Application of SWOT Analysis of Exploitation of Mineral Resources for Defining the Strategy of Support of Sustainable Development of the Slovak Republic

Jana Ocilková[1,*], *Martin* Ocilka[1], and *Martin* Cvoliga[1]

[1] Institute of Earth Resources, Faculty of Mining, Ecology, Process Control and Geotechnologies, Park Komenského 19, 0420 00 Košice, Slovakia

Abstract. The article deals with a quantifiable approach which leads to the definition of a strategy for promoting sustainable development through the exploitation of mineral resources in Slovakia. It points to a clear identification of a potential strategy by using SWOT analysis, which integrates the interaction of strengths and weaknesses, opportunities and threats to the exploitation of mineral resources, which forms the basal platform for the functioning of sustainable development of the Slovak Republic. The paper presents the implementation of the principles of Saaty's matrix in the quantification of the factors weights of individual areas of SWOT analysis with the aim of their objectification. It describes in detail the quantification of predefined weights of the mentioned analysis, which leads to the definition of the strategy of promoting sustainable development of the Slovak Republic through the exploitation of mineral resources. In conclusion, it presents a graphical representation of the SWOT analysis with an emphasis on supporting the mitigation of developmental interregional disparities in Slovakia.

1 Introduction

Exploitation of mineral resources is a significant phenomenon concerning all areas of existence of anthropogenic society and its sustainable development. Exploitation of mineral resources is a basic platform of industrial production, it participates in the creation of macroeconomic indicators, it is an integral part of production factors, a significant article of import and export, but also an element influencing the development of environmental and socio-economic area of development of regions of the Slovak Republic, which shows significant interregional disparities in recent years [1].

Sustainable development is possible to define in accordance to § 6 of Act no. 17/1992 Coll. about the environment as, "development that retains the ability of present and future generations to meet their vital needs while not detracting from the diversity of nature and preserving the natural functions of ecosystems." Given the fact that the exploitation of

* Corresponding author: zuzana.simkova@tuke.sk

mineral resources has a negative impact on the environmental quality of SR regions, in some cases also on the health of the population and biodiversity, it is necessary to clearly identify their further strategy in the described processes, mainly with its positive impact to socio-economic area of regional development [1, 2].

The regional development of the Slovak Republic is determined by the type of exploited mineral resource, which influences the formation of heaps, sludge ponds, contamination of individual components of the environment and the costs of the reclamation of the affected area [3], as well as the municipality's income in the form of reimbursement for mining area and local taxes and charges, where deposits are allocated, state income in the form of levies and taxes on employment, corporate income tax, VAT, employment and secondarily, on the purchasing power of the population and their standard of living [4, 5].

2 Materials and Methodology

We have implemented SWOT analysis for the purposes of defining an effective strategy for integrating of the use of mineral resources in the processes of regional development support in the Slovak Republic mainly because above mentioned reasons.

For the need to define strategy of integrating of raw material base using of the processes of sustainable development of regions we identified factors of Strengths and Weaknesses, as well as Opportunity) and Threats), to which we quantify weights – αi. We determine to all factors numeric value of weights αi accepting generally applied condition ∑αi=1. Value of weights had been quantified in the sense and principles of Saaty matrix with dimensions m x n, when m = 1 ... i and n = 1 ...j, were given by number of row and columns, while we observed condition m = n. This symmetric shape of the matrix corresponds at the same time with the fact that the method is constructed in interactive comparison of all defined factors of individual SWOT areas of the same order with evaluation in Table 1 [6].

Table 1. Evaluation of factors of individual areas in SWOT analysis by Saatys matrix [1].

