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Contribution of V4 countries to mineral sustainable development in EU

Introduction

Most Member States have taken measures to implement the principles of sustainable development. These range from legislation implementing the concepts of sustainable development to the formulation and publication of specific strategies aimed to sustain the minerals supply and supply of flow of benefits from mining. The principles of sustainable development were introduced to all stages from formulating strategies, to implementing, monitoring and reviewing the law and regulations) (Ali et al. 2017). In most Member States the emphasis has been on environmental protection, promoting the reduced use of minerals, and the recycling of materials (Adamisin et al. 2018). Land use planning as an instrument to protect

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minerals from other developments is used by some of the Member States. The challenge is to achieve a balance between securing minerals and protecting the environment seen in the context of human social and economic welfare. Many challenges may occur, which are linked to different kind of balances; one of them is certainly the balance between the high level of environmental protection and to secure an adequate supply of minerals. The system of "land banks" has been implemented in England and Wales. In terms of this concept the requirement is placed on mineral planning authorities to provide a stock of mineral planning permissions to meet a specified level of demand. Some other countries also seek to achieve a similar end, albeit they rely on development allocations rather than a stock of planning permissions.

Similarly, as in other EU states, the extraction of mineral aggregates presents in the V4 countries makes up a considerable part of the mining industry. The Raw Materials (RM) of the states are related to the non-energetic mining industry and Nature 2000 and to react to the initiative to provide European raw material security. The aim of the paper is to review and analyze the development of mineral extraction in the Visegrad group with the orientation towards the mineral planning and perspective, impacting the development of the mining sector. The aim is to explore the position of the mining industry in the V4 countries and its contribution to the European mining industry, contributing to the sustainable development of mining and the material independence of Europe (Franks et al. 2011). Due to the above we firstly examined and researched the present state of minerals supplying in Europe with economic and environmental significance of materials. Secondly we compared the development of mineral production in the EU with the worldwide situation, followed by Critical Raw Materials (CRM) need and the prediction of critical mineral raw materials used for EU mineral planning and perspective. The third part is orientated towards the evaluation of raw materials used in the individual V4 countries, which have a similar historical background. The last part of the contribution is orientated towawrds the determination of possible risks and obstacles for mining industry development in European conditions.

1. Present state of problem solving

Mineral commodities (metals, fuels, and industrial and construction minerals) are required for agriculture, water supply, and power, housing transport, communications, new economy industries and life style. The general situation of minerals supplying in Europe is provided by the strong position of the aggregate sector.

Within the context of this study, construction minerals are aggregates (i.e. sand and gravel) and crushed rock (limestone, sandstone, igneous rock etc.), common clay and shale, gypsum, limestone and dolomite, and building stone (dimension stone). This is by far the largest of the three sub-sectors in terms of the tonnage of minerals extracted. The industrial minerals sector provides minerals such as barites, fluorspar, magnesite, kaolin, mica and salt. It also includes metallic minerals used for non-metallic purposes, such as limonite and construction minerals used for non-construction purposes, such as limestone. The sector produces important raw materials for the chemicals and fertilizer industries, as well as for ceramics, glass, paper, paints and plastics. The EU is a major user of metals, for some, accounting for 25% and 30% of global consumption (Chapman et al. 2013). Some EU countries are major producers of particular metals, for example Finland, Ireland, Greece, Poland, and Sweden. A number of Member States currently have no metal ferrous mining industry, except Sweden. In complete contrast to construction minerals, there is therefore very heavy reliance on imports (Tiess 2011).

The annual mineral production is summarized in Figure 1. In Europe around 20 million tons of metals, about 100 million tons of industrial minerals and more than 3 billion tons of construction minerals are produced annually. Detailed figures of mineral consumption are difficult to obtain. This is particularly so in the case of metal consumption and to a lesser extent industrial minerals. In the case of construction minerals, the consumption of construction minerals is more or less equal to the production.

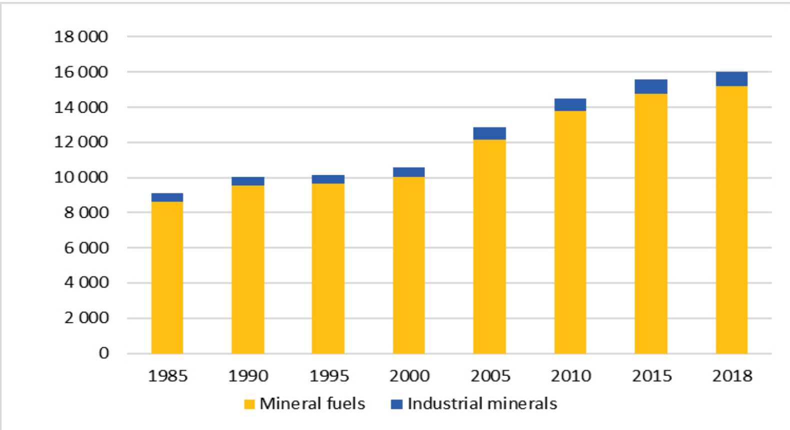

Fig. 1. Raw Mineral Production (in Mil. metr. t)
Source: World Mining Data 2020

Rys. 1. Produkcja surowców mineralnych w Europie [mln Mg]

In Figure 2 the European minerals production is shown as a part of total world production. With the exception of industrial minerals, the minerals production of Europe is insignificant by world standards. Construction minerals, which account on a tonnage basis for about 90% of minerals, produced in Europe are not shown. These minerals are produced in Europe and are usually used within a relatively short distance from their point of production.

China is the world's largest producer of 28 different raw materials (Yun 2020). Developing countries share around 60% of global production. 2/3 of global production is mined in politically unstable countries. Europe mined only around 9% of world production. Considering the large quantities of minerals required by the European Society and industry

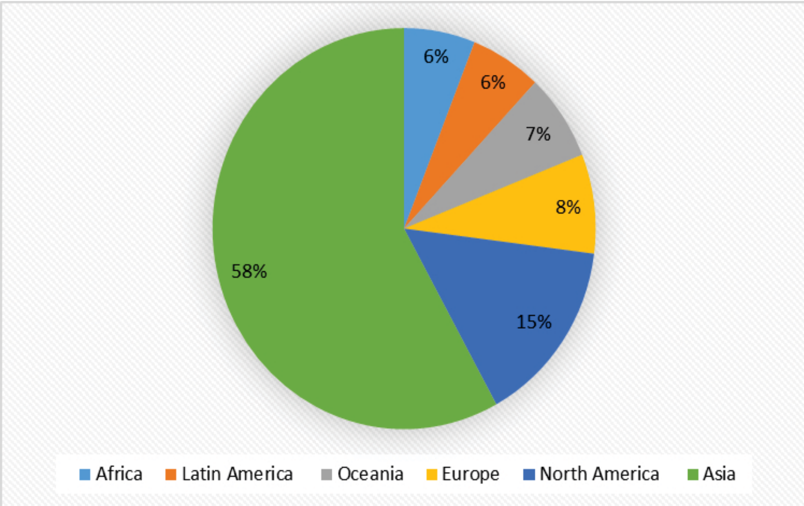

Fig. 2. Mineral productions in 2018
Source: World Mining Data 2020

Rys. 2. Produkcja surowców mineralnych w 2018 roku

sustainable development in Europe will depend on actions at the central European level, at the national level and at the regional level. While there are many common elements and linkages at all levels, requirements will vary from country to country. In the important area of construction minerals solutions for an ongoing and uninterrupted local supply will have to be found whereas in the case of metal ores Europe will have to rely on imports with all associated risks as the latest development in the area of ferrous metals have shown. The supply shortage of iron ore was caused primarily by limitations of the harbour capacities in the major producing countries and shortages in shipping capacity. Considering that economic growth in the population rich countries of China and India over the past two decades has been double that of the world average it is foreseeable that the demand for minerals in these two countries will grow significantly and could put pressure on the supply of Europe with metal ores. Indeed, there are signs that this is already happening. Appropriate measures will have to be taken to secure the ongoing supply of Europe's industry with metal ores. Table 1 illustrates the nonfuel mineral production according to Mineral Commodity Summaries to 2020 in the V4 countries.

