- To assess and anticipate quickly financial and operational risks – track signs of growth of direct costs and profitability loss to begin negotiations on contract revisions. Those who do not respond promptly or are unable to review the arrangements may face financial problems with long-term consequences.

- To create a contingency fund (if this has not been done beforehand) can keep the company afloat for several months or a year.

To track factors that may affect consumers, suppliers, contractors and partners.

3. Interaction with stakeholders. Transparent, direct and regular dialogue can become a good foundation for business transformation and ongoing support from consumers, employees, suppliers, creditors, investors and regulators.

Consumers. Companies should inform consumers on time about possible disruptions in the supply of goods or services. It is essential to have open communication channels in case of non-fulfilment of contractual obligations due to production or supply failure to inform contractors about delays or force majeure timely. Such anticipatory actions will help to avoid penalties for non-fulfilment of obligations.

Employees. Interaction with the staff should help find a balance between taking preventive measures and maintaining a positive work environment. Owners of a company should develop a different strategy and identify key employees who will ensure its implementation. Measures taken during the pandemic to optimize the company's activities and reduce costs should prevent the company's key employees' outflow.

Suppliers. Companies need to keep in touch with suppliers of goods and services to be prepared for possible disruptions due to the COVID-19 epidemic, understand their time frame, and quickly find alternatives.

Creditors and investors. It may be necessary to analyze credit agreements, the non-fulfilment of which involves unique risks. It is also essential to avoid formal violations. Due to timely measures, it is possible to prepare the ground for negotiations with creditors to revise debt conditions or refinancing.

Regulators. It may be necessary to consult with the company's lawyers regarding its potential liabilities. Business units may be required to enhance their interaction with stakeholders to resolve discrepancies and collect evidence.

MSMEs should become members of professional or business associations, even if it requires paying a fee. These associations make a crucial contribution to protecting MSMEs from harm and conflict with public authorities through advice and information support. The fine for non-compliance with the established rules is usually much higher than the annual fee of a professional or business association. Besides, MSME employees should attend training courses offered by chambers of commerce and industry or similar institutions. In general, training of personnel or parts of personnel is always recommended. The primary measure during a pandemic is to keep MSME specialists. MSMEs can build a community and become a reliable partner for the government to benefit from trade facilitation measures, actively participate in public-private consultations and be aware of regulatory issues. This involves improving knowledge and compliance with legal obligations regarding financial solvency, record keeping, and accounting standards. This means that SMEs should at least:

- Introduce internal procedures for assessment of risks and ensuring compliance with regulatory requirements;
- Introduce a registration procedure to verify information received by government agencies and commercial partners, as well as monitor government decisions;
- Create a reliable record-keeping system that is perfectly integrated or cross-referenced with an internal accounting system that allows the tracking of goods and shipments.

b. Policy recommendations applicable for Ukraine

The introduction of restrictive measures to prevent the spread of acute respiratory disease COVID-19 caused by coronavirus SARS-CoV-2 in Ukraine has led to significant negative consequences for businesses, especially, for small and medium enterprises, due to partial or complete cessation of operations of some enterprises, complicated logistics, declining demand and broken supply chains. Formal mechanisms to coordinate MSME policy among stakeholders need to be established. Regular assessments of MSMEs' regulatory impact need to be performed, and business closure and bankruptcy procedures need improvement. The collection and dissemination of MSME statistics need to be improved to improve access to finance, continue to amend the legal framework for public grants, promote financial education programs focused on the demand of SME entrepreneurs, use credit guarantee schemes as a risk-sharing mechanism, and improve alternative non-bank and equity financing for MSMEs.

The economic crisis caused by the COVID-19 pandemic has created a need to liberalize and reduce the amount of bureaucracy involved in labour relations, develop more flexible and mobile forms of labour relations, in particular by increasing the freedom to determine terms of employment, expanding the scope of fixed-term, short-term employment contracts or employment contracts with non-fixed working hours. Therefore, the development of fundamentally new labour legislation that can adequately respond to such challenges should be one of the critical tasks of anti-crisis measures.

It is necessary to pursue a policy aimed at creating new opportunities (good protectionism) for the development (recovery) of domestic production of a full cycle of critical products and meet market demand, which is a matter of life safety in the face of global crises. In recent years, there have been increasing protectionist trends in international trade, which have led to significant changes in traditional trade flows and fluctuations in commodity prices on world markets. During the COVID-19 pandemic, global demand for non-critical goods is declining. For Ukraine's economy, which has developed industry and at the same time is significantly dependent on export, such development is an additional medium-term challenge. Therefore, it is necessary to take urgent measures to expand and diversify Ukraine's foreign economic relations with other countries globally, taking into account national priorities.

The COVID-19 pandemic is a global driver for changes in established management systems, patterns of public relations and economic relations, and it accelerates the digital transformation of the economy.

To implement a complex system of new opportunities for stabilization and sustainable development of Ukraine's economy and increase the rate of employment by maintaining existing and stimulating the creation of new high-productivity jobs with decent working conditions during 2020-2022, the Resolution of the Cabinet of Ministers of Ukraine dated 27.05.2020 № 534 approved the State program of economic stimulation to overcome adverse effects caused by restrictive measures related to the prevention of occurrence and spread of acute respiratory disease COVID-19 caused by coronavirus SARS-CoV-2, for 2020-2022⁶⁸.

The program involves the implementation of measures to support SMEs aimed at:

⁶⁸ Source: <https://zakon.rada.gov.ua/laws/show/534-2020-%D0%BF#Text>

- access to finance;
- access to markets;
- creation of infrastructure for SME development.

It anticipates:

- solving SMEs' liquidity problem by implementing measures aimed at preserving jobs, simplifying access to finance, and reducing business costs. Also, to improve access to finance, it has been suggested to create and ensure the effective operation of the Fund of Funds;

- expanding access to markets by involving small and medium enterprises in the implementation of measures for socio-economic development of certain territories;

- optimization of regulation and simplification of administrative procedures for small and medium enterprises will be accompanied by creating an adequate infrastructure to support entrepreneurship.

In addition to these general procedures, the implementation of subsoil use reform is expected to continue. It anticipates creating equal conditions for access to subsoil use, an increase of transparency, deregulation, strengthening of institutional capacity, and modernization and simplification of access to geological information.

New rules for subsoil use must be progressive, attractive and predictable for investors. Among the main innovations offered by the State Service of Geology and Subsoil of Ukraine (Derzhgeonadra), there are the following:

- Digital approach to the regulation of the industry (online auctions, interactive map of deposits, e-cabinet);

- Transparent rules of access to the subsoil (objective calculation of the cost of special permits, calculator of the price of geological information, assessment of mineral reserves according to international standards);

- Support of small subsoil use (simplification of issuance of permits for the development of minerals of local importance);

- Increase of the attractiveness of geological exploration (complex permits for exploration and extraction, and instalment payment for a special permit);

- Liberalization of the circulation of subsoil use rights (free alienation of subsoil use rights).

All these measures will facilitate the development of the mineral raw material base of Ukraine, including the extraction of critical raw materials.

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