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Determine school performance evaluation model based on data envelopment analysis and TOPSIS (Case Study: urban High Schools in Qazvin)

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Abstract
Performance evaluation is one of the most important management agendas as key to achieving continuous improvement in the ability to evaluate the ongoing performance of the organization. Many organizations have realized the importance of ongoing evaluation of performance and performance appraisal systems employ a variety of organizations. In this regard between 1850 and 1975, only on the basis of financial measures to assess the performance of the organizations involved, for reasons such as: encouraging short-term view of the lack of strategic focus and inability to provide data about the quality, responsiveness and flexibility, encouraging an optimistic view, the failure to provide information about what customers want and how competitors were criticized. Methods: This study intends to evaluate the model ordinary native city through the provision of integrated model questionnaire and analyze the results it provides. The proposed model schools ranked theoretical and mathematical description is composed of two parts. This model utilizes the model of the Balanced Scorecard, developed its shape or conceptual cross section of the rating model, the recall is complete. All the research community to the city of Qazvin is no ordinary high school. A total of 177 patients were collected points. For the analysis of data obtained from the decision matrix with TOPSIS technique and Excel software to compare the two choice expert significant part of this research is 5%.packaging determined. The results of the ranking of schools with units 2 TOPSIS indicate that the school is the top priority compared to other options. Conclusion: All the components of the index and rank high schools in the city of Qazvin no effective diagnostic data obtained for decision criteria are less than 0.05. So all indicators can be used to evaluate the performance of ordinary high schools, theoretically, contribute to the city of Qazvin.

Key words: *fusion model, TOPSIS, school performance, performance evaluation*

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Introduction

Performance evaluation refers to one of the most important management agendas, because it is the key to access constant improvement in the ability for constant evaluation and measurement of organization's performance. Most of organizations have understood significance of constant performance evaluation and evaluation systems have utilized a diverse performance in the organization. In this regards, organizations have evaluated performance based on financial standards during 1850-1975, which have been criticized due to the reasons such as encouraging short-term view, lack of strategic focus and inability to provide data about the quality, responsiveness and flexibility, encouraging an optimistic view, the failure to provide information about what customers want and how competitors' performance is (Zarei Matin et al. 2010, p. 102). By increasing complexity at business environment per decade, further standards have been considered in the concept of performance (Olia, 2010). To improve quality of education system and depict the proper status, it requires taking major steps, i.e. considering the education system not as a consumer entity but as a capital entity, considering the short-term and long-term goals from the prospect of children's future life in such a way that the growth and success can be provided for them at various dimensions (Jahanian & Beladi Nejad, 2012, p. 26). In a study, the strategic plot has been designed for the scientific and research non-governmental institutes based on balanced scorecard (case study: Jahad Daneshgahi). The results indicated that the one-year status for performing the strategy in this institute has been analyzed through analysis of obtained indices and the approaches for successful performance of strategy have been presented and then the existing gaps have been reduced(Dadkhah et al. 2013). Another research has evaluated performance of sports organizations using the integrated TOPSIS-balanced scorecard model in Department of Physical Education in Yazd province. Findings from these results with the balanced scorecard indicated that Department of Physical Education in Yazd province have outperformed in two aspects of domestic processes and growth and learning and have not outperformed in two aspects of finance and customer. Further, fuzzy Topsis technique has displayed priority of 37 indices in separate for four aspects (Dadkhah et al. 2013). A study entitled "higher education institutes via balanced scorecard and multi-criteria decision making methods" was conducted aiming at developing a model in form of a balanced scorecard and multi-criteria decision making methods to evaluate non-profit higher education institutes and universities and increase the beneficiaries' satisfaction and improve four-criteria dimensions inside the organization in an efficient and effective way; the results indicated that the most important criterion is to increase income, reputation and acceptability at higher education grades in higher education institutes. Further, Sajad higher education institute has been selected as the best non-profit institute in Mashahd city and then Azad University and Khayam institute have been selected (Ahmadi, 2013). In an article entitled "evaluation of performance of schools via balanced scoarecard and data envelopment analysis", an applied model to rank, plan and improve performance of schools was represented. In this research, the integrated model of balanced scorecard and data envelopment analysis has been used. This research has been conducted by selecting the statistical population consisting of the schools at all academic grades in Takestan during 2012-2013, so that the results from this research have proposed a suitable model to rank, plan and improve performance of schools which can be utilized in other organizations including Banks, department of water and so on(Rahmani, 2013). In a research, productivity of higher education institutes using data envelopment analysis has been measured and DEA(P2) has been used to measure values; the results indicated that the

