



## EFFECTIVENESS OF SIX SIGMA METHODOLOGY THROUGH BSC IN BANKING INDUSTRY



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### ABSTRACT

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This paper aims to discuss the effectiveness of Six Sigma through balanced scorecard in banking industry. Six Sigma is a powerful analytical technique which yields a dramatic reduction in defects, errors, or mistakes in production and service processes. So it can be useful to find defectives in financial institutions and banks while it can accompany with BSC to approach all organization aspects. Reaching this aim, this paper tries to survey the effectiveness of Six Sigma through balanced scorecard aspects in one of Iranian pioneer banks in deploying aforementioned methodologies. Respondents have been extracted among bank experts with various backgrounds who experienced both techniques in practice for at least four continues years. Findings depict that customer aspect is the most appropriate aspect for implementing Six Sigma, while Learning; Financial and Internal process aspects are less suitable respectively. It is fruitful to declare that all BSC aspects are prone to use the advantages of Six Sigma in practice according to respondent's points of view.

### 1. INTRODUCTION

Organizations should improve their management constantly, business and supportive processes in order to remain competitive. However, problems widen in the translation of strategy to actual processes, which need more consideration (Kaplan and Norton, 2001, Conger, 2015). So organizations should have special focus on improvement and quality. Quality as a means of competition among organizations and businesses has been a major topic since 1970 (Liang, 2014). There have been various perspectives on how quality helps organizations to increase their competitive advantage. Some argue that emphasis on quality enhance the direct profit returns of a company by driving increased sales on a better product than one's competitors. Some argue that the emphasis on product quality reduces the risk of systematic variance and unexpected variance in returns (Liang, 2014). Product and Process quality improvement is attainable through Six Sigma methodology. Six Sigma is a widely implemented methodology that utilizes common quality

management techniques. It has been described as a way to improve company processes and overall company performance by reducing at the detailed level (Balasubramanian *et al.*, 2015). So, as an improvement method, Six sigma seek out to eliminate defects, mistakes, or failure in business processes and therefore combines human elements of improvement and process management (Brocke and Rosemann, 2015; Johannsen *et al.*, 2015). Six Sigma has recently gained a wide popularity because of its success at revealing large cost savings as well as quality improvement. Six Sigma focuses to improve the quality of products and services as well as to make them better, faster and cheaper (Mahanti and Antony, 2006; Kaushik and Khanduja, 2009). Although there are some unsuccessful implementations of the methodology due to several reasons, many organizations worldwide have implemented Six Sigma and achieved remarkable improvements in their market share, customer satisfaction, reliability and performance of products and services with impressive financial savings (Gijo and Rao, 2005).

On the other hand, organizations evaluate their performance to find their strengths and weaknesses to reach their best performance while looking for its improvement. Performance evaluation is usually synonym with effectiveness of the organization's activity (Yalcin *et al.*, 2012 and Rostami *et al.*, 2015). Overall, performance evaluation refers to specified assessment process in unique term that all expectations and indicators are clear before. It is an effective way to improve an organization. So, managers try to find suitable route to evaluate the whole organization performance (Ghasemi and Ahmadi, 2013). Nowadays, the issues raised in the most recent scientific field are directly or indirectly related to performance evaluation. The reason is that each of the concepts, techniques, and practices of organizations in order to achieve better performance needs to know the present situation. Balanced Scorecard (BSC) is one of the measurement systems that cover short and long term plans and strategies and also, internal as well as external control. BSC consider four main organization aspects financial, customer, internal processes and learning and growth (Rostami *et al.*, 2015).

Therefore applying Six Sigma within BSC aspects can be fruitful for considering all aspects of organization in improvement plans which is aimed to be investigated in this study. In addition to above, financial organizations also are interested in implementing some successful improvement techniques to keep themselves in their market. Actually, over the last couple of years, financial services have been growing continuously both in market share and significance (Johannsen *et al.*, 2015) and this justifies to be emphasized as a case of this study.

