Flexible Balanced Scorecard for nonprofit organizations

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Abstract

Low flexibility and effectiveness of the Balanced Scorecard in the field of nonprofit organizations in which profitability is not the main goal, makes it unproductive. In this paper the problem is solved by using two new factors such as: Employers and encouragement and Management besides the four basic factors introduced by the primitive version of the model. This alteration makes it flexible and more comprehensive, in comparison with the traditional version of the model. In this manner the logistic regression and Bradley-Terry-Luce methods are employed for classifying, sorting and ranking the factors and finding the two or three most important indexes in each six bounded levels and establishing the organizational strategy map. Finally, the proposed model is practically tested and the results are illustrated in the following paragraphs.
Keywords: Balanced Scorecard, Bradley-Terry-Luce, logistic regression.

1 Introduction

Nowadays, the Balanced Scorecard (BSC) is a widely used method for organizational performance measurement and increasing productivities in the entire world. This method is first introduced as one of the strategic management tools, by Kaplan in 1980 and then in company with Johnson in 1987 [1]. Some researchers believe that it was proposed by Art Schneiderman in 1987 [2]. But the university based idiom of balanced assessment was introduced by Kaplan and Norton in 1992 [3] and rapidly developed in 1993 [4] until their related book published in 1996 [5] and introduced as a tool to turn the strategy into practice [6–10]. Despite, it is not completely and practically emphasized that measurement must be balanced or goals must have coherence with related factors

WIT Transactions on Engineering Sciences, Vol 80, © 2012 WIT Press
www.witpress.com, ISSN 1743-3533 (on-line)
doi:10.2495/AIE120171

in any publication of Kaplan and Norton [3−5] until Speckbacher *et al*. [7] emphasized on it in 2003 and finally, the strategy plan is used to complete the model in 2004 [8]. Brief review of BSC literature convinces that it has been widely applied in western English language and Scandinavian countries in the 1990s and then it has been applied in Middle East, Asian and Spanish language countries in the first decade of the 21st century.

The model is based on four vital factors – (1) Financial (how do we look to stakeholders?) (2) Internal business process (What must we excel at?) (3) Customer (How do customers see us?) (4) Innovation and learning (Can we continue to improve and create value?) – to establish a relation between short term operational control with long term strategic goals [1–15].

The model is balanced operating and it not only establishes balance between financial and nonfinancial, short term and long term and internal and external goals, but it balances the anterior and posterior factors in some cause and effect chains [10].

What literature says leads the model to be the tool not only for performance measurement but also for complementing the strategy [10]. But, beside all of the stringiness and usefulness of the model, it has some weaknesses such as: (1) putting no suitable emphasize on organizational stakeholders, (2) having theoretical weakness in using scorecard, (3) establishing appropriate relations instead of extinct ones [14], (4) having no agreeable and casual internal relationship between factors or any method for recognizing these relationships, (5) having weakness in getting contact with organizational environment [15], (6) paying poor attention to employees and suppliers effects on organization and its goal approaching, (7) performing measurements only for attracting stakeholders [16, 18] (8) paying poor attention to human resources and their encouragements as the large weakness of the model, (9) having no success in establishing long term view, (10) having no benchmark to show the performance of the model, (11) needing empirical credibility [17, 18], (12) introducing no algorithm to recognize measuring parameters, based on goals, (13) proposing four fixed factors for entire organizations [18].

In this paper, a new flexible Balanced Scorecard is introduced. This model considers factors in more than four classes that include entire organizations with deferent fields, goals and visions. The proposed model includes six classes of factors by adding two new vital factors that named Employers and encouragement and Management – as an example to solve the 8th and 13th weaknesses of model. Then Factor analysis, logistic regression and Bradley-Terry-Luce methods are used for recognizing independence and importance of factors, sorting and ranking them and then selecting two or three important indicators of each level of factors that solve 4th and 12th weaknesses. Finally, the proposed model is practically tested in the Water Regional Organization of Kurdistan and the results demonstrate the usefulness and validity of the proposed model.

2 Methodology

2.1 Principles of factor analysis model

Factor analysis is a method to classify the total deviation of data series into two rations: (1) Error, (2) Treatment. It analyzes them to identify whether deviation is significant or not. The Method says that, if k is the number of random sampling and n is the sample size then hypothesis is established as shown in (1).

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k$$
$$H_1 : \textit{at least one equation is not available} \tag{1}$$

Total corrected sum of squares (SST) is given by (2)

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n}(x_{ij} - \bar{x}_{..})^2 \quad , \quad \bar{x}_{..} = \frac{1}{nk}\sum_{i=1}^{k}\sum_{j=1}^{n} x_{ij} \tag{2}$$

This deviation is shared to two rations that are shown in (3).