1.1. Critical Raw Materials need for EU mineral sustainable development

In recent years in the globalized world, there is a growing fear that is connected with the availability and providing of proper supplies of raw materials and minerals, necessary for the material development of the society. Such fear results from the large growth of the demand

Table 1. Nonfuel mineral production in V4 to 2020

Tabela 1. Produkcja nieenergetycznych surowców mineralnych w krajach Grupy Wyszehradzkiej do 2020 roku

Country	Material		2018	2019	Reserves
Czech Republic	Bentonite Kaolin	Mine production, Data in thousand metric tons	277 73,620	280 73,600	
	Feldspar and nepheline syenite	Mine production, Data in thousand metric tons	449	460	23,000
	Lime	Production, Data in thousand metric tons	1,040	1,100	
Poland	Lime (hydrated and quicklime)	Production, Data in thousand metric tons	2,680	2,700	
	Nitrogen (fixed) ammonia	Plant production, Data in thousand metric tons	2,170	2,200	
	Peat	Plant production, Data in thousand metric tons	700	700	
	Rhenium	Mine production, Data in kilograms of rhenium content	9,090	9,300	
	Sand and gravel (industrial)	Mine production, Data in thousand metric	5,120	5,000	
	Selenium	Refinery production, Data in metric tons of selenium content	76	70	
	Silicon	Production, Data in thousand metric tons of silicon content	43	36	
	Silver	Mine production, Data in metric tons of silver content	1,470	1,700	100,000
	Sulfur	Production – All forms, Data in thousand metric tons of sulfur content	1,230	1,230	
Slovakia	Zeolites (natural)	Mine production, Data in metric tons	117,000	120,000	
	Magnesium compounds	Mine production, Data in thousand metric tons of magnesium oxide content	475	500	120,000
Hungary	Perlite	Production, Data in thousand metric tons	39	40	49,000

Source: own study according to Mineral Commodity Summaries 2020 USGS.

for raw materials that is caused by a permanent increase of the need for the majority of raw materials. Due to the increasing global population, economic growth (mostly in developing countries), demand for new innovative and environmental technologies, as well as renewable energy and electric vehicles, the demand for the growth of raw materials is still expected.

Table 2. EU producers of Critical Raw Materials (average 2010–2020)

Tabela 2. Producenci mineralnych surowców krytycznych w UE (średnia w latach 2010–2020)

Critical Raw Materials	Producer EU	Main importers to EU	Sources of supplies to EU		Measure of import dependence
			From World Country	From EU country	
1	2	3	4	5	6
Antimony	Any	China 90% Vietnam 4%	China 90% Vietnam 4%	Any	100%
Fluorite	Any	Mexico 38% China 17% South Africa 15%	Mexico 27% China 12% South Africa 11% Namibia 9% Kenya 7%	Spain 13% Germany 5% Aulgaria 4% UK 4% Other EU 1%	70%
Barites	Any	China 53% Morocco 37%	China 34% Morocco 30%	Germany 8% Turkey 6% UK 5% Other EU 4%	80%
Beryllium	Any	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Bismuth	Any	China 84%	China 84%	Any	100%
Borate	Turkey 38%	Turkey 98%	Any	Turkey 98%	100%
Cobalt	Any	Russia 91% Congo 7%	Any	Russia 31% Finland 66%	32%
Coking coal	Russia 7%	USA 39% Australia 36% Russia 9% Canada 8%	USA 38% Australia 34% Canada 7%	Russia 9% Poland 1% Germany 1% Czech Republic 1% UK 1%	63%
Fluorite	Any	Mexico 38% China 17% South Africa 15% Namibia 12% Kenya 9%	Mexico 27% China 12% South Africa 11% Namibia 9% Kenya 7%	Spain 13% Germany 5%ˇ Bulgaria 4% UK 4% Other EU 1%	70%
Gallium	Germany 7%	China 53% USA 11% Ukraine 9% South Korea 8%	China 36% South Korea 15% USA 8%	Germany 27% Ukraine 6% Hungary 5%	34%
Germanium	Finland 11%	China 60% Russia 17% USA 16%	China 43%	Finland 28% Russia 12%	64%
Hafnium	France 43% Ukraine 8% Russia 8%	Canada 67% China 33%	Canada 19% China 10%	France 71%	9%
Helium	any	USA 53% Algeria 29% Qatar 8% Russia 8%	USA 51% Algeria 29% Qatar 8%	Russia 7% Poland 3%	96%

Table 2. cont.

Tabela 2. cd.

1	2	3	4	5	6
Indium	any	China 41% Kazakhstan 19% South Korea 11% Hong Kong 8%	China 28% Kazakhstan 13% South Korea 8% Hong Kong 6%	Belgium 19% France 11%	0%
Magnesium	any	China 94%	China 94%	any	100%
Natural graphite	any	China 63% Brasilia 13% Norway 7%	China 63% Brasilia 13%	Norway 7% EU less 1%	99%
Natural rubber	any	Indonesia 32% Malaysia 20% Thailand 17% Ivory coast 12%	Indonesia 32% Malaysia 20% Thailand 17% Ivory coast 12%	any	100%
Niobe	any	Brasilia 71% Canada 13%	Brasilia 71% Canada 13%	any	100%
Phosphate rock	any	Morocco 31% Russia 18% Syria 12% Algeria 12%	Morocco 28% Syria 11% Algeria 10%	Russia 16% EU-Finland 12%	88%
Phosphor	any	Kazakhstan 77% China 14% Vietnam 8%	Kazakhstan 77% China 14% Vietnam 8%	any	100%
Scandium	Russia 26% Ukraine 7%	Russia 67% Kazakhstan 33%	Kazakhstan 33	Russia 67%	100%
Silicon metal	Norway 7% France 5%	Norway 35% Brasilia 18% China 18%	Brasilia 12% China 12%	Norway 23% France 19% Spain 9% Germany 5%	64%
Tantalum	any	Nigeria 91% Rwanda 14% China 5%	Nigeria 81% Rwanda 14% China 5%	any	100%
Wolfram	Russia 4%	Russia 84% Bolivia 5% Vietnam 5%	any	Russia 50% Portugal 17% Spain 15% Austria 8%	44%
Vanadium	Russia 20%	Russia 71% China 13% South Africa 13%	China 11% South Africa 10%	Russia 60% Belgium 9% UK 3% Netherlands 2% Germany 2% Other EU 0.5%	84%
Metals from platinum group	Russia 46% (palladium)	Switzerland 34% South Africa 31% USA 21% Russia 8%	South Africa 31% USA 21%	Switzerland 34% Russia 8%	99.6%

Source: own study according to Critical Raw Materials 2020.

