

TYPES OF DECISIONS BASED ON MULTI-CRITERIA ANALYSIS APPLICABLE TO EXTRACTIVE INDUSTRY. THEORETICAL APPROACHES

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ABSTRACT: *In order to ensure the competitiveness, the innovation and the jobs in the industrial sector it is crucial to solve the problems concerning the secure, reliable and constant access to raw materials. In a world characterized by an able legislation, the resources' efficiency on the global economy might motivate the industrial competitiveness and reach the environment objectives of every country. Access and sustainable management of raw materials, requires the adoption/optimization of some decisions based on multicriteria analysis of situations considered. Due to the diversity and complexity of decision problems that are going to solve by the managers in the extraction, preparation, storage and transportation unit of extractive industry, the paper presents a systematization of them according to certain criteria or elements.*

KEY WORDS: *extractive industry; decisions; multi-criteria analysis.*

JEL CLASSIFICATION: *L16, L71, M11, M12, M51.*

1. THE TYPOLOGY OF DECISIONS IN THE MINING INDUSTRY

Any company or organization can be defined as a system with three major components: inputs, processes and output processing. They permanently transform the material, financial, informational and human resources, which are combined according to the interests and priorities of the company and are found in shape of multiple forms output. But what moves this system are the *management decisions*.

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The decision may be defined as a rational process of choosing a solution, a line of action from various possibilities, in order to reach a particular result (Fundătură, 1992).

Decision may be regarded as a specific human rational choosing process; it is found in all management functions, is the final act in setting the objective or objectives undertaken by manager and is an act of drawing, combination and allocation of various resources in the production process. However, the integration of economic unity in the environment depends on the quality of decisions.

Herbert Simon, Nobel laureate in Economics, shows that "decision-making and management can be considered one and the same. Therefore, decisions are the essence of both marketing management and human resources management".

Activity across business units operating under the influence of events of diverse nature and frequency are not all decision problems, some cases required to be solved in a certain way.

For an event to become a "decision problem" must fulfill the basic condition "to be able to obtain the same result in several ways, with different characteristics."

The emergence of decision problems in the economic units in general and the mining industry in particular is generated by at least two situations:

- where disturbances have created an imbalance between operational and functional subsystem with negative implications on the objectives and functioning of the system is required to restore default settings (for example, blocking one of the pistons from the coal extraction combine and creating impossible situation in front of their submission of coal);
- where there is balance between the two subsystems on the proposed objectives, but the manager wants to achieve superior performance.

The diversity and complexity of decision problems to be solved by managers from mining units of extraction, preparation, storage and transport require systematization according to certain criteria or elements.

According to economic theory (the acceptance of Igor Anseff) decisions are grouped into three broad categories: operational decisions (current), tactical decisions and strategic decisions. An approach from two angles is necessary in the analysis of the decision of any company and therefore a unit of the mining industry:

- *the economic unit in itself is a system* with components and specific relationship of interdependence between them;
- *the company in turn is a part* of the general economic system in which there is mutual conditioning relations with other firms.

Therefore, specific decisions at the level of mining companies should be analyzed both internally and externally.

Regarding the *decisions inside the firm*, they can be classified into:

- *the production decision* or the technical decision, which circumscribe, in fact, an entire decision-making system with the components:
 - decision on *the structure* of minerals extracted (to be achieved over a certain period of time);
 - decision on *the amount* that will be extracted from each type of mineral resource;

- decision on *the quality* of the chemical breakdown of minerals extracted and the total volume of extraction in different quality categories.
- *the decision inputs* has the components:
 - the decisions related to *material inputs*:
 - a *quantitative and qualitative* determination of the level of each machine/equipment in hand, that the company must supply with on a certain period. This decision is directly subject to the production decision;
 - an interval setting to be supplied with the necessary materials.
 - the decisions on company staff:
 - determining *the number of employees* of the company on various professional categories, age, experience, qualifications and training;
 - the decision on *the wage policy* of the company, including payroll issues and forms of rewarding the amount and quality of work performed by the staff, risk factors that the employees are subjected to in the production process;
 - the decision on socio-professional and inter-human relations: health insurance and health care, safety, psycho-sociological climate in company departments, programs and professional education, protection of employees' family members.
- *the business decision* circumscribe the price fixing for company products, activity that includes both aspects from within the company (cost of raw materials, materials and technologies used, depreciation, labour productivity and wages) and aspects concerning the market for these products (type of market, mechanisms to regulate demand/supply ratio, the quality of products on the market).
- *the financial decision* can be in turn decomposed into the following segments:
 - the decision on *funding sources* for the company's business activity for different periods (short, medium and long);
 - *the investment decision*, the decision on the use of the financial funds for investment;
 - the relative decision to *the time of use* for the company's funds, that is the distribution for present and future consumption.

