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Efficiency Analysis of Gold Mining Companies through Financial Statements

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Abstract
In this study, efficiency analysis of six companies (IHMAD, IPEKE, KOZAL, KOZAA, METAL and PARKME) that have been active in gold production sector and operating within the scope of Borsa Istanbul (BIST) was procured by considering financial statements through Efficiency Analysis Technique with Output Satisficing (EATWOS) method. Data used in the analysis were collected through financial statements belonging to 2008 – 2015 fiscal period partaken in Public Disclosure Platform (PDP). Within the scope of this study, measurement of economic efficiency of establishments is aimed. In accordance with this purpose, number of employees, total asset values and capitals constituted input factors while output factors are specified as net sales and net profits. In consequence of comparative analysis of results obtained from this implementation, annual performance of companies was designated, and procurement of basic data for future strategic decisions was targeted. When the results of the study conducted is analyzed comparatively, it is determined that KOZAL Company is the most successful company of all periods, and IHMAD Company is determined as the least successful company.

Keywords: Efficiency Analysis, Mining, EATWOS, Multiple Criteria Decision Making (MCDM)

1. Introduction

In this day and age, over 10 billion tons with the value of 1,5 trillion USD has been produced all around the world by annual means. 75% of this amount belongs to energy raw materials, 10% of it belongs to metallic mining and 15% of it belongs to industrial raw material production (TBMM Research Commission Report 2010). USA, China, South Africa, Canada, Australia and Russia are the leading countries that play an important role in mining reserves and global mine production (Mining Sector 2012).

Turkish mining sector has become one of the most important sectors of industrial production with its endorsement rising from 1,365 (1 USD = 2,93 Turkish Lira) billion USD to 5,154 billion USD between the years of 2002 and 2008 and number of business enterprises rising from 1.388 pieces to 2.422 pieces, with its capacity of employment of 114.000 persons by the year of 2010 and totally 30.795 pieces of licenses. While gross domestic product of mining sector was 546 million USD in the year of 2000, this amount had reached to 5,358 billion USD in 2010 and total

gross domestic product share of sector within the same period had risen from 1% to 1,4% (Mining Sector 2012).

Total workable gold reserve of the world is specified as 56.000 tons. Approximately 50% of the reserve is shared between South Africa, USA, China, Australia, Canada and Peru that are placed near the top of global gold production. According to USGS (United States Geological Survey) estimations, global gold production is around 3000 tons (2015) and 51% of this production is performed in these six countries. In Turkey, moreover, gold production was around 31,26 tons according to the year of 2014. Gold potential of Turkey is approximated as around 6000 – 7000 tons and it is estimated that it can be the second country of the world with this reserve (Energy Ministry).

Mercantile establishments need to show a critical tendency towards the topic of efficiency in order for them to continue their existence in heavy competition environment, to perform a steady growth and to increase their profitability. Efficiency is defined as the ratio obtained through division of the output value at the end of production period into the inputs used for generating these outputs. The higher the economic value obtained at the end of production period means that the performance of the company is better. Rapid developments in production technologies force the companies to compete in a more complicated and a more uncertain environment. Therefore, in our day when global competition has been progressively increasing, firms shall perform their production by making use of their resources in the best way. Principle norm of establishments in obtaining competition advantages is to produce more outputs with higher economic values by using the current inputs actively and not fiddling them away. The companies, while they are sustaining their transactions, shall progressively improve and shall take the necessary precautions that will maximize their efficiencies in order to maintain their continuity, to provide a steady growth and to climax their profits which is the most basic purpose of all.

Likewise each establishment has predetermined targets, companies involved in gold production sector have also predetermined objectives. For accomplishing these objectives, evaluation of the fact that to what extent are the transactions active and whether the services are performed in compliance with the predetermined targets and standards shall be implemented. It is possible to define the evaluation of the compliance between the goods and services provided by the firms and predetermined targets and standards as an analytical process. Multiple Criteria Decision Making (MCDM) methods are prevalently used for efficiency analysis in recent years. Such methods are the alliance of analytical methods that evaluate a wide range of alternatives in accordance with a series of criteria. MCDM is used for choosing the most appropriate alternative or for arraying each other according to a number of criteria. These methods are used in numerous fields such as group decision making, planning of human resources, production, education, health, financing, capital investment, etc. In consequence of efficiency analysis, lacks and needed improvements of the firms are revealed. Establishments recognize their weak and strong points as a result of these inferences obtained, and they become able to ground their futuristic strategies upon these analysis.

