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Adjustment of balanced score card framework to measure performance at the area of copper industries (Case study: Songon copper complex)

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Abstract

At the present age, the great evolution of management knowledge made inevitable existence of performance measurement system, so that in order every organization to know the amount of activities desirability and performance results in complicated and dynamic environments, they need to create systems proportionate to their own special supervision and evaluation. At this research, the performance of copper company was investigated based on balanced score card model from four viewpoints including financial, customer, trade interior processes and growth & learning ones with indices proportionate to that company showing performance amount of the same company. This research is an applied one and its method is descriptional-analitical. The tools used to collect information are questionnaires and specific worksheets through environmental and library studies. Statistical population is all personnel of Songon Copper Complex in which samples selected by using Morgan table were 344 samples. Data related to qualitative indices were collected by use of questionnaires and then SPSS software was used to calculate and analyze them. Data related to quantitative indices were collected by interviewing with responsible persons and using documents, then comparison index was employed to analyze. The results show that Songon Copper Complex met 43/34 percent of goals and also it is meeting 56/66 percent of goals.

Keywords: performance measurement, strategic planning, balanced score card model, measurement index.

Introduction

Experts and researchers believe that performance measurement is the main subject of all organizational analysis and it is hardly imagined that evaluation and performance measurement doesn't happen at one organization (Elahi, 2009).

In the past time, only financial indices were taken into consideration to evaluate organization performance, but financial indices have some limitations, although they provide a high review from what was happened at the past, but they are insufficient to show real process of creating value at the present organizations that they are obscure assets such as personnel's knowledge and performance and customer's satisfaction (Valmohammadi & Firouzeh, 2011).

Therefore, according to above statements, it's necessary that Songon Copper Complex employs a proper evaluation system to measure its performance and identify organization weak and strong points, and then it is used to optimize these strong and weak points, so identify opportunities and threats and optimum use of opportunities and convert threats to opportunities. At the present study, the performance of copper company is investigated based on balanced score card model from four viewpoints or aspects including financial, customer, trade interior process and

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growth & learning ones and then available performance is compared by anticipated indices and goals at company planning. This method prohibits different understandings through converting organization strategies and views to understandable statement. Also it helps individual and organizational goals go along each other to perform strategy successfully.

The main purpose of this study is to measure the performance of Songon Copper Complex using balanced score card procedure, so that reaching this purpose needs following sub purposes:

1. To measure mentioned company performance from financial aspect in comparison to strategic planning purposes.

2. To measure mentioned company performance from customer aspect in comparison to strategic planning purposes.

3. To measure mentioned company performance from growth & learning aspect in comparison to strategic planning purposes.

4. To measure mentioned company performance from interior process aspect in comparison to strategic planning purposes.

Since along time ago, measurement was important factors of organizational success and organizations constantly attempted to use reliable measuring tools in order to evaluate them and exploit results to remove defects and develop organizations. Nowadays, importance and necessity of evaluation is so obvious that it is considered as necessary and inevitable affair. Also it's necessary for correct and dynamic management (Alavi Matin, Dadjouyan & Nejad Irani, 2010).

"Performance measurement" refers to efforts employed to measure, compare and evaluate efficiency and output of one unit including organization or paln in order to determine the amount of success of that company (Imanie Jajromie & Firouz Abadie, 2007). In other words, it is a necessary attempt to respond the questions about improvement of yields on the side of efficiency, effectiveness, capability of responsibility (Haji Jabbari & Sarabadani, 2008).

One of constant and basic questions in organizational procedures is why some organizations have better performance than others (Najafi & Ebadi, 2009). In fact, in order a performance to manage, it should be exactly measured, because organizational success depends on management quality. Decision quality and organizational understanding depends on data quality, data quality depends on measurement quality and its proportionate, namely measurement, evaluation and precision of that organization have key role on organization success (Ebne Rasoul, 2008).

One of the most famous and well-known models of performance measurement system is the "Balanced score card" model that it was created by Kaplan and Norton in 1992 and it was developed. This model suggests that in order to evaluate performance of every organization, a series of balanced indices should be used. So by this, lofty managers can have a general view from four important organizational aspects. These different aspects make four basic questions possible to respond.