In such a situation, the especially alarming position of "critical" raw materials exists, mainly due to their growing economic importance and high risk of their supply shortage.

List of Critical Raw Materials in EU (to 2020) is as follows:

- Strategic importance of CRM for industrial sectors;
- Secure, sustainable and price availability of CRM supplies;
- Access to raw materials;
- Risk of threatens of raw materials supplies, important for European industry (CRM);
- Necessity to stimulate European production of CRM;
- In the case of the need to provide and make an easy start of new mining activities;
- Actual list – 30 CRMs, assumption of their effective use and recycling;
- CRMs are priority area of action plan for the EU circular economy;
- Risks of lack in CRMs supply and their influence on the economy, which is higher than in area of other raw materials.

Table 2 presents the existence of the domestically most influential country from the view of whole world supplies of a majority of CRMs.

The 2020 EU list of critical raw materials contains 30 materials as compared to 14 materials in 2011, 20 materials in 2014 and 27 materials in 2017 (see Table 3) 26 materials remain on the list. Bauxite, lithium, titanium and strontium have been added to the list for the first time. Helium remains a concern as far as supply concentration is concerned, but was removed from the 2020 critical list due to a decline in its economic importance. The Commission will continue to monitor helium closely, in view of its relevance for a range of emerging digital applications. It will also monitor nickel closely, in view of developments relating to growth in demand for battery raw materials.

Demand for CRMs to 2020 is presented in Figure 3. V4 countries are almost totally dependent on the import of critical raw materials. Since critical raw materials cannot be replaced

Table 3. CRM in Europe in 2020 (30)

Tabela 3. Mineralne surowce krytyczne w Europie w 2020 roku

Antimony	Fluorspar	Magnesium	Scandium
Baryte	Gallium	Natural graphite	Silicon metal
Beryllium	Germanium	Natural rubber	Tantalum
Bismuth	Hafnium	Niobium	Tungsten
Borate	HREEs	PGMs	Vanadium
Cobalt	Indium	Phosphate rock	**Bauxite**
Coking coal	LREEs	Phosphorus	**Lithium**
			Strontium
			Titanium

Source: own study according to Critical Raw Materials 2020.

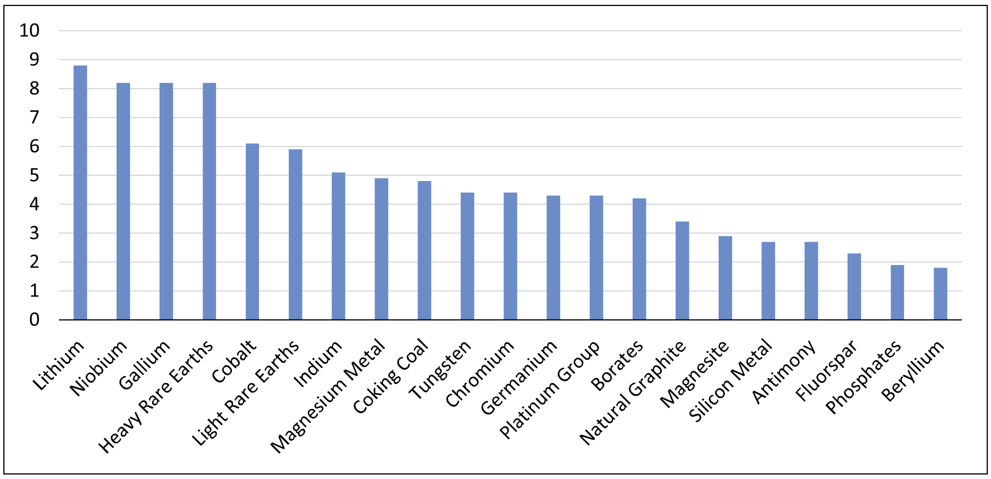

Fig. 3. Assumed growth of demand on CRM to 2020 (% per year)
Source: Joint Research Centre 2019

Rys. 3. Zakładany wzrost popytu na mineralne surowce krytyczne do 2020 roku (% rocznie)

by similar materials, and they cannot be effectively recycled (a measure of recycling is commonly lower than 1%), it is possible to expect shortages of critical raw materials in the future, which can negatively influence economic growth and prosperity of the business environment.

The following materials are not available (or they are not extracted)from the mentioned critical raw materials in V4 countries: Beryl, Cobalt, Fluorite, Galium, Germanium, Graphite, Indium, Metal manganese, Niobium, the rare earth elements (oxides of rare earth), tantalum, tungsten.

Poland and Slovakia are the most important producers of CRMs in the V4 (see Table 4), where the rate of EU magnesite sources in Slovakia presents 32% (Mineral Commodity Summaries, USGS 2020).

Table 4. List of CRM development in Poland and Slovakia

Tabela 4. Wykaz mineralnych surowców krytycznych w Polsce i na Słowacji

CRM	Country	2014	2015	2016	2017	2018
Raw magnesite (tones)	Poland	92,000	96,000	77,920	101,920	102,110
	Slovakia	557,100	501,200	433,500	610,000	615,500
Platina (kg)	Poland	40	40	50	11	11
Paladium (kg)	Poland	25	20	30	7	7

Source: British Geological Survey 2019.

2. Methodology

During the evaluation of mineral production and raw materials of the state we considered relationship to the non-energetic mining industry and Nature 2000 and reaction to the initiative to provide European raw material security. We determined the following goals of the paper:

- to review and analyze the development of mineral extraction in the Visegrad group with orientation towards the mineral planning and perspective, impacting development of the mining sector;
- to explore the position of mining industry in V4 and its contribution to the European mining industry, contributing to the sustainable development of mining and the material independence of Europe.

Due to the above, the research was processed as follows:

1. Examination of present state of minerals supplying in Europe with economic and environmental significance of materials.
2. Comparing the development of mineral production in the EU with the worldwide situation,
3. Followed by critical raw materials need and prediction of critical raw materials (CRM) used for EU mineral planning and perspective.
4. Evaluation of raw materials (RM) used in the individual V4 countries, which have a similar historical background.
5. Determination of the possible risks and obstacles for mining industry development in European conditions.

Research of the development and evaluation of mineral production was done according to the newest available data from databases of the individual V4 countries.

3. Results of mineral production development in the V4 countries

In the frame of mining industry in the V4 region various types of raw materials, which are possible to be classified according existing world statistics to following five groups, are extracted, processed and adjusted:

- Iron and Ferro-alloy metals,
- Non-ferrous metals,
- Precious metals,
- Industrial minerals, and
- Mineral fuels.

Similarly, as other states, producing raw materials, V4 countries are also evaluated according available and worldly used international classification standards UNCTAD (United Nations Conference on Trade and Development) and IIASA (International Institute for

Applied Systems Analysis). V4 countries are, according to the glossary of statistical expert terms, used by theOECD format are considered as transition countries (Simonidesová et al. 2018). Despite this Slovakia, Czech Republic, Poland and Hungary are considered as "Economies in Transition", they have a rather good developed mining industry, but from the view of extracted raw materials rate on the GDP creation they are not ranked to the evaluation according UNCTAD methodology, mainly due to the fact that the rate is too far below the demanded level of 25%. The weak situation of the V4 countries in the globalised world of mining industry, in which mainly multinational and corporation world mining companies dominate, creating big profits and considerably influencing economic environment in all geopolitical and economic regions of the world follows from this. The V4 countries are trying in their limited economic possibilities to use their own natural resources of raw materials and to provide for a sustainable mining industry, not only according principles of market economy and law of demand and offer, but also according to principles, guaranteed by state investments, determined to social and sustainable mining. In the mining industrial and production sector, representing V4 countries, national and regional legislation is obligatory for individual producers, resulting from EU Decrees (OECD 2019).