Within the scope of present study, efficiency of six companies that have been active in Borsa Istanbul Corporation (BIST) and operating particularly in gold mine hoisting field between the

years of 2008 – 2015 are analyzed through the method of EATWOS (Efficiency Analysis Technique with Output Satisficing) which is one of the MCDM methods. In the first part of the study; numeric data in relation to mining sector and brief information about the importance of performance measurement are given, and in the second part of the study; literature review is performed. In the third part of the study; method used within the context of efficiency measurement is introduced and in the fourth part, moreover; implementation and findings are presented. In conclusion part, the study is evaluated by general means and suggestions for researchers are rendered.

2. Literature Review

Saranga (2009) examined 50 corporations that produce spare parts for automobiles in India with the method of Data Envelopment Analysis (DEA). According to this study, it is resulted that short-term effectiveness of working capital net increases operational efficiency in industry. Liu and Wang (2009) measured the performance of firms that manufacture printed circuits in Taiwan through DAE and it was found that aforementioned firms had been maintaining their activities in an unproductive way. Ertuğrul and Karakaşoğlu (2009) used TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) and Fuzzy Analytic Hierarchy Process (FAHP) methods in their studies in an integrated way and evaluated financial performances of cement companies who were active in BIST. Wang (2008) calculated performance measurements of domestic air operators in Taiwan. Data collected with the use of grey relational analysis and ratio analysis in the study are evaluated through fuzzy analytic hierarchy process methods. Dumanoğlu (2010) evaluated financial performances of cement companies active in BIST between the years of 2004 – 2009 through TOPSIS method. In consequence of this measurement, it was found that certain establishments hold their own in performance gradation in a steady way. Karğın (2010), in his study, analyzed financial performances of 26 textile establishments registered to BIST through the use of financial ratio, FAHP and TOPSIS methods. Altın (2010) measured fiscal activities of 142 companies registered to BIST industrial index belonging to the year of 2008 with DAE. It was identified that 44 of those companies were effective by aforementioned period. Ozer et al. (2010) measured effectiveness of establishments in food and drink sector that were active in 2007 – 2008 in BIST through DAE, clustering analysis and TOPSIS methods, and compared the results that were obtained in consequence of each method. It was determined that results of analysis showed variance between companies in accordance with each of three methods. Türkmen and Çağıl (2012) analyzed financial performance of 12 firms that are registered to BIST, active in information sector between years of 2007 – 2010 by using financial statements and TOPSIS method. Within the study, eight financial ratios were used and performances of companies were measured in accordance with aforementioned ratios. Uygurtürk and Korkmaz (2012) measured performances of 13 main metal industry companies active in BIST by basing upon 8 criteria, with respect to 2006-2010 periods. It was revealed that performances of establishments show differences according to different years. Soba et al. (2012) performed performance evaluation and effectiveness measurement of 26 establishments active in the sector of stone and land sector and 28 establishments active in metal furniture, machine and tool manufacturing sector,

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through the methods of DEA and TOPSIS. In consequence of this study, it was found that costs of energy use of those establishments which had been active in sectors based on stone and land with sectors based on metal furniture, machine and tool manufacture were high. Tosunoğlu and Uysal (2012) analyzed effectiveness of firms taking place in ISO 500 within the scope of manufacturing sector with foreign capital share within the borders of BIST through DEA method with respect to the data belonging to the year of 2009. It was identified that 0 of those 29 inspected firms had been working effectively. Özbek (2015a) analyzed efficiency of individual retirement companies between the years of 2010 – 2014 through EATWOS method in three different ways. According to the first implementation, it was seen that performances of companies with the names of ANADOLU, VAKIF and ZİRAAT were higher. In the 2nd implementation, companies with the name of ALLIANZ, ANADOLU, AVIVASA, CIGNA, GARANTİ, VAKIF and ZİRAAT were continuing their transactions in an efficient way. Within the scope of third implementation, moreover, ALLIANZ, AVIVASA, GARANTİ and VAKIF companies were specified as performing in an effective way. Bakırcı et al. (2014) tried to evaluate the financial performance of 14 firms that are active in BIST between the years of 2009 – 2011 in the sector of iron steel and metal industry by DEA and TOPSIS. In consequence of the analysis, it was indicated that four firms had been carrying on their activities in an effective way. Özbek (2015b) evaluated the activities of public banks that belong to the term of 2005 – 2014 through Operational Competitiveness Rating (OCRA) and Analytic Hierarchy Process (AHP) methods. It was determined that Vakifbank had the highest effectiveness level until the year of 2012, and it was designated that Ziraat Bank had become effective by this year. Akbulut and Rençber (2015) compared three-year financial performance to market / book value of 32 establishments active on BIST in sector of manufacture between the years of 2010 – 2012. Within the scope of the analysis, 10 variables were used for the measurement of financial performances, while market / book value ratios were used for stock market performances. This study designated 5 establishments with the highest financial performance levels and 3 establishments with the lowest financial performance levels. In the second part of the study, moreover, financial performances of the establishments were compared to the stock market performances. When the results of the analysis were compared to each other, it was identified that all findings share similarities with each other. Özbek (2015c) measured the effectiveness of 32 deposit banks between the years of 2011-2014 through the use of OCRA method and it was determined that Yapi Kredi Bank was the most effective bank. While the number of branches, the number of personnel, deposit Money and interest expenses represented input criteria, loan and receivables, interest receipts and other incomes represented output criteria. Ömürbek and Mercan (2014) evaluated the sector of manufacturing that was divided into 22 sub-sectors in accordance with nine specified criteria in compliance with TOPSIS and ELECTRE (Elimination and Choice Translating Reality) methods by financial means. In consequence of the evaluation, coking coal and refined petroleum products manufacturing sectors had become the first one through both methods. Özbek (2015d), evaluated efficiency of 9 deposit banks with foreign capital between the years of 2005 – 2014 through the methods of Simple Additive Weighting (SAW), MOORA (Multi-Objective Optimization by Ratio Analysis) and OCRA. According to these three methods, Finansbank and Denizbank were determined as the banks with the highest