productivity of all the factors in research department in higher education institutes in Sirjan city has reduced, which the reason can be technological changes; further the productivity of factors in department of education has developed which the reason can be changes in management efficiency(Yazdi & Ahmadi, 2011). Another article has examined effectiveness of universities based on data envelopment analysis and has examined 16 input and output variables based on the research activities and teaching to measure efficiency and/or inefficiency of the university under study in China, whereby the efficiency of these dimensions has been estimated, detected with 13 efficient variables as the result of this study (Chuen & Kuan, 2011). In an article entitled with "multi-dimensional evaluation of organizational performance using data envelopment analysis and balanced scorecard", three task units of an organization regarding aspects of balanced scorecard have been evaluated. The researchers have represented an algorithm in 9 stages to perform their study and defined suitable sub-criteria for each of criteria to evaluate performance of units (Bentes et al. 2012). In a study entitled "strategy of Centralized School: implementation of balanced scorecard in the institutes providing educational services", it has been stated that balanced scorecard as a strategy to evaluate performance used in non-profit and governmental centers can lead to further effectiveness of schools as a useful tool associated to inputs, processes and outputs in utilization of leading strategies for these components. In this regards, it requires paying attention to the structure of management and utilizing the operating and executive plans in form of balanced scorecard as a tool to measure performance measurement management system to achieve the goals at schools (Yuksel & Coskun, 2013). In a fundamental study, the theoretical plan to represent a novel model based on integrated model of data envelopment analysis and balanced scorecard has been examined. The researchers stated in their results from study that proper integrated models of data envelopment analysis and balanced scorecard can be useful to achieve comprehensive performance and performance management systems for industrial companies and their processes(Kádárová et al. 2015). This research intends to represent a model to evaluate performance of high schools via the integrated model through preparing the questionnaire and analyzing the results from it.

Research method

To conduct this research, the stages below have been considered:

1. detect components of balanced scorecard using field method to detect beneficiaries' expectations at high schools
2. divide these expectations based on components of balanced scorecard
3. formulate and design the questionnaire to determine significance and effect of indices of performance evaluation at high schools and weigh those using Shannon's Entropy and PROMETHEE techniques
4. collect the data at conceptual part of model
5. determine efficiency of institutes using data envelopment analysis and rank them
6. rank institutes using Topsis technique
7. compare the results from ranking in data envelopment analysis and Topsis to evaluate model
8. represent the final model

The proposed model to rank the high schools has developed from descriptive and mathematical sections. This model using the balanced scorecard model has the developed model; the descriptive or conceptual part of this ranking model enjoys a totality. The proposed model includes five major components of financial, domestic processes, management, growth and learning, customer orientation at descriptive dimension. There are 30 indices as the total indices in the proposed model which 5 indices relate to the financial component, 4 indices relate to the domestic component, 5 indices relate to the management component, 7 indices relate to the growth and learning, and

9 indices relate to the customer orientation. The proposed indices are the quantitative and qualitative indices. The statistical population consists of high schools at Qazvin province. Among all districts of Qazvin province, district 1 of Qazvin at equipped and Takestan regions was selected of the semi-equipped region and Khoramdasht city was selected of non-equipped region. The students and instructors at each class were selected as the target sample. School- unit 14, school-unit 12 and school-unit 17 were selected of Qazvin, Takestan and Khoramdasht, respectively; the second Empirical sciences class with 25 students, 11 instructors and 25 parents were selected in School- unit 14 at district one of Qazvin; the fourth mathematical class with 28 students, 9 instructors and 28 parents were selected in Takestan; the third humanities class with 17 students, 10 instructors and 17 parents were selected in Khoramdasht. The experts at high school of three cities were considered as target sample. Points of view of 177 persons were collected. To increase reliability of questionnaire, Cronbach's alpha coefficient has been selected among re-test, parallel test, Spearman formula, stability coefficient test, Cronbach formula. Reliability coefficient of the questionnaire to determine the performance indices of high schools was obtained based on Cronbach's alpha coefficient and software SPSS-19. To calculate Cronbach's alpha coefficient, the questionnaire was given to 19 persons of the sample so as to determine the evaluation indices, which the persons were selected in random. The responses less than middle at likret scale meant "disagree" and represented with codes 0 and 1; responses greater than middle meant "agree" and represented with codes 3 and 4; middle responses represented with code 2 at software. At this software, the horizontal column and vertical column represent the respondents and questions, respectively. To determine validity of questionnaire, an attempt has been made to prepare the questions from the literature review related to the subject of research and to be criticized by the experts so as to increase the validity of research. To increase validity of questionnaires, the questionnaires have been distributed among professors at education sciences and the first and second supervisors so as to remove the questions which were not valid. In addition, the questionnaires were given to the individuals in research group of the department of education in Qazvin so as to put aside the questions which are not associated to their considered goals. To analyze the collected data, descriptive indices including mean and standard deviation have been used. To analyze data from questionnaire, the test of success has been used. To weigh indices, Entropy Shanon and software entropy were used. To examine effect of indices, factor confirmatory analysis and model fit were used. For this, software LISREL was used. Software Lingo has been used to determine efficient and inefficient high schools and data envelopment model for ranking. Decision making matrix with Topsis technique and expert choice-Excel software were used to analyze the obtained data. Sig equals to 5% in all parts of this research.