The European industry of aggregates is considered as heavy industry with the production of 2,700 million tons of aggregate, including 26,000 mining operations and 15,000 companies. This presents high numbers, but less than 50% of the industry is organized in the frame of national or regional associations. The European Aggregates Association (UEPG) Association identified trends, clarifying, why these trends could cause problems for aggregate producers. In the close future the European mining industry, also including aggregate production, is attacking by the growing demands of interested subjects, while access to primary sources will be more and more complicated, not only from the view of their technological availability, but also due to the increasing of conflict situation and administrative obstacles. The mining industry will meet threats by way of sources taxation or limitations, resulting from "market tools" in spite of the fact that the industry is without donations, with the obligation of reclaiming and revitalizing of regions renovation. In the mining industrial sector there will be greater ambitious goals will be promoted, connected with the recycling of secondary raw materials and waste during full regarding of access to the sustainable supply of raw materials, respecting waste of raw materials to the "circular economy". In this connection there is an emphasis on strengthening and the better organization of the whole mining industry and its individual sectors, during full participation of all interested companies and mining organizations, but also their managers (EU Annual Review 2015–2016).

Solutions, always respecting anti-monopoly prescriptions, could be achieved by organizing companies in some regional or national association. In the frame of individual raw materials strategies in the EU, including V4 the common interest for the achievement of the rational and sustainable provision of raw materials during known principles of management and using of raw materials sources is emphasized. Due to the following mentioned in the frame of the EU and V4, complex data about geological research, mining (including waste management), raw materials processing, suggestion of the product, substitutability of one raw materials by other raw materials, management of semi products (considered till present time as waste), products using, intelligent waste collection, recycling (including evaluation and repeated using), and processing after life cycle is demanded. The data and knowledge are keys for the creation of raw materials strategies, as well as for the decision on how to treat with raw materials rationally. In this connection raw materials management is expected to identify indicators of primary and secondary raw materials stocks (inflows and outflows), in individual industrial sectors and for the needs of circular economy in EU and V4. An analysis of the "critical situation" of some chosen raw materials and the updating of the CRM list remains dominant from the view of raw materials development. In the analysis great attention is given to the Thematic Strategy on the Sustainable Use of Natural Resources, resulting from the division of raw materials, correspondent to the possibilities of the sustainable provision of raw materials supply. The process of raw materials sources transformation to primary sources that are considered as product of primary production sector, firmly anchored in mining industry is analyzed. Through holistic analysis 85 non-energetic primary raw materials, including metals (27), minerals and other raw material (16), fossil raw material (11), terrestrial biomass (20), water biomass (2), raw material, obtained from waters (6) and raw material obtained from atmosphere (3) were identified and structured. Secondary raw materials up to the present time do not have a unique definition in EU legislation. Therefore, pragmatic process is using, together with the Decree of treatment with waste from the mining industry (2006/21/ES), or the Decree of waste (2008/98/ES), including the definition of waste and its treatment.

Raw materials development, regarding conditions of EU needs to illustrate the Supply Chain Viewer, which provides a review of the supply chains for any material, country, application and sector, connected to the supply chain, similarly as countries profiles, enabling the creation of necessary information flows of the countries for EU member states. To create an information base for SURPOL, a decisive indicator of evaluation that will serve the monitoring of raw materials flow in relation to the circular economy is needed.

Activities, oriented to the development of a stronger EU market with secondary raw materials are planned in the circular economy with the goal to strengthen worldwide competition, to support sustainable economic growth and to create new working posts through using sources in more sustainable manner.

3.1. Mineral production development in Slovakia

As for Slovakia, the current evaluation of raw materials development is under the authority of the National Technological Platform for Research, Development and Innovation of Raw Materials, of which Slovakia has been member since 2016. The main contribution of Slovakia to raw materials development is that regional consumption of aggregate by using opened bearings, where the economic effectiveness of mining is registered, could enable the effective assumption of financial reserve creation for mining activity termination. Unfortunately, however, at present there is no legislation enabling the avoidance of the creation of ad hoc companies, which after the "successful" project completion could finish mining activity without "smoothing". In 2014 a document – Sustainable Planning of Aggregate Extraction and Use in Southern and Eastern Europe, which Slovakia provided by the Ministry of Living Environment was prepared. Slovakia should deal with the evaluation of the development of primary and secondary (recycled) aggregates. The development of mineral production in Slovakia is presented in Table 5.

Table 5. Mineral production in Slovakia

Tabela 5. Produkcja surowców mineralnych na Słowacji

Commodity	Annual production (kt)	Employment	Number of operations
Brown coal & Lignite	1,338.34 168.60	2,900	2
Magnesite	732.03	580	2
Building materials	27,821	1,850	59
Industrial minerals	5,533	349	48
Ores & precious metals	650	789	1

Source: Mineral resources of Slovakia in 2018 (2019).

Slovakia is a modest regional producer of a variety of minerals. Aluminium and steel production formed the dominant elements of the country's metals sector. Steel production was largely based on imported raw materials and that of aluminium was based entirely on imported bauxite. Small quantities of copper, gold, lead, and zinc also were produced; the commercial deposits of these minerals have virtually been depleted. Industrial mineral production included that of barite, clays, magnesite, and salt. Slovakia's production of mineral fuels comprised brown coal and lignite and minor quantities of gas and petroleum (Csikosova et al. 2013).

In Slovakia 939 deposits of raw materials are registered. Only deposits of energetic raw materials (brown coal, oil and earth gas), ores (Au, Ag, Zn), magnesite, construction materials (aggregates, gravels, sands and brick raw materials), limestone (production of concrete, lime and other special materials), as well as other raw materials (Bentonite, Perlite, Talc, etc.) are of economic importance.

The economy of Slovakia continued to develop towards a full market system. The need to denationalize the state's commercial assets and to reduce subsidies to the public sector expeditiously was tempered by strategies promulgated to maintain social stability that often resulted in increased public sector employment and uneven economic performance.

