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# INNOVATIVE SOLUTIONS FOR ASSESSMENT THE MOTIVATION OF EMPLOYEES IN THE MINING COMPANIES[\*\*\*\*]

## Abstract

*Today in the modern business of the mining companies, the management puts emphasis on assessment the motivation of employees. Motivation of employees is a precondition for the successful operation of the company. This paper is aimed to present an innovative solution applying the multi-criteria method (MCDM) for assessment the motivation of employees in the mining companies. The obtained results show that the most effective is the theory of motivation for implementation in mining companies. Innovative solution as an auxiliary tool gives managers a complete view for assessment the motivation of employees in mining companies in order to increase profits.*

*Keywords: Motivation, multi-criteria methods, mining companies*

## 1 INTRODUCTION

In the modern business of mining companies, the motivation of employees is gaining more and more. The word motivation among employees is their driving agent, their inner strength giving them the strength to achieve their goals and needs. In order to successfully manage of the mining company, the company's management must find an optimal combination of material and non-material incentives for motivation of the employees.

The key to the sustainable organizational success and survival of a company lies not only in practical, quantitative approaches, but also in the commitment of employees to motivate them to work [1].

The paper assesses the motivation of employees by the Analytical Hierarchical Process (AHP). As the offered solutions for assessment the most effective alternative, the following motivation theories were used: the expectation theory, the justice/equality theory, the integrative theory and the goal setting theory.

The motivation theories are assessed by the following criteria: criterion C1 - salary, criterion $C_2$ - rewarding of employees, criterion C3 - Benefits and criterion C4 - gratitude for the work done.

Multi-criteria methods (MCDM) are used by managers or decision makers as the auxiliary tools in solving the real problems or deciding in different areas of economy. Recently, many MCDM methods are used, such as AHP, ELECTRE, PROMETEJ, TOPSIS, ARAS, SVARA and many others [2-8]). The combined MCDM methods [9, 10] are also used as well as the new models [11].

The applied methodology gives managers the opportunity to implement the most effective motivation theory for successful operation of the mining companies and increase the satisfaction and needs of the all interested parties.

Each company uses different models to analyze the motivation of its employee and makes a decision to accept the most effective motivation theory.

## 2 THEORETICAL BASIS

The business success of a mining organization depends on many factors, and one of these factors is the motivation of employees. Motivation is a complex process of organizing, guiding the behavior of employees in order to meet their own and organizational needs [12]. It is a significant element of an organization affecting their working performance.

The working performance consists of three general factors [13]:

Work performance of employees $= f$ $(S, K, M)$

Where in:

➢ S-ability of employees to perform the work activities
➢ K-knowledge and use of rules, procedures and principles
➢ M-motivation for performing the work tasks.

According to the authors Srivastav and Barmol [14] and Hong and his associates [15], the employee motivation is equated in some cases with productivity. Motivation for work originates from the attitude of individuals toward work and achievement of goals, because it is a psycho-sociological category [16]. Modern business requires from the manageress of organizations to better organize and motivate their employees in the occurred situation in order to achieve the better working results [17]. Because the employee motivation is one of the irreplaceable factors for performing the work activity [18].

When the employees are motivated, then the work goals are achieved and thus increases the profit of organization and employee satisfaction. Employee satisfaction is defined as a favorable, i.e. positive emotional state [19]. The key factor in motivating the employees are managers, who are responsible for creation the working environment, representing the company's attitude toward employees and consciously or unconsciously affecting their behavior. Very important motivators of employees, the motivation of the employee and his inters for performance depend on the highest percentage of creative management [20]. Managers are those who choose which of the motivating methods or theories of motivation for their employees is the most effective. Implementation of motivation theory in the mining companies contributes to greater productivity, good positioning, competitiveness and sustainability.

Many research has been carried out and many theories have been developed, but the factors that motivate employees to perform their activities are still controversial in the modern business with mining companies.

Theories of motivations in the modern world are considered to be powerful motivators that are divided into two groups: content theory and process theory [21]. The content theories are: the theory of hierarchies of the needs of Abraham Maslow and Herchrberg's dual-factor theory or motivational hygiene theory. These two theories are directed to the needs of individuals and are fairly represented, but the managers of modern companies turn to the process theories.