Results

This research deals with quantitative analysis at explanatory analysis level. The collected data are analyzed using Statistical techniques and operational research (ratio test, Entropy Shanon, data envelopment analysis, Peterson Anderson model, TOPSIS). In doing so, software SPSS, Entropy Shanon, Lingo and Topsis are used.

The variables of balanced scorecard have consisted of 30 indices which this model was performed in software LISREL and the indicators of this model were drawn. The early model performed in software LISREL has not included suitable fit indices, thus the early model should be modified. Accordingly, at modifying the model, it can help for performing and fitting the model by putting aside the less significant indictors or making free relationships in model. Indeed, the factors loadings and all

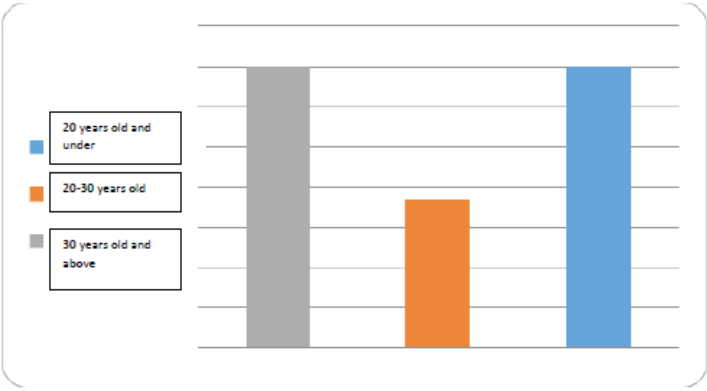

Chart 1. Frequency related to status of respondents in terms of age

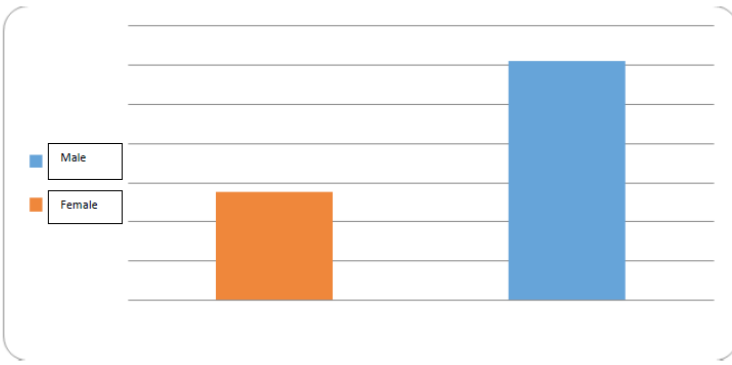

Chart 2. Frequency related to status of respondents in terms of gender

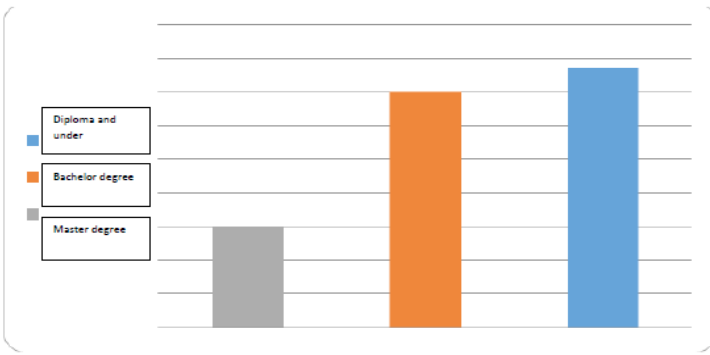

Chart 3. Frequency related to status of respondents in terms of education level

the approaches under study enjoy definite sig in the fitted model.