Table 6. Review of mining in Slovakia in 2014–2018

Tabela 6. Przegląd górnictwa na Słowacji w latach 2014–2018

	2014	2015	2016	2017	2018
Production of primaryaluminium metals (kg)					
	167,767	171,328	173,600	173,500	173,500
Production of Bentonite and fuller's earth (metric tones)	205,000	205,000	158,000	226,082	270,000
Production of Coal (metric tones)					
Lignite	166,000	97,000	195,000	56,000	169,000
Brown coal	1,885,000	1,636,000	1,622,000	1,619,000	1,257,000
Mine production of copper metal content (tonnes)					
	46	58	39	32	21
Production of Feldspar					
	6,000	4,000	8,000	15,800	17,000
Mine production of Gold (kg of metal)					
	582	603	466	447	515
Production of Gypsum, including anhydrite (metric tones)					
	65,000	67,000	53,000	45,700	55,000
Production of pig Iron (metric tones)					
	3,838,000	3,738,486	3,987,000	4,106,000	4,200,000
Production of crude steel (metric tones)					
	4,705,000	4,561,000	4,808,000	4,980,000	4,947,000
Production of ferro-allyos (metric tones)					
Ferro-manganese	17,554	24,500	35,000	41,300	40,000
Ferro-silico-manganese	29,643	27,100	35,700	40,100	40,000
Ferro-silicon	39,300	38,200	30,900	44,600	45,000
Other ferro-alloys	4,700	5,700	4,300	2,700	2,000
Production of Magnesite (metric tones)					
	557,100	501,200	433,500	610,000	615,500
Production of Perlite (metric tones)					
	17,000	25,000	19,000	47,510	36,000
Production of crude Petroleum (metric tones)					
	8,000	10,000	9,000	5,000	5,000
Production of natural gas (million cubic metres)					
	99	104	87	88	80
Mine production of Silver (kilograms, metal content)					
	437	532	391	410	345
Production of Sulphur and Pyrites (tones, sulphur content)					
Recovered (b)	4,900	4,900	4,900	4,900	4,900
Recovered (a)	85,300	85,300	85,300	85,300	85,300
Production of Talc (metric tones)					
	3,000	1,000	700	13,988	43,000
Mine production of Zinc (metric tones)					
	176	200	200	200	200

Source: own study according to British Geological Survey 2019.

Slovakia is expected to continue to produce modest amounts of industrial minerals and mineral fuels. With the possible exception of gold, metal mining has practically ceased as a result of the depletion of economic reserves. Aluminium and ferrous metals will continue to be produced from imported ores and concentrates. The country will remain dependent on imports of energy carriers and metals for its industrial needs. Aggregate is extracted in almost the entire territory of Slovakia, but at the mutual comparison the volume of mining in individual mining operations – quarry is different. The difference in the volume of extracted aggregate according regions presents result from the demand of consumers on produced aggregate, but this is given also by level of competition ability of the companies, extracted aggregate.

The extraction and processing of aggregate for sale in Slovakia is made by hundreds of quarry operations, among which there are quarries with big, average, low or very low mined volumes. The structure of quarries and extraction spaces with volume of aggregate extraction over 100 kt and over 200 kt is given in Table 7. The mining of aggregates and gravels depends on the economic situation and condition of investments and construction in Slovakia.

In mining business in Slovakia some risk factors that are generally connected with production and technical activity, but also with natural influences, such as macroeconomic and micro economic surroundings that are given mainly by market, economic and financial factors, representing cost risks, connected with increasing of energy prices, growth of wages, sale prices, competition environment, but also with for example political and social factors, playing considerable role in last period of mining business during termination of big mining operation are reflected.

In Slovakia, it should also be possible to consider the renovation of antimony ores mining in Pezinok, not in Dúbrava (Nízke Tatry), since the renovation of the mining would not be economical. The unanswered question is also the production of metals from antimony ores in existing stoves in Slovakia or in Poland. In spite of rather high mining of raw magnesite and clinkers production in Slovakia, metal magnesium is presently not produced; in spite of the production technology that was developed at the Geological Institute of Dionyz Stur in Bratislava. A review of other mining in 2014–2018 is processed by BGS (British Geological Survey 2019) with individual commodities that are actually extracted (or elaborated for example at metals production) in Slovakia (see Table 6).

3.2. Mineral production development in Hungary

The extraction of non-energy minerals in Hungary is mainly made up of aggregates (sand, gravel, building and dimension stone) and industrial minerals (RM for the cement, lime and ceramic industry as well as silica sand, gypsum, perlite, zeolite, diatomite and bentonite). The metal mining sector has been declining in the last decades. There are several small or depleted ore deposits including iron ore, bauxite, lead and zinc ore, copper ore, precious metal ores and manganese ore and there is one large (Recsk Deep ore complex) copper-zinc deposit which has not been turned to extraction yet. At present only bauxite and manganese ores are mined, but extraction from the only manganese deposit (Úrkút) has recently been terminated.

The primary legal basis of mineral extraction activity is Act No. XLVIII of 1993 on Mining (Mining Act) as last amended by Act No. LXXXVI of 2014 and 311/2014 (XII. 11) Government Regulation. Important acts of law for permitting procedures are Governmental Decree No. 203/1998. (XII.19.) (detailed permitting rules), Government Regulation No. 267/2006 on the Hungarian Office of Geology and Mining (MBFH) (on involvement of co-authorities), Government Regulation No. 53/2012 on mining construction permitting, Government Regulation No. 314/2005 on EIA and IPPC, Act No. LIII of 1996 on nature conservation, Government Regulation No. 275/2004 on Natura 2000 sites, Government Regulation No. 312/2012 on construction permitting, Ministerial Decree No. 14/2008 (IV. 3.) on mining waste management, and Ministerial Decree No. 8/2014 on the mining concession tender procedure. For permitting procedures, Act No. CXL of 2004 on the General Rules of Administrative Proceedings and Services is also highly important (European Commision 2017).

The balance-like registry of national mineral raw materials is based on the obligatory data delivery from mining entrepreneurs as well as the resolutions issued by the concerned County Government Offices (the Division of Mining Supervision and four Departments of Mining of Divisions for Authority Affairs). Raw data of the registry are as follows:

- quality and quantity of the mineral resources and reserves;
- annual change in mineral resources, reserves (production, exploration, reclassification, etc.) according to annual delivery;
- mineral resource, reserve left behind subsequent to mine closure, field abandonment.

All major mineral producers were privately owned, with the exception of bauxite producer Magyar Aluminium Ltd. (MAL) and hydrocarbons producer Hungarian Oil and Gas Co. plc (MOL). MAL was nationalized in 2013 following its declaration of bankruptcy. The Government held a 25.2% ownership interest in MOL. Foreign ownership was concentrated in the cement and iron and steel sectors. ISD Dunaferr Co. Ltd., which was the leading iron and steel producer, was owned by the Industrial Union of Donbass Corp. (ISD) of Ukraine (Hastorun 2019).

The total coal production (black and brown coal, lignite) in Hungary has been around 8 million tons in the past years. The coal production is insignificant, and brown coal has been less than 100,000 tons for years.

As for the 325 registered crude oil and natural gas mining plots, all changes in mineral resources, reserves in 2018 are due to the activity of 24 mining entrepreneurs. Practically, the data of non-conventional crude oil as well as natural gas concerning resources were constant.

Ore mining in Hungary decreased significantly in the past few years. There was only a single mine producing bauxite in 2016, the production of manganese ore (Úrkút) terminated in mid–2016.

Based on such available data, mineral resources and reserves are recorded separately by each raw material including occurrence(s). The National Registry on Mineral Raw Materials and Geothermal Resources consists of more than 4,108 registered mining areas. Resources and reserves from January 1, 2019, as well as production of Hungary in 2018 are presented in Tables 7 and 8.

