

TERRITORIAL MANAGEMENT WITHIN THE SYSTEMS AFFECTED BY MINING. CASE STUDY THE SOUTH-WESTERN DEVELOPMENT REGION IN ROMANIA

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ABSTRACT

The study is a concise form of some present days researches within the Interdisciplinary Centre for Advanced Researches on Territorial Dynamics within the University of Bucharest, which had as main major objective to identify and to underline the instability from the natural environment, determined by coal exploitation, as well as to identify the efficient management systems in some areas located in the south-western part of Romania, Oltenia. Researches identified the major effects these economic activities have upon air pollution, slopes' dynamic, air and soil pollution. A special importance is given to the human component within territorial systems, as population is often dislodged to other localities and this phenomenon implies many social and economic consequences. One of the most important aggressions upon natural and built environment is that related to the landscape damage, following exploiting and processing rough material in order to obtain the final product, the coal. The direct impact of mining activities upon environment may be translated by a local biodiversity decrease, even if these coal mines are rehabilitated after they're closed. Therefore, an integrated approach is necessary and it must refer to the way of administering mines for long term, by common actions of all the implied factors (government, mining companies and the local communities). The scientific demarche of building the model of environment management in the areas affected by mining took into account the new European context, which represents a supra system imposing the strategic coordinates where the process of managing territorial instability takes place.

Key words: Territorial management; Natural instability; Pollution; Mining

INTRODUCTION

Besides certain economic advantages coal exploitation brings at local, regional or even national level, it produces major instability upon natural and built environments from the exploitation areas. In these conditions, it is necessary to have an integrated approach of institutional structures with responsibilities in managing instability. This approach should have in view the particularities of the affected territorial systems, too.

The researches from the South-Western Development Region identified the weak points of the global approach of the strategies of rearrangement of affected systems, which must take into account local needs and distinctiveness at local level.

The mines Law no. 85/2003, modified by Law no. 237/2004, establishes the legal coordinates of the way coal exploitation can be opened in Romania, in the conditions of the environment protection. The exploitation license can be obtained after an environment impact study and an environment

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review, as well as the environment recovery plan are done. The same norms establish the companies' obligation to present the technical program of the exploitation scrapping after the activity ceases. However, field researches identified major malfunctions related to the application of these norms. At the same time, the legislation stipulates for the recovery of surfaces directly affected by exploitations, being ignored the areas indirectly affected by coal exploitation (landslides, underground water pollution etc).

The responsible approach of environment problems is an important task of the decision factors, in the complex process of elaborating integrated development directions (Ianoş *et al.*, 2009; Alimohammadi *et al.*, 2005; Teodosiu, 2007; Gavrilesu, 2009a; Robu *et al.*, 2005; Robu and Macoveanu, 2009; Naghibi and Shirmohammadi, 2008; Naddafi *et al.*, 2006; Ranade, 2007). The elaboration of development strategies must avoid the concentration of economic activities in only one sector of economy, determining a series of economic vulnerabilities which may affect the interventions' amplitude of rehabilitation of the environment affected by exploitations (Bebbington *et al.*, 2008).

The impact of mining upon environment may be translated by a local biodiversity decrease, even if these mines are rehabilitated after they're closed. Therefore, an integrated approach is necessary and it must refer to the way of administering mines for long term, by common actions of the implied factors (mining companies, government and local communities). Consulting local communities has got a crucial importance within the mines rehabilitation process, as achievement the sustainable development objectives depends on this (Izanlo and Nasser, 2005; Bebbington and Bury, 2009; Gavrilesu, 2009b; Golmohammadi *et al.*, 2009).

One of the most important aggressions upon environment is that related to the landscape damage, following exploiting and processing rough material in order to get the final product, the coal.

A large part of the material resulted after exploitation is exposed as wastes/ dumps, occupying large land surfaces and showing a pronounced degradation in the aesthetic of the local landscape (Braghină *et al.*, 2010).

The adhesion to the European Union determined profound changes at the level of decisional processes distributed on classified scales, from supranational (European Commission, European Parliament) to local level, with the involvement of both governmental and private actors. The multi-level hierarchy of governing processes and of institutional structure became the governing model of community public policies. The actors taking part into the elaboration and implementing process of public policies are situated at different administrative levels, and the relationship between them is one of partnership and competition (Chiriac, 2009).