After specifying the performance evaluation indices based on balanced scorecard components and generalizing it to 5 components, 30 indices and 14 goals, inputs and outputs of this model were specified. In this regards, 11 indices were considered as outputs and 19 indices were considered as inputs of this model. The model presented to determine efficiency of units is a model with fixed scale of Anderson and Peterson type with input-oriented approach. In this regards, inputs and outputs were specified.

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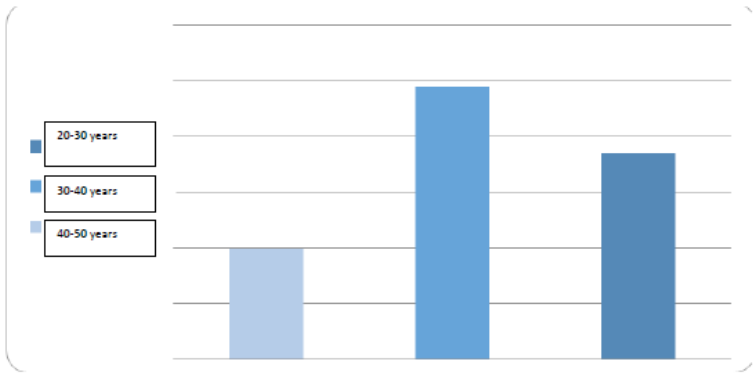


Chart 4. Frequency related to status of respondents in terms of age

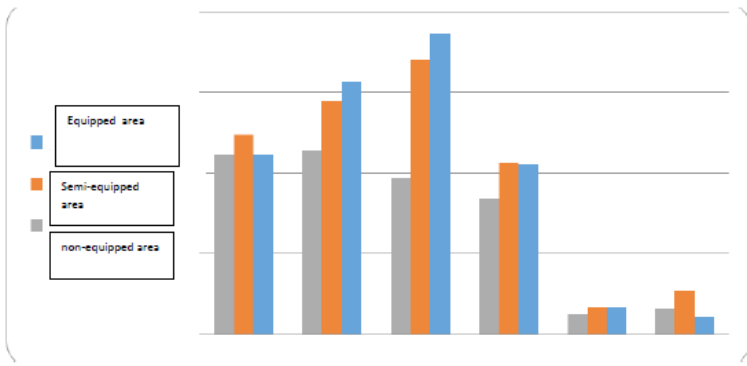


Chart 5. The information of target sample in ranking based on the designed model

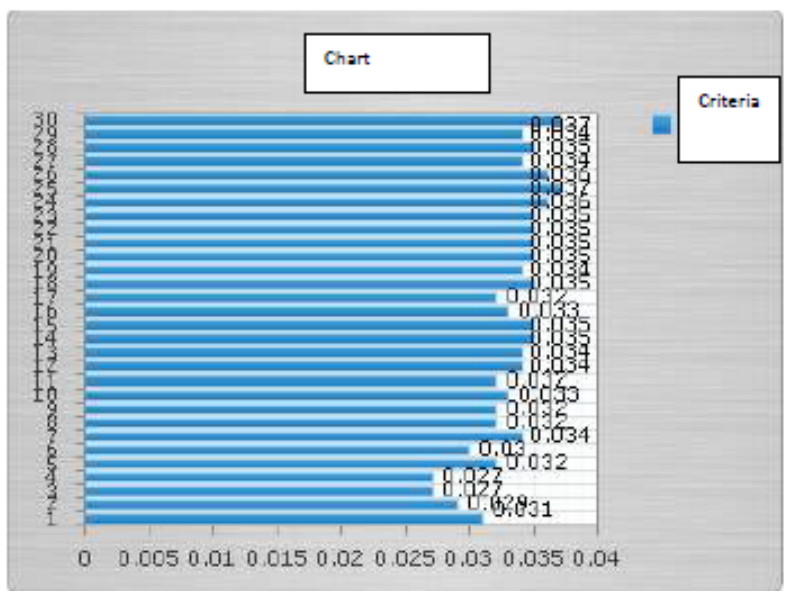
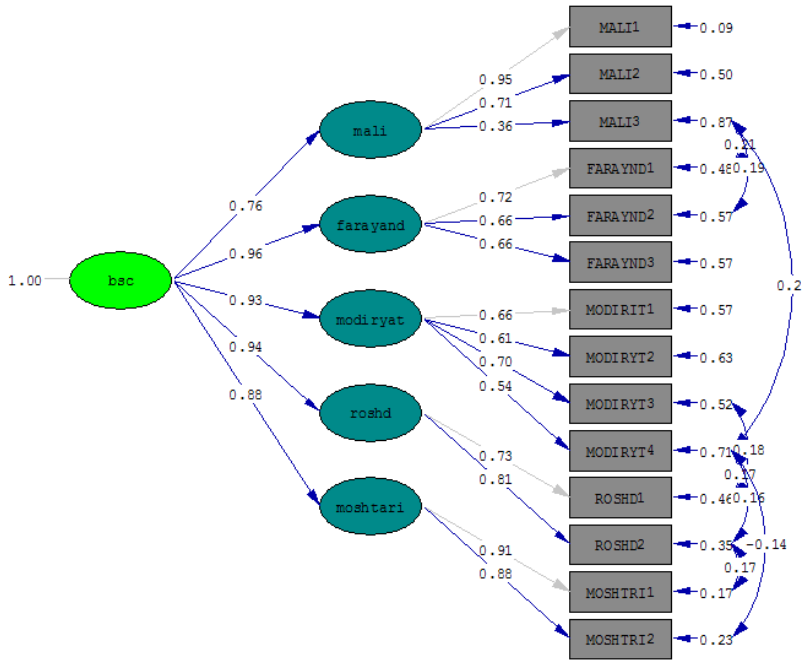