Non-metallic mineral raw materials are recognized as more than 60 solid mineral types (of various geologic age and generation, except fuels and ores) used in many areas of the national economy. The total recognized non-metallic geologic resource is 10,988 Mil. m^3 from

Table 7. Resources, reserves and production of mineral resources in Hungary in 2018

Tabela 7. Zasoby geologiczne i operatywne oraz wydobycie surowców mineralnych na Węgrzech w 2018 roku

Mineral resource	Production in 2018		Geologic resources as of 1 Jan 2019		Exploitable reserves as of 1 Jan 2019	
	Mm^3	kt	Mm^3	kt	Mm^3	kt
Crude oil						
Conventional	0.97		274.27		23.60	
Non-conventional	0.00		537.11		58.52	
Natural gas						
Conventional	2,099.73		187,133.76		76,909.29	
Non-conventional	3.92		3,923,318.1		1,565,328.52	
CO_2 gas	135.32		44,539.50		28,662.80	
Black coal		2.083		1,625,042		1,915,321
Brown coal		53.606		3,195,910		2,241,135
Lignite		7,843		5,678,435		4,232,806
Uranium ore		0		31,483		31,483
Iron ore		0		43,151		43,664
Bauxite		4.2		123,955		79,783
Lead – zine ore		0		90,775		100,817
Copper ore		0		781,170		726,459
Precious ore		0		36,588		36,507
Manganese ore		0		78,868		51,982

Source: own study according to Mining and Geological Survey of Hungary 2019.

Table 8. Non-metallic mineral resources, reserves and production of Hungary in 2018

Tabela 8. Zasoby geologiczne i operatywne surowców mineralnych niemetalicznych i ich produkcja na Węgrzech w 2018 roku

Non-metallic mineral Raw Materials	Production in 2018	Geologic resources as of 1 January 2019	Exploitable reserves as of 1 January 2019
	Mm^3	Mm^3	Mm^3
Industrial minerals (selected)	1.38	1,714.33	525.84
RM for cement and lime industry	1.28	1,134.16	566.20
RM for building and decoration stone industry	6.32	2,027.14	1,318.09
Sand	7.39	867.79	627.49
Gravel	17.68	3,640.33	2,315.22
RM for ceramics industry	1.36	1,006.73	651.61
Peat, paludal mud, paludal lime	0.27	538.35	305.09
Others	2.32	59.76	46.68
In total	37.87	10,988.45	6,356.15

Source: own study according to Mining and Geological Survey of Hungary 2019.

which 6,356 Mil. m^3 is exploitable. The present resources are split between 3,255 deposits. Based upon utilization, non-metallic mineral raw materials are classified into 7 main raw material categories as follows:

1. Industrial minerals (selected): such as alginite, fire- and acid proof clay, industrial and glass sand, different quality limestones and dolomites, kaoline, etc.; main users are: chemical industry, metallurgy, cheramics industry, agriculture, building/construction industry (facing plasters, insulating materials).
2. Peat, paludal mud, paludal lime.
3. RM for cement and lime industry: basic materials of cement and lime industry such as limestone, marl.
4. RM for building and decoration stone industry: main users are: building/construction (material) industry, transport, water engineering, sculpture.
5. Sand for building industry.
6. Gravel for building industry: concrete component, basic material for road construction.
7. RM for ceramics industry: main users are: brick-, tile- and porcelaine factories, small ceramics industry.

The production of non-metallic raw materials in 2018 is increased by 4.9 million m^3 as prepared to the previous year (Hastorun 2019).

3.3. Mineral production development in Czech Republic

The Czech Republic was an important Central European producer of heavy industrial goods manufactured by the country's chemical, machine building, and tools making industries. Steel making, the mining and processing of industrial minerals and the production of construction materials continued to be of domestic and regional importance. The value of industrial production increased by 11.2% compared with that of 2015; the value of mining and quarrying increased by about 2.5%, of which the mining and quarrying of mineral fuels and no mineral fuels increased by 0.6% and 7.2%, respectively (see Table 9). In 2016, mining and quarrying constituted 1.4% of the Czech economy's net value of output and a 2.5% share in the value of industrial output (Czech Statistical Office 2018).

Table 9. Selected statistical data on exploration and mining in Czech Republic

Tabela 9. Wybrane dane statystyczne dotyczące poszukiwań i wydobycia surowców mineralnych w Republice Czeskiej

Statistical data/Year		2013	2014	2015	2016	2017
Registered geological works	Total	3,340	3,585	4,128	5,610	6,225
	Economic geological	22	27	26	11	11
Protected deposit areas – number		1,098	1,100	1,105	1,112	1,123
Mining leases – total number		969	973	974	967	968
Number of exploited reserved deposits		502	504	505	507	506
Number of exploited non-reserved deposits		203	209	208	221	203
Mine production of reserved deposits, mill.t		107	109	114	110	109
Mine production of non-reserved deposits, mill.t		11	10	12	12	12
Organizations managing reserved deposits		321	318	319	322	326
Organizations mining reserved deposits		179	181	179	184	180
Organizations mining non-reserved deposits		170	152	165	166	147

Source: own study, Czech Statistical Office 2018.

In 2016, the Czech Republic reported production increases for such major metals as iron, steel, and steel semi manufactures (Dvořáček et al. 2018). The estimated output of secondary refined metals (with the exception of lead, which reported a production increase) remained at about their same levels of production as in 2015 (see Table 10). Positive growth in the construction materials sector included the output of common sand and gravel, dimension stone, glass sand, and limestone. The production of gypsum continued to decrease; the production of coal increased, however. Among mineral fuels, production decreases were reported for natural gas and crude petroleum (Mineral commodity summaries of the Czech Republic 2019).

Table 10. Trends of reserves of minerals (economic explored disposable reserves)

Tabela 10. Tendencje w zakresie zasobów operatywnych surowców mineralnych (ekonomiczne zasoby do dyspozycji)

Statistical data/Year	2013	2014	2015	2016	2017
Metallic ores	26	27	27	46	92
Energy minerals	2,847	2,807	2,769	2,850	2,850
of which: Uranium (kt)	1	1	1	1	1
Crude oil	21	21	21	21	21
Natural gas	6	6	6	6	6
Industrial minerals	2,684	2,673	2,612	2,398	2,541
Construction minerals	5,153	5,107	5,156	5,140	5,174

Source: own study according to Ministry of Industry and Trade Czech Republic (in mill.t/kt).

As for the mine production and reserves in the Czech Republic, the development in 2018––2019 is illustrated by Table 11, when mine production slowly increased almost in all the mined materials. Reserves are determined for lithium, feldspar and garnet.

Table 11. Czech Mine production and Reserves (in thousand m^3)

Tabela 11. Produkcja i zasoby operatywne czeskich kopalń, tys. m^3

	Mine production		Reserves
	2018	2019	
Bentonite	277	280	–
Fuller´s earth	–	–	–
Kaolin	3,620	3,600	–
Lime	1,040	1,100	–
Feldspar	449	460	23,000
Lithium (mill.t)	–	–	1,3

Source: own study according to MCS 2019.

Table 12. Analysis of deposit resources of selected RM in Poland

Tabela 12. Analiza zasobów złóż wybranych kopalin w Polsce

Raw materials	RM license mining 1	RM license mining 2	% RM (1/2) (Mt)	RM reduced (2 – 1) (Mt)	Extractable RM – (Mt)	(1 · 0,75) (Mt)	% RM (6/5)	RM enlarged (5 + 6) (Mt)
	1	2	3	4	5	6	7	8
Crushed stones	41.30	1684.17	2.45	1642.87	2407.13	30.98	1.29	2438.11
Chalk	1.11	1.83	60.66	0.72	3.26	0.83	25.46	4.09
Foundry sands	0.21	0.91	23.08	0.70	16.78	0.16	0.95	16.94
Sand and gravel	402.64	2,019.68	19.94	1,617.04	2,346.82	301.98	12.87	2,648.80
Quartz sands for cellular concrete production	0.04	17.26	0.23	17.22	23.66	0.03	0.13	23.69
Quartz sands for lime sand brick production	3.56	33.88	10.51	30.32	20.63	2.67	12.94	23.30
Building ceramics RM	19.24	224.77	8.56	205.53	221.07	14.43	6.53	235.50
Clay RM for cementproduction	0.43	0.43	100	0	0	0.32	–	0.32
Peat (mm^3)	0.65	7.68	8.46	7.03	25.64	0.49	1.91	26.13
Limestone for the lime industry	5.51	595.27	0.93	589.76	720.46	4.13	0.57	724.59

Source: own study according to Polish classification system and the UNFC 2016.

