Conceptual Model of Knowledge Management Performance Evaluation Based on the Balanced Scorecard and Game Theory in Terms of Uncertainty (Case Study: South Oil Company)

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ABSTRACT

Nowadays, knowledge management as a tool to document the existing knowledge in the organization is very important. In this article we are going to offer a new model for evaluating and ranking knowledge management and industrial companies the uncertainty in terms. Accordingly, we consider knowledge management based on the balanced scorecard and game theory concepts to cooperation. In addition, instead of using linguistic variables and absolute numbers we tried to use of gray numbers three parameters. The use of gray numbers and methods of game theory in this paper, three parameters have been to reduce the uncertainty prevailing environmental data and models. Shaply method with weighted exposure can be used as a new method of decision-making. At the end this paper has been of this case study of the South Oil Company which the ratings companies is obtained using Shaply rate and Poisson distribution.

KEYWORDS: Knowledge Management, Balanced scorecard, Games theory, Uncertainty, Gray numbers.

1 - INTRODUCTION

Recently, a knowledge management is placed in culture vocabulary words. In 1989 to prepare knowledge management technology-based consortium of organizations began its work in the United States. To his predecessor declared for the purpose of knowledge management in organizations as its capital. In 1991 and first time articles published on knowledge management in Known publishing houses. Perhaps the greatest research work in the field of knowledge management to date in organizations come into existence in 1995 by Cojeh and Nafuka, Hirotakatakishy. Knowledge can be arises broader, deeper and richer than data as knowledge of dynamic human mind which there are own knowledge and specific expertise when analyzing the data, and is processed and Enter the text to be and converted to knowledge. Knowledge refining and corrects in dealing with information and new situations. In fact, knowledge, has grown interaction with the environment and improved. Knowledge in science is higher order and contained it. In a clear and complete idea of the nature, importance is with explanation about a topic.
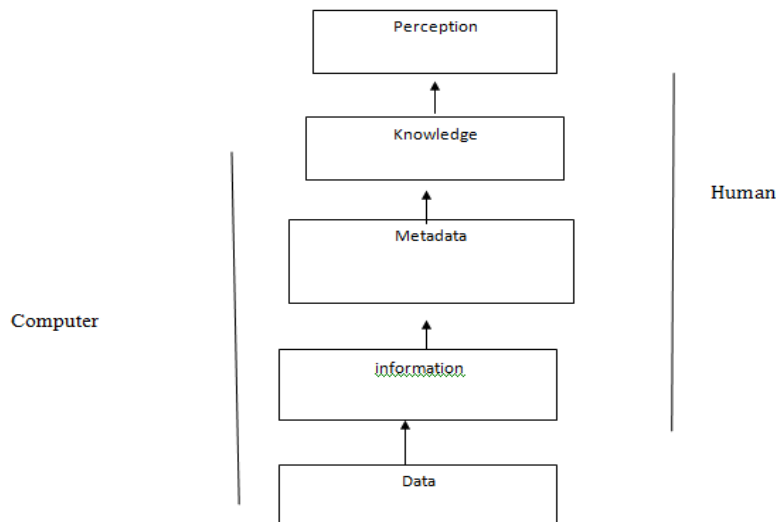
Without doubt, the development of the balanced scorecard model is still the most important event that has occurred in the area of performance measurement. Witness to this claim is that all the tools and models of

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management, balanced scorecard has been among 10 top tools in the early 21st century. Statistics Fortune journal show that 60% of 1000 companies have experienced world best balanced scorecard. In 2001, 52% of companies surveyed cooperative association balanced scorecard, were used balanced scorecard, 21% said they were planning to use it in the near future 23% were research in use or non-use of the balanced scorecard. This figure clearly shows that there is an important innovation of the balanced scorecard. That result was a wave that it was formed "strategically to everything". Wave that could be called a "strategic revolution".

2 - Literature
2.1 Knowledge Management
Knowledge management is the process through which organizations generate a wealth of knowledge and intellectual capital (Takeuchi, 1995). It also states that the definition of knowledge management Malhutra Where Knowledge management is the process through which organizations to acquire in the field of learning (self-knowledge), codified knowledge (external knowledge), the distribution and transfer of knowledge, skills (Abtahi and Salvati, 2006). Blunt is also believed that knowledge management is the process through which organizations are employing data collected (Abtahi and Salvati, 2006). Approaches to knowledge management related to landscape management. The difference could be due to the prospects of the foundation of information foundation technology and foundation of culture (Gottschalk, 2005).

