THE COMPLEX MECHANIZATION IN THE COAL MINING BASIN JIU VALLEY - AN APPROACH FROM THE PERSPECTIVE OF COSTS RELEVANCE IN THE DECISIONAL PROCESS

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Abstract: The decision making component has a privileged position within the architecture, operation and performances of the management system in the mining enterprise. On its level, in their different shapes, structured in relationship with ones or others of the criteria, the costs represents the main element, which lies on the basis of the management decisions. In order to correctly fundament many of the managing decisions, the costs provided through calculations is not sufficient. Due to its complexity, the managerial decision may require taking into account different other costs than the accountancy ones. Thus towards the management of the mining enterprise, it is manifested the requirement of an economic approach of the decisional situation, which supposes the ability of identifying and quantifying the costs that are relevant in the decision making process. This paperwork tries to demonstrate that these costs have been ignored in the decisions of complex mechanization within the underground face workings in the mining basin of Jiu Valley.

Key words: Mining enterprise, management, decision, cost, complex mechanization.

1. THE IMPORTANCE OF THE RELEVANT COSTS IN DECISIONS FUNDAMENTING

Almost every decision making situation suppose identifying and setting out the amount of certain costs, which the manager has to have in view when he proceeds to analyzing the decision alternatives are named relevant costs. Even if defining the relevant costs is a relatively simple process (the costs in relation with which the decision has to be made), their identification is not as easy. Each decision making has its own specificity, and the relevant costs in a certain situation may become irrelevant in a different one.

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To depict the aforementioned, we have a suggestive example. A mining enterprise has in its patrimony, a face cutter-loader shearer which has been used to exploit the coal from several face fields, being completely amortized from the accountancy point of view. Still, a technical analysis of the combined status shows this can be used more to extract the coal from another face field. If the cutter-loader shearer would be quashed, there would be different items still recoverable in a total amount of 50,000 RON. In these conditions, the costs of using the cutter-loader shearer to extract the coal within the new face field could be considered equal to zero? The answer to this question is an affirmative one only if we analyze the situation from a strictly account point of view (the cutter-loader shearer being completely quashed, the cost of its further using is equal to zero). From an economical point of view, the costs of further using the cutter-loader shearer is not equal to zero, but represents 50,000 RON, which is the value of the components that might be recovered today, but which won’t have any value anymore when the coal reserve in the new face field will be completely exhausted. This means that in the decision of the further using of the cutter-loader shearer or to dismantle it, the accountancy costs in the past has no relevance, relevant being only the cost of a future use of the cutter-loader shearer, which is equal to 50,000 RON.

Another example shapes even more clearly the concept of a relevant cost in the same time carrying out the connection to a different category of costs, having a special importance for the managerial decisions in the mining branch. A mining enterprise in the idea of beginning a new project, had acquired an entry driving machine, paying for it the amount of 400,000 RON. The project has been stopped and the entry driving machine has been left unused for four years. The tries to sell it failed and a market analysis for mining machinery showed that not even in the future are not foreseen prospective of finding a buyer. Opening the coal reserves in a new horizon can represent though a possibility of using the entry driving machine. In this situation the following question appears: which is the relevant cost for the entry driving machine? It is probable that an accountant will accurately calculate the amortizing rate and he will say this is the cost of using it. An advised manager shall though understand that using the entry driving machine generates a relevant cost equal to zero because, if the opportunity of using it does not occur then the entry driving machine will stay unused. The entry driving machine is integrant part of the mining enterprise patrimony. It was bought in the past, but it has an economic value only as much as it will be used in the future. The price paid to buy the machine represents a past cost, definitively supported, irrelevant for the decision of using or not the machine when alternatives lack.

The irrelevant costs in relation to the decision making alternatives are named “sunk” costs because they do not “play a role in determining the optimal course of action” [4]. These costs have been generated by past decisions and they cannot be influenced in the present times, regardless of the adopted decision alternatives. As a consequence, they “are not relevant to the future events, they can be ignored in decision making process” [2].