Once the integration process accentuates, it becomes more and more obvious this system of government through decisional levels, also named multi-level system, by means of which integrated countries transfer responsibilities to the superior supra-system. The process is accompanied by decentralization towards inferior decision levels, specific for each country (Pollack, 1994; Hooghe and Marks, 2001).

This territorial management institutional system may contribute to the transmission of innovations and good practices from superior level to local level, where complex strategies for attenuating the natural environment instability are necessary, and at the same time the particularization of interventions depending on the new territorial context of the affected territorial systems.

The more and more pronounced dynamic of the processes within territorial systems also determined multiple preoccupations, both of researchers and decision factors. Institutional mechanisms were re-thought, in order to be able to coordinate the restructuring of economic activities, which determine areas regeneration (Brenner, 2004; Makhelouf, 2009).

MATERIALS AND METHODS

The most important mining exploitations from Romania developed in the Development Region South-West Oltenia before 1990, in order to provide the energetic coal necessary for the national economy. This study aims to assess the impact of mining upon the components of the natural environment and to propose an integrated management system, able to produce

effects according to the standards imposed by the European Union.

The exploitation of brown coal from the South-West Development Region is coordinated by the National Society of Coal Oltenia SA Tg. Jiu, which coordinated the exploitation activity in 12 mining areas (nine pits and three underground exploitations) (Fig. 1).

The highest concentration of these mining activities is between the rivers Motru and Jiu, where the most important changes within natural ecosystems are registered.

The study followed the assessment of the quality of the main components of the natural environment from the territorial systems affected by coal exploitations. The analyses were based on the recordings done by the specialized institutions (environment county agencies) and on a series of specialized studies (Haneş, 2006; Bebbington and Williams, 2008; Sârbu *et al*, 1995; Vinke-de Kruijf *et al*, 2009; Jafarzadeh *et al*, 2004; Massoidi Nejad *et al*, 2007; Nabi Bidhendi *et al*, 2007; Krausz and Ciocan, 2006; Alamgir and Ahsan, 2007; Chaulya, 2003), which contributed to the contouring of the working methodologies. The analysis of the data provided by environment agencies and of the specialized studies was completed by numerous field researches in the most affected areas, situated between the rivers Motru and Jiu. A special attention was given to projects initiated up to present in order to attenuate the effects of coal exploitation, upon the way in which they contributed to the recovery of the affected systems. The results obtained were integrated in a management system able to implement the strategies of reducing the unbalance from the

territorial systems, according to the standards in the field of environment management: the Cycle of the European Environment Management System (EMAS) and the ISO Standard 14000. To these, the Convention regarding the assessment of the impact upon environment in cross-border context (Espoo, 25.02.1991, ratified by Law nr.22/2001) and the Convention regarding cross-border effects of industrial accidents (Helsinki -17.03.1992, ratified by Law nr. 92/18.03.2003) add.

The study insisted upon the effects of the pollution generated upon the population health by mining, as an important argument in building some efficient management systems (Bădulescu and Sârbu, 2006; Ciolea and Bociat, 2006; Karimi *et al*, 2005; Raihan and Alam, 2008).

The proposed management system is structured in such a manner that it should respect the EMAS objectives, which aim to contribute to the permanent development of the management system, by establishing and implementing the environment policies, the periodical assessment of the system's performances and the permanent information upon results of the public opinion.

RESULTS

The attenuation of territorial instability within areas with mine exploitations is possible by the adaptation of the institutional system to the new context offered by the integration in the European Union, where decisional impulses are given at the level of European Commission, from where they are assumed by national and regional mechanisms up to local level.