The process motivation theories are on employees who focus on performing the work tasks with expectations of rewards or benefits. The most commonly implemented process theories in the modern business are: Theory of Justice - Adams's Theory of Equality, Expectancy Theory - Vroom's Cognitive Expectancy Model, Integrative

Theory of Motivation and Theory of Setting Objectives.

***Alternative $A_1$:*** Theory of Expectation or Vruman's Theory of Motivation is leading in the process theories and is valid for the theory that most explains how the employees need to be motivated. It is often referred to as the VIE theory because it indicates the initial three letters of this theory, such as valence, instrumentality, and expectancy [22].

- Valency or value - means the attraction of the prize.
- Instrumentality or belief that employees will be adequately rewarded for their work.
- Expectation is an employee's assessment of performing a work activity.

Employees perform their work tasks more efficiently if they bring them the desired goal (instrumentality), where there is a value (valency) and where the expectations are likely. The advantages of this theory are the association of advocacy and achievement the desired goals. The negative side of the VIE's theory of expectation is the irrationality, impulsibility and emotionality of the employees.

***Alternative A2:*** The theory of justice or as it is called the Adams's theory of equality is a motivator where the employees for a particular type of work should be justly rewarded. But the question arises whether they do it fairly or not. This is a key part of this theory. The fair distribution of rewards to the employees is when a balanced relationship between dedication and rewarding is otherwise unjust. In the event of unfair distribution, the employees are demotivated and do not invest their efforts to perform the work goals of the organization. In large cases, they are so dissatisfied with leaving the organization. The problem of this theory is the personal assessment of employees on the reward assessment for the work done.

***Alternative $A_3$:*** The integrative motivation theory is an extended model of expectation theory where the following variables are added: role perception, capability and employee satisfaction. This method contains the relationships of variables of the content and process theory of motivation and integrated needs, where the needs are the basis for determining the preferences by which the name is called an integrative process model [23].

Two reverse links are built into this model [24]:

- The first between the variance of performance and variance of effort and rewards
- Another feedback between the satisfaction and value of prizes.

***Alternative $A_4$:*** Goal Setting Theory: The very title of this theory tells us that the motivators of this method are the goals. The employee goals are motivated if they are clear, precisely defined, desirable, difficult but feasible, and if the employees are allowed to define them together.

According to Jordan [25], the goal should be divided into several smaller goals, so that the accomplishment of goals can be relatively easy, but nevertheless be awkward enough to provide the necessary satisfaction in their accomplishment.

The Goal Setting Theory provides managers with the following lessons [26]:

1. Define clear and specific objectives;
2. Define difficult or achievable goals, and
3. Give employees the feedback information on achieving the organizational goals.

In order for managers to choose the most effective motivation theory, they have a task to determine the criteria. The criteria serve to rank the given alternative, that is, the criteria that have been operationalized in relation to the premise of assessment: the expected or accomplished

achievement. The criteria depend on the expectations of the decision maker. The criteria can also be conflicting.

Criteria for the assessment of alternatives are proposed by the mining team's management team: criterion C1 - wage, criterion C2 - employee rewards, criterion C3 - benefits and criterion C4 - gratitude for the work done.

*Criteria C1 - wages*, wages of employees are determined in accordance with the organization 's strategy. For every work done in the organization, there must be compensation, salary or salaries. The greater the compliance of the organization and the salary system, the organization is more successful.

*Criterion C2 - employee rewards*, is a process by which the employees are provided with funds for work performed as a supplement with a certain remuneration.

*C3 Criteria - benefits*, benefits are very important for employees. Organizations with their benefits attract the best workers to retain them and thus achieve the positive results. There are various benefits: vacation, life insurance, hot meals, etc.

*C4 Criteria - acknowledgment for the work done*, acknowledgments of the employees' gratification for the work done is related to care and support to employees.