performance levels. Banks were evaluated in accordance with 6 criteria as deposit, capital, workforce, credits, interest receipts and non-interest revenues.

3. Method

3.1. EATWOS

EATWOS is an efficiency analysis method which leads Decision-Making Unit (DMU) towards satisfying solutions instead of optimum solutions beyond measuring the maximum yield between the inputs and outputs. It is a new technique developed in the year of 2006 by Peters and Zelewski (2006) by basing upon the term ***satisficing*** coined by Simon. The term of ***satisficing*** is an idea that means individuals tend to search for satisfactory solutions rather than optimal solutions (Peters and Zelewski 2006). This method was implemented on the measurement of the efficiency of heat treatment furnaces and supply chain by the authors who had developed (Peters and Zelewski 2006; Peters et al. 2012). Additionally, Bansal et al. (2014) had used this method within the scope of the evaluation of suppliers, Özbek (2015a, 2015e, 2015f) had used this method within the scope of the evaluation of the efficiency analysis of individual retirement companies and non-governmental organizations (NGO) and Kumar et al. (2016) had used this method within the scope of the evaluation of success rating of the footballers who had played in Indian Super League in the season of 2013.

The general EATWOS procedure is described as below (Peters & Zelewski 2006)

Determination of the inputs and outputs to be taken into account is the first step. In addition, the DMUs to be measured should be determined by the decision maker. Next, as the EATWOS requires, the decision maker has to establish the output quantities y_{ij} as well as the input quantities x_{ik} for all DMUs. So, the quantities y_{ij} of all outputs j $(j = 1, \dots, J)$ of all DMUs i $(i = 1, \dots, I)$ have to be entered into the output matrix $\underline{Y}$.

$$\underline{Y} = \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1J} \\ y_{21} & y_{22} & \cdots & y_{2J} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ y_{I1} & y_{I2} & \cdots & y_{IJ} \end{bmatrix} \qquad y_{ij} \in R_{\geq 0} \quad \forall i = 1, \dots I, \quad \forall j = 1, \dots, J \qquad (1)$$

As each column of this output matrix $\underline{Y}$ corresponds to an output j, each row corresponds to a DMU i. The way the input matrix $\underline{X}$ is established is the same (Eq. 2)

$$\underline{X} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1K} \\ x_{21} & x_{22} & \cdots & x_{2K} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ x_{I1} & x_{I2} & \cdots & x_{IK} \end{bmatrix} \qquad x_{ik} \in R_{\geq 0} \quad \forall i = 1, \dots I, \quad \forall k = 1, \dots, K \qquad (2)$$

Similar to the process followed for the output matrix, each column of this input matrix $\underline{X}$ corresponds to an input k $(k = 1, \dots, K)$, and each row corresponds to a DMU. Inputs and outputs must be cardinal measures, as EATWOS requires.
EATWOS provides the chance to consider satisficing levels (SL) for outputs. This means that the decision maker is capable of determining a SL_j for each output *j*. In addition, the exogenous assessment of the relative importance weights v_j of the outputs as well as the relative importance weights w_k of the inputs must be carried out, as EATWOS requires (Peters & Zelewski 2006). A scoring technique or Analytic Hierarchy Process (AHP) can also help to determine the importance weights (Saaty 2004).