Factor value	Description of comparing factors
1	Factors *i* and *j* are equal
3	Factor *i* is rather preferred before factor *j*
5	Factor *i* is significantly preferred before factor *j*
7	Factor *i* is very strongly preferred before factor *j*
9	Factor *i* is absolutely preferred before factor *j*

Consequently we produced a value of 1 on the diagonal of the matrix, since we accepted principle of comparison of the same factors, which means their equality and we identified pair comparisons of individual factors, while if the factor mentioned in the row is preferred over factor, mentioned in the column, we have given them reciprocal value. After such evaluation of individual factors we created partial multiplication of the rows according relation [1, 6]:

$$S_i = \prod_{j=1}^{f} S_{ij} \qquad j = 1, 2, 3 \ldots\ldots f \qquad (1)$$

where:

f – number of factors,

Sij – individual factors.

Further we quantified value Ri for any factor, which means row of the created matrix according equation:

$$R_i = (S_i)^{\frac{1}{f}} \tag{2}$$

According such calculation we created sum Ri, according which we quantified final value of individual weights αi reflecting mutual interactions of compared factors for raw material base using and their priority for the need of SWOT analysis. Consequently we add to individual factors points from interval <1, 5>. In next step we realized multiplication of weights and points of individual factors and by their sum we defined vector boundaries between strengths and weaknesses, internal environment, as well as opportunities and threats, as external environment. The results had been graphically illustrated and evaluated according SWOT matrix. By this way we could identify proper strategy for raw material base using for regional development. The matrix consists of four basic quadrants [7]:

I quadrant → balance of external opportunities with internal strengths, resp. offensive strategy,

II quadrant → disability to use offered opportunities due to its critical weaknesses, strategy of alliance,

III quadrant → risks, resulting from external environment threaten using of raw material base by attacking to its weaknesses, strategy of retreat,

IV quadrant → external risk, threatening internal strong position of raw material base using, defensive strategy.

3 Identification of effective strategy of exploitation of mineral resources for the need of regional development of the Slovak Republic

From the information given so far about the impacts of the exploitation of mineral resources, we could identify the necessary factors of strengths and weaknesses, opportunities and threats limiting the definition of the strategy of their implementation in the processes of development of the regions of the SR. Among factors of strengths in Slovakian regions development from the view of raw material base using belongs:

S1 – income to state budget, to budget of communities, and environmental fund, created by payment for mining space and extracted minerals,

S2 – income to state budget from fees and payroll taxes,

S3 – income to state budget by the way of value added tax,

S4 – income to state budget by the way of income taxes from legal entity,

S5 – increasing of employment,

S6 – rate on GDP creation,

S7 – rate on value added creation.

In accordance with higher methodology of weights quantification and according Saaty matrix we determine explicitly weights of individual factors of strengths of raw material base using in processes of sustainable development in Slovakian regions, as mentioned by Table 2.

Table 2. Quantification of weights for strengths of raw material base using in processes of regional development.

factor/interaction	S1	S2	S3	S4	S5	S6	S7	S_i	R_i	α_i
S1	1	1/3	1/3	1/5	3	1/5	1/5	0.00267	0.4288	0.05
S2	3	1	3	1	1/3	1/5	3	1.80000	1.0876	0.13
S3	3	1/3	1	3	3	1/3	3	9.00000	1.3687	0.17
S4	5	1	1/3	1	3	1/3	5	8.33333	1.3538	0.17
S5	1/3	3	1/3	1/3	1	5	7	3.88889	1.2141	0.15
S6	5	5	3	3	1/5	1	5	225.00000	2.1678	0.27
S7	5	1/3	1/3	1/5	1/7	1/5	1	0.00317	0.4396	0.05
SUM									8.06	1.00

Among factors of weaknesses of raw material base application in processes of Slovakian regions development, to which we quantified explicitly level of weights, given in Table 3, belong:

W1 – investment costs, necessary for realization of projects with raw material base exploitation,

W2 - production of mining waste,

W3 – slather and dredgers rising,

W4 – decreasing of environmental quality in area of mined deposit of minerals,

W5 – environmental costs, connected with reclamation of the area after extraction termination,

W6 – negative influence to the local system with ecologic stability.