2-2 Balanced scorecard
The view followed in the 1990s, developments in the design and development of systems emerged for measuring and monitoring performance, and was developed by Professor Robert Kaplan of Harvard and David Norton from advisors international strategy.

Statement balanced in balanced scorecard or balance refers to the balance. The attitude is established of the between financial goals and objectives of the non-financial side the other hand, short-term goals, long term goals on the other hand, internal goals and objectives of foreigners on the other hand (Kaplanunurton, 1996) in balanced score card devised by Kaplan Norton, can be seen the four aspects of financial, customer, internal business processes and learning and growth that the diagram is shown in Figure 1. Various aspects of the balanced scorecard, allows answer the following four basic questions.

➢ How can shareholders look? (Financial aspects)
➢ How do customers look to us? (Client aspects)
➢ Do we perform well in what areas? (Aspects of internal business processes)
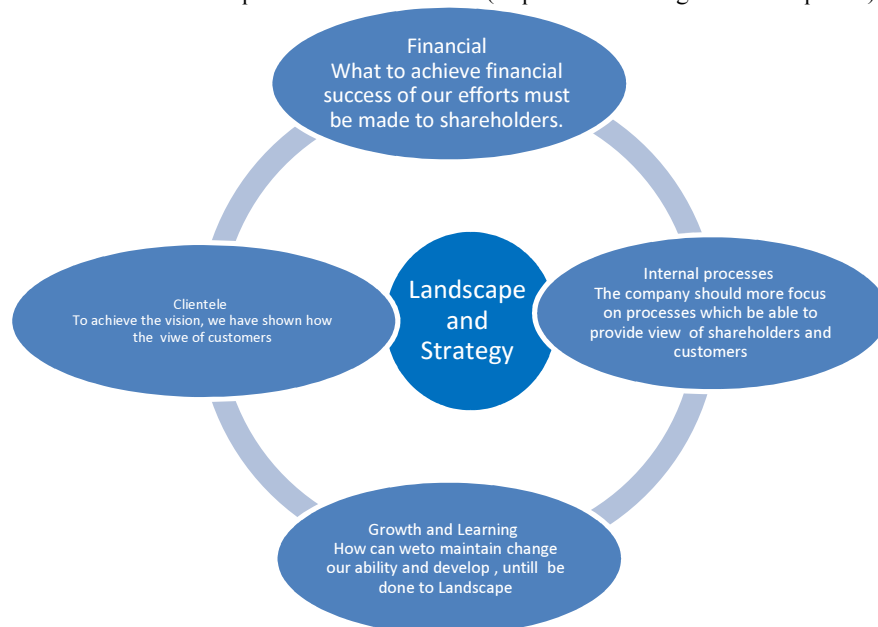➢ How can we continue to improve and create value? (Aspects of learning and development)

Figure 1: Elements of the Balanced Scorecard

2.3 Uncertainty
Uncertainty principle pioneered was introduced by German physicist Heisenberg in 1926. It was then considered by many philosophers. They have Comments two doctrines of thought main about this Principle (French 1980; Henrion and Morgan, 1990):

1-   **Doctrine repeater**: The doctrine probability knows the objective. This means that the estimated effect of reducing uncertainty need sensory information and experience, the occurrence of long periods of time and more repeats.

  2- **Doctrine Bayesian**: The doctrine knows the possibility of subjective, this means that even in the times when the actual data are not available in the environment people have estimate 's ability to use the knowledge and experience. In other words, even based on empirical data objectively not possible to estimate the effect.

   The classification of various kinds in effects of uncertainty will be in references pet Cornell (1996) and (Hltvn, 1996).Bassoon (2004) has tried to provide a model on several occasions to classify uncertainty in the study. He knows uncertainty in the three categories of uncertainty data, uncertainty in preferences and the model.

2-4. Grey numbers three parameters
  Gray systems theory proposed first time by Deng (1989) and was expanded by another (Lin and Sifing, 1999).If black representing completely unknown and white consists of information is perfectly clear, gray is information that somewhat and somewhat unknown. System that contains data is gray, it call gray system. Deng (1989) claims that gray numbers compared to phase numbers is more flexibility and convenience. Grey three parameters numbers [(*) a] can be either showed**, a lower bound, ã center of gravity (the number has the greatest possible), āUpper bounds. The case is not obvious that the center, three-parameter number becomes gray to gray typical number.