1. How is our view on stockholders? (financial aspect)

2. In which field should we act better? (trade interior aspect)

3. How is our customer's view on it? (customer aspect)

4. How can we proceed to improve and create value? (learning & innovation aspect) (Karimie, 2007).

Financial measurements are one of important parts of evaluation method. These measurements show that successfully performing goals determining three other aspects, meet lastly financial results and achievements (Kaplan & Norton, 2008). Rather, nonprofit organizations, like commercial units, should pay attention to financial costs and benefits of performance management, because without knowing general financial structure (such as sources and budgets), it's impossible to meet view or reach mission (Shahabi & Anvari Rostami, 2008).

In order to select goals and measurements related to financial aspect, the organizations should respond two vital questions: First, who are our target customers? And second, what are our suggested values for them? (Nioun, 2008).

From view point of interior processes of balanced evaluation, we determine key processes in which organizations should be important cases to continue creating value for customers and stockholders (Kaplan & Norton, 2008).

How can we perform determined high purposes from interior process, customer and lastly financial aspects? The answer to this question is behind measurements and goals related to growth & learning aspect, when we determined goals and measurements related to customer and interior process aspect, we will immediately understand skills and capabilities needed for personnel and the present level of these skills and capabilities. The goals of growth & learning aspect should focus on filling and covering these gaps (Nioun, 2008).

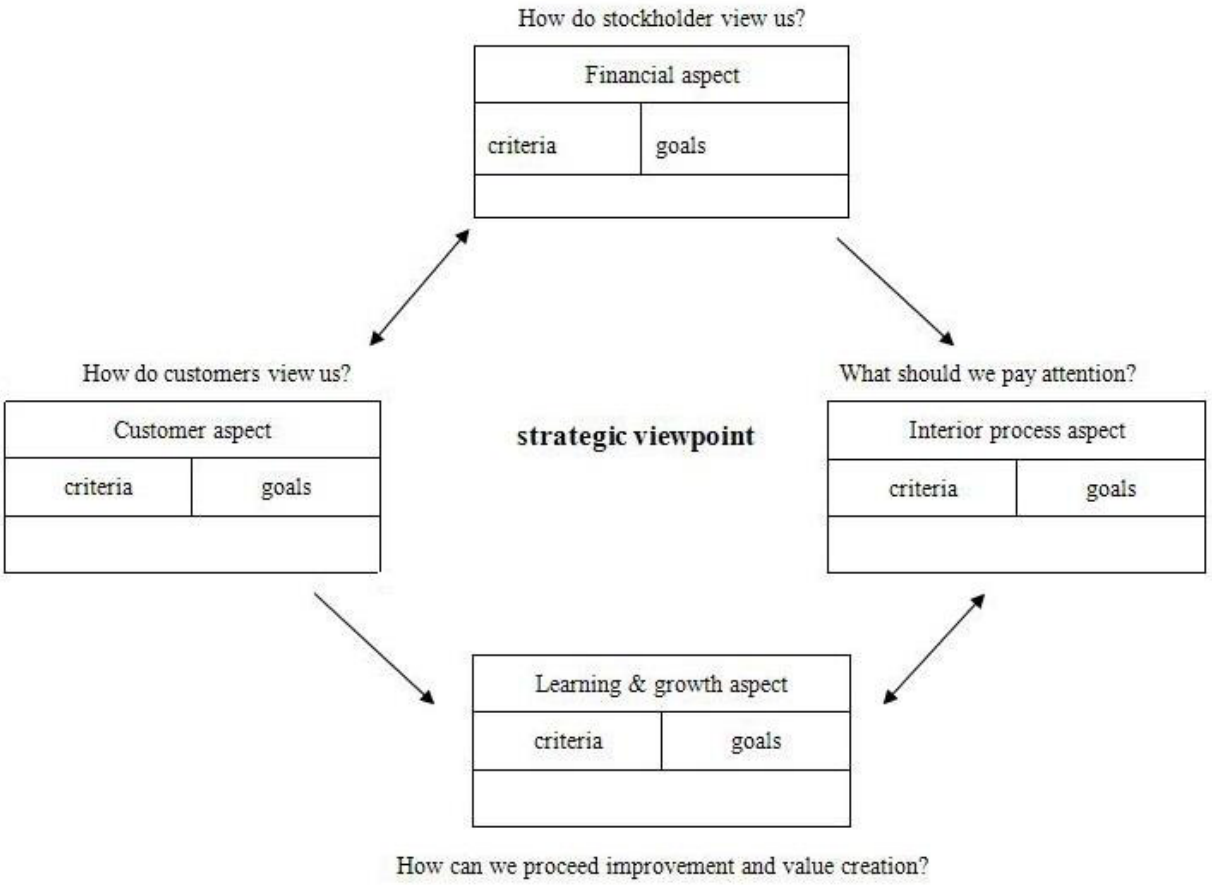

Figure1. Conceptual model of balanced score method (Tabarie and Arasteh, 2009).