## 2. LITERATURE REVIEW

### 2.1. Six Sigma

Six Sigma is a lateral quality improvement technique which is widely accepted in industry, but suffers from lack of theoretical underpinning and basis in research except "best practice" studies (Linderman *et al.*, 2003). Sigma is the eighteenth letter of the Latin alphabet used in statistics to show the standard deviation. The fundamental objectives of Six Sigma methodology are implementation of strategies based on performance measurement through improvement projects (Sadrabadi *et al.*, 2015). In the mid-1980s, Motorola created and used a statistically-based methodology called Six Sigma to improve the performance of its processes. It is a business improvement approach that seeks to find and eliminate causes of mistakes or defects in business processes by focusing on process outputs that are critical to customers. Six sigma projects also often focus on improving productivity, process yields, production rates and process downtime (Snee, 2004). It employs a variety of specialists to achieve its goals, who called Master Black Belts, Black Belts, Green Belts and Project Champions (Linderman *et al.*, 2003; Snee, 2004). As it mentioned the term sigma is a measure indicating the deviation in the performance characteristic of a service from its mean performance (Antony, 2006). Since its origins, there have been three generations of Six Sigma implementations. Generation I focused on defect elimination and basic variability reduction, primarily in manufacturing. Motorola is a classic exemplar of Generation I. In Generation II, the emphasis on variability reduction and defect elimination remained, but now there was a strong

effort to tie these efforts to projects and activities that improved business performance through improved product design and cost reduction. General Electric is often cited as the leader of the Generation II. In Generation III, Six Sigma has the additional focus of creating value throughout the organization and for its stakeholders. Creating value can take many forms, such as increasing stock prices and dividends, job retention or expansion, expanding markets for company products/services, developing new products that reach new and broader markets, and increasing the levels of customer satisfaction throughout the range of products offered (Hahn *et al.*, 1999; Montgomery and Woodall, 2008) which enable Six Sigma to be accompanied by BSC reaching a wider approach to organizational improvement from financial to non-financial aspects. The fundamental difference between Six Sigma and other process improvement programs (such as TQM, Lean, and the Baldrige model) is related to the ability of Six Sigma in providing an organizational context that facilitates problem solving and exploration across the organization (Parast, 2011). It has been claimed that Six Sigma enables organizations to become more ambidextrous by switching structure, act organically when being challenged by new ideas and operate mechanically in focusing on efficiency (Parast, 2011). In this form of organization, when some of the business units focus on efficiency, other units focus on innovation and changes. This dual structure enables organizations to focus on exploration and production and handle productivity and innovation.

Also, the Six Sigma improvement initiative is having a major impact on the culture, operation, and profitability (Hahn *et al.*, 1999), and knowledge level of organizations. In Six Sigma, the creation of knowledge occurs through intentional or explicit learning that employs formal improvement methods. Intentional learning requires regulation of actions taken by organizational members. Goals serve as regulators of human action by motivating the actions of organizational members. Thus, improvement goals motivate organizational member to engage in intentional learning activities that create knowledge and make improvements (Linderman *et al.*, 2003). Each project in Six Sigma follow a disciplined process of some macro steps (Hahn *et al.*, 1999), Define, Measure, Analyze, Improve and Control (DMAIC). This tool is meant to decrease variation in the process by identifying and improving specific areas (Kumar *et al.*, 2008). The purpose of each step in the DMAIC process is:

Define – Identification of a process which needs to be improved.

Measure – Process performance related data should be gathered.

Analyze – The gathered data should be analyzed in order to determine the most likely causes of defects.

Improve – Once performance related data gathered and analyzed, the improvement step will begin to establish ways to eliminate the identified causes of variation.

Control – A plan will be established to maintain systematically the improvement set in place (Kumar *et al.*, 2008; Montgomery and Woodall, 2008).

## 2.2. *Balanced score card (BSC)*

One of the most famous and best-known models in performance evaluation is “Balanced scorecard” that is developed by Kaplan and Norton in 1992 and expanded by scholars. BSC consider the non-financial indicators in addition to financial indicators. Nonfinancial indicators are prerequisite of future financial performance.