Table 1: Field surfaces affected by mining exploitations in the South-Western Development Region

The coalfield	The surface occupied (hectares) from the land fund				
	Total	from the land fund			
		Infield (ha)	(%)	Forest (ha)	(%)
Rovinari Coalfield	8932	7191	80,5	1741	19,5
Motru Coalfield	3789	2630	69,4	1159	30,6
Jilț Coalfield	2278	1766	77,5	512	22,5
Berbești Coalfield	1962	1492	76	470	24
Mehedinți Coalfield	614	337	54,9	277	45,1
TOTAL National Society of Brown Coal Oltenia	17575	13416	76,3	4159	23,7

Source: Spârchez Gh., 2009

Mining and the land use changes

The development of mining exploitations affects the environment by the landscape modifying, by the brutal intervention of coal pits in the ecosystems' natural processes and rhythms. From this reason, many countries raise the problem of limiting the activity of exploitation depending on the supporting capacity of the natural environment. During the entire period of coal exploitation in Oltenia there were occupied almost 18,000 hectares of land, out of which, after 1990, there were taken out from the economic circuit 3529 hectares, divided into 2515 hectares infield and 1014 hectares forest land (Fodor and Lazăr, 2006; Spârchez, 2009) (Table 1). The open cast coal exploitation profoundly influences environment factors and it requires big expenses in order to reestablish the ecological balance and to reintegrate the affected surfaces into the economic circuit (Fodor and Lazăr, 2006; Fodor, 2006).

The development of mining led to profound relief changes, to the occurrence of negative and positive forms. Also, geomechanical phenomena appeared: squeezes, landslides, qualitative and quantitative changes of the surface and underground waters, and the last but not the least, changes in the air quality. The materials which were uncovered and stored in the exterior and interior dumping sites suffered important pedological, agrochemical and biological changes, with persistent and obvious consequences following rearrangement, refertilization and recultivation of the surfaces free of technological loads (Fodor and Lazăr, 2006).

Restrictive elements are those elements generated by the relief conditions, in connection with other elements, for example hydro-geological elements. Therefore, for a large part of the surfaces situated in the affected sectors, with high fragmentation degrees, with pronounced slopes, especially from the hydrographic basin of the Jilt, erosion is a dominant process, reaching extreme values on the eastern general flanks of the Motru Valley or Jiu Valley.

An area strongly affected by mining is centred upon the Jiului Valley and its surroundings, where a few areas are representative for the natural environment instability: Tismana II, Rovinari Est, Roşia, Peşteana-Nord, Peşteana-Sud, Urdari,

namely those areas where surface exploitations introduced fundamental changes within natural ecosystems.

In the area of the coal exploitation Husnicioara Vest, there were deforestations on large surfaces, which determined the development of torrential organisms.

Taking into account that approximately 1/3 of the inland is affected by erosion processes and almost 5% by the water stagnation on low lands, an objective necessity is that of applying some complex measures of stabilising landslides and vertical erosion, the adjustment of some water courses (especially Motru, Jiu, Jilt, Şuşiţa), in order to prevent floods and avoid water stagnation.

The researchers from the area of the coal pits Roşiţa, Husnicioara Vest and Jilt highlighted major instability in the natural environment, during the monitored period, the slope processes expanding themselves very much. To the north of the coal pit Husnicioara Vest, the exploitation affected the heart of Negreşti village, where there can be noticed the depression of torrential valleys and the releasing of landslides which affect the village heart (Fig.2). In the area of this coal pit, there can be noticed a degradation of lands on large surfaces, by the forming of drips and ravines. The coal pit Husnicioara Vest presents four working levels (four technological lines), and the surface effectively drawn out from inland and forest circuit is of 304 hectares. In the case of this mining exploitation, the major impact upon the way of using lands was noticed, too. Changes were determined by the amplification of some slope processes of big importance, which drew large land surfaces out from the inland circuit. The subsidence phenomena, identified following field researches, may be caused by the closing of the hollows remained from the underground exploitation of useful mineral substances and by the altering of hydro-geological conditions, due to the applying of a forced and high intensity dewatering of the aquifer system within the area (Mohammadi, 2009). In the Motru basin, the subsidence phenomenon, determined by the underground exploitation of brown coal deposits, varies between 100 and 3500 mm, and only in isolated cases spectacular sinking appears, having values between 5000 and 6000 mm (Oncioiu,

1985; Whittaker and Reddish, 1993; Onica, 2001; Fodor, 2006). The subsidence process frequently appears in the area of mine exploitations, seriously affecting the integrity of the land at the surface and the infrastructure serving mine exploitations (Onica *et al.*, 2006).