At least up to 1990, as far as we know, in the Romanian economy it had not
occurred the issue of identifying and analyzing such costs, so that the lack of an equivalent linguistic term consecrated to reflect the concept is justified. Afterwards, at least two reference paper works presented and exemplified this concept - named “hidden cost” [2], respectively “indifferent cost” [8]. The importance of these costs in decisions analysis is significant, but even in the US economy - from where the concept originates, it is mentioned a relatively high frequency of incorrectly dealing with them. The mining branch, through its activities specificity, offers many examples of “sunk” costs. In the mining enterprises patrimony a significant balance is contained by special constructions, represented mainly by mining constructions and various amenities and plants related to them. From a decisional point of view, all these actives represent past costs, definitively supported, “sunk” costs, irrelevant to many current and future decisions regarding a future exploitation of reserves. This means, for example, that a shaft that costed 1,000,000 RON has the value equal to zero if the reserve which was relied on is exhausted and by amortizing couldn’t recover anything. The shaft and many other mining constructions and installations, unlike to a universal lathe in the mine workshop, do not show any value of recovery or availability through re-selling, but only a usefulness value through the future profit fluxes, in the case of a efficient activity or, possibly by expenses savings, in the case of an activity that recovers it current exploitation costs and carry out something additional compared to this by selling the exploitation products.

This economic particularity of capital participation to the mining production is essential for a correct assessment of the mining enterprises patrimony in the decisions of beginning investments, starting or restricting activities, as well as in those related to re-investment for the purpose of maintaining activity or additional investment for the development of production capabilities. With all their simplicity, the showed examples may serve as a basis to assess the importance of the relevance aspects of the costs used in the decisional process. The issue of the costs relevance becomes straightly complex when it is coupled with the error calculations, having in view foundamenting of complex decisions, as the continuation or stopping coal exploitation activity within certain mining perimeters are, respectively those related to passing into a different stage of development in the exploitation unit.

2. THE COMPLEX MECHANIZATION IN THE COAL MINING BASIN OF JIU VALLEY

In the collective perception, at a national level, the coal mining had been associated with Jiu Valley. Hosting underground the biggest pit coal deposit in Romania, the area became “of interest” from an economic point of view only approximately 150 years ago. The underground exploitation of pit coal represented, through all this period, the main (and sometimes the only) factor of economic development for the entire region. After 1990, a long transition period (which hasn’t ended yet, in our opinion) led to transforming a mineral wealth (a special form of capital) in an element generating not welfare but rather economical problems with
serious incidences on a social level and even on an institutional one.

The first coal faces endowed with mechanized face roof supports had been commissioned at the Mine Exploitation Paroșeni, in 1970. The face roof supports that had been equipped these coal faces were of a soviet manufacture (OMKT sets), and the face cutter-loader shearsers were manufactured in Poland (KVB-3RDS type). These first tries did not give satisfactory results, and so another type of a roof support was required to be experimented. Importing was again the chosen method and the supporting elements HEMSCHEID type (German manufacturer) were employed together with a soviet cutter-loader shearer KS-3M. The first indigenous powered roof supports (SMA) were employed in the coal faces in 1978, together with the continuous importing of powered roof supports, HEMSCHEIDT, FAZOȘ (Poland) and KM-87 (U.R.S.S.). In order to exploit together some close strata (for example 17-18), to wholly exploit them (and not dividing them into slices) the strata with thicknesses between 3 and 5 m, but also out of the desire of increasing the slice thickness on the strata number 3, there had been promoted imports of mechanized roof supports for big heights of the coal face (KLOCKNER-BEKORIT and GLINIC), and as an indigenous construction was the powered roof support CMA-5H type. All the faces equipped with powered roof supports, including the ones manufactured in our country, used cutter-loader shearsers for narrow slices mainly imported: KVB-3RDS, KVB-3RDU (Polish manufacturer), KS-3M, 2KS-1KG, 2K-52, KS-68, 2K-52-MY, 2KS-3 (soviet manufacturer), EDW-170L (German manufacturer), AM 500 (British manufacturer).