Balanced Scorecard is a strategic management system that helps organizations to identify strategies and make it executable (Braam and Nijssen, 2004; Chen *et al.*, 2008). Balanced Scorecard is a tool used by many organizations to evaluate the performance of different aspects of an organization. The model is not only to consider the organization performance internally, but many investors and shareholders, are able to monitor, assess and to be ensured of the organization results (Wu *et al.*, 2009). This model suggests four major aspects of the organization to be considered related to each other, in order to evaluate the performance of any organization. Above mentioned aspects are as follows:

- Financial aspect
- Customer aspect
- Internal business aspect
- Learning and growth aspect

Kaplan and Norton (1996) believed that considering these aspects, helps disappearing problems and would lead to accumulation of information by classifying the performance indicator. Forcing managers to focus only on a limited number of financial indicators are crucial and critical while taking several different aspects prevents decision makers from erroneous decisions. Balanced Scorecard objectives derived from organization's vision and strategy.

Contrary to the old view, balanced scorecard focuses on learning and growth, customers and environment as well as the business process in addition to the financial aspect of the organization. It also includes analyzing of the competitors strengths and weaknesses and focuses on quality improvements plans while consider all these issues simultaneously (Ghasemi and Ahmadi, 2013; Rostami *et al.*, 2015).

### 3. METHODOLOGY

As it is mentioned before this paper aims to consider the effectiveness of six sigma methodology in balanced score card aspects. Six Sigma is a method of solving problems by implementing QCC and through this study the authors aim to clarify which aspects of BSC in banking industry will reveal more practical results by implementing Six-sigma.

According to its aim, it is an applied research while it can be called a descriptive – survey research according to deployed methodology. Therefore it is developed implementing a justified questionnaire with five point Likert scale ranging from strongly agrees to strongly disagree . According to the literature and based on prior experiences, the research model is developed as Figure 1.

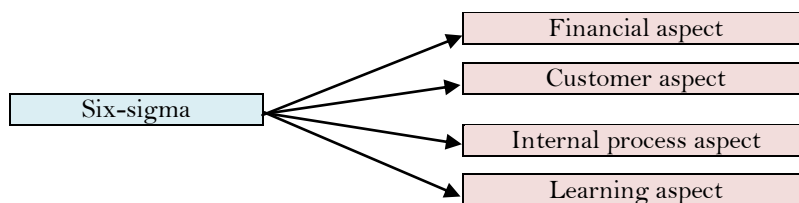


Figure-1. Theoretical model of Six Sigma effectiveness in BSC aspects

According to above model four hypothesizes are developed and investigated as follows. The results are provided and will be discussed in the rest of the paper.

- Implementing Six Sigma is effective in financial aspects of balanced scorecard.
- Implementing Six Sigma is effective in customer aspects of balanced scorecard.
- Six Sigma is an effective tool in processes aspects of balanced scorecard.
- Six Sigma is an effective tool in growth and learning aspects of balanced scorecard.

Table 1 clarified the questionnaire items within BSC aspects.

Table-1. BSC scale

Aspects		Indicators
Financial aspects	a1	Is Six Sigma effectiveness in strengthening the competitive position and increase market share?
	a2	Is Six Sigma can identify the expected benefits of the quality improvement initiative?
	a3	Can Six Sigma identify the benefits of investment projects?
	a4	Is Six Sigma is effective in reducing the costs associated with quality?
Customer aspects	a5	Is Six Sigma is a reduction in customer complaints and grievances?
	a6	Can Six Sigma reduce the response time to the customer?
	a7	Does Six Sigma in service delivery can be more up to date recommendations to be followed?
	a8	Does Six Sigma methodology increase the deposits received from customers?
	a9	Is Six Sigma methodology to improve the bilateral relationship of the bank and the customer?
Internal processes aspects	a10	Is Six Sigma able to consider all stakeholders in the bank?
	a11	Does Six Sigma increase the participation of staff and excellence and quality programs?
	a12	DMAIC approach is the use of improved processes?
	a13	Does the use of black belts and green continue the improvement of the organization?
	a14	Does Six Sigma raise Employee's interest?
	a15	Does Six Sigma explore appropriate improvement plan according to organization strategy?
	a16	Can Six Sigma provide clear and applicable instructions to evaluate organization?
a17	Can Six Sigma identify appropriate indicators to assess its performance?	
Learning and growth aspects	a18	Are the incentives for the staff in the implementation of Six Sigma effective?
	a19	Do grouping and creation of working groups on the implementation of Six Sigma will be a success?
	a20	Are there resources to train employees in the organization?
	a21	Did skills group for planning and development control plan has been increased?
	a22	Do we need expert and alert people more than now during Six sigma implementation?
	a23	Is there teamwork and solidarity among employees?