As you know, traditional system of performance measurement mostly depends on financial measurements that is effective at the age of industrial economy, but at the economy age depended on knowledge, valuing activities of organizations don't rely on obvious assets (Mostabserie, 2007). Therefore, it needs a system that considers both obvious and non-obvious assets. For this reason, balanced score card was provided (Ebne Rasoul, 2007).

For the first time, BSC was introduced by Kaplan and Norton in early 1990. At first, it was developed for trade activities with the aim of creating non-financial indices and with completing the method of traditional financial reporting, but it was gradually converted to a strategic management method that provides a framework for explaining and managing strategy at economy and knowledge (Kong, 2010). Kaplan and Norton (2008) provided BSC as a tool to evaluate company performance from four different aspects including financial, trade interior process, customer, learning & growth (Sharma 2007, p. 57).

"Globerson" introduces indices as a tool to follow organization and states that nonexistence of proper performance criteria that evaluate people and organization performance makes difficult controlling and planning.

At the field of selecting useful indices to plan a performance evaluative system, some researchers state suggestions and guidance. For an example, they suggest parameters that performance indices should effect clearly on performance, instead of focusing on deviations, they should focus on improvement and also they should be available and obvious for all personnel (Hejabi, 2011).

Also, Globerson (1985) is one of researchers who provided useful guidance at this field. His suggestions at the field of performance indices are as follow:

1. Performance indices should be segregated from organization goals.

2. Performance indices should make possible the comparison of similar organizations.

3. The purpose of every performance index should be clear.

4. Data compilation and calculation methods of every index should be clearly defined.

5. Performance indices should be under control of organizational unit.

6. Performance indices should be selected by interviewing with individuals such as customers, personnel and managers.

Concrete performance indices are preferred to abstract indices (p. 79).

• Mohammad Reza Morgan & Mohammad Dehghan Niri (2010) evaluated faculties of high management at universities of Tehran province by considering strong points of balanced score card at strategic performance measurement and also by mixing them with Topsis technique to evaluate and rank some faculties of high management at Tehran province. On the other hand, this research concluded evaluations resulted from viewpoint of BSC model by use of Topsis model.

• Ghazi Nouri, Seyyed Sepehr & Sadegh Tavassolizadeh (2009) evaluated efficiency and efficacy of national plan of Iran nanotechnology to make sure of completing the string of Nano-innovation at the framework of national system of innovation. For doing this, methods of strategic plan and balanced score card about technology strategy at a national level was planned and performed, so at this way, balanced score card aspects were adjusted at the framework of innovation national system and based on heir purposes and performances and then performance needs were defined.

• Mansour Momeni, Mojtaba Bashiri & Somayye Khodaie (2010) in their research calculated firstly the performances of branching units using balanced score card that is a useful tool to plan performance measurement index and measure them from four aspects including customer, interior process, financial, growth & innovation. Then the efficacy of these branches were measured based on aspects of indefinite data at a planned data using Model BSC and covering analysis of phase data.

• Erick Kong (2010) conducted a research at the nonprofit organizations. This research was considered as a starting point or reference point in application of intellectual capital as a conceptual framework of strategic management at nonprofit organization.

• Bigliardi & Dourimo (2010) conducted a research to develop and research that this paper provides a structure of performance measurement system designed to research and develop, so it may be used as a source for companies which perform research and developing activities by using indices of applied performance measurement.

• Sharma & Bigwat (2007) evaluated management of security string. Purpose of their research is to develop blending of AHP-BSC approach to evaluate management of security string. Also the purpose is to measure management performance of security string from four financial, interior process, customer and growth & learning viewpoints.

Research method

This research is an applied one and its method is analytic-descriptive. From among current tools to collect data, methods of studying documents and interviewing were selected, so questionnaires and specific worksheets collecting data were developed. First, at these questionnaires, reliable and basic sides of every criteria mentioned above were identified and then by using operational definition of each variable, measurement criteria of each variable was identified and also for every criterion, questions were developed, so that totally 20 questions for measuring personnel's efficacy amount, 31 questions for measuring personnel's creativity and innovation amount and lastly 15 questions for measuring personnel's fettering amount on moral behaviors were designed. By using Likert spectrum, alternatives with scores 1 to 5 were taken for every question.