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n}(x_{ij} - \bar{x}_{..})^2 = n.\sum_{j=1}^{n}(\bar{x}_{i.} - \bar{x}_{..})^2 + \sum_{i=1}^{k}\sum_{j=1}^{n}(x_{ij} - \bar{x}_{i.})^2 \tag{3}$$

Finally, factor F that given by (4) is compared with $F_{k-1,k(n-1)}$. If F is lower than $F_{k-1,k(n-1)}$ then it is accepted and if F is larger than $F_{k-1,k(n-1)}$ then it is not accepted [19].

$$F = \frac{MS(Tr)}{MSE} = \frac{SS(Tr)/(k-1)}{SSE/k(n-1)} \tag{4}$$

If deviance of treatments is significant (H_0 is not accepted) then comparison of treatments can define priority of them and if H_0 is accepted, treatments must be combined or some of them must be eliminated to gain the independent treatments that have the significant deviance. In other words, using this method can identify the credit of factors classification. After this phase, Logistic regression can select the significant ones.

2.2 Principles of logistic regression model

Logistic regression statistically used to identify chance of accuracy of events or logistic function fitness that shows the model for binomial linear regression. It is an appropriate tool to analyze the existence of relation between two or more independent or binary parameters. The logistic function which is shown in (5) translates data entries (Random variables series between $-\infty$ to $+\infty$) to numbers between 0 and 1 as a chance of events occurrence and (6) is even available for that.

$$f(z_i) = p_i = e^{z_i}/e^{z_i} + 1 = 1/e^{-z_i} + 1 \tag{5}$$

$$z_i = Logit(p_i) = \ln(\frac{p_i}{1-p_i}) = \beta_0 + \beta_0 x_{0,i} + ... + \beta_k x_{k,i} \tag{6}$$

Variable z_i shows a ration of any independent variables of model that named by Logit and each β_i shows a ration of each risk factor that may calculated by Maximum likelihood method. Thereafter, (7) is used to identify the level of fitness that is exists between data and function. In our proposed model it can identify the importance level of each factor and even necessity of it.

$$-2\log(Likelihood\ ratio) \approx \chi^2 \tag{7}$$

Afterward, (8) shows that if new factor entrance make the chance of occurrence better or not, where L_0 is chance of primary model and L_1 is chance of modified model.

$$\lambda = \frac{L_0}{L_1} < 1 \tag{8}$$

Until now, important factors are identified. After this phase, Bradley-Terry-Luce method shows the order of these important factors in strategy plan of organization.

2.3 Principles of Bradley-Terry-Luce model

This model is using simple logistic regression for binary comparison of data. It is similar to Thurstone or Rasch models that apply normal distribution in their comparisons. In the model, priority chance of parameter *j* in comparison with parameter *i* is given by (9), where δ_i is shows the scale position of parameter *j*.

$$\Pr(X_{ij} = 1) = \frac{e^{\delta_j - \delta_i}}{1 + e^{\delta_j - \delta_i}} = Logit^{-1}(\delta_j - \delta_i) \tag{9}$$

3 Empirical examples

As an empirical study, Kurdistan Regional Water Organization is proposed as an example of nonprofit organizations to demonstrate usefulness and validity of the proposed model. The data for this study were collected in spring 2008 in Kurdistan, Iran. Data include 88 creditable performance indexes that Factor analysis in SPSS software classified them into six levels of factors where the weight of each index in relation to related factor achieved at least 0.5. Data classified as: (1) 15 financial indexes, (2) 7 internal business process indexes, (3) 7 customer Indexes, (4) 24 innovation and learning indexes, (5) 13 employers and encouragement indexes, (6) 22 management Indexes, that shown in table 1.

After classifying, indexes returned to experts to give them privileges according to organizational strategies by using Five Point Likert. After quantifying, the average of each factor preferences was calculated and analyzed

by Factor analysis method and compared with $F_{5,36,0.05}$=2.482. Parameter *F,* in factor analysis was equal to 3.165, so H_0 was rejected and credit of classifying was proved.

Table 1: Summary of experts ranking, factor analysis and logistic regression.