Application of EATWOS without consideration of satisficing levels (Peters & Zelewski 2006)
As the next step, EATWOS is applied without consideration of SL's. This way, SL's are ignored for all outputs. The output quantities y_{ij} are normalized first. The normalization of the output quantities takes place as in TOPSIS (Hwang & Yoon 1981).

$$\exists i \quad \exists j \quad y_{ij} \neq 0: \qquad r_{ij} = \frac{y_{ij}}{\sqrt{\sum_{i=1}^{I} y_{ij}^2}} \qquad \forall i = 1, \dots, I \quad \forall j = 1, \dots, J \qquad (3a)$$

$$\forall i = 1, \dots, I \quad \forall j = 1, \dots, J \quad y_{ij} = 0: \qquad r_{ij} = 0 \qquad (3b)$$

The normalization process gives the normalized output matrix $\underline{R}$:

$$\underline{R} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1J} \\ r_{21} & r_{22} & \cdots & r_{2J} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ r_{I1} & r_{I2} & \cdots & r_{IJ} \end{bmatrix} \qquad (4)$$

Then, for each output *j*, the maximum normalized output quantity r_j^* is determined on basis of the column vectors of $\overrightarrow{r_j}$ of the normalized output matrix $\underline{R}$.

$$r_j^* = \max_i\{\vec{r_j}\} \qquad (5)$$

The calculation of the distance measures op_{ij} for the outputs can be carried out on the basis of the matrix $\underline{R}$ and the maximum normalized output quantities r_j^*.

$$op_{ij} = 1 - (r_j^* - r_{ij}) \qquad \forall i = 1, \dots, I, \quad \forall j = 1, \dots, J \qquad (6)$$

The distance measure op_{ij} suggests that the smaller the distance of r_{ij} to r_j^*, the closer op_{ij} is to one. This distance measure is taken as output score.
The normalization of the input quantities is the next step. This process is a similar one to the normalization of the output quantities.

$$\exists i \quad \exists k \quad x_{ik} \neq 0: \qquad s_{ik} = \frac{x_{ik}}{\sqrt{\sum_{i=1}^{I} x_{ik}^2}} \qquad \forall i = 1, \dots, I \quad \forall K = 1, \dots, K \qquad (7a)$$

$$\forall i = 1, \dots, I \quad \forall k = 1, \dots, K \quad x = 0: \quad s = 0 \qquad (7b)$$

So, the way the normalized input matrix $\underline{S}$ is calculated is similar to way of the normalization of the output matrix.

$$\underline{S} = \begin{bmatrix} s_{11} & s_{12} & \cdots & s_{1K} \\ s_{21} & s_{22} & \cdots & s_{2K} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ s_{I1} & s_{I2} & \cdots & s_{IK} \end{bmatrix} \qquad (8)$$

The determination of the minimum normalized input quantity s_k^* for each input k on basis of the column vectors $\overrightarrow{s_k}$ of the normalized input matrix $\underline{S}$ is the following step.

$$s_k^* = \min_i\{\overrightarrow{s_k}\} \qquad \forall k = 1, \dots, K \qquad (9)$$

The calculation of the distance measure for inputs can be done, then, by adding the respective value s_{ik} from the matrix $\underline{S}$ to 1 and subtracting the minimum normalized input quantity s_k^*.

$$ip_{ik} = 1 + s_{ik} - s_k^* \qquad \forall i = 1, \dots, I \quad \forall k = 1, \dots, K \qquad (10)$$

It can be concluded from this distance measure that the smaller the distance of s_{ik} to s_k^*, the closer ip_{ik} is to one. The distance measure ip_{ik} must not be zero, so the value 1 is added. The distance measure ip_{ik} is taken as input score, as it is done in the output score.
In order to obtain an efficiency score for each DMU, the input distance measures (input score) and the output distance measures (output score) can be used.

$$E_i = \frac{\sum_{j=1}^{J} v_j * op_{ij}}{\sum_{k=1}^{K} w_k * ip_{ik}} \qquad \forall i = 1, \dots, I \qquad (11)$$

When E_i of a DMU i is low, this means the efficiency is relatively lower than the other DMUs, while E_i is high the efficiency is high. These efficiency scores allow preparing a rank order R of the efficiency of the DMUs by sorting the efficiency scores from high to low.

Application of EATWOS with consideration satisficing levels (Peters & Zelewski, 2006)
In this step, EATWOS with consideration of SL_j is applied for at least one of the outputs *j* with $j \in \{1, \dots, J\}$. The way the outputs without SL's are treated is the same as described in the previous section.
This model uses five logical constraints. This idea belongs to from Yan, Yu, and Cheng (2003). The following five constraints are applied for all outputs for which the decision maker determines SL's:

$$\left(\frac{SL_j - y_{ij}}{SL_j}\right) + z_1 \leq 1 \qquad (12a)$$

$$\left(\frac{SL_j - y_{ij}}{SL_j}\right) * z_2 \geq 0 \qquad (12b)$$

$$z_1, z_2 \in \{0; 1\} \qquad (13)$$

$$z_1 + z_2 = 1 \qquad (14)$$

$$a_{ij} = \frac{y_{ij}}{SL_j} * z_2 + 1 * z_1 = f(y_{ij}) \qquad (15)$$

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The constraints (12a) and (12b) are used to restrict the possible values of the logical variables. Constraint (13) describes the logical variables z1, z2 as binary variables. The duty of constraint (14) is that, in connection with constraint (13), only one of the logical variables can take the value one, while the other one takes the value zero. The possible values of the logical variables in constraint (15) are determined by using the constraints (12a), (12b), (13), and (14).
If a SL_j is determined for the respective output, the normalized output quantities a_{ij} are obtained by applying the constraints (12a), (12b), (13), (14), and (15). These quantities are necessary for making up the normalized output matrix $\underline{A}$. However, if no SL is established for an output j, the respective column vector $\vec{a}_j$ in the matrix $\underline{A}$ is equal to the column vector $\vec{r}_j$ in the matrix $\underline{R}$.

$$\underline{A} = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1J} \\ a_{21} & a_{22} & \dots & a_{2J} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ a_{I1} & a_{I2} & \dots & a_{IJ} \end{bmatrix} \tag{16}$$

Next, the determination of the maximum normalized output quantity a_j^* is realized for each output j by taking the maximum value of each column vector $\overrightarrow{a_j}$.

$$a_j^* = \max_i\{\overrightarrow{a_j}\} \qquad \forall j = 1, \dots, J \tag{17}$$

The maximum normalized output quantity a_j^* is used to calculate the distance measures for outputs. This distance measure is calculated for all DMUs i and for all outputs j.

$$op_{ij}^{SL} = 1 - \left(a_j^* - a_{ij}\right) \qquad \forall i = 1, \dots, I \qquad \forall j = 1, \dots, J \tag{18}$$

An efficiency score is calculated for each DMU, as before. But this time, E_i^{SL} incorporates the distance measures op_{ij}^{SL} in order for the SL's for the outputs to be considered.

$$E_i^{SL} = \frac{\sum_{j=1}^{J} v_j * op_{ij}^{SL}}{\sum_{k=1}^{K} w_k * ip_{ik}} \qquad \forall i = 1, \dots, I \tag{19}$$

By sorting the efficiency scores E_i^{SL} from high to low, a rank order R^{SL} of the efficiency of the DMUs can be obtained once again.

4. Implementation and Findings

With this study, efficiency analyses of 6 companies that are active in gold production sector between the years of 2008 – 2015 were performed in two different ways. Input and output factors that were used for the research were determined in compliance with the literature survey. Within the scope of the study**; *total assets, shareholder's equities, foreign assets*** and ***number of employees*** represented input factors, while ***net sales*** and ***net profits*** represented the output factors. In the study, data sent by the companies that are active in BIST to the PDP were used. Data covering 2008 – 2015 periods in accordance with specified input and output factors of companies are given in Annex 1.

EATWOS method was implemented in two different ways, both by taking *SL's* into consideration and not taking SL in consideration. While the weight of each output factor was determined as 0,5 within the scope of both implementations; factor weights of **total assets, shareholder's equities** and **foreign assets** are determined as 0,3 and the number of employees was determined as 0,1.

Efficiency values and ratings obtained in accordance with these values which were determined in consequence of implementation of EATWOS method by excluding **SL** are given in Table 1. Additionally, distribution graphic which is shown in Figure 1 was originated by using these findings.

Table 1: Efficiency Values and Gradation according to EATWOS Method

	2008	**Rank**	**2009**	**Rank**	**2010**	**Rank**	**2011**	**Rank**	**2012**	**Rank**	**2013**	**Rank**	**2014**	**Rank**	**2015**	**Rank**
IHMAD	0,362	6	0,376	6	0,416	6	0,422	6	0,374	6	0,369	6	0,368	5	0,349	6
IPEKE	0,517	5	0,579	3	0,580	4	0,604	3	0,576	3	0,571	3	0,573	2	0,557	2
KOZAA	0,526	4	0,581	2	0,598	3	0,601	4	0,587	2	0,581	2	0,571	3	0,557	3
KOZAL	0,729	1	0,717	1	0,717	1	0,676	1	0,679	1	0,668	1	0,672	1	0,662	1
METAL	0,562	3	0,541	4	0,686	2	0,647	2	0,382	5	0,373	5	0,368	6	0,350	5
PRKME	0,634	2	0,382	5	0,432	5	0,469	5	0,442	4	0,429	4	0,397	4	0,415	4

When Table 1 and Figure 1 are evaluated as integrated, it is seen that KOZAL Company was the company that had the highest efficiency level for 2008 – 2015 years, and it is seen that IHMAD Company was the company that had the lowest efficiency level.