The field researches from the area of mine exploitations from Mehedinti identified accentuated subsidences in the areas Gârdoaia and Zegujani.

Environmental pollution in the areas affected by mining processes

In order to avoid waters pollution, a series of hydro-technical works along main rivers were carried out. An important hydro technical work is the retention dam on the river Jiu, the deviation and regularization of the Jiu, by means of which there became possible to exploit the brown coal situated under the old river bed of the Jiu from the mining perimeters Cicani, Beterega, Roşia de Jiu, Gârla. The protection of the pits against floods was ensured, too. The deviation and regularization of the Jiu, initially executed only for protecting the pits Cicani, Beterega and Gârla was prolonged in the second stage up to Vlădueni level, on a length of 5800 metres, for the protection of the pit Roşia de Jiu, and presently the deviation is accomplished downstream Vlădueni level, in order to protect the pits Peşteana Nord and Sud, up to Cocoreni level.

Coal pits, being situated close one to another, have had even from the beginning a unitary conception of jointly solving surface arrangements. Therefore, in order to assemble equipments and other functions, a platform of equipment assembling and the common enclosure, situated between the two pits, there was built a common coal deposit, a common expedition and loading point etc. Moreover, there were done the necessary arrangements for the lines of sterile and coal bands, the access roads and the bands' maintenance etc.

In the area of the coal pits Peşteana Nord and Sud, there were executed a series of hydro technical works regarding deviations and rectifications of the river Jiu from Vladuleni level downstream the perimeter of the coal pit Peşteana Sud, Plopşoru level, as well as a series of channels (Plopului, Fântâni, Graurului Valleys), which collect and orient pluvial waters accumulated in the east hilly area, which borders the two coal pits' perimeter. In the area of Motru town, the river with the same name was embanked, between NR 67 (road bridge) and the release of Lupoia stream, as well as downstream the bridge (500 metres) for the protection of Meris enclosure. Also, the deviation and rectification of the same river upstream the town, to the locality Catunele was done, in order to facilitate the settlement of the dump of Lupoia coal pit.

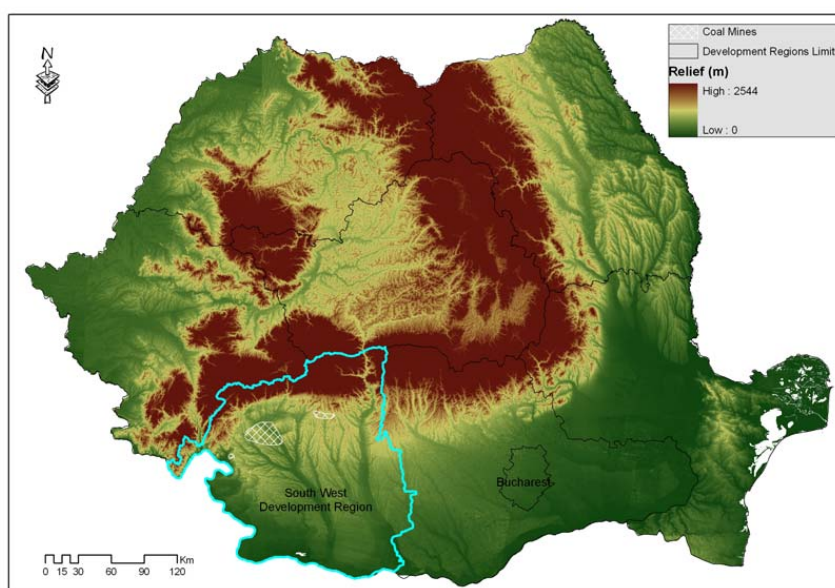


Fig.1: Mines and open pits in South-Western Region

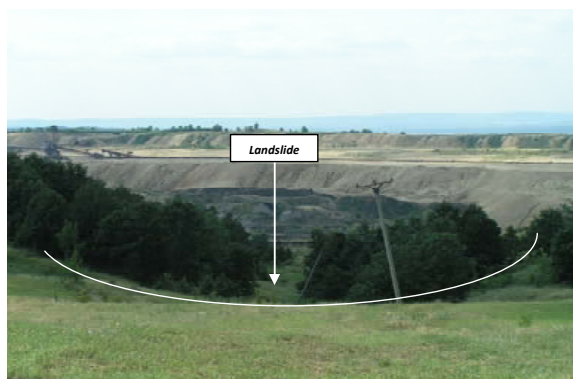


Fig.2: Landslide in the south of Negresti (to the north of Husnicioara Vest coal pit)

Data registered by the Agency for environment protection (AEP) Gorj underlines frequent overtaking of maximum allowed concentrations for indeterminate powders (Table 2).