Freq.	Ranking numbers of 7 selected experts							F.	Factor
	1	2	3	4	5	6	7		
15	0.7421	0.7682	0.7836	0.8069	0.7082	0.7569	0.6492	1	Financial
7	0.7243	0.7556	0.7556	0.7672	0.7473	0.7753	0.6206	1	Customer
7	0.7144	0.7385	0.7301	0.7879	0.6942	0.7458	0.5988	1	Internal business process
24	0.6683	0.6783	0.6903	0.7342	0.6685	0.6983	0.5755	1	Innovation and learning
13	0.6576	0.6667	0.6862	0.7186	0.6816	0.6829	0.5757	2	Employer and encouragement
22	0.6428	0.6582	0.6786	0.7007	0.6748	0.6926	0.5688	2	Management

Afterward, Logistic regression applied on data shown in Table 1 and after achieving 85.5% of accuracy, by using MINITAB software, results of table 2 was achieved. Then applying (8) revealed that entrance of Employers and encouragement factor lead the model to be better (λ=0.99845<1) and Management was not a good factor, so it must be eliminated. Thereafter, using Bradley-Terry-Luce method, according to the order that is shown in the first column of the Fig. 1, prepared maximum of likelihood that is equal to 0.92484. One can see that the order of the Table 1 is the same as the order of the BSC in its basic scheme. The likelihood of this order is calculated in order to have a comparison between these two set of orders. The result is interestingly showing the value of approximately zero.

After this phase, key indexes of each factor must be identified. For achieving this goal, Logistic regression and Bradley-Terry-Luce was used subsequently. For instance, the data for the index "Internal process" is shown in Table 3, and the same process is followed for the other factors. To select the two or three preferred indexes, the difference between column "Score" and column

Table 2: Results of MINITAB software.

Chi-square	Log(Likelihood)	Alteration of model
1.499	-1.287	Four basic factors
1.504	-1.289	employers and encouragement + Four basic factors
1.394	-1.228	management + Four basic factors
-	-0.855	+management + Four basic factors employers and encouragement

"Significance" is used as the preference index. Each of the indexes which have a higher difference is the better. In this table, the two preferred indexes are signed by asterisks which are indexed in Fig. 2 in their related rows. Finally, by using flow process of organization and asking experts, strategic plan is achieved that is shown in Fig. 1.

Table 3: Results of MINTAB software.

Variable (Index)	Score	df	Sig.
CDI01	0.524	1	0.469
CDI02	2.042	1	0.153
CDI03	*2.366	1	0.124
CDI04	1.317	1	0.251
CDI05	0.579	1	0.447
CDI06	*3.840	1	0.050
CDI07	0.112	1	0.737

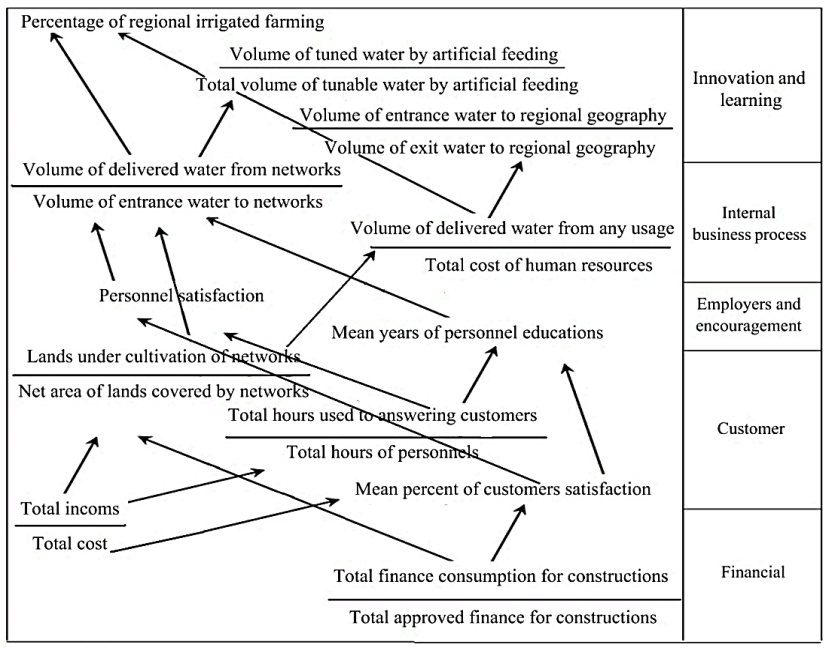

Figure 1: Strategy plan of Kurdistan regional water organization.

4 Conclusions

In this paper, major problems of BSC, such as emphasis on only four fixed factors, incomprehensiveness for all organizations, poor emphasize on employers and having no agreeable and casual internal relationship between factors or any method for recognizing these relationships were analyzed. These problems were solved by adding two new factors and using Factor analysis, logistic regression and Bradley-Terry-Luce methods. In according to the achieved large number for likelihood, the accuracy of model was more increased and the position of Innovation and learning in the top of the strategy plan of this nonprofit organization besides using creditable quantitative methods validates and proves the accuracy of the proposed model in comparison with traditional model.

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