The first mechanized complexes of roof supporting came into use in 1970 at E.M. Paroșeni, they had been used in strata no. 15 (with a slope of 10° and a mean thickness of 1.8 m, work efficiency in the coal face reaching then 7.2 tons per post). The powered roof supports HEMSCHEIDT (with the shearer KS-3M, respectively KVB-3RDS) had entered exploitation in 1976 and 1978 at E.M. Lupeni and in 1977 at E.M. Paroșeni. The ones in Lupeni had been used in strata 3 to slopes up to 8° and thicknesses of 3.5 m, work efficiency in the coal face reaching then values between 9.6 and 13.4 tons per post). The E.M. Paroșeni powered roof support was employed in strata 13 at slopes between 5° - 10° and thicknesses of 1.5 - 3.1 m, with a efficiency in the coal face of 7.4 tons per post. The last HEMSCHEIDT powered roof support (with a shearer EDV-170L) was employed in 1980 at E.M. Livezeni, in the strata 13 (at a slope of 15°, thickness of 1.8 m and a work efficiency of 4.9 tons per post). In year 1977 at E.M. Paroșeni had been employed another two powered roof supports: FAZOȘ + KVB-3RDS shearer, respectively KLOCKNER-BEKORIT + KS-3M shearer (both in strata 13, at slopes between 5°-10° and thicknesses between 1.5 and 3.1 m, with work efficiencies of 17.3 tons/post, respectively 7.4 tons/post). The FAZOȘ powered supports + KVB shearsers, respectively the KS1-KG shearer were employed in exploitation in 1978 at E.M. Lupeni (in strata 8-9, at a slope of up to 20° and thickness around 3.2 m, with a face work efficiency of 11.2 tons/post). At E.M. Uricani, a FAZOȘ powered support was inserted in strata 17-18 at slopes of 10°, thicknesses of 3.5 m and a work efficiency of only 5.3 tons/post. The KM-87E powered supports, respectively KM-87DM, with 2K-53 shearsers were employed in 1977 at E.M. Vulcan
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(in strata 18 with slopes of 5° - 8° and thicknesses of 1.6 - 1.8 m with a work efficiency of 7.22 tons/post), respectively at E.M. Petrala in year 1978 (strata 13, with slopes of 30° - 40° and thicknesses of 1 - 1.6 m with a work efficiency of 5.3 tons/post). A KM-87LI powered roof support with a 2K-52 shearer was employed at E.M. Uricani in 1979 in strata 15 (slope of 10° and thickness of 1.8 m) with a work efficiency of only 6.5 tons/post). At E. M. Uricani also were employed another two powered roof supports KM87-DN with 2K-52 shearers in strata 18, at 10° slope and 1.8 m thickness, but with low results (3.67, respectively 4.47 tons/post). The indigenous powered roof supports SMA-2 type were employed in underground starting from January 1978 (at E.M. Lupeni in strata 3 at slopes of 6° - 10° and thicknesses of between 3 and 3.5 m with a work efficiency of 10.3 tons/post). Another ten SMA-2 powered roof supports were employed at E.M. Livezeni (1980, 1982, 1983), E.M. Petrala (1980 and 1981), E.M. Lupeni (1980) and E.M. Paroșeni (1980 and 1981), in strata 3, 5 and 18. The best results using SMA-2 were obtained at E.M. Lupeni (strata 3, slope 8°, thickness 3.5 m, face efficiency 17.23 tons/post), and the lowest results at E.M. Livezeni (strata 5, slope 13°, thickness 2.8 m, efficiency 3.5 tons/post). An ASCIM type of powered roof support designed for high slopes was experimented at E.M. Petrala, year 1984 (in strata 4, slope 60°, thickness 1.4 m, efficiency 9.7 tons/post). The first indigenous type of powered support CMA-5H, with a KŚ-3M type of shearer was employed at E.M. Lupeni, in year 1984 (strata 3, slope 10°-14°, thickness 2.5-4 m, efficiency 13.55 tons/post). The same type of powered roof support was employed in 1985 at E.M. Paroșeni, with a KWB-3RDU shearer (in strata 5, slope 10°, slope 5.8 m, efficiency 19.2 tons/post).