### 3.1. Research population and sample

This study is done within an Iranian Bank which is pioneer in implementing Six Sigma as a tool for seeking improvement. About 50bank experts who are trained for Six Sigma and are familiar with the bank defectives as bank research and development practitioners are sampled. All of the surveyed experts fully responded to the administered questionnaires and the gathered data analyzed by SPSS software which lead to following results.

## 4. FINDINGS AND RESULTS

In order to analyze the reliability of the employed questionnaire, Cronbach's alpha for each aspect is considered (Table 2). And also, for construct validity of the measurement tools, Confirmatory factor analysis is employed. Since all hypothesizes test are done based on Structural Equation Modeling (SEM), the sample adequacy test is deployed at first. To this aim KMO and Bartlett's tests are used and the results are provided. According to KMO test results which is about 0.86 and based on Bartlett's test, significant level which is 0.00 the sample adequacy of the data for factor analysis is confirmed.

Table-2. Cronbach's alpha

Title	Indicators No.	Aspects	Indicators No.	Cronbach's alpha
Six sigma $\alpha = 0.903$	23	Financial	4	0.719
		Customer	6	0.728
		Internal processes	7	0.821
		Learning and growth	6	0.805

According to collected data, 52 percent of sampled experts were female and 48 percent were male. Minimum age of the gathered sample was 31 year old and maximum was 62 year old. Also, Minimum work experience was about 8 years and maximum was about 40 years.

Table 3 depicts T-values and the coefficients of all aspects and items. As it is clear since that T-value for the entire mentioned variables (both aspects and items) are more or less than  $\pm 1.5$ , all variables are significant except a few ones.

Table-3. T-values and Coefficient estimates of whole developed model

Aspects (Constructs)		Coefficient estimates	T- Values	Indicators	Coefficient estimates	T-Values
Six-Sigma	Financial aspect	0.78	2.33	a1	0.55	1.45*
				a2	0.72	2.62
				a3	0.73	2.62
				a4	0.62	2.87
	Customer aspect	0.95	2.50	a5	0.42	1.2*
				a6	0.75	2.35
				a7	0.67	4.19
				a8	0.39	2.39
				a9	0.53	2.64
				a10	0.87	2.39
	Internal processes aspect	0.75	4.62	a11	0.16	2.45*
				a12	0.42	4.52
				a13	0.43	3.92
				a14	0.66	5.45
				a15	0.45	2.97
				a16	0.97	6.29
				a17	0.50	4.33
	Learning and growth aspect	0.83	5.86	a18	0.94	na
				a19	0.07	4.12
				a20	0.42	3.13
				a21	0.62	4.65
				a22	0.58	5.91
				a23	0.07	4.87

\* Not significant at 95 % confidence interval

In Figure 2 coefficients estimates according to SEM final model are provided. It is clear that all research questions are answered positively.