2-5 games with assistant
  Game theory is as a new branch of applied mathematics science, the study of decision making in various situations. Game theory is divided into two main branches: 1- Non cooperative games. 2- Cooperative games. In non-cooperative games, it is assumed that actors behave rationally and think only of their own interests and there is not also cooperation and agreement between them. But in, cooperative games, players have the possibility of cooperation and the main objective of these games provide a way for a fair share net income of partnership (Gibbons, 2005).

  A N-player cooperative game in characteristic function form is an ordered pair G (N, v), where N is a finite set with n members N= {1, 2, …, n}. N is actually a collection of actors. Subset S is called a coalition. Can easily be found in the collection of waste 2^n is shapeable which contains the empty set and N (Radzick, 2012). One of the most popular solutions were proposed in 1953 by Shaply that this is known as the Shaply. However, we note that this value is of transferable utility (games with side payments). Shaply value of non-transferable utility was introduced in 1969 by Shaplylater in 1992 by Mashlr and she became more extended. Suppose *G (n)* is the set of all games (all possible characteristic functions), which it has *n* player. Shaply value is a mapping (which is one-dimensional Euclidean space) which shall satisfy the following conditions.

1- Symmetry: if players *i, j* to be replaced in a particular game *V*, In this case, $\Psi v_i . \Psi v_i = \Psi v_j$ means an individual award *i* in the game *V* is worth Shaply.
2- Performance: $\sum_{i=1}^{n} \Psi v_i = V(n)$
3- Gathering variability $\Psi(v+h)_I = \Psi v_i + \Psi h_i \Psi v_\phi = 0$
4- Player empty $\Psi v_\emptyset = 0$

Theorem: $$\psi v_i = \frac{1}{n!} \sum_M [V(K_i \cup \{i\}) - V(K_i)]$$

So for all of different transforms *n* (count *n!* mode) varies and *K_i* a collection of players who have been in *M* the order of *i*.
Shaply value is also calculated as follows:

$$\psi v_i = \sum_{\substack{S \subset N \\ i \in S}} \frac{(s-1)!(n-s)!}{n!} [V(S) - V(N \setminus S)]$$

As $S \subseteq N$a coalition consisting of the *S* player that the player *i* is included. Sign N/S as previously mentioned, is a subset amendment S coalition. It has been suggested that *V(S), V (N/S)* Viewer utility of the two coalitions gain based on Nash response (This relationship is further discussed in the next chapter). In fact, this is done by bargaining between *N/S* and *S* coalitions when the Nash desirability to be replaced of attribute values. Ψv_i Shaply value adjustment is called *i* player. Characteristic functions of the game do not show sufficient.

3 - Research Methodology
In research the methodology doing is described below:

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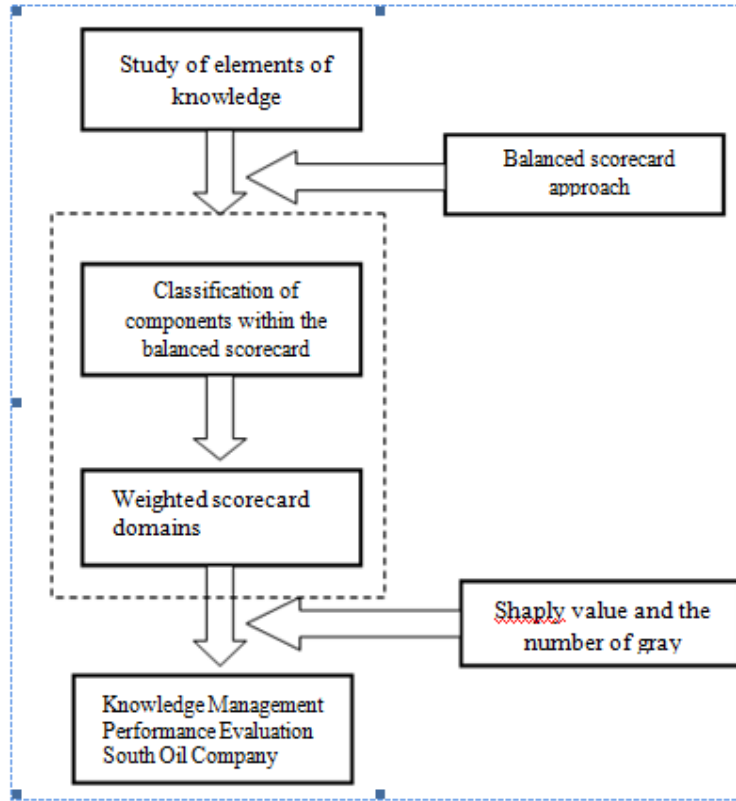
However, we will continue to implement the methodology steps. First, in Table (1) is shown characteristics of the four areas of assessment and based on the balanced scorecard.