The most accented decline of the pit coal exploitation recorded after 1990 marked in the most straightforward way, the output extracted from the coal faces endowed with powered roof supports. The majority of the powered roof supports and shearsers that operated after 1990 were the ones acquired in the previous period. The powered roof supports acquired before 1990 were repaired or partially completed with spare parts of indigenous manufacture. The performances of these powered roof supports were in a continuous decline, so as their use became inefficient. As consequence, it was decided to remove them from the underground, at E.M. Uricani and E.M. Vulcan.

Between 1970 and 1989, in the mining basin of Jiu Valley were employed 55 powered roof supports. The efforts of mechanizing the underground were oriented towards the most important strata of the basin, strata number 3 (where 17 powered roof supports worked) taking also into account the less thicker strata (9 powered roof supports were employed in strata 13, 6 roof supports in strata 15; 12 powered roof supports were inserted in strata 17-18). In strata 5 (second as importance in this basin) operated 9 powered roof supports. In the figure number 1 is presented the distribution of the efforts of the complex mechanization on coal strata.

The central and western area of the basin offered favorable conditions for using the powered roof supports. In this way, 15 powered roof supports were employed in the coal field of Lupeni, 10 in the coal field of Paroșeni, 10 in the coal field of
Livezeni, 8 in the coal field of Uricani, 5 in the coal field of Vulcan, 5 in the coal field of Petrila and 2 in the coal field of Valea de Brazi. In the figure number 2 is presented the distribution of the efforts of the complex mechanization on mining fields.

![Figure 1](image1.png)

**Fig. 1.** Distribution of the efforts of the complex mechanization on coal strata

![Figure 2](image2.png)

**Fig. 2.** Distribution of the efforts of the complex mechanization on mining fields

As far as concerning the thickness of coal strata (or slices exploited) where the powered roof supports worked, it must be underlined the relatively big number of powered supports inserted into strata with lesser thicknesses than 2 m (13 powered supports). In the figure number 3 is presented the distribution of the efforts of the complex mechanization related to coal strata thickness.

As previously shown, the first two powered supports were commissioned in 1970 and the third only in 1976. Year 1977 marks the debut of a rapid process of employing the powered supports into the coal mines in Jiu Valley. So, 6 powered supports were employed in 1977, 4 powered supports in 1978, 3 powered supports in 1979, 10 powered supports in 1980, 4 powered supports in 1981, 5 powered supports in 1982. Between 1983-1986 were employed in underground only 9 powered supports,
but in 1987 were commissioned another 8. In the figure number 4 is presented the efforts of complex mechanization in time.

![Fig. 3. Distribution of the efforts of the complex mechanization related to coal strata thickness](image)

![Fig. 4. Distribution of the efforts of the complex mechanization in time](image)

The big number of powered supports employed in underground in a relatively short period of time (50 powered supports in only 13 years) could induce the idea of a true “explosion” of coal output at the general basin level. In reality things were different. The causes, of a geological, technological and managing nature of this state of facts are reflected into the periods when these powered supports were used, and respectively the work efficiency obtained in the coal face. So, 15 powered roof supports were used for a period shorter than one year (the KM-87E powered roof support equipped with a 2K-52 shearer, employed at E.M. Vulcan worked only for 3 months), 17 powered roof supports worked for 1-2 years, 5 powered roof supports worked for 2-3 years and only 7 powered roof supports worked for more than 5 years.
Taking into account the speeds of face advancing at a general basin level and the mean values of the face fields lengths, results that more than half of the powered roof supports employed in the Jiu Valley mines served to exploit a single face field (without being recycled not even once). In the figure number 5 is presented the duration in operation of the powered roof supports.