Chart 6. Final weight of each index



Chi-Square=89.37, df=64, P-value=0.01984, RMSEA=0.061

Chart 7. The fitted model for measurement of variables

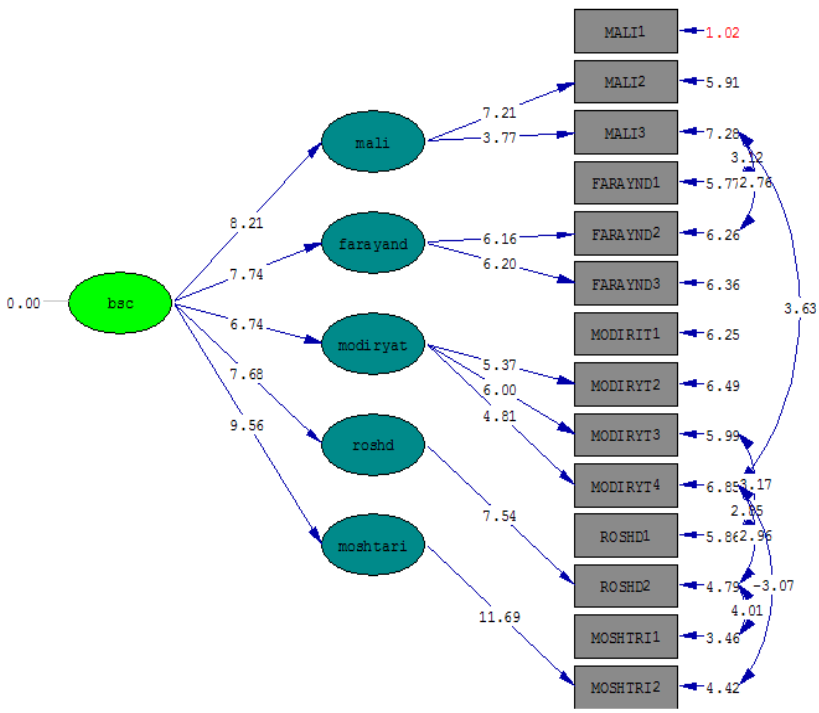


Chart 8. T-values to examine significance of the parameters of fitted model

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row	Input indices	Output indices
1	The aids from people and donors	Percent of students who have acquired average grade point (14) and above at final exams
2	Others' income	Percent of students who enter into the governmental universities
3	Thematic classes and the allocation of space	Students' satisfaction with staffs' proper treatment
4	Administrative and educational equipment	Students' satisfaction level with existing research and education facilities at school
5	Reduction of costs for energy carriers, space repair communications and equipment	Students' satisfaction with quality of classes.
6	Proportionality of lessons taught with the field of study of the instructor	Students' satisfaction level with instructor's teaching method
7	Using participatory and active teaching method	Represent the education counseling to students
8	Use of constant evaluation	Schools' reputation in registry of students
9	The school's evaluation method for staffs' performance	Gain scientific and education successes
10	Direct monitoring and timely closing the offices	Handling the staffs' problems
11	Invent creative methods	Job division regarding the duties
12	Proper response to students' needs and expectations	
13	The extent to which staffs cooperate with assembly of instructors	
14	Familiarity with rights, the extent to which staffs and instructors are familiar with rights and tasks	
15	Facilitate the instructors" job conditions	
16		