Raw material license mining 1 – anticipated economic RM resource, licensed for mining with concession issued by a county chief; RM license mining 2 – anticipated economic RM resource, licensed for mining with concession issued by a county chief and Marshal.

3.4. Mineral production development in Poland

Poland is endowed with significant mineral resources, which include bituminous coal, copper and lead-zinc ores, salt, silver, and sulphur. The latest available inventory of the country's mineral resources indicated net gains in geologically documented resources, mainly for bituminous coal, ceramic clays, coal bed methane, and sulphur.

In 2016, after Russia, Poland remained the leading producer of copper in Europe and Central Eurasia and remained among the top 10 world mine producers of copper. Poland also continued to be among the leading world producers of nitrogen (in ammonia), salt, silver, and sulphur. In Europe and Central Eurasia, the country was a significant producer of lead and zinc and a leading producer of lime. According to the International Monetary Fund (2017), Poland's real gross domestic product (GDP) registered a growth of 6.1% compared with that of 2005; industrial production in constant prices increased by about 9.2% compared with that of 2005. During the same period, the value of output of the mining and quarrying sector in constant prices declined by about 1.2%. Steel trade issues and efforts to restructure and privatize Poland's steel industry continued to be among the leading mineral industry concerns. As for the legal form of business in the mining sector, limited-liability companies, joint-stock companies, and partnerships constituted about 80%, 11%, and 4%, respectively, of the total mining enterprises. Table 12 illustrates selected raw materials resources in Poland in 2016.

The development of mineral raw materials in Poland in 2011–2015 is presented in Table 13 and Table 14.

Data from Table 13 and 14 illustrates the total value of mineral raw materials increased in 2012 against 2011, but in the next years the value decreased slowly to value EUR 19.91 billion. The development of the total value of mineral raw materials in tons in the analyzed

Table 13. The estimated structure of demand value of mineral RM consumed in Poland in groups

Tabela 13. Szacunkowa struktura wartości popytu kopalin zużytych w Polsce

Group of mineral raw materials (%)	2011	2012	2013	2014	2015
Fuels excl. Natural gas	71	74	72	70	66
Metallic	12	11	12	12	15
Ceramic	7	6	6	7	8
Chemical	5	5	5	6	7
Construction	5	3	5	5	3
Others	1	1	1	1	1
Total value (billions Eur)	26.84	27.27	26.41	24.24	19.91

Source: own study according to Lewicka and Burkowicz 2017.

Table 14. The estimated structure of demand by volume of mineral RM consumed in Poland in groups

Tabela 14. Szacunkowa struktura popytu na kopaliny użytkowane w Polsce

Group of mineral raw materials (%)	2011	2012	2013	2014	2015
Fuels excl. Natural gas	33	37	39	38	37
Metallic	5	5	6	6	6
Ceramic	17	18	17	18	18
Chemical	4	4	5	4	5
Construction	41	35	33	33	34
Others	1	1	1	1	1
Total value (mil.tons)	526	459	439	439	448

Source: own study according to Lewicka and Burkowicz 2017.

periods gradually decreased during 2011–2014; consequently, a smooth increase was recorded in 2015.

In their study, Galos et al. (Galos et al. 2020) determined strategic minerals for the Polish economy from the view of the mean value of consumption and net importance reliance in 2009–2018, which is evaluated as follows (see Table 15).

4. Discussions and conclusions

The evaluation of state minerals demands to regard risks and obstacles in mining business and environment impact. The base of the state raw material development in existing economic conditions and the conomic system of the country mainly presents the forming of the state orientation in processes of obtaining and consequent providing of raw materials. Those are necessary for the development of own prospering industrial sectors, as well as for domestic production and the business sphere, which production is based on raw materials.

From the main postulates in present available and new prepared raw material strategies results concrete practical demands, connected quality and stocks of raw materials, but also real technical access and economic availability of the disposal of natural resources, but similarly also methods and technical equipment of capacities, determined for minerals extraction.

In raw materials states documents, the demand of the state to extract mainly own stocks of raw materials and minerals, but only in case when evaluation of rather great volume of influencing factors (economic, technical, social and environmental) would enable it is also implicitly presented. From the view of the state, as exclusive owner of all natural resources and minerals stocks, this means the legal and legitimate demand. The characteristics of

Table 15. Strategic minerals for the Polish economy

Tabela 15. Strategiczne surowce mineralne dla polskiej gospodarki

Raw materials	Mean value of consumption 2009–2018 (mil. Eur)	Net imports reliance, mean value 2009–2018 (%)
Aluminium, metal (non-alloyed)	512.32	100
Antimony minerals	6.34	100
Chromium minerals	5.26	100
Coal, hard (steam and coking)	5,098.42	15.5
Ferroalloys	59.33	100
Gas (natural)	Over 2,813.73	86.0
Indium (metal)	6.13	100
Iron ores and concentrates	1,746.6	100
Lignite	378.04	0.4
Magnesium (metal)	13.33	100
Manganese minerals	10.11	100
Molybdenum minerals	4.96	100
Nickel (metal)	100.1	100
Oil (crude)	9,721.83	97.4
Phosphate rock	94.02	100
Phosphorus (elementary)	29.46	100
Platinum group (metals)	28.33	100
Potash salts	203.02	96.0
Rare earth elements, Yttrium, Scandium	2.92	100
Silicon (metal, ferrosilicon)	44.0	100
Tin (metal)	11.38	83.5
Titanium (ores and concentrates)	18.74	100
Tungsten (metal)	9.03	100
Zinc (metal)	189.71	Less 10 (as over 50% of Zn ores and concentrates are imported, hence ultimately classified as strategic)

Source: own study according to Galos et al. 2020.

this demand is basic the axiom of mining, connecting to the need of minerals extraction and obtaining raw materials (primary and secondary, which means collected through the years at waste slathers – communal, construction, industrial, etc.), which a priory defines as a base situation, assumed a certain, or concrete appearance of utility minerals stocks and raw materials at the locality of the state. The obligation of the state is to protect, administer, eventually mine and rationally and economically use the extracted minerals and this state of stocks – so-called raw material wealth of the state. Also while the state registered appearance of minerals stocks will be present in the territory of, it would be reasonable to extract them and process them into raw materials with the maximum possible value added. At the same time, it would be reasonable to prepare experts in the process of formal education at the state education institutions (but also not excluding expert and specialized preparation in informal education according to agreements with employers, which means extraction companies).

The mining business is the base of the mining industry, since the sector provides raw materials for individual industrial sectors in a given structure of the national economy. At the same time it presents the basic pillar of the state raw material perspective, where raw materials have their specific economic value, empirically expressed according achieved volume of mining production, so-called "mine output".