Since the firm does not act alone in the general economic system, it must always take decisions that guides its work in relation to and in harmony both with their own objectives and the mode of action (behaviour) of other similar companies or those with whom it enters into collaborative relationships (suppliers, customers, banks).

Essentially, these decisions are:

- the decision on *consumers segment* which the company's products address to, namely the identification of its customers (traditional, new and potential);
- the decision on *the bank* through which it ensures the financial flows, as well as on the funding policy by borrowing on capital markets;
- *the insurance decision* of the building, equipment, personnel, patents and patent for operation and processing;
- the establishment of *suppliers* for machinery and raw materials needed in the processing activity and of partners for joint projects;

- the decision on *relations with other firms* in the market: cooperation or mergers with other companies, conquering new market segments, entering new markets, setting up new branches in different parts of the country and abroad.

All the decisions of the company in solving problems naturally bear the mark for the time horizon considered, i.e. the time dimension of the effects of decisions. From this point of view, any unit in the mining industry can take the following categories of decisions:

- *short-term decisions* that can be production decisions, decisions regarding the provision of material resources, or components of decision on staff;
- *medium-term decisions*: which fall within the financial decision, the distribution of dividends, bank borrowing, investment decision for retrofitting;
- *long-term decisions* include: firm profiling; decision on the ownership and organization of the company; change of possession stakes; the decision on expansion or growth in specific markets or new markets; the decision on the location of branches in areas considered strategic; the decision to merge with other companies or to participate in the formation of cartels.

Because the underground or surface mining sites and the oil or natural gas exploitations are complex socio-economic units, *strategic decisions* are required in order to conduct their work efficiently. These are at the interface between the system/company and its business environment and consist of managing this interface/relationship, because different levels of company are becoming increasingly unstable and changing. Strategic decisions are for long term company management.

Choosing a strategy is always a single decision. These decisions concerning the future are always taken based on internal and external information, quantitative and qualitative, regarding the outcome or an assumed and uncertain future.

In the strategic decision-making processes of the mining unit, managers have to solve three fundamental problems:

- to define the activities of the unit or reorientation of its activities;
- to set up a technical system to make operational the problem entrepreneurial, i.e. the selection of a production technology and a system of products and services distribution, communication and control for this technology to function well;
- an administrative one, that defines the structures needed and the processes that allow the proper functioning of the unit, including in terms of future development opportunities.

Modelling strategic decision processes is to identify the items to be taken into account in decision-making processes within firms and to present the sequence of steps to be taken by the successful application of these models. Although, in general, the variables involved are the same, the authors' private view individualizes them. Among the most recognized models can be mentioned: The Serge Oreal model, Alain Descremaux model, model of Joseph Carles, Gerard Konig model, model Ovidiu Nicolescu, etc.

In his book "75 of the Best Decisions Ever and 21 of the Worst" Stuart Crainer presents in a new way the problem of decision-making and in particular the decision-making strategic processes. The author claims that: "Really important decisions just happen. They occur as a result of spontaneous phones, crazy ideas born of desperation, a visionary plan within company midst. Even the greatest experts on strategy are too willing to recognize that any strategy can be fatally brushed away by reality's hazards."

Referring to strategic management, Crainer underlines one of the great shortcomings of theories that define it, namely the huge volume of data and information to be processed and taken into account to substantiate a strategy.

Another aspect of decision theory points out that an efficient process of decision-making involves a series of logical steps. Known as "rational decision making model" or "synoptic model", it involves several stages: identifying the problem; clarifying it; prioritizing goals; generating and evaluating options; comparing the results expected for each operation with the goals set; selecting the option that best fits the goals.

Therefore, in extractive industry, strategic decisions, which can be both decisions marketing and decisions on human resources, aim for the long-term organizational development. They include investment decisions, information management, supply management, planning and organization of production and in fact a large part of all decisions ever.

Following the implementation of the mining sector strategy, the subsequent effects are mainly expected:

- operation of the mining sector in Romania on the principle of free market in condition with efficiency, safety for local communities, protection of the natural environment and sustainable recovery;
- control of subsidies in the coal mining activities, under Regulation (EC) 1407/2002 of the European Commission;
- privatization of the coal pits in the organizational form of companies or companies with integrated power plant;
- providing enough coal for the domestic energy sector to achieve a 36% in Romania's energy balance;
- supplying enough nuclear fuel from domestic production for units 1 and 2 of the Cernavoda Nuclear Power Plant to ensure the achievement of 15% in Romania's energy balance;
- ensuring the priority of providing fuel for heating plants;
- carrying out mining operations for solid mineral exploitation in environmental conditions, in accordance with the law;
- sustainable use of natural resources by integrating environmental protection and nature conservation in sectorial policies. This integration is particularly important in areas such as land use, rural development, sustainable use of water resources, waste management and environmental safety, as well as regional development and planning of human settlements;
- closing activity on unprofitable mines, in accordance with programs developed by each company/mining company;