Models of environmental risk management in the systems affected by mining

In the studied area there was noticed an inefficiency of the environment management system in the areas with mine exploitations, where mining companies are preoccupied with the recovery of the affected lands, ignoring large areas indirectly affected by mine exploitations.

The management model, briefly presented below, has in view the involvement of the human component from the affected systems, almost ignored at present.

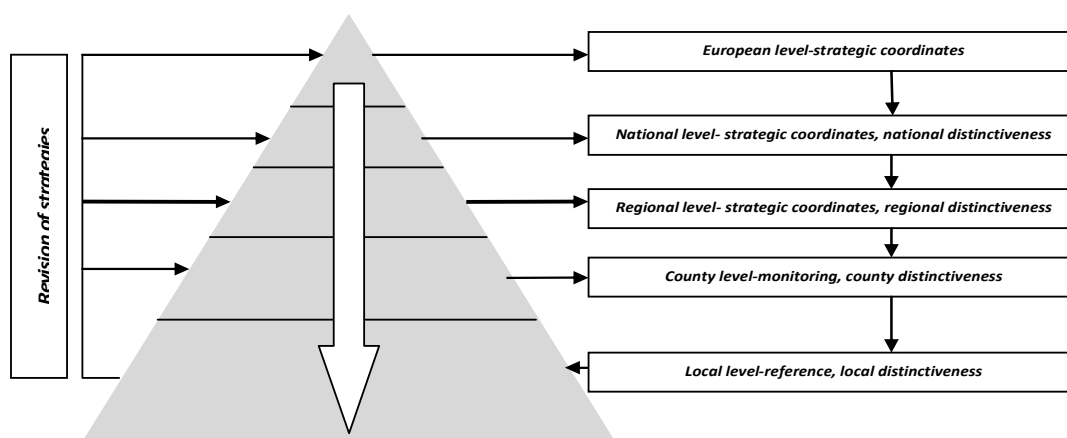


Fig.3: Macromodel of management

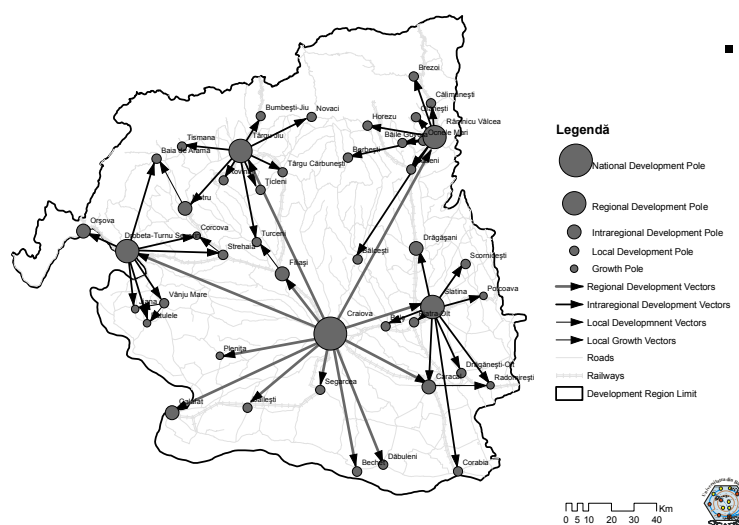


Fig.4: The South-Western Polycentric Network

Source: Peptenatu D., Pintilii R.D., Cepoiu L., Drăghici C., 2009, with amendments

The environment management in the systems affected by mine exploitations supposes the elaboration of some management systems, which can integrate themselves in a global vision coordinated at the supra-system level. The management models proposed for the systems affected by mine exploitations comprise two

strategic levels, the European level and the national level, where general directions of actions are established, and three executive levels: regional, county and local, each of them with a certain degree of distinctiveness in implementing management policies (Fig.3).