Table 3. Quantification of weights for weaknesses of raw material base using in processes of regional development

factor/interaction	W1	W2	W3	W4	W5	W6	S_i	R_i	α_i
W1	1	1/3	1/5	1/3	3	3	0.20000	0.7647	0.11
W2	3	1	1/3	1/5	1/7	1/5	0.00571	0.4228	0.06
W3	5	3	1	3	1/3	3	45.00000	1.8860	0.27
W4	3	5	1/3	1	5	3	75.00000	2.0536	0.30
W5	1/3	7	3	1/5	1	1/3	0.46667	0.8807	0.13
W6	1/3	5	1/3	1/3	3	1	0.55556	0.9067	0.13
SUM								6.91	1.00

Among factors of opportunities for raw material base using in processes of Slovakian regions development, which explicitly quantified level of weights is given in Table 4, could be considered following:

O1 – increasing of purchase ability of inhabitants in the region,

O2 - increasing of GDP creation per inhabitant in the region,

O3 – increasing of average wage in the region,

O4 – support of SMEs business in the region,

O5 – increasing of living standard of the inhabitants in the region,

O6 – decreasing of interregional disparities,

O7 – FDI inflow.

Table 4. Quantification of weights for opportunities of raw material base using in processes of regional development.

factor/ interaction	O1	O2	O3	O4	O5	O6	O7	S_i	R_i	α_i
O1	1	1/3	1/3	1/5	3	1/5	1/5	0.00267	0.4288	0.05
O2	3	1	3	1	/3	1/5	3	1.80000	1.0876	0.13
O3	3	1/3	1	3	3	1/3	3	9.00000	1.3687	0.17
O4	5	1	1/3	1	3	1/3	5	8.33333	1.3538	0.17
O5	1/3	3	1/3	1/3	1	5	7	3.88889	1.2141	0.15
O6	5	5	3	3	1/5	1	5	225.00000	2.1678	0.27
O7	5	1/3	1/3	1/5	1/7	1/5	1	0.00317	0.4396	0.05
SUM									8.06	1.00

Among factors of threats in the frame of raw material base using in processes of Slovakian regions development, which explicitly quantified level of weights is given in Table 5, belong:

T1 – inconvenient profitability of investment from the project realization for raw material base using,

T2 – decline of economic effectiveness of the region,

T3 – continual growth of automotive transport density in the region,

T4 – lack of qualified working power,

T5 – unequal building of infrastructure,

T6 – low FDI inflow.

Table 5. Quantification of weights for threats of raw material base using in regional development.

factor/ interaction	T1	T2	T3	T4	T5	T6	Si	Ri	αi
T1	1	1/3	1/3	5	1/5	1/3	0.03704	0.5774	0.08
T2	3	1	5	3	7	3	945.00000	3.1326	0.42
T3	3	1/8	1	1/3	1/3	1/5	0.00833	0.4503	0.06
T4	1/5	1/3	3	1	5	3	3.00000	1.2009	0.16
T5	5	1/7	3	1/5	1	1/5	0.08571	0.6640	0.09
T6	3	1/3	5	1/3	5	1	8.33333	1.4239	0.19
SUM								7.45	1.00

After identification and explicit weights quantification of weaknesses and strengths factors, as well as opportunities and threats of raw material base using in processes of sustainable regional development we realized calculations, orientated to the quantitative identification of vector boundaries of individual partial areas to complex SWOT analysis (Fig. 1), and by graphical illustration of the factors we could identify strategy for using of development potential of raw material base in processes of regions development in Slovakia.

