EVOLUTION OF THE COAL MINING SECTOR IN JIU VALLEY IN TERMS OF SUSTAINABLE DEVELOPMENT AND CURRENT SOCIO-ECONOMIC IMPLICATIONS

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***Abstract**: The concept of sustainable development has crystallized gradually in the ninth decade of the last century, ecologists and environmental economists defining it, initially, as that form of society development based on both the use of renewable natural resources at rates below their regeneration capacity and the optimal use of non-renewable resources, taking into account their substitution provided by technological progress. Although the sustainable development of a region implies a type of development that satisfies the needs of the present generation, without compromising the opportunities (chances) of the next generations to satisfy their own needs, we consider that the closure of the mining exploitations in Jiu Valley does not answer to either of the two desires. As it is known, the process of "restructuring" the mining sector in Jiu Valley region started in the 90s continues today, so that only two mines (Livezeni and Vulcan) are expected to remain in operation after 2018. Invariably, any discussion related to energy resources is associated with the concept of sustainable development, so in the present paper, we analyzed from this perspective the situation in Jiu Valley. For this purpose we used one of the best known tools in the field for analizing a region from the point of view of its integration into the concept of sustainable development of the society, represented by the SWOT analysis (strengths-weaknesses-opportunities-threats). Starting from the definition of sustainable development and taking into account the available data, in the present paper, we analyzed the situation of coal mining industry in Jiu Valley (more precisely from the perspective of mine closure) and its implications on the "sustainable development" of this region.*

***Key words:** coal mining, sustainable development, Jiu Valley, SWOT*

INTRODUCTION

The history of the southern region of Hunedoara County, known as the Jiu Valley, is definitely linked to the discovery and exploitation of coal deposits (hard coal).

Although the first observations on the existence of coal strata were made around 1782, when they have self-ignited and burned for a long time (LUNGU ET AL., 1968), it was only in 1840 that the first surface operations began, (LAZAR AND FAUR, 2016), simultaneously at Vulcan, Petroșani and Petrila (figure 1), and in 1845 massive migrations of German miners mainly from Bucovina, but also from the rest of Transylvania occurred.

Against the backdrop of the increase in domestic demand for coal, undoubtedly due to the industrialization process, the population of the Jiu Valley increased from 2,556 inhabitants (according to the 1818 census) to almost 200,000 in 1989. Proportionally with this increase and the number of employees in the mining sector coal has grown from several hundred to 60,679 employees (GEORGESCU, 2003).

Simultaneously with the coal mining industry, other educational (the establishment of the Coal Institute in Petroșani in 1948 and the further training of skilled workers at the level of secondary or vocational education), research (the Institute for Research and Mining Design and the National Institute for Research and Development in Mine Safety and Protection to Explosion) and industrial activities (Mining Equipment Enterprise and UPSRUEM) have developed ensuring the socio-economic evolution of the area.(FAUR, LAZĂR, 2012)

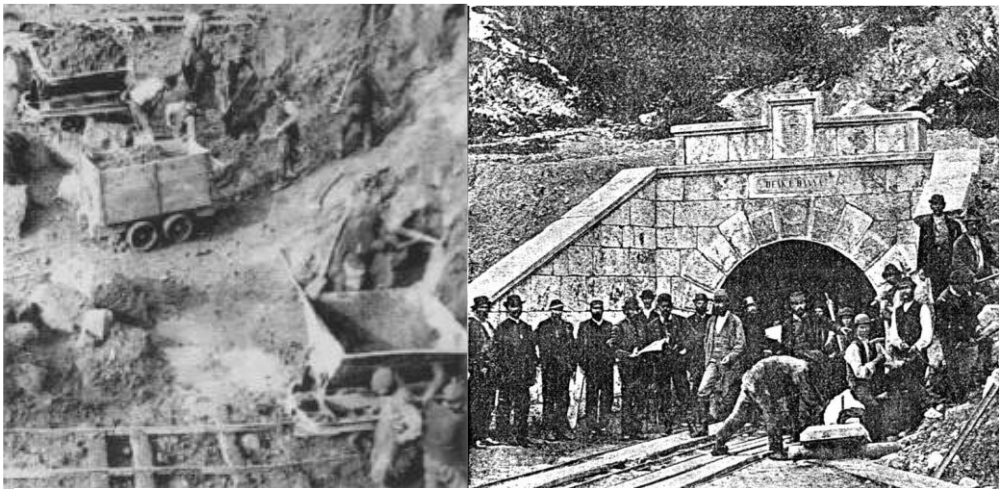

Figure 1 Surface exploitation and underground access gallery (Petrila) at the middle of the nineteenth century (WOLLMANN, 2010; JUJAN AND SVOBODA, 2009)