## 3. MODEL OF RESEARCH

The AHP method (analytical hierarchical process) [27], by implementing, allows us to rank the motivation theory. It is based on a hierarchical analysis of decision problems. The hierarchy of the problem of decision making was constructed through defining its goal, assessing criteria and sub-criterion, and finally variance. On each level of the hierarchy, based on the comparison of criteria, subcriteria and variants, the professional information DM is defined in the form of relative weights [27].

The AHP method algorithm focuses on finding a solution for the so-called inherent value problem [27] at each level of the hierarchy. As a result, a set of vectors containing normalized, absolute values of weight for criteria, subcriteria and variants are generated. The collection of vector elements is 1 (100%).

Based on the Saati scale (Table 1), the relative importance between the two criteria is determined (Table 2). The relative importance of the criteria is made by the decision makers or team managers together with the experts from a particular field.

**Table 1** *Scale of criteria comparison*

| $Value_{ik}$ | Interpretation of results |
|---|---|
| 1 | j and k are equally important |
| 3 | j is a little important than k |
| 5 | j is more important d k |
| 7 | j is very important than k |
| 9 | j is absolutely more important than k |
| 2,4,6,8 | intermedia value |

**Table 2** *Matrix of criteria comparison*

| Criteria | $C_1$ (wage) | $C_2$ (rewarding of employees) | $C_3$ (beneficiations) | $C_4$ (appreciation for done work) |
|---|---|---|---|---|
| $C_1$ | 1 | 3 | 5 | 7 |
| $C_2$ | | 1 | 3 | 1 |
| $C_3$ | | | 1 | 1/2 |
| $C_4$ | | | | 1 |

Table 3 shows the results obtained by calculating the AHP method using the Criterion Decision Plus software. The degree of consistency should be less than 1, which in this calculation was 0.054.

The obtained results are shown in Table 3. It was obtained that criterion C1, the employees wage has the greatest influence on the motivation of employees and it depends on which theory of motivation as a recommendation is most effective for implementation in the mining companies to managers.

**Table 3** *Final results*

| Criteria | $C_1$ | $C_2$ | $C_3$ | $C_4$ |
|---|---|---|---|---|
| m | 0.602 | 0.183 | 0.079 | 0.136 |
| Consistency coefficient, | 0.054<0.1 | | | |

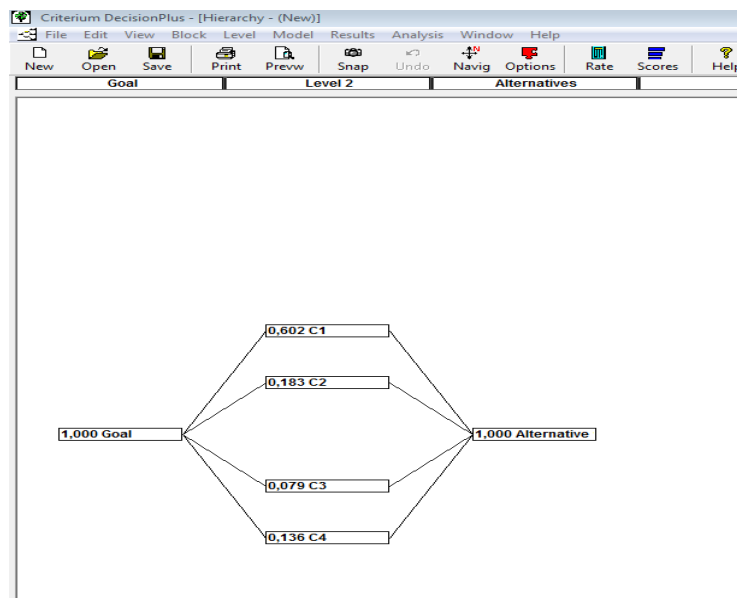Figure 1 Displays the hierarchy of criteria obtained with the software.



**Figure 1** *Hierarchy of criteria*

Figure 2 Show the criteria by the values of activity on the motivation of employees.
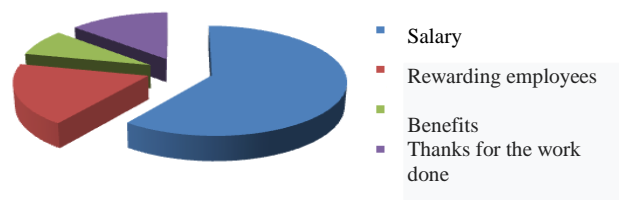


**Figure 2** *View of crteria by the values of activity on he motivation of employees*

The next step of the AHP method is to rank the individual alternatives with each of the criteria Table 4-7.