![Duration in operation of the powered roof supports](image)

**Fig. 5.** Duration in operation of the powered roof supports

As far as concerning the efficiencies obtained, these are situated much lower than the ones attained on a world level (regarding this aspect, the particular specific conditions of the deposit must be taken into account). So, 7 powered roof supports recorded efficiencies lower than 5 tons/post (the KM 87 DN powered roof support, employed in 1980 at E.M. Uricani recorded an efficiency of only 3.67 tons/post), 17 powered roof supports recorded efficiencies situated between 5 and 7.5 tons/post, and only for 16 powered roof supports the efficiencies were above 10 tons/post. In the figure 6 is presented the efficiencies of the powered roof supports.

![Efficiencies of the powered roof supports](image)

**Fig. 6.** Efficiencies of the powered roof supports
3. CONCLUSIONS

The period 1975-1989 records at the level of the entire Jiu Valley basin, a “forcing” to increase the mine workings network. In parallel to complex mechanization, at every mining field level, there had been made efforts to extend the workings network in underground (having in view the purpose to ensure a basis of open and prepared reserves for exploitation phase). In the conditions of a socialist type of organization in the mining production (a continuous activity, 365 working days) and of neglecting the economic aspects, still, between planning and output there had been significant differences. As a direct consequence, the amount of open reserves was decreased and from here arises the unfavorable influence over the coal output dynamic (which did not increase in a significant manner). Unfulfilling the scheduled volume of opening workings led to delays also regarding the preparing works (which contour the coal faces, the places where the coal is actually exploited).

Starting with 1990, the restrictions regarding coal output started to get diluted. In a practical way, there has been no more a coherent and consequent investment policy. The principle of effort focusing was not respected anymore, and the result consisted in an accented dispersion of the funding (diminished day by day) allocated to maintaining and development of the mining workings network.

The present paperwork did not aim to demonstrate the success or failure of the complex mechanization process in pit coal exploitation in Jiu Valley. Those above presented suggest though that a research oriented towards the economical efficiency of mechanization could lead to interesting conclusions (at least from a point of view of the evolutions in the production costs structure). Related to this paperwork, the complex mechanization shows importance from a perspective of using the production factor “capital” connected to the effects on the coal output. During 1948-1969, without making use of the powered roof supports (but by opening or re-opening of six mining fields: Uricani, Paroşeni, Bărbăteni, Livezeni, Dâlja, Vulcan), the coal output in Jiu Valley increased from 1,813,269 tons to 7,260,635 tons (increased over 4 times). In the period 1970-1989, employing in underground exploitation 55 powered roof supports and opening another 3 new mining fields (Valea de Brazi, Câmpu lui Neag, Petrila Sud), the coal output increased to 10,720,928 tons (the largest output in Jiu Valley basin, attained in 1989). Concluding, the complex mechanization process generated an annual increase of production of approximately 3,000,000 tons. Taking into account the efforts supposed by the complex mechanization process (by assimilation with the mining component, assessed as approx. 7,500,000 USD, of the last big project in Jiu Valley the ITOCHU-KOPEX project) and the results of a previous analysis (regarding duration of operation and the productivities obtained by using the powered roof support), the conclusion imposed is an obvious one: for the decision of a complex mechanization of pit coal exploitation in Jiu Valley, the capital costs generated by the acquiring or manufacturing powered roof supports had been irrelevant. Even if the economic studies showed for each specific case the economic efficiency and
feasibility, all the data regarding operation and results obtained by using the powered roof supports strengthen the previous conclusion: the decision or a complex mechanization had been founded considering as relevant different criteria than the ones regarding the economic efficiency of the invested capital.

REFERENCES