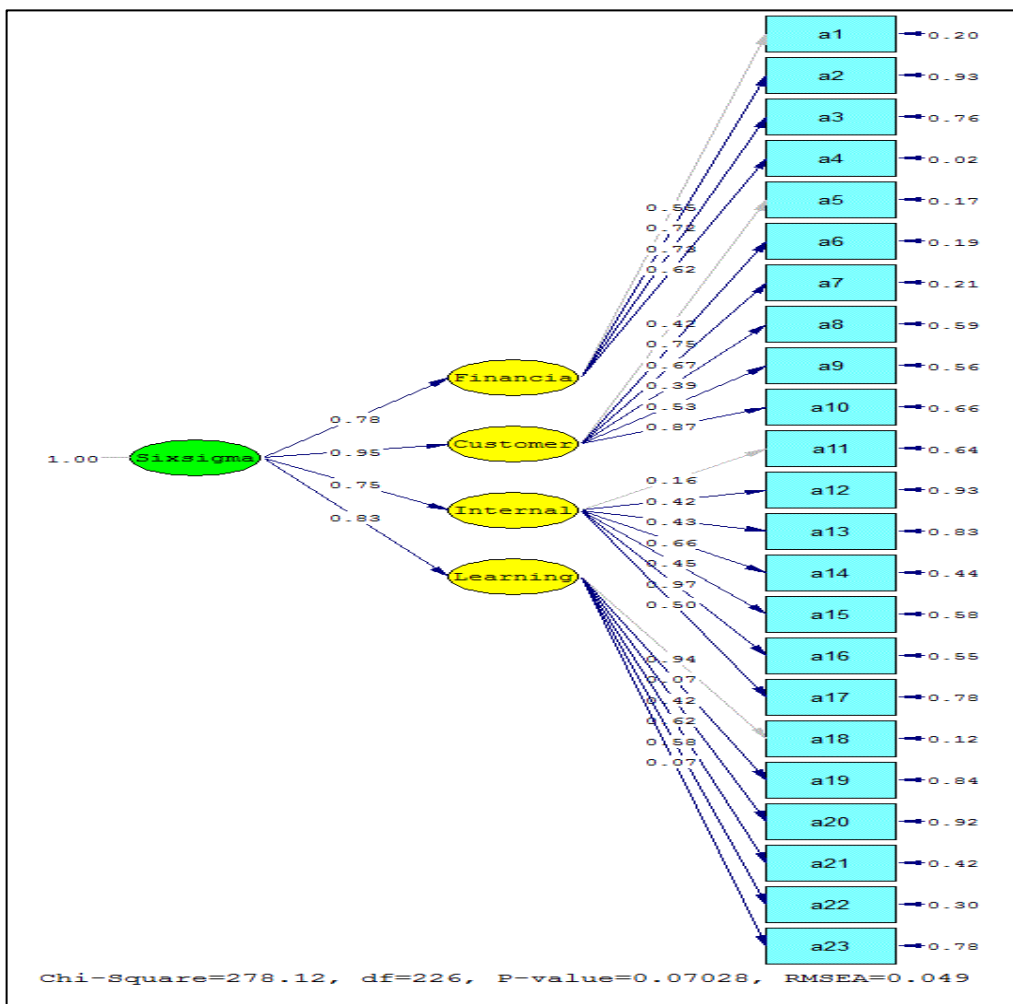


Figure-2. Research model, Six Sigma within BSC approach (Estimates)

4.1. Fit indices

It is mentioned that the sample adequacy test was deployed before the data analysis. In addition to data adequacy the whole final model fit indices are necessary which are clarified here. Based on fit indices indicators, Chi – square is 278.12 and DF is 226, in other words, “Chi – square/DF” ratio is equal 1.23 and is less than 3. This calculation shows this model is valid. Also, RMSEA is 0.049 that is less than 0.08, Normed Fit Index (NFI) = 0.93, Non-Normed Fit Index (NNFI) = 0.96, Comparative Fit Index (CFI) = 0.95, Incremental Fit Index (IFI) = 0.88, Goodness of Fit Index (GFI) = 0.91, Adjusted Goodness of Fit Index (AGFI) = 0.89 which are all about 0.9 and are valid. Actually, these indices define that research data well fitted with CFA and theoretical base.

Although SEM analyses all indicators and aspects in a model simultaneously, for more details a T-test is also applied to the gathered data. Findings are provided in Table 4. The middle point of the Likert scale (3) is determined as a test value and the majority of the respondents around the middle of the scale for any aspect is scrutinized for defining the importance of Six Sigma in that aspect of BSC. Since that all aspects are significant, results prove that Six Sigma can affect through all BSC aspects according to respondents point of view.