	Create culture of response for instructors among students	
17	Create the required conditions to improve staffs' job	
18	The extent of e-learning for the staffs	
19	Staffs' mutual satisfaction from each other	

Table 1. Input and output indices

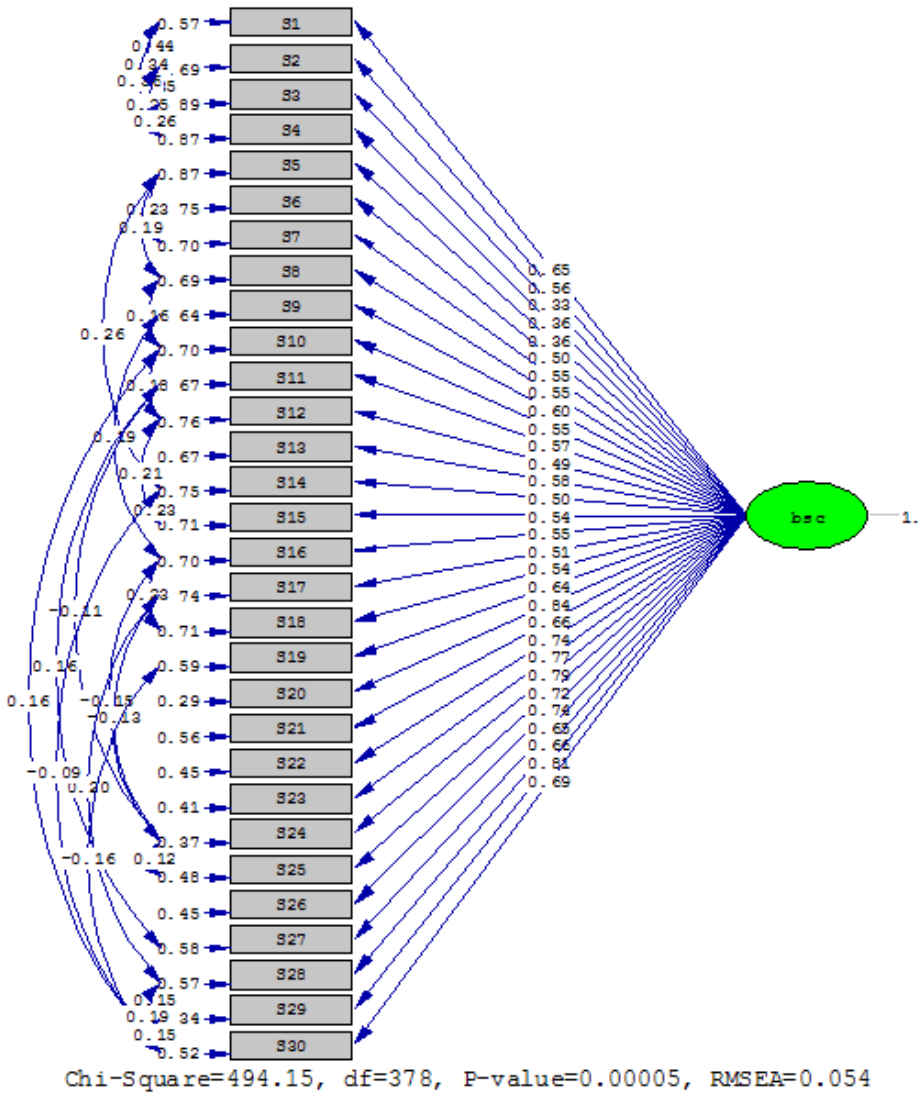

Chart 9. The fitted model for measurement of variables

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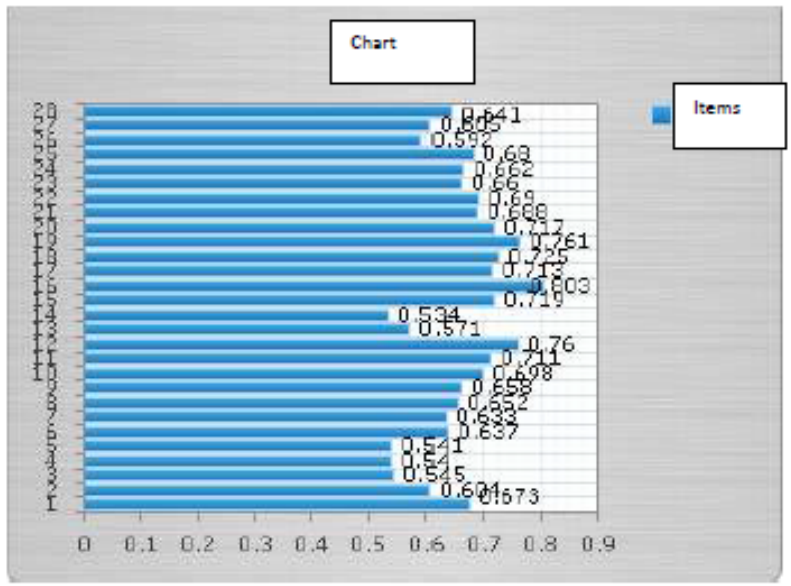

Chart 10. Ranking schools at equipped region

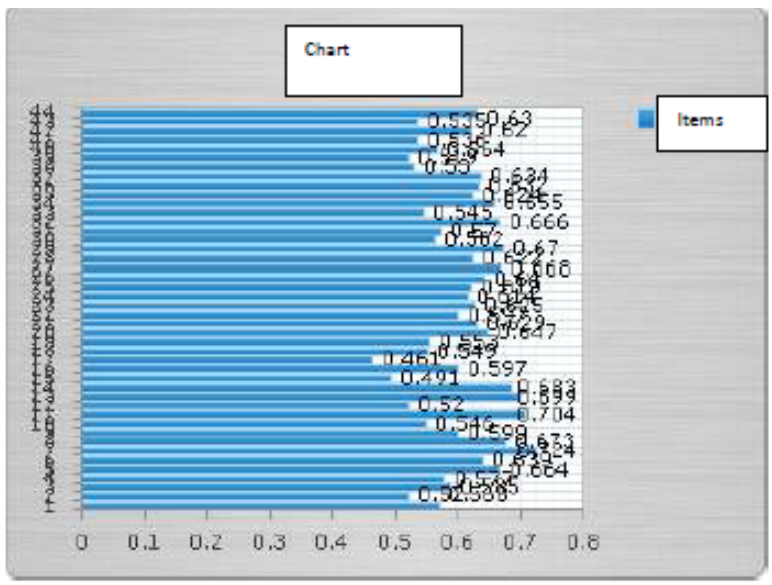

Chart 11. Ranking schools at semi-equipped region

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In this research, with regard to the results from decision making matrix, it can determine the positive and negative ideal for tanking by normalizing this matrix and descaling and weighing it at three districts in Qazvin province. The results from ranking schools via Topsis technique indicate that the unit 2-school enjoys better priority to other items.

Discussion and conclusion

All the above components and indices were found effective in raking high schools in Qazvin province, because the obtained values in decision making criterion are under 0.05. Thus all the indices can be effective in evaluating performance of high schools in Qazvin province. With regard to the results from Shannon entropy, a score well suited to the sub-indices is given to each of indices in a range between 0-1000 in a model with 1000 scores by applying uncertainties and operationalizing the documents and polling. With regard to the findings from fit model, it can make decision on appro-