In order to determine content validity of research, experts and professors' views were employed.

Table 1. Statistical sample size.

Degree	M.A. and PhD	B.A.	Associated diploma	Diploma	Total
Population size	22	160	110	179	572
Sample size	22	113	86	123	344

Also, in order to determine research reliability, Alpha Kronbach was used that 91% shows high reliability and validity of research questions. Statistical population of research is Songon Copper Complex. In order to determine sample size, limitation formula and Morgan table were used that you can refer it at table 1.

Results

Data related to every qualitative indices of personnel's innovation, creativity and fetter on moral behaviors collected by questionnaires were calculated and analyzed based the methods of descriptive statistics, mean, variance, standard deviation and other figure parameters and also by using SPSS software.

By observing and surveying documents and interviewing with responsible people of Songon Copper Complex, information related to balanced score card was collected and compared by comparison matrix to quantitative values defined for every purpose in order annual improvement amount of indices and also gap between performance and purposes of organization to be determined. In order to calculate available space, gap and annual improvement amount of company performance, comparison matrix and following formula were employed (Alkenz & Payborn, 1992) and (Shahmoradi, 2005).

Formula (1)

$$Xi=\frac{Mi,n-\ Mi,n-1}{Ti\ -M}$$

Xi: percent of improvement amount of i index
Mi,n: related value of i index in n year
Mi, n-1: real value of i index in n-1 year
Ti: total value of i index
M: value of i index in first year of planning period

Therefore, according to formula 1, comparison matrix of every aspect of balanced score card and percent of improvement amount of related indices were designed at table 2.

Table 2. Comparison matrix of intended aspect.

Quantitative value of index	Percent of improvement amount			Weight	Index	Goal
	2010	2011	2012			

Table 3. Index access to goals at intended aspect.

Weight of each aspect	Amount of access to goals			Percent of improvement amount			Weight of each index	Index	Goals
	2012	2011	2010	2012	2011	2010			
Amount of total efficient index of organization at intended aspect									

For calculating amount of access to organizational goals at every aspect of balanced score card, the following relation and matrix were employed (Alkenz & Payborn, 1992) and (Shahmoradi, 2005).

Formula (2)

$$Yi=\sum_{i=1}^{n}\sum_{j=1}^{m} Mi,j\ Xi,j$$

(Yi: total efficacy index of i aspect- Mi, j: i index weight- Xi, j: percent of improvement amount of i index and j aspect.).

Therefore, according to formula 2, table of index access to goals in every aspect of balanced score card is designed as table 3.

Performance analysis of Songon Copper Complex from financial aspect

Results obtained from table 4 show that Songon Copper Complex met 14/17% in 2008, 4/5% in 2009, 16/5% in 2010 and totally 37% during four periods of strategic goals. Also the results infer that Songon Copper Complex has slow and positive

trend in sale yield indices, working capital yield, the collection amount of claims, full cost of one ton of product, debt and working capital ratio. Negative trends were also observed at indices related to fixed assets to specific ratio and available goods to working assets ratio.

Table 4. The amount of access to goals from financial aspect in Songon Copper Complex.

Weight of each aspect	Amount of access to goals			Percent of improvement amount			Weight of each index	Index	Goals
	90	89	88	90	89	88			
0/35	0/5	0/08	0/13	0/06	0/07	0/13	0/35	Sale yield (income)	Income growth
				0/06	0/06	0/09	0/3	Working capital yield	
				1/32	0/09	0/18	0/35	Collected amount of claims	
				0/22	0/33	0/17	0/4	Full cost of one ton of product	Cost reduction/exploitation
0/3	0/05	0/015	0/49	-/22	0/33	0/17	0/4	Fixed assets to specific value ratio	Use of assets
				0/16	-0/44	0/7	0/25	Available goods to working assets ratio	
				0/11	0/14	0/14	0/25	Debt ratio	
				0/16	0/36	0/1	0/25	Working ratio	
1	0/165	0/045	0/147	Amount of efficiency index of organization from financial aspect					
	35/7			Amount of total efficiency index of organization from financial aspect					

Table 5. The amount of access to goals from customer aspect in Songon Copper complex.