Mining in the Jiu Valley, experienced a continuous development during 1945 -1989, which will not be encountered in any other historical period of its existence. During this time, the production of coal has increased by more than four times, the number of employees in the mining sector was increasing, the number of mining perimeters almost doubled, and technically and technologically the mines in the Jiu Valley have known the greatest progress. [DAVIDOIU, 2017]

The situation of coal mining in the Jiu Valley was about to experience major changes after 1989, or even better after 1996, when two new concepts, namely "restructuring" and "layoffs", appeared in the local landscape.

MATERIALS AND METHODS

Evolution of coal exploitation in the Jiu Valley after 1989

At the beginning of the '90s, 14 mine perimeters were delineated and put into operation in the Jiu Valley (Figure 2).

Figure 2*Mining perimeters in the Jiu Valley in the early 90s (Pop, 1993)*

After 1989, the coal production experienced an upward trend, from approx. 5.27 million tons in 1991 to 7.17 million tons in 1996, despite the fact that, due to the depletion of some deposits (especially those from floodplains, exploited at the surface or shallow waters

exploited through coastal galleries) but also of natural outflows (retirement), the number of employees has decreased from over 60,000 to 44,920.

In other words, if we make a gross calculation, in 1996 the production/employee in Jiu Valley mines (labor productivity) was 159.61 tons/man and year (although labor productivity is normally calculated taking into account employees in the productive sectors not total employees).

The year 1996 also marked the beginning of the restructuring of the mining sector in Romania and implicitly in the Jiu Valley.

Thus, in only three years (i.e. by 1999) the number of employees decreased from 44,920 to 19,914 and the production of coal from 7.17 to 3.82 million tons. However, in terms of productivity, there is an increase from 159.61 to 191.84 tones / man and year.

After 1999 the decline in the number of employees continued, so that in 2001 it reached 17,700 employees. Also during this period, coal production registered an upward trend, so 4.5 million tons were extracted in 2002, or productivity increased to 254.24 tons / man and year.

At the same time, the restructuring process (closure of some mining units and layoffs) continued, so coal production also declined from year to year. Moreover, the mining units in the Jiu Valley were not allowed to recruit new staff, so there was a new problem, that of sub-dimensioning the number of jobs (especially with qualified staff).

In 2008, 2,809,925 tons were extracted, 2,196,681 tons in 2009, 2,283,345 tons in 2010, and 2,121,574 tons in 2011.

The finale of 2012 brings new changes to the Jiu Valley, by setting up the Hunedoara Energetic Complex, consisting of Mintia and Paroseni thermal power plants and the coal mining units.

But the establishment of the Hunedoara Energetic Complex also meant a division of the mining units in viable and non-viable. EM Lupeni, EM Vulcan, EM Livezeni and EM Lonea were viable, and EM Uricani, EM Paroseni and EM Petrila (closed at the end of 2015) were among the non-viable (those that are to be closed by the end of 2018).

Meanwhile, it seems that EM Lupeni and EM Lonea will definitely function until the end of 2018, after which the situation of the two mines is an uncertain one.

Against the backdrop of gradual restraint and cessation of productive activities in non-viable mines, coal production continues to decline, so in 2012 it was 1,876,062 tons, in 2013 - 1,839,667 tons, in 2015 - 1,583,350 tons, and in 2016 a production of only 1,600,000 tons was estimated.

This decline is also reflected in the productivity aspect, decreasing to approx. 200 tons/person and year.

Future of coal mining in the Jiu Valley according to the current energy strategy

At present, in Romania, a coherent energy strategy can hardly be discussed. The strategies developed by the line ministries change once in a few years, and the role of the Jiu Valley coal mines in these strategies plows between a strategic resource of great importance and a marginal resource of minor importance.

In this context, it is difficult to predict the future of coal mining in the Jiu Valley. Currently, closure programs for EM Uricani and EM Paroseni are being finalized, and for two of the viable exploitations, EM Lupeni and EM Lonea, a protocol has been concluded that ensures the continuation of the extractive activity at least until the end of 2018. After 2018 their situation is uncertain, of course, because of the lack of a clear energy strategy.