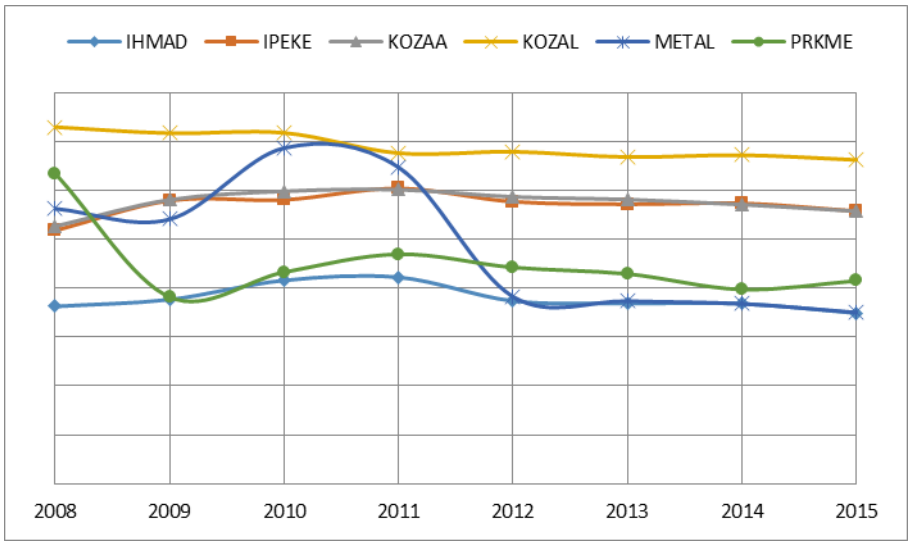

Figure 1: Distribution Graphic

When the graphic presented in Figure 1 is viewed, it is observed that although KOZAL Company had been pointing the highest performance among all firms, there is a slight decrease in its efficiency by the year of 2010. PRKME firm which is in the 2nd place in 2008 could not perform the same success in 2009 and regressed to 5th line. Although PRKME had come across to a serious performance loss between 2008 and 2009, this circumstance had the tendency of improving from the year of 2009 to 2011, however, this performance could not become permanent and it is stated that it had a slight performance decrease by the year of 2011 until 2015. METAL firm had carried its performance which is stated in the 3rd line in 2008 to a better level in the years of 2010 and 2011. Nevertheless, it could not maintain its success and it was seen that it encountered a great performance loss in 2012, and degraded within the scope of the gradation. It was also identified that IPEKE and KOZAA companies obtained the most successful performance after KOZAL firm in the name of all years. Provided that the performance of METAL firm between the years of 2010 and 2011 is not considered, these firms generally shared 2nd and 3rd place within the scope of the list. In consequence, between the years of 2008 and 2015, no significant change was observed in performances of IPEKE and KOZAA firms. However while these firms performed a relative performance increase until 2011, it is also seen that they had a slight tendency of degrading after that year. For IHMAD Company, moreover, it is observed that there had been an increase in performance level by the year of 2008 until 2011, and there had been a degrading tendency by the year of 2012.

Efficiency values and ratings obtained in accordance with these values which were determined in consequence of implementation of EATWOS method by including **SL** values are given in Table 3. Additionally, distribution graphic which is shown in Figure 2 was originated by using these findings. SL values considered within the scope of implementation are given in Table 2. SL values are designated for **net sales** and **net profit**. SL values are formed by averaging positive values of the companies belonging to the related year.

Table 2: Satisficing Level Values

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Kriter	2008	2009	2010	2011	2012	2013	2014	2015
SL_1	181.811.374	280.987.205	435.156.076	584.513.458	735.100.735	674.088.357	641.921.028	409.255.249
SL_2	60.105.896	81.302.349	172.943.600	284.632.786	457.724.771	275.093.384	328.945.731	128.858.590

Table 3: Efficiency Values and Gradation according to EATWOS Methods through the Use of SL Values

	2008	Rank	2009	Rank	2010	Rank	2011	Rank	2012	Rank	2013	Rank	2014	Rank	2015	Rank
IHMAD	0,000	6	0,000	6	0,000	6	0,002	6	0,001	5	0,001	5	0,010	5	0,001	5
IPEKE	0,521	4	0,614	3	0,602	3	0,615	3	0,610	3	0,613	3	0,611	3	0,614	3
KOZAA	0,529	3	0,618	2	0,619	2	0,617	2	0,615	2	0,615	2	0,613	2	0,616	2
KOZAL	0,762	1	0,742	1	0,742	1	0,697	1	0,704	1	0,699	1	0,706	1	0,699	1
METAL	0,367	5	0,367	4	0,500	4	0,500	4	0,000	6	0,000	6	0,000	6	0,000	6
PRKME	0,612	2	0,202	5	0,169	5	0,278	5	0,261	4	0,279	4	0,182	4	0,280	4