**Table 4** *Comparison of alternatives regarding to the criterion $C_1$*

| Alternative | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|
| $A_1$ | 1 | 1/2 | 1/3 | 1 |
| $A_2$ | | 1 | 1/2 | 1/2 |
| $A_3$ | | | 1 | 1 |
| $A_4$ | | | | 1 |

Consistency degree 0.077<0.1

**Table 5** *Comparison of alternatives regarding to the criterion $C_2$*

| Alternative | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|
| $A_1$ | 1 | 2 | 1/2 | 3 |
| $A_2$ | | 1 | 3 | 2 |
| $A_3$ | | | 1 | 1 |
| $A_4$ | | | | 1 |

Consistency degree 0.099<0.1

**Table 6** *Comparison of alternatives regarding to the criterion $C_3$*

| Alternative | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|
| $A_1$ | 1 | 2 | 3 | 2 |
| $A_2$ | | 1 | 1/2 | 2 |
| $A_3$ | | | 1 | 3 |
| $A_4$ | | | | 1 |

Consistency degree 0.097<0.1

**Table 7** *Comparison of alternatives regarding to the criterion $C_4$*

| Alternative | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|
| $A_1$ | 1 | 2 | 3 | 2 |
| $A_2$ | | 1 | 1 | 1 |
| $A_3$ | | | 1 | 2 |
| $A_4$ | | | | 1 |

Consistency degree 0.044<0.1

The results obtained with software are shown in Table 8.

**Table 8** *Final results*

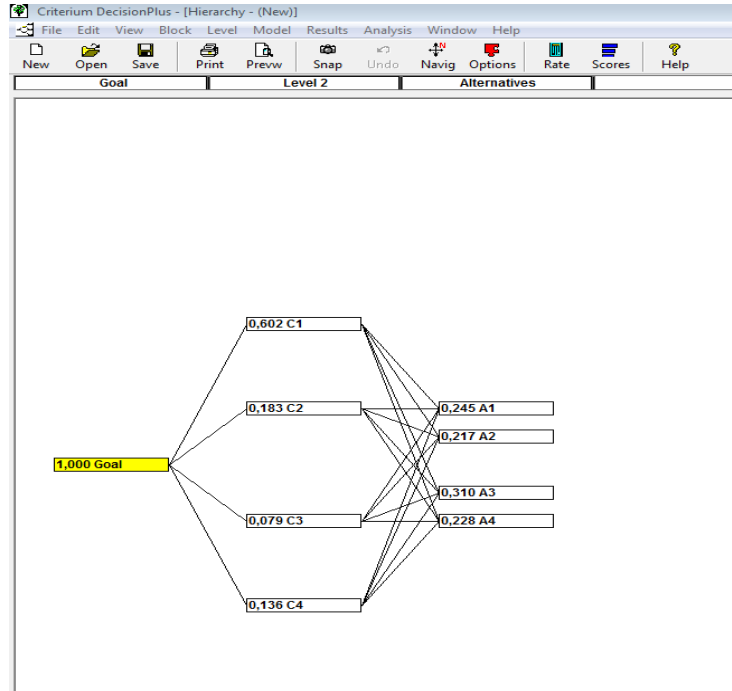| Alternative | Results |
|---|---|
| Expectation theory $A_1$ | 0.245 |
| Theory of Justice $A_2$ | 0.217 |
| Integrative Theory $A_3$ | 0.310 |
| Theory of goal setting $A_4$ | 0.228 |

**Figure 3** *Hierarchy of criteria and alternatives*

## 4 ANALYSIS OF THE RESULTS - DISCUSSION

The algorithm of the AHP methodology for finding the solution of the most effective theory of motivation for the so-called problem results show that this is the integrativity theory, an extended model of the theory of expectation of the alternative $A_3$. The integrativity theory occupies the first place for efficiency and is recommended to the managers of the mining company as the most efficient for its implementation. Its weight coefficient is 0.310 or in percentages of 31%. For this theory, the motivation of employees is not only a psychological and sociological problem of work and work behavior, but the behavior of employees is directed towards an operational goal that arouses the needs caused by it, and the goal is to behave in meeting their needs.