Table 1: Evaluation criteria are based on the Balanced Scorecard

Index Score	Field goals	Field Scorecard
Profit margins	Optimization aimed to increase Production efficiency and profitability	
		Financial sphere
Waste ,manpower, energy	Cost optimization	
Increase the value	Achieve competitive prices	
Improvement of product quality and standardization	Customer satisfaction	Sphere
	Maintaining and sustaining customer	Customer Sphere
Value for Competitive Advantage		
Market share	Identify new markets	
Converting new ideas into action	Applying technologies	The new field
Value Added Products	Changes in the production process	Internal process
	To enhance product quality	
Experience and knowledge	Process problems	
Laws and Regulations	Standard Products	
Reward and fees	The performance-based incentive system	
The number of lesions, number of referrals	Maintenance and updating equipment	
Continuing Education	Maintenance capture ideas	
Employee Satisfaction	Uptake and maintenance of forces and employee participation	Sphere Learning and development

After considering the value of each coalition value to obtain the value function Shaply. Results can be seen in Table (2).

Table 2: Values Shaply for different areas of the balanced scorecard

Areas of the balanced scorecard	Value Shaply
Financial sphere	$\varphi_A = 0.28$
Customer sphere	$\varphi_B = 0.26$
Field of internal process	$\varphi_C = 0.24$
Sphere of learning and development	$\varphi_D = 0.22$

Thirty-one-member committee formed to study and record companies, their collective expert opinion were considered in relation to the evaluation of each company (Table 3).

Table 3: Evaluation of linguistic experts

Growth and learning	Internal processes	Customer	Financial	Company Name
L	L	H	M	Petrochemical Company mahshahr
L	M	VH	L	Oil and Gas Company GACHSARAN
M	L	MH	VL	Oil and gas companies Omidieh
ML	VL	MH	M	Offshore Oil and Gas Company
VL	M	M	L	Oil and Gas Company in Ahvaz

Using Table 4, linguistic values are converted to numbers on a gray three parameters.

Table 4 linguistic variables and values of each three parameter grey

Linguistic Variable	Gray Interval
Medium Low(ML)	[0.3,0.35,0.4]
Medium (M)	[0.4,0.45,0.5]
Medium high(MH)	[0.5,0.55,0.6]
High(H)	[0.6,0.75,0.9]
Very high(VH)	[0.9,0.95,1.0]

4 - Data Analysis and Interpretation of Results:

Individual characteristics of subjects (268n =) is presented Tables (5).

Table (5) - Individual characteristics of the subjects

Field of Study				Education			Job				Experience		Variable
Other disciplines	Engineering	Management Economics	Accounting / Finance	PhD	Master of Science	Bachelor	expert	Master of Science	Mid manager	Senior Manager	More than 10 years	5 to 10 years	
86	50	73	59	6	60	202	128	78	44	18	200	68	South Oil Company

To evaluate of normal variables Knowledge Management and improvement the performance South Oil Company BSC model, Before the implementation of BSC and the 5-year period (2006-2001) and after the implementation of the BSC for the period (2011-2007) In this study, was used Kolmogorov - Smirnov test. Test results Kolmogorov – Smirnoff is provided in Table (6). According to the probability value statistics, Kolmogorov - Smirnov test for all variables is greater than 5%, so for all of these variables will be accepted hypothesis of normal distribution of variables. It should be noted that for this test was used the statistical software SPSS version 16.

Table (6) Evaluation of normal variables

Probability statistics K-S	K-S Statistics	Number	Statistics Variables
0.134	1.187	268	Knowledge Management
0.77	1.136	268	customer-centric before the implementation of BSC
0.132	1.181	268	Centered internal processes before implementation BSC
0.054	1.108	268	Centered growth and learning before implementing BSC
0.112	1.154	268	Financial Centered before implementation BSC
0.073	1.126	268	Customer-Centered after the implementation of BSC
0.066	1.119	268	internal process-centered After the implementation BSC
0.087	1.141	268	Centered growth and learning after implementation BSC
0.125	1.187	268	Financial Centered after implementation BSC

As the Tables (6) is taken, the sampling distribution is normal study. Non-parametric statistics for the different variables in the descriptive statistics is used of the direct comparison of the mean, minimum and maximum, standard deviation, coefficient of variation. Descriptive statistics for variables are presented in Table 7. Comparing the coefficient of variation (standard deviation divided by the mean) of the independent variables

(knowledge management) during the study comes to the conclusion dispersion (0.22) and the result has been stable. However, the dependent variables improve performance BSC model in comparison with the independent variables of knowledge management have variation coefficients and scatter equally and therefore dependent variables were also stable during the study period. Therefore, due to the relatively high stability of knowledge management in public organizations, improve the performance of organizations based on BSC before and after the implementation of the knowledge management, be affected by other factors that need to be addressed in future research on this topic.