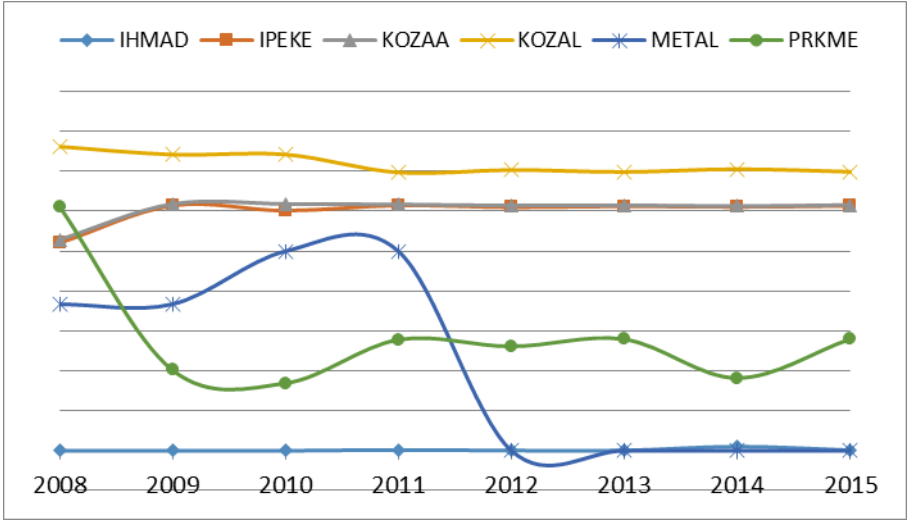

Figure 2: Distribution Graphic through the Consideration of SL

When Table 3 and the graphic presented in Figure 2 are viewed, it is observed that KOZAL Company had the highest performance level. This company was followed by IPEKE and KOZAA companies. Between 2008 and 2015, no significant change was observed within the scope of

performances of IPEKE and KOZAA firms. Despite the fact that PRKME Company encountered a serious performance loss by the year of 2018 until 2009, this circumstance performed a tendency of improving by the year of 2009. Although METAL firm increased its 4rd-graded performance in the years of 2010 and 2011, it could not continue this success and had significant performance losses by the year of 2012. By means of all years, it is understood that IHMAD Company had the lowest performance levels.

5. Conclusion

Survival of the establishments in heavy competition environment depends on how much importance do they attribute to certain functions such as production, costing, profit, workforce, production Technologies, etc. by providing paying attention to the characteristics of the sector in which they carry their operations on. Parameters such as efficiency, effectiveness and performance are directly proportionate to the fact that to what extend do the establishments give importance to the aforementioned functions. The higher the economic value obtained at the end of production period means that the performance of the company is better. Rapid developments in production technologies force the companies to compete in a more complicated and a more uncertain environment. In our day when global competition has been increasing, establishments shall make use of their resources in the best way in order to make a difference between themselves and their rivals.

With this study, 6 companies included in gold production field are comparatively analyzed through the use of financial data collected between the years of 2008 - 2015 with EATWOS method. Within the scope of the study, EATWOS method was implemented in two different ways, both by excluding and including SL. ***Total assets, shareholder's equities***, ***foreign assets*** and ***number of employees*** represented input factors, while ***net sales*** and ***net profits*** represented the output factors.

In consequence of the analysis procured by considering SL, it was determined that KOZAL Company is the most and IHMAD Company is the least successful company. It was also found that KOZAL Company was followed by IPEKE and KOZAA by means of all years. It was seen that METAL and PRKME firms conducted an undulating performance, and they were less efficient when compared to first three companies by general means.

On the other hand, in consequence of the analysis procured without considering SL, it was determined that IHMAD Company is the least successful company while KOZAL Company is the most successful company. It was also recognized that IPEKE and KOZAA companies remained right under the KOZAL Company. It was found that performance of METAL firm had significantly dropped down by the year of 2011. PRKME Company, moreover, is found out to have been keeping its performance by the year of 2011.

According to comparative consequence of both methods, it was stated that KOZAL Company was the most successful company while IHMAD Company was the least successful company. It was seen that IPEKE and KOZAA companies shared 2nd and 3rd lines. It was determined that performance of PRKME company reached a plateau by the year of 2011 according to both analyses. IHMAD, PRKME and METAL companies need to take measures and become more efficient.