In the second place, it is obtained by calculation the AHP method by efficiency that it is alternative of $A_1$ the theory of expectation. Its weight coefficient is 2.45, or in percentages 24.5%. The theory of expectation is valid for the theory that explains the best way and how to motivate the employees in mining companies. Expectation theory or VIE is a product of valency, instrumentality and expectation.

In the third place according to the efficiency of the given alternatives, it was obtained as the method of goal setting theory, that is an alternative to $A_4$ whose weight coefficient is 0.228. Clearly de

fined, specific, difficult but achievable goals are strong motivators for the employees. In addition to getting the feedback information for their realization, it initiates a higher motivation for the employees. When the employees are motivated, the management expectations are justified for the success of mining company.

In the fourth place in terms of efficiency of the theory of motivation, the results show that this is the theory of righteousness alternative $A_2$. Its weight coefficient is 0.217. In the theory of justice, equity in salaries is of relevance to the employees in mining companies. And this is a true motivator for all employees.

Figure 4 gives a schematic representation of the given motivation theories. Between the given theories there are no big differences because the results of weight coefficients are approximate. All estimated motivation theories are important for the motivation of employees in the mining companies and can be used by the managers. But it's very rare for managers to remember that they exist.
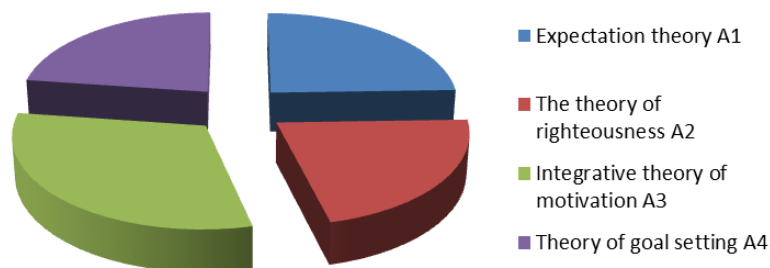


**Figure 4** *Schematic representation of the estimated motivation theories*

The C1 criterion is for the employee of an organization the largest motivator, a payroll for completing a work assignment so that most acts on the evaluation of motivation theory. Salary is the largest motivator of employees, occupying the first place because the weight coefficient is 0.602. Salary satisfaction is direct, linked to the motivation of employees.

For the employee reward the criterion C2 is in the second place, which as a motivator acts to the evaluation of motivation theory. Its weight coefficient is 0.183. The rewarding of employees brings better organization of the employees themselves and the mining organization which contributes to higher profit.

In the third place is the criterion C4, a gratitude for the work done with the weight coefficient of 0.136. Caring for employees and providing support is a motivator that drives the employees to easily carry out the work tasks.

Benefits, the criterion C3 is in the third place with a weighting coefficient of 0.079. If the employees receive various benefits, a retention of the best workers who can achieve positive results in mining companies is achieved.

## 5 CONCLUSION

This paper shows the possibility of using the multicriterial decision making (MCDM) as an innovative solution in selecting the most effective motivation theory.

The algorithm of AHP method for finding the solution for the most efficient theory of motivation for the problem of motivation assessment in the mining companies shows

that the theory of integrity, the expanded model of the theory of expectation, the alternative $A_3$ is the most effective for implementation.

Salary in the mining companies is the biggest motivator of employees, criterion $C_1$, so that it mostly works on the evaluation of motivation theory. The motivation of employee is directly linked to the salaries of employees.

The task of managers in the mining companies is to understand the particularity of motivation theory and human complexity, so that, depending on their specific business, they select and apply the most effective motivation techniques.

By applying the theory of motivation the managers will involve the employees and motivate them to work.

The key methodology chosen is the survival, sustainability and organizational and financial success of the mining companies.

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