Weight of each aspect	Amount of access to goals			Percent of improvement amount			Weight of each index	Index	Goal
	2012	2011	2010	2012	2011	2010			
1	0/413	-0/21	0/225	0/27	0/18	0/18	0/2	Average time providing product	Customer satisfaction
				0/28	0	0/08	0/2	Received complaint to total customers ratio	
				0/21	0/1	0/26	0/2	The amount of attending complaints	
				1/1	-1/5	0/33	0/2	Average amount of undesirable products	
1	0/413	-0/21	0/225	Amount of efficiency index of organization from customer aspect					
	42/8			Amount of total efficiency index of organization from customer aspect					

Performance analysis of Songon Copper Complex from customer aspect

Results obtained from table 5 show that Songon Copper Complex met 22/5% in 2010, 4/5% in 2011, -21% in 2012 and totally 41/3% during four periods of strategic goals. Also the results infer that at average indices of time providing product, his Complex had positive trend in relation to reached to complaints reached all customers and amount of attending complaints. Also, at average index, the amount of undesirable products has negative trend.

Performance analysis of Songon Copper Complex from interior process aspect

Results obtained from table 6 show that Songon Copper Complex met 21% in 2010, 10/7% in 2011, -16/4% in 2012 and totally 48/18% during four periods of strategic goals.

Table 6. The amount of access to goals from interior process aspect in Songon Copper Complex.

The amount of access to goals				Percent of improvement amount			Weight	Index	Goal
	2012	2011	2010	2012	2011	2010			
0/02	0/1	0/102	0/14	0/12	0/12	0/17	0/25	Ascertained amount of ap proved programs of complex	Planning process of work force
				0/1	0/08	0/21	0/25	Ascertained amount of anticipated incomes	
				-0/1	0/05	0/15	0/25	Performance amount of current costs	
				0/26	0/16	0/03	0/25	Performance amount of capital costs	
0/15	0/05	0/12	0/15	0/26	0/13	0/21	0/2	Performed projects ratio	Engineered process of distribution
				0	0	0	0/2	The amount of great engineered projects	
				0	0	0/33	0/2	The amount of reviews on list of confirmed equipments	
				0/09	0/16	0/04	0/2	The amount of performed projects based on new technologies	
				-0/08	0/15	0/11	0/2	The amount of performed projects to reduce casualties	
0/15	0/08	-0/005	0/14	-0/33	1/27	-0/15	0/5	Percent of casualties growth or reduction	Process of exploit. from distr. net work
				1	-1/4	0/57	0/5	Undesired goods to total productions ratio	
0/15	0/31	0/26	0/21	0/15	0/31	0/3	1	Use of production line coefficient	Process of consumption manageent
0/15	0/2	0/1	0/1	0/36	0/15	0/24	0/5	The amount of happenings coefficient	Professional security and health
				0/46	0/2	0/11	0/5	Happening intensity coefficient	
1	0/164	0/107	0/21	Amount of organization efficiency from interior process aspect					
48/16				Amount of total organization efficiency from interior process aspect					

Table 7. The amount of access to goals from growth & learning aspect in Songon Copper complex.

Weight of each aspect	The amount of access to goals			Percent of improvement amount			Weight of each index	Index	Goals
	2010	2009	2008	2010	2009	2008			
0/35	0/31	0/04	0/24	0/12	0/12	0/25	0/4	Amount of articles presented at scientific conferences	Personnel capabilities (too keep, exploit and satisfy personnel
				0/44	0/16	0/16	0/2	Average years of personnel service	
				0/58	0/38	0/46	0/2	Organization desertion rate	
				0/28	0/17	0/07	0/2	Amount of personnel's suggestions	
3	21	18	127A	0/08	0/23	0/31	0/25	Personnel accessing simultaneously to automation per all personnel ratio	Capabilities of informational systems
				0/3	0/19	0/13	0/25	Exterior organizational communication at automation ratio	
				0/38	0/23	0/07	0/25	Exterior organizational communication at automation in last year ratio	
				0/08	0/08	0	0/25	Amount of company portal users	
				0/24	0/09	-0/05	0/2	Ratio of personnel having M.A. and PhD degrees	Motivate, make able and act
				0/64	0/64	0/25	0/2	Education distribution among personnel	
				0/52	-	-	0/2	Amount of personnel flatter on moral behaviors at organization	
				0/33	-	-	0/2	Innovation and creativity amount	
				0/21	-	-	0/2	Creating occupation amount	
1	0/3	0/12	0/136	Amount of organization efficiency from learning & growth aspect					
	55/76			Amount of total organization efficiency from learning & growth aspect					

Also it is inferred that this complex in relation to indices of ascertained amount of approved programs, ascertained amount of anticipated programs, performance amount of capital costs, performed project ratio, credit attraction of new technologies ratio, use of production line coefficient, the amount of happenings coefficient and intensity of happenings coefficient have positive trends. In relation to indices of performance amount of current costs, the amount of engineered projects, the amount of review on equipments listed, credit attraction ratio, casualties reduction, percent of casualties growth or reduction and desired products to all products ration, negative trend was observed.