- promoting a coherent process of closing the mines, in terms of informing and attracting local communities in the process;
- establishing a monitoring system able to report the environmental impacts that occur and to detect and report on time the dangers that can appear, in a form able to pass an effective program of planning and response in emergency situations;
- ensuring social protection for almost 32,200 people, representing redundant employees from 2004 to 2008, and those who are to be made available in 2009-2012;
- promoting a transparent process of closing the mines, in terms of informing and attracting local communities in the process;
- creation of about 56,000 medium-term jobs, including 23,000 limited-term (2-3 years), representing specific occupations in infrastructure works;
- developing an attractive business environment for domestic and foreign investors;
- developing a private sector in mining areas, capable to absorb the available local labour force;
- establishment of an attractive environment for expansion of tourism activities, where the area is suitable;
- adapting education systems to the new demands of businesses and activities that are to be developed in the region;
- ensuring active social assistance to the most disadvantaged groups represented by children without means of subsistence, low-income elderly persons, aged persons with unattractive professions for the new activities in development, and people with disabilities.

In the mining units, *tactical decisions* are frequently adopted which relates to a period of one year. This group of decisions is meant to translate into practice the strategy adopted by the economic unit, integrated into the annual, quarterly or monthly plan.

The present decisions are another category of decisions that resolve everyday problems that arise in specific activity of the economic unity. These are to be found in a greater frequency with the decision-makers at the bottom of the hierarchy. Their frequency decreases towards the top of the hierarchical pyramid, being replaced by the tactical and strategic decisions.

Depending on the nature of the problems to be solved, decisions can be grouped into the following categories:

- *economic decisions* include issues regarding the use of unit resources, such as labour utilization and ensuring increased productivity, streamline costs and the costs of production, income level etc.;
- *technical decisions* concerning measures on the introduction of modern production technologies, retooling and modernization of equipment etc.;

- *organizational decisions* include: the organization of labour, the distribution for means of work in the organizational subdivisions etc.;
- *social decisions* include: labour recruitment and other aspects of workers motivation and training at the economic unit.

According to the specific activities covered, there can be: operational, design and foresight decisions.

Operational decisions are about specific activities in order to achieve programmed objectives, have a high frequency, refer to a period less than one year and are taken at lower hierarchical levels of the unit.

Design decisions and foresight decisions include the management of the economic unit's development such as: profiling and specialization, introduction of new production technologies, the development of mechanical tools, etc..

Depending on the frequency of adoption there are: *single decisions* and *repetitive decisions*.

Single decisions include activities that occur accidentally. Their elaboration and adoption raise a number of difficulties for the planners related to the information support, experience gained in such situations, assessing the consequences etc. This decision is adopted more frequently in the mining industry than in other sectors due to its specific environment (unexpected infiltration of water or hydrocarbons in a salt mine, crossing isolated lithologic formations when advancing in the frontage of the coal/ores mines, increased temperature in ore mines, etc.).

Repetitive decisions concern the problems with almost cyclical frequency. With a rhythmic frequency, this requires a certain repetition of phenomena, either on the same plane and at the same time or on a higher plane or at a time larger. However, by adopting these decisions some experience can be gained, since information is usually more complete, raising fewer problems when evaluating the consequences. Nevertheless, policymakers should consider with great competence the variations and consequences of putting them into practice.

Decisions can also be grouped depending on the number of people participating in their development. Therefore, there can be:

- *individual decisions* derive from the group ones and provide increased efficiency of management activities;
- *group (collective) decisions* are taken by bodies in existing management units.

They are the result of opinions of the group's components, are complex and usually determine a series of individual decisions which are designed to materialize in practice.

Decisions can be grouped after *the degree of information on the occurrence of certain events* into: decisions under certainty, under risk and under uncertainty. These types of decisions are some of the forms commonly adopted in underground or surface mining units, in preparation stations or storage areas.

Any decision has elements of certainty and uncertainty given the specific activity in the mining industry. The problems are different from case to case, depending on the degree of uncertainty likely to happen.

Universes or contexts, in which the decisions are placed, can be grouped into four categories based on classification of the forms of uncertainty:

- safe universes in which case it is assumed that each action alternative corresponds to a single result, which is perfectly known by decision maker;
- random universes, in which the consequences of decisions taken into account are estimated to depend on a series of random events;
- undetermined universes, when the uncertainty is generated by the fact that the effects of intended actions depend on events over which there is no information;
- antagonistic universes specific to market economy with a high level of competition.