Table-4. Importance of Six Sigma in BSC aspects

BSC aspects	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Financial	3.454	51	0.001	0.331	0.138	0.524
Customer	3.853	51	0.000	0.358	0.172	0.546
Internal process	2.969	51	0.005	0.288	0.093	0.483
Learning and growth	4.716	51	0.000	0.451	0.259	0.644

## 5. CONCLUSION

According to findings, Six Sigma is more effective in customer aspect with the highest influential weight (0.95) in respect to the other aspects. The second more effective aspect is learning aspect with weight of 0.83 and then financial aspect and internal process aspect are highlighted with 0.78 and 0.75 importance according to findings. Six sigma with some methods such as DMAIC (Define, Measure, Analyze, Improve, and Control) and DMADV (Define, Measure, Analyze, Design and Verify) can be employed in banking industry to solve probable problems and process improvement plans. Results prove that six sigma method is strongly useful in customer aspect to define, measure, analyze relative issues and to improve, control or verify those and make suitable opportunity to gain more loyal customers which may lead to more profit and competitive advantages. Also it can be useful to concentrate on employees and managers learning and growth in order to improve business processes in banking industry.

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## REFERENCES

- Antony, J. (2006). Six sigma for service processes. *Business Process Management Journal*, 12(2), 234-248.
- Balasubramanian, S. S., Jones, E. C., Gray, B., Armstrong, H., & Samdurkar, R. (2015). Evaluating six sigma implementation effectiveness through statistical process control. *Strategic Management Quarterly*, 3(1), 49-70.
- Braam, G. J., & Nijssen, E. J. (2004). Performance effects of using the balanced scorecard: A note on the Dutch experience. *Long Range Planning*, 37(4), 335-349.
- Brocke, V. J., & Rosemann, M. (2015). The six core elements of business process management. In *Handbook on Business Process Management*, (pp. 105-122). Springer Berlin Heidelberg.
- Chen, T. Y., Chen, C. B., & Peng, S. Y. (2008). Firm operation performance analysis using data envelopment analysis and balanced scorecard: A case study of a credit cooperative bank. *International Journal of Productivity and Performance Management*, 57(7), 523-539.
- Conger, S. (2015). Six sigma and business process management. *Handbook on Business Process Management 1* (pp. 127-146). Springer Berlin Heidelberg.
- Ghasemi, A., & Ahmadi, S. H. (2013). Evaluation of higher education institutions with the help of a balanced scorecard and multi-criteria decision methods. *Journal of Medical Education*, 6(10), 38-49.
- Gijo, E. V., & Rao, T. S. (2005). Six Sigma implementation—hurdles and more hurdles. *Total Quality Management & Business Excellence*, 16(6), 721-725.
- Hahn, G. J., Hill, W. J., Hoerl, R. W., & Zinkgraf, S. A. (1999). The impact of Six Sigma improvement—a glimpse into the future of statistics. *The American Statistician*, 53(3), 208-215.



- Johannsen, F., Leist, S., & Zellner, G. (2015). Implementing six sigma for improving business processes at an automotive bank, in handbook on business process management 1, *International Handbooks on Information Systems*, pp. 393-416, Springer Berlin Heidelberg.
- Kaplan, R. S., & Norton, D. P. (2001). Transforming the balanced scorecard from performance measurement to strategic management: Part I. *Accounting horizons*, 15(1), 87-104.
- Kaplan, R. S., & Norton, D. P. (1996). *Translating Strategy in to action the balanced scorecard*. Harvard Business School Press.
- Kaushik, P., & Khanduja, D. (2009). Application of Six Sigma DMAIC methodology in thermal power plants: A case study. *Total Quality Management*, 20(2), 197-207.
- Kumar, U. D., Nowicki, D., Ramirez-Marquez, J. E., & Verma, D. (2008). On the optimal selection of process alternatives in a Six Sigma implementation. *International Journal of Production Economics*, 111(2), 456-467.
- Liang, C. P. (2014). *A review of lean six sigma and Malcolm Baldrige national quality award and a proposal for the future*. National university of Singapore, Msc. dissertation.
- Linderman, K., Schroeder, R. G., Zaheer, S., & Choo, A. S. (2003). Six Sigma: A goal-theoretic perspective. *Journal of Operations management*, 