Table 7 -Descriptive statistics of variables

Coefficient of variation	Standard deviation	Mean	Maximum	Minimum	Number	Statistics \ Variables
0.22	15.09	69.01	95	26	268	Knowledge Management
0.18	3.21	17.89	27	8	268	customer-centric before the implementation of BSC
0.26	2.68	10.33	19	5	268	Centered internal processes before implementation BSC
0.29	3.91	13.50	24	6	268	Centered growth and learning before implementing BSC
0.22	4.10	18.15	25	8	268	Financial Centered before implementation BSC
0.17	3.62	20.16	28	8	268	Customer-Centered after the implementation of BSC
0.19	3.50	18.14	25	8	268	internal process-centered After the implementation BSC
0.20	3.72	18.85	25	8	268	Centered growth and learning after implementation BSC
0.22	5.94	26.84	39	8	268	Financial Centered after implementation BSC

In this section, to test the hypothesis using statistical tests significant level ($P \leq 0.05$) Pearson's correlation coefficient to determine whether or not significant impact on knowledge management on improving the performance South Oil Company before and after implementation based on BSC pattern has been analyzed during the course of the study (85-1381) and (90-1386).

Shaply value is also calculated as follows:

$$\psi v_i = \sum_{\substack{S \subset N \\ i \in S}} \frac{(s-1)!(n-s)!}{n!} [V(S) - V(N \setminus S)]$$

As $S \subset N$ a coalition consisting of the S player that the player i is included. Sign N/S as previously mentioned, is a subset amendment S coalition. It has been suggested that V(S), V (N/S) Viewer utility of the two coalitions gain based on Nash response (This relationship is further discussed in the next chapter). In fact, this is done by bargaining between N/S and S coalitions when the Nash desirability to be replaced of attribute values. Ψv_i Shaply value adjustment is called i player. Characteristic functions of the game do not show sufficient.

In this study, four balanced scorecard perspectives are considered as four players. The four players in order to create the maximum possible efficiency cooperation between its use for set. But how much is the value of each of the players in this game? In other words, the components of which one is more bold? Obviously meet only one of these components alone will lead to failure. The individual values are zero. Values of coalition set are specified in Table 8.

Table (8)- the value of coalitions set

V({})=0	The value of empty set
V({F})=0, V({I})=0, V({C})=0, V({L})=0	The value of single-member
V({C,F})=0.5, V({I,F})=0.2, V({L,F})=0.15, V({L,I})=0.25, V({L,C})=0.15, V({I,C})=0.3	The value of two-part series
V({I,C,F})=0.75, V({L,I,F})=0.85, V({L,I,C})=0.75, V({L,C,F})=0.80	The value of three-part series
V({L,I,C,F})=1	The value of four-part series

Using the value function Shaply and consider making these values as input Shaply method, each element of the scorecard will be in this table.

Table (9) the value of each element of the balanced scorecard

	L	I	C	F
Φ	0.22	0.24	0.26	0.28

Accordingly, the financial component (F) is of paramount importance in this game. Then the elements of the client (C), internal processes (I) and learning (L) have its importance later.

5-DISCUSSION

This article was intended as a new method to evaluate the performance of knowledge management should be the number of companies south. Therefore, using the balanced scorecard indicators were categories in four dimensions. The opinions of the experts who evaluated that become a gray three parameter values and using the weighting method Shaply was paid the weighting of each index. In this study game partnering with respect to rehabilitation in condition of coalition, helped the researchers to calculate the weights of indicators.

Of course you can gather such that knowledge management significant impact on improving the performance South Oil Company based on the BSC model implemented are during the study period (1390-1386) (the Pearson correlation coefficient).But independent factor of knowledge management to improve the performance of the South Oil Company before the implementation of the BSC model were not significant for the first period of study (1385-1381).However, in this paper, using game are weighted partnership with Shaply values dependent variables. The failures ignoring of coalition between the indicators and the lack of certainty on the model parameters on the sides.

Future studies can use other methods to be used weighting on Knowledge Management. Methods such as entropy and analytical hierarchy methods that can be used for this purpose.

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