Table 2: Values of indeterminate powders in Gorj county

Recording point	Overtaking frequency of the maximum admissible concentration
Rovinari (max = 118.22 g/m ² /month)	63%
Turceni (max = 19.98 g/m ² / month)	2.8%
Rosiuta - Motru (max = 235.88 g/m ² / month)	80%
Matasari (max = 27.03 g/m ² / month)	50%
Jilt (max = 33.44 g/m ² / month)	24 %
Telesti (max = 19.79 g/m ² / month)	5.6 %
Timiseni (max = 66.64 g/m ² / month)	64 %
Plesa (max = 27.30 g/m ² / month)	33.3 %

Source: AEP Gorj., 2009

At each level, the model comprises institutional mechanisms which coordinate, at strategic or executive level, the implementation of territorial management strategies.

The European decision model comprises strategic coordinates of the management process of the territorial systems affected by mine exploitations. At European level, the principles of the environment management system and the performance standards in attenuating instability at natural ecosystems level are established

The national level is characterized by the specificities imposed by economic activities and the judicial framework of each country in the field of environment protection. In Romania, legislation stipulates the recovery of surfaces strictly affected by mine exploitations of mining companies. For the surfaces indirectly affected by mining activities, clear intervention methods are not included in legislation.

Regional level is presently contoured by setting, at the level of each development region, of some executive organisms of the Regional Development

Council, which by its competences of strategic planning contributes to the permanent development of the region. These regional structures which are at an incipient stage, manage by financial impulses the complex development state policy of the region, environment problems having an important weight. The regional decision level has a very important role, as it can correct efficiently the errors from the management systems applied at local level.

The county level, by means of environment agencies, represents today the main monitoring level of the environment state, and in the proposed model this function must be amplified by a proper institutional development. The proposed model includes the introducing of an institutional system based on development poles from the South-West Development Region, structures which can coordinate the implementing of management strategies and their correction by the dialogue with the decision factors from the local level.

The last decision level, the local level, is the main pole of debating the problems the territorial system confronts to. This decision level supposes the

involvement of all decision factors besides civil society, which by a permanent dialogue can impose and correct the impulses given to the system, in order to ensure durable development.

DISCUSSION

The risks management in the territorial systems affected by mining activities represents a complex process, determined by the scale of the imbalance resulted as a consequence of these decisional impulses.

The concentration of the economic activities and population in a time relatively short, determined major imbalances at the level of these territorial systems, the attenuation capacity of the others components being exceeded. In these conditions, the territorial systems models represent some usefull instruments in the decisional process, their efficiency being conditioned by the integration of some specificities of the affected systems. The efficient management of risks is conditioned by a double approach: the existence of an efficient institutional system and a quantification and a hierachy of environmental and social risks (Braghină et al., 2010; Ianoş et al., 2009, Karamouz et al., 2004; Khellaf and Zerdaoui, 2009; Mahvi et al., 2009; Ogwueleka, 2009).

Over time, there were elaborated many standards for the risks management, and in many cases being a sum of three important steps: identification, evaluation and treatment of the risks.

Romania's integration within the European Union supposes the adaptation to the European norms in the field of environment management, as management systems adopted individually by each state has proved to be inefficient.

The development of the multi-level model of environment management at the level of each state ensures the transmission of good practices from the supra system level to local level, and permanently improves these good practices and innovations which are stored up at the supra system level and then redistributed at inferior levels.

Applying this management model is indispensable for reducing the instability from natural environment, at present the management system for the systems affected by mine exploitations being unsynchronized with the European management system or with the local level.

In the South-Western Development Region the management model can be built on the structure of polycentric network (Peptenatu et al, 2009; Peptenatu et al, 2010; Humeau et al, 2010), projected in order to contribute to the reduction of territorial disparities (Fig.4). The institutional structure of environment management can be distributed at the polycentric network level, ensuring the necessary distinctiveness at the level of county structures affected by mine exploitations.

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