The other two operating units, EM Vulcan and EM Livezeni, will continue to supply the two thermal power plants, Mintia and Paroseni, until 2024.

We have to make it clear that European countries which rely heavily on coal-fired power generation, such as Germany, Poland or the Czech Republic, have developed clear energy strategies (including coal exploitation) in the medium or long term, meaning the prospect of the years 2040 - 2050.

In the absence of a visionary policy in the energy sector of Romania, the future of coal exploitation is uncertain, permanently foreseeing the prospect of mine closure and job loss.

How many millions of tons of coal and jobs are lost on the "energy strategy"?

According to currently available data, the exploitable reserves in the concessioned perimeters amount to more than 100 million tons of coal. In terms of maintaining the current operating rate, 1.4 million tons / year, they would be enough for another 70 years, and in the conditions of increasing production to 1.8 million tons / year they would be enough for another 55 years.

The closure of the coal mining operations until 2024 would mean the immobilization or the abandonment of approx. 90 million tons of coal. It is hard to believe that in the near future somebody will make massive investments to reopen the exploitation perimeters, especially knowing that the deposit is characterized by difficult geological exploitations (depth, tectonic, stratigraphy, variability).

As far as the jobs are concerned, there will be lost about. 4,500 (mining exploitations and the two mines), but as we pointed out in paragraph 1, other mining activities are linked to the Jiu Valley. Closure of mining would have a domino effect in terms of jobs in the Jiu Valley, a domino that could only stop with the total collapse and depopulation of the region.

RESULTS AND DISCUSSIONS

The effects of coal mining on the economic environment in VJ

The main roles of the mining activity in the socio-economic evolution of the Jiu Valley are:

- Solid fuel supply of the two thermal power plants, Mintia and Paroseni, which are part of the CEH, of other thermal power plants in the country, of the thermal power stations of the residential districts of some of the Jiu Valley settlements. Also, a relatively insignificant quantity is intended to supply the population using the hard coal as a heating source;
- The contributions of the mining entities to the own revenues of the budgets of the localities.

The contribution to the implementation of the local budget has been established taking into account the three categories of income from which a local budget is constituted, namely: direct taxes and duties, income tax deductions and levies from the state budget as well as donations and sponsorships. (Table 1)

Table 1

Contribution of mining to the local budget of the Jiu Valley

Value, lei / Localities	Period 2013÷2015, cumulate		Contribution of mining entities during years 2013÷2015, %	Contribution of mining entities in 2018 Estimate, %
	Contribution of mining entities , lei	Local budget, lei		
Petrila	9.108.047	127.776.347	7,13	1,93
Vulcan	2.962.703	84.644.461	3,50	2,19
Uricani	1.346.486	57.634.829	2,33	0,00
Petroşani	1.516.923	187.741.500	0,81	0,81
Lupeni	1.582.023	82.482.469	1,92	1,92
Aninoasa	0	-	-	-
Total	**16.516.182**	**540.279.606**	**3,06**	**1,71**

Table 3 summarizes the main indicators characterizing the coal mining in Jiu Valley in two of its crossing periods: 1990 and 2018.

Table 2

Synthesis of main indicators of the Jiu Valley mining

No.	Indicator	U.M.	Period	
			1990	2018
1.	The population of Jiu Valley	loc.	167.456	120.734
2.	Workers in the mining sector	no.	43.791	4659
3.	Mining perimeters in operation	no.	17	4
4.	Active preparation plants	no.	5	1
5.	Exploited strata	no.	12	3
6.	The mining production achieved	mil.t	10,5	1,3
7.	State investment in the mining sector	mil.lei	128,59	-
8.	Population below the poverty line	%	-	10,25
9.	Unemployment rate	%	-	1,26
10.	Contribution to the local budget	%	76	1,71

The social impact on the mining communities in Jiu Valley

Closure of the mines has led on one hand to a decrease in the income of the population of the Jiu Valley region, with restrictive consequences on the local economy, and, on the other hand to the decrease of local budget revenues.

The impact of the cessation of mineral resources exploitation on the standard of living of the population is manifested in several ways: the difficulty of finding a job according to professional training, the difficult access to basic services and the decrease of the government's financial support.

In the short term, when the process of economic diversification and re-employment chances are limited and fired employees in mining areas are experiencing a drastic change in their standards of living as a result of loss of income, a program of specific social protection measures could reduce the effect.