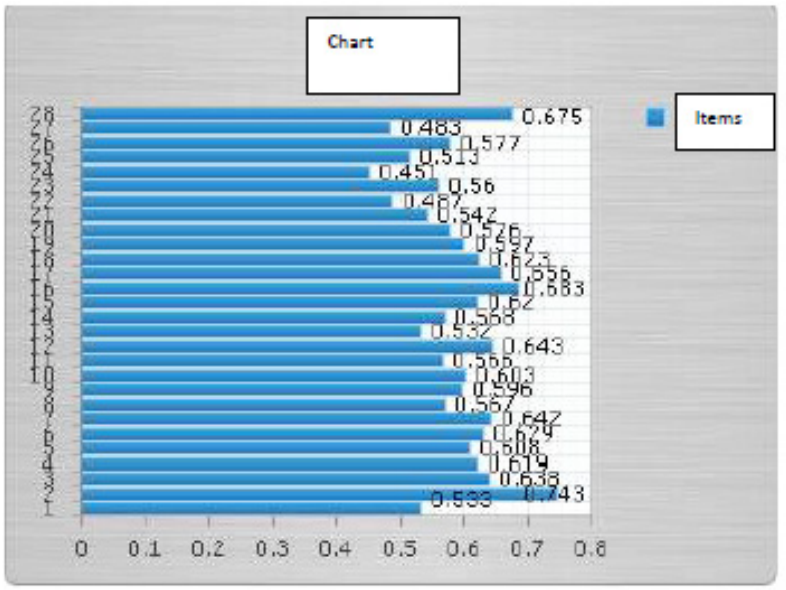

Chart 12. Ranking non-equipped schools

priateness of variables under study to measure constructs and putting aside the insignificant sub-scales of each construct with much more accuracy than the early model. Values of the square root of the variance estimation of approximation error have reached to acceptable value, thus it can know the estimated parameters reliable and use the adjustment of indicators with the constructs under study. The indicators next to each other confirmed the constructs related to them regarding the structure considered by the researcher, because the present model has been performed properly using the confirmatory factor analysis method. Since the value of the square root of the variance estimation of approximation error has been reported under 0.1, it can make decision upon the appropriateness of the selected questions. Results indicated that the estimated parameters in model have been reliable, thus it can use adjustment between indicators and constructs under study. T-values for each of factor loadings of each residue indicator with construct or the hidden variable go beyond 1.96, thus it can display the alignment in subscales of questionnaire to measure concepts at this stage. Indeed, the results indicate that what intended to be measured by the researcher via sub-scales of questionnaire have come to realize via these instruments, thus the relationship between constructs and hidden variables is evident. To display to which extent obtained values adjust with the existing facts in the model, the fit indices under study should be examined. Further, with regard to the existing factor loadings in each of dimensions, it can make decision upon significance of each of indicators. According to the fit features, data of this research are fitted with factor structure and theoretical infrastructure of research, indicating the alignment between factors and theoretical constructs. With regard to the results from Pearson correlation coefficient, each of dimensions, goals and variables are correlated with each other. Among 28 units at equipped region, 4 regions had relative efficiency and efficiency of other units is under 1. Anderson-Peterson model is used for ranking; with regard to the results from this model, ranking based on Anderson-Peterson model at schools (unit 16, 12 and 9) gained ranks 1, 2 and 3. The last ranks were given to schools (unit 5, 4 and 14). Among 44 units at semi-equipped region, 6 units have relative efficiency and efficiency of other units is less than 1. With regard to the results from this model, ranking based on

Anderson-Peterson model at schools (unit 1, 11 and 13) gained ranks 1, 2 and 3. The last ranks were given to schools (unit 39, 15 and 17). Among 28 units at non-equipped region, 2 units have relative efficiency and efficiency of other units is less than 1. With regard to the results from this model, ranking based on Anderson-Peterson model at schools (unit 2, 16 and 28) gained ranks 1, 2 and 3. The last ranks were given to schools (unit 22, 27 and 24). With regard to the decision making matrix, 28 high schools at equipped region, 44 high schools at semi-equipped region and 28 high schools at non-equipped region were designed via Topsis method. Ranking based on Anderson-Peterson model at schools (unit 16, 19 and 12) gained ranks 1, 2 and 3. The last ranks were given to schools (unit 5, 4 and 14). At semi-equipped region, schools (units 7, 11 and 13) gained ranks 1, 2 and 3. Schools (units 39, 15 and 17) gained the last ranks. Schools (units 2, 16 and 28) gained ranks 1, 2 and 3 at non-equipped region. Schools (units 22, 27 and 24) gained the last ranks. According to comparison of ranking based on data envelopment analysis and Topsis, there is a significant difference between ranks 2, 3, 5, 8 and 24 at equipped region; there is a significant difference between ranks 25, 15, 26 and 41 at semi-equipped region; there is a significant difference between ranks 12 and 5 at non-equipped region.

Suggestions

It is suggested to spread the results from ranking throughout the schools at various regions so as to let other centers increase their efficiency and make suitable planning by modeling the schools which have high efficiency. Schools move to board of trustees so as to work out more successful in students' admission and increase their efficiency. For more effective and accurate evaluation of efficiency at schools, future efficiency of units has been predicted insufficient and then strategic decisions have been made to make the inefficient units efficient. With regard to the results from research for inefficiency of schools, a more accurate study on the reasons to this problem should be made at education system so as not to face such crisis in future. Educational courses should be held for staffs' learning and growth and the seminars should be held for the staffs and managers at high schools. To make suitable conditions to implement the model represented to evaluate performance of high schools, facilities should be provided for them. To validate the proposed model, it is suggested extending it after performing model in few schools and gaining the required experiences and ultimately using it at other regions of country so as to evaluate performance of schools.

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