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Appendix 1: Initial Values

		Input				Output	
Year		***Total Assets***	***Shareholder's Equities***	***Foreign Assets***	***Number Of Employees***	***Net Sales***	***Net Sales***
2008	IHMAD	23.181.310	13.074.592	10.106.718	2	0	-8.220.575
	IPEKE	527.093.626	366.886.838	160.206.788	1.284	232.227.159	42.899.036
	KOZAA	499.677.488	341.134.599	158.542.889	1.149	231.607.207	42.423.810
	KOZAL	246.076.853	153.401.732	92.675.121	600	196.104.544	80.271.838
	METAL	1.353.033	1.313.213	39.820	3	-138.404.126	-1.613.646
	PRKME	283.745.068	223.413.202	60.331.866	417	110.713.833	74.828.898
2009	IHMAD	37.426.231	29.538.546	7.887.685	6	0	-607.543
	IPEKE	614.168.994	447.795.412	166.373.582	1.465	389.349.959	120.565.173
	KOZAA	598.285.006	421.160.499	177.124.507	1.329	388.086.915	119.682.500
	KOZAL	335.477.553	230.567.586	104.909.967	700	342.381.493	146.819.752
	METAL	1.348.531	1.330.557	17.974	2	206.416.527	17.344
	PRKME	335.670.828	305.697.691	29.973.137	496	78.701.129	19.426.974
2010	IHMAD	32.780.976	23.241.515	9.539.461	34	0	-6.290.244
	IPEKE	1.000.645.284	783.359.631	217.285.653	1.737	543.289.454	208.426.655
	KOZAA	977.817.059	800.563.569	177.253.490	1.606	541.544.967	210.627.806
	KOZAL	545.755.621	438.619.149	107.136.472	847	472.074.894	235.551.563

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	METAL	5.434.705	4.094.230	1.340.475	2	535.076.798	-136.327
	PRKME	375.574.488	342.560.841	33.013.647	516	83.794.267	37.168.377
2011	IHMAD	70.890.769	65.067.702	5.823.067	63	1.148.152	646.769
	IPEKE	1.609.920.958	1.365.866.837	244.054.121	2.188	909.098.723	432.339.946
	KOZAA	1.574.849.888	1.325.657.618	249.192.270	2.187	890.479.608	428.787.505
	KOZAL	1.062.654.000	869.452.000	193.202.000	1.500	805.799.000	460.494.000
	METAL	3.403.727	3.379.442	24.385	2	728.034.068	-714.788
	PRKME	484.103.555	443.456.552	40.647.003	635	172.521.194	100.895.711
2012	IHMAD	61.782.447	55.011.312	6.771.135	55	751.028	-7.065.572
	IPEKE	2.327.290.000	2.051.144.000	276.146.000	2.222	1.183.354.000	531.097.000
	KOZAA	2.275.068.000	2.001.601.000	273.467.000	2.187	1.183.366.000	550.363.000
	KOZAL	1.568.732.000	1.400.006.000	168.726.000	1.550	1.043.145.000	642.124.000
	METAL	1.676.068	1.662.948	13.120	2	0	-1.716.494
	PRKME	503.271.783	450.470.157	52.801.626	623	264.887.648	107.315.083
2013	IHMAD	56.640.129	54.130.698	2.509.431	45	797.492	-919.719
	IPEKE	2.578.832.000	2.303.693.000	275.139.000	2.579	1.089.854.000	394.860.000
	KOZAA	2.545.974.000	2.272.769.000	273.205.000	2.569	1.089.363.000	413.159.000
	KOZAL	1.853.270.000	1.693.287.000	159.983.000	1.900	929.414.000	497.973.000
	METAL	1.911.803	1.884.502	27.301	1	0	222.056
	PRKME	584.183.110	520.205.970	63.977.140	577	261.013.293	69.252.863

2014	IHMAD	58.117.053	54.412.763	3.704.290	17	13.429.982	-63.362
	IPEKE	2.816.878.000	2.515.218.000	301.660.000	2.343	1.053.007.000	401.753.000
	KOZAA	2.782.162.000	2.481.228.000	300.934.000	2.338	1.034.608.000	398.680.000
	KOZAL	2.019.552.000	1.868.679.000	150.873.000	1.649	885.888.000	494.890.000
	METAL	6.023.037	5.930.428	92.609	2	0	-54.074
	PRKME	553.262.207	498.676.380	54.585.827	479	222.672.159	20.459.924
2015	IHMAD	58.793.037	55.532.357	3.260.680	8	962.740	-381.052
	IPEKE	3.006.448.000	2.657.050.000	349.398.000	2.412	667.177.000	183.450.000
	KOZAA	2.969.372.000	2.621.552.000	347.820.000	2.403	663.347.000	181.912.000
	KOZAL	2.210.811.000	2.007.126.000	203.685.000	1.559	549.942.000	249.669.000
	METAL	14.566.251	5.957.493	8.608.758	3	0	27.065
	PRKME	529.550.018	436.727.510	92.822.508	463	164.847.504	29.234.883