The impact on the standard of living is also felt by household access to basic services. In the areas affected by the drastic reduction of the mining activity there is a deterioration of the services in the field of education, health and utilities. Losses of qualified human resources

such as teachers and medical staff fundamentally affect the quality and availability of basic services. Local habits and traditions can also make it difficult to integrate other large-scale industrial activities.

Since all mines have a limited life span, and once they are closed down, with the disappearance of direct benefits from exploitation, communities are dealing also with the infrastructure issues which, for modernization, maintenance or even diminution, involve the allocation of financial resources. All these trends significantly change the cost - benefit balance at the community level and contribute to the rethinking of mine - community relationships.

A direct consequence of the massive redundancies started in the mid-1990s is the decrease in the number of inhabitants in the Jiu Valley from about 200,000 in 1989 to about 100,000 at present.

The rise in unemployment and the lack of alternative jobs for workers in the mining sector and related industries have been the causes of tensions and social conflicts that have in the past created a negative image of the area and a general misconception vis-à-vis the inhabitants from the Jiu Valley Basin. These aspects were able to keep away investors from the country and abroad so the economic recovery of the region has a slow rate.(STRETENIE, FAUR, MARCHIȘ, 2017)

Indicators of sustainable development

One of the most used tools for analyzing the situation of a region in terms of its integration within the concept of sustainable development of society is represented by the SWOT analysis (SÂRBU, MARCHIȘ, 2010).

In the following, the SWOT analysis of the coal mining resources in the Jiu Valley from the perspective of the cessation of extractive activities (modified after ME, 2017) is presented:

Strengths

- The existence of a concessioned exploitable reserve of more than 100 million tons, concentrated in a single deposit with a degree of insurance of about 60 years;
- existing infrastructure, both surface facilities and main opening mining works, that can be used on long-term for the actual extraction and for transport to the beneficiaries by rail;
- Territorial concentration of mining units in a relatively small area;
- The existence of qualified personnel in mining, tradition and professional expertise;
- contributing to national energy security in crisis situations compared to other resources;
- The relatively small distance from the beneficiaries;
- The existing environmental permits and operating licenses.

Weaknesses

- Difficult geological and mining conditions (depth, tectonic, stratigraphy, variability);
- High exploitation hazards due to the high methane content of the reservoir, with predisposition to self-ignition and explosions;
- Low calorific value compared to the international offer;
- Reduced degree of mechanization of exploitation, physically and morally used machinery;
- Difficulties in the selective exploitation of coal;
- reduced possibilities for significant improvement of the production quality with the current exploitation technology;
- Low competition in coal extraction;
- High production cost.

Opportunities

- maintaining a mining infrastructure appropriate to the domestic coal demand so as to ensure the continuity of production over a long period of time and the security of supply of energy resources;

- The possibility of implementing modern capture technologies of the methane from coal and methane emissions from the exploited fields;

- The degassing of coal.

Risks

- The increase in production costs, generated by the obligation to comply with environmental protection and health and safety conditions at work;

- High social vulnerability due to the mono-industrial character of the area;

- The dependence of hard coal production on the operation of a limited number of energy production capacities;

-Affecting environmental requirements and climate change.

CONCLUSIONS

As can be seen from the above, the situation currently faced by Jiu Valley is generated by a multitude of factors (both economic and political), both objective and subjective.

In any case, we believe that the current direction of Jiu Valley coal mining somehow inconsistent with the current mineral and energy strategies or the promises made by various "personalities" with different political orientations, on many occasions, is wrong.

On the one hand, closure of mines means basically the socio-economic sacrifice of the current generation, and on the other hand abandoned coal resources will be difficult to access and will involve very high costs for the future generations.

A second important conclusion is related to the division of the mining operations between viable and non-viable on the basis of at least dubious criteria.

Even if this division has been made on economic criteria, it cannot be considered as fair. It is enough to look at Western European countries (such as Germany or the United Kingdom) who included, in the process of closure of coal mines, criteria and indicators related to social protection (usually mining areas being mono-industrial), to local economy, and how education, health, and public utilities will evolve under the pressure from the possible closure of mines.

In fact, it is hard to believe that for a region (Jiu Valley) that has emerged, has practically developed because of the exploitation of coal for almost 200 years, mining can no longer be a solution for the future. At present, Jiu Valley needs jobs and the prosperity brought by mining, it needs a future built on the mining tradition.

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