Performance analysis of Songon Copper Complex from learning & growth aspect

Results obtained from table 7 show that Songon Copper Complex met 13/6 in 2008, 12% in 2009, 30% in 2010 and totally 55/76% during 4 periods of strategic goals.

Evaluating general performance of Songon Copper Complex

According to Complex performance evaluation from four financial, customer, interior process and learning & growth aspects, the matrix of total performance evaluation was calculated at table 8.

Table 8. The matrix of total performance evaluation of company.

Aspect	Aspect weight	Efficiency index			Efficiency index of period
		2010	2011	2012	
Financial	0/3	0/147	0/045	0/165	0/107
Customer	0/4	0/225	0/21	0/413	0/171
Interior process	0/15	0/21	0/107	0/164	0/072
Growth & learning	0/15	0/136	0/12	0/30	0/083
Total performance		0/186	0/036	0/284	0/4334
		Total efficiency			0/4334

Total performance analysis of Songon Copper Complex

Results obtained from table 8 show that this company didn't met 6/18% in 2008, 6/3% the goals in 2009 but it met 4/28% in 2010 and totally 34/34% of strategic goals at the four-year period.

The results of total performance of this company

According to calculations shown at table 9, it can be concluded that this company met 35/7% of defined goals from financial aspect, 42/7% from customer aspect, 48% from interior process aspect and 55/7% of defined goals from learning & growth aspect. Also there are 64/31 gaps from defined goals based on financial aspect, 57/3% based n customer aspect, 52% based on interior process aspect and lastly 44/3% gaps from defined goals based on learning & growth aspect.

Therefore, this company totally met 43/34% of goals and didn't reach 56/6% of goals. The results of total performance of this company have been shown at table 9 and diagram 1.

Table 9. The results of measuring total perfomance of complex.

Aspects	Amount of access to goals	Percent of ascertain of goals	Percent of non-ascertain of goals
Financial	0/107	35/7	46/3
Customer	0/171	42/7	57/3
Interior process	0/072	48	52
Learning & growth	0/083	55/7	44/3
Total performance	0/4334	43/34	56/66

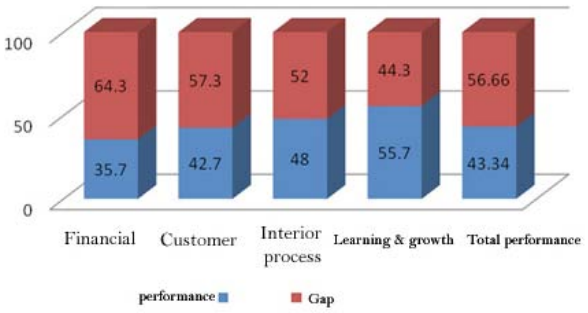

Diagram 1. The results of total performance of complex.

Recommendations

Based on research results shown at tables and diagrams on last pages, it's recommended that this company uses the results obtained from performance measurement to identify weak and strong points and to define improvement projects from all financial, customer, interior process and learning & growth aspects. So it's necessary that complex uses financial aspect to reduce costs and use asset, uses customer aspect to identify and analyze customers' needs and desires, uses leaning & growth aspect to create and increase personnel motive, to increase and cooperate among personnel by use of current management tools and improvement procedures along with strategic goals of copper industry and lastly company itself. At this way, followings are recommended:

1. To use value engineer in performing projects
2. To cooperate with industries and mines ministry to attract maximum credits
3. To use CRM to manage relationship with customers
4. To define and perform suitability process at all levels of organization

5. To identify, protect and motivate self-teaching and creative personnel

6. To protect and motivate personnel with M.A and PhD degrees

7. To increase information, collaboration between organization personnel in relation to similar and pioneer organizations

8. To perform security management systems such as OHSAS

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