Smooth and consistent conduct of activities and exchange processes implies the existence of administration and management activities that are coordinated by marketing management. The decision, as an essential element of marketing management, is considered the most important tool of expression.

"Marketing is a distinct and unique business operation. A firm is different from all other human organizations in that it promotes and sells a product or a service," says Peter Drucker (Crainer, 2002).

In general, it is estimated that achieving proper management of all marketing functions, depends largely on the quality of decisions, the merits of their substantiation. Appropriate decisions by which to achieve the scientific management of marketing activity, is the result of a complex process and involves overcoming certain difficulties. Many of these decisions have a unique character, in that decision makers don't have any "historical" data, which to use in fundament with the help of the statistical methods.

Moreover marketing phenomena and processes are extremely complex, therefore solutions are more difficult than in other areas of decision-making belonging to the enterprise. The complexity of these decisions is amplified by the fact that this type of decisions, exercising an important influence on the achievement of organizational objectives, are often made under uncertainty of the results.

The decisions in the marketing of extractive product can be grouped after the nature of followed objectives into:

- *strategic* which have the character of framework decisions and are aiming at screening the way for reaching the set marketing basic objectives and the line of action that the company has settled it to follow it towards them;
- *operational tactic*, which have the character of derived decisions and target the concrete means the company will act through to accomplish the marketing objectives subordinated to the fundamental objectives.

Decisions are distinguished depending on the methodology for developing and adopting into: recurrent decisions (which are taken with a certain frequency, after a well-defined routine for their implementation) and non-recurrent decisions (they have a character of novelty, unique and are carried out in a specific way in each situation).

The systematization of decisions according to certain criteria has of particular importance because, according to their nature, there are established: the volume and the structure of information; the methods of data analyzing and developing the decisional alternatives; the system of indicators and parameters for assessing the consequences etc.

Establishing the systematization criteria and classifying the decisions in certain groups is a complex problem caused by the multiple effects it produces when putting it into practice. For example, a decision to purchase and to operate a machine more powerful than the existing ones in a mining unit can be placed in the "technical decision" group, but by operating that machine there can be economic effects obtained materialized in physical production growth, product quality, reducing specific consumption, labour productivity growth, etc., influencing the expression indicators of the economic efficiency of the products obtained.

There can also be social effects when exploiting the machine in question, especially if it is obtained through a complex technology involving worker retraining or if has some ergonomic qualities, simplifying maintenance and repair may lead to the need to resize unit staff.

Therefore, one can say that the vast majority of decisions in an economic mining unit have a triple dimensionality: technical, economic and social.

A brilliant decision in terms of human resources management was that of 1956, when General Electric founded a centre for training managers at Crotonville, New York. General Electric Leadership thus decided to invest in people. This investment was huge in view of the costs it required the establishment of a school of managers and the costs to effectively conduct the training. However, it was necessary as training people was absolutely necessary for the survival of the company in the future.

The technique and the modern technology, their constant improvement within each company, produce significant changes in the nature and the scope of the work. Applying science and technology is indisputably linked today more than ever to better use of labour resources. Professional training and its improvement are today the essential conditions of modern production. The continuous professional training must be a constant concern of all companies and employees. It allows maintaining a high standard of professional competence, acquiring new skills which lead to a higher appreciation of the work submitted by each person and of course increasing the reward obtained. The improvement in professional training has a beneficial effect on both the company and the individual.

All these innovative decisions have led to a new vision on the employee: the machine completes the employee by increasing the effects of his skills and therefore he is considered a unique resource it has to be developed. Thus, the tasks should be grouped requiring multiple skills to achieve. Job design should take into account both people's needs and technical requirements.

The decisions that take into account the human resource are very important for the performance of the organization. When taking decisions on the human resource, the employees' needs of all kinds should be considered, because only through proper motivation can increase the performance. You also need to consider workforce training

as an important step towards improving quality and productivity. A good manager should, through a process of decision-making, succeed in driving people to do whatever is necessary to achieve the goals of the organization.

REFERENCES:

- [1]. Crainer, S. (2002), *75 of the Best Decisions Ever and 21 of the Worst*, Editura Teora
- [2]. Fundătură, D. (1992) *Dicționar de management*, Editura Diacon Coressi, București
- [3]. (2010) *Romania's Reindustrialization: Policies and Strategies*, conducted by the Group of Applied Economics – GEA –, www.gea.org.ro
- [4]. *Manual Mine Closure and Mining Strategy for the Period 2008-2020*, www.minind.ro
- [5]. *Report on State of the Environment in Romania*, www.anpm.ro
- [6]. *Gas Law* no.351/14.07.2004, www.minind.ro
- [7]. *Mining Law* no.5/18.03.2003, www.minind.ro