Strengths	αi	Point	Multiplication	Weaknesses	αi	Point	Multiplication
S1	0,05	3	0,16	W1	0,11	3	0,33
S2	0,13	4	0,54	W2	0,06	3	0,18
S3	0,17	4	0,68	W3	0,27	4	1,09
S4	0,17	3	0,50	W4	0,30	3	0,89
S5	0,15	3	0,45	W5	0,13	3	0,38
S6	0,27	3	0,81	W6	0,13	3	0,39
S7	0,05	3	0,16				
Sum			3,30	Sum			3,27
Opportunities	αi	Point	Multiplication	Threats	αi	Point	Multiplication
O1	0,05	4	0,21	T1	0,08	2	0,16
O2	0,13	3	0,4	T2	0,42	3	1,26
O3	0,17	3	0,51	T3	0,06	2	0,12
O4	0,17	3	0,5	T4	0,16	3	0,48
O5	0,15	4	0,6	T5	0,09	3	0,27
O6	0,27	3	0,81	T6	0,19	2	0,38
O7	0,05	3	0,16				
sum			3,20	Sum			2,67

Fig. 6. SWOT analysis of raw material base using in processes of sustainable regional development.

From graphical illustration of SWOT analysis (Fig. 2) for application of raw material base, as a tool of sustainable development in Slovakia with accent given to the moderation of development interregional disparities we can state that raw material base dispose with rather significant potential, to which there would be proper to orientate regional activities with application of principles of offensive strategy. Due to the strengths that characterize significantly potential of raw material base in realized SWOT analysis according detail partial analysis we evaluated that exploitation of raw material deposits, as a tool of sustainable development support, is able to use all opportunities, while the size of its competitive advantage could be changed in time in dependence on character of provided intervention from the side of villages and communities in the regions, as well as state support programs.

Conclusion

Identified offensive strategy - SO - strengths opportunities, is the most attractive strategic option. It can be chosen when the forces over weaknesses and opportunities over threats prevail. Due to powerful forces, it can be taken advantage of all the opportunities offered. An offensive strategy from a strength position is recommended.

This strategy, which came from the SWOT analysis diagram is also for application of raw material base, as a tool of sustainable development in Slovakia very useful. It shows us that our raw materials base has potential, which should be utilize, not only by state, but also by region to eliminate interregional disparities.

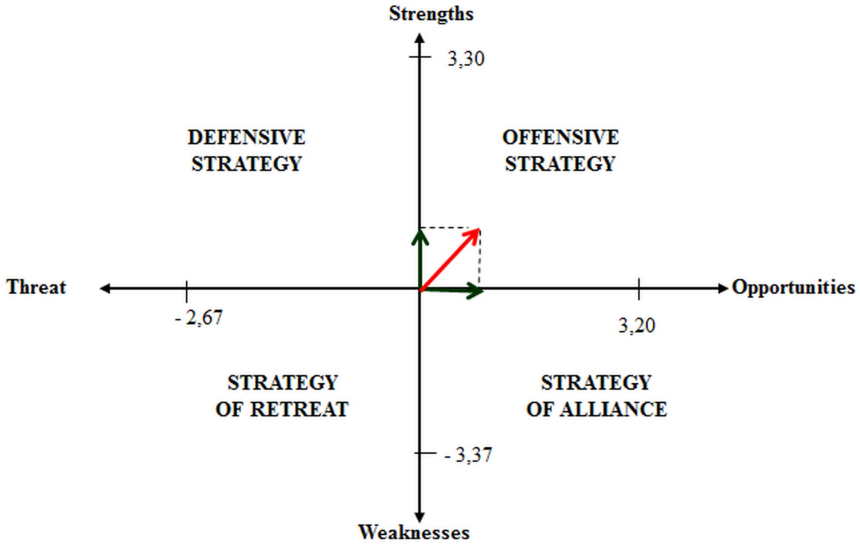

Fig. 2. Graphical illustration of SWOT analysis from raw material base using in sustainable regional development.

The best way how to do this is to raise awareness of raw materials, create and update raw material policy, inherent position of raw materials in legislation of lower territorial units - regions, support of raw materials policy tools, as well as support of transition to circular economy, which is currently very popular at EU level and which creates new opportunities not only for environmental protection but also for efficient use of raw material resources.

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