The mining industry mainly serves the provision of raw materials to other connected industrial sectors of the economy. Mining industry means the extraction of raw material by surface or underground way. This means a complex of works, necessary for finding, extraction, transport and processing of raw material utility. A majority of raw material is mined this way. In the broader sense mining also includes the extraction of any not renewable sources of minerals, ores, oil and earth gas. But mining cannot be evaluated only from the view of economic inputs and outputs, since the mining industry demands significant investment inputs, producing outputs with very low added value and long term of return. The mining industry will not prosper, if not subjected to market economy and supply and demand law. The mining industry cannot react to the job market changes quickly. To open and to finish mining operation is a very financially and timely demanding process. If necessary to increase economic balance with goal to maintain mining operation by costs decreasing, there is necessary to do it by basic intervention to single mining process. It needs not to be allowed by mining and technical conditions and demands of work security.

Minerals extraction can be evaluated from two points of view. In case a miner manages to extract with profit and to export extracted minerals without problems, this means the golden era of mining. If high investments are connected with mining and only mines finance them without a guarantee of investments return, this leads to the mining decline. If the state, as an owner, invests in mining, it could also bring about a golden era, or at least profitable time.

Obviously mining has an impact on price development on the commodities markets; positive example is growth of the price of gold from 2005, or antimony prices from 2010. The opposite example is the decrease of gold price in the 19th Century after finding new deposits in North America and the decrease of opal prices in the last decades after finding new deposits in Australia.

In the 19th century governments of various states experimented with various systems of gold and silver standards with the goal to limit the volume of money circulating. In that time there was strong economic pressure in the worldly financial sector. Periods of strong growth were replaced by recessions. Gold mining decreased and increased in accordance with real price development and currency strength, as well as the willingness of the state to invest or to provide space for mines development.

The objective existence of effectively mined stocks of raw materials is very considerable for the mining development, as well as sufficiently geologically verified and properly technologically adjusted stocks, the use of which would be supported and guaranteed from the side of the state. But in many cases states provide obstacles during mining business, which could be: tax burden, volume of registration and administration duty, instability of legislation, respectively too often changes of legislation, real law enforcement, and pressure of interest in mining business, declaration of interests and support of the state.

Recycling and secondary raw materials do not provide for the industrial consumption sufficient inputs and there is still necessary to extract also natural sources. Also it would be further necessary to obtain minerals also from existing deposits in the assumption of successful afford to observe sustainable development during using of global raw materials flows and full mobility of circular economy.

The main emphasis of the raw materials development strategy is given to provide reliable and qualitative data about raw materials or about the knowledge of the available raw material base, which influence competition of ability of the mining industry. Non-energetic and non-agricultural raw materials, including individually defined energetic raw materials, from primary and secondary sources, could presently be competitive only in case of supporting the ecological stability and sustainable development of the regions. The great importance of raw materials is registered from various existing accesses to national raw material strategies, which try to emphasize not only key political documents, resulting from the EU level, but also to reflect relevant international initiatives to raw material strategies. Important sources of data for elaboration of raw materials development strategy in the individual EU members are all information, from interesting organizations and agencies. Primarily, the evaluation of raw materials development presents the base for the evaluation of domestic raw materials and the identification of "critical" materials in the individual regions.

Existing available and important European strategic documents, relevant for raw materials, as for example the European Raw Materials Knowledge Base, Strategic implementation plan for the European Innovation Partnership and EU Raw Material Initiative, emphasize the necessity of raw materials providing for sustainable economic progress of modern societies, but also a necessity to achieve access to raw materials without problems for competition prices. Sectors, as for example the construction, chemical industry, automotive industry, aviation, engineering, etc., which provide a total value added EUR 1,324 billion and employ approximately 30 million people, depends on access to raw materials.

Despite this, in the V4 countries there is an obvious certain boom and annual growth of mining volumes, although growth does not mean the mining industry is in parallel with sustainable development.

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CONTRIBUTION OF V4 COUNTRIES TO MINERAL SUSTAINABLE DEVELOPMENT IN EU

Keywords

extraction, sustainable development of mining industry, Mineral Raw Materials, Visegrad group, European Union

Abstract

Most EU member states have taken measures to implement the principles of sustainable development. Mineral extraction in Europe has become more difficult, since most member states have taken measures to implement the principles of sustainable development. The industrial minerals sector provides important mineral commodities for the industries. The general situation of minerals supplying in Europe is provided by a strong position of aggregate sector. The paper evaluates the development of mineral extraction in the Visegrad group of EU countries with the aim to find the position of the mining industry in the V4 countries and its contribution to the European mining industry, regarding the sustainability of mining. A task of sustainability assessment is the evaluation of the V4 mining sector's contribution to the European economy and finally to assess the risks and obstacles for mining industry development. Due to the mentioned present state of minerals supplying in Europe, this is evaluated with economic and environmental significance of materials, connected with development of mineral production and critical mineral Raw Materials in EU, compared with worldwide situation, followed by the prediction of mineral production. The third part is orientated towards the evaluation of raw materials used in the individual V4 countries. The situation of mineral production is evaluated especially in the V4 region. Thre results show that despite the fact that there is an obvious certain boom and annual growth of mining volumes in the V4 countries, the growth does not mean the mining industry follows sustainable development. There is a vast space for the industry to improve. The further evaluation of state minerals demands the consideration of risks and obstacles in mining business and the environment impact.

WKŁAD KRAJÓW GRUPY WYSZEHRADZKIEJ V4 W ZRÓWNOWAŻONY ROZWÓJ POZYSKANIA SUROWCÓW MINERALNYCH W UE

Słowa kluczowe

wydobycie, zrównoważony rozwój górnictwa, surowce mineralne,
Grupa Wyszehradzka, Unia Europejska

Streszczenie

Większość państw członkowskich UE podjęła działania mające na celu wdrożenie zasad zrównoważonego rozwoju, co spowodowało, że wydobycie surowców mineralnych stało się trudniejsze.

Sektor materiałów budowlanych i ceramicznych zaopatruje przemysł w wiele ważnych surowców mineralnych. Wśród nich, w skali Europy, ważną rolę odgrywa sektor kruszyw.

W artykule dokonano oceny rozwoju wydobycia kopalin w krajach Grupy Wyszehradzkiej (V4) w celu ustalenia pozycji przemysłu wydobywczego tych krajów i ich wkładu w europejskie zrównoważone górnictwo. Oceniono znaczenie sektora wydobywczego Grupy Wyszehradzkiej dla gospodarki europejskiej oraz określono bariery i zagrożenia dla rozwoju górnictwa.

Biorąc pod uwagę stan zaopatrzenia Europy w surowce mineralne, oceny dokonuje się pod kątem ich ekonomicznego i środowiskowego znaczenia, a zwłaszcza zapotrzebowania na surowce mineralne i surowce krytyczne dla przemysłu Unii Europejskiej na tle sytuacji światowej, z uwzględnieniem prognoz wydobycia. Kolejna część artykułu dotyczy oszacowania zapotrzebowania na surowce mineralne w poszczególnych krajach Grupy Wyszehradzkiej. Roczny wzrost wolumenów wydobycia surowców mineralnych w krajach V4 nie oznacza, że górnictwo rozwija się w sposób zrównoważony. Branża ma ogromne możliwości poprawy w tym zakresie. Dalsza ocena możliwości rozwoju produkcji surowców mineralnych wymaga wzięcia pod uwagę występujących zagrożeń i barier w działalności górniczej oraz uwzględnienia wpływu na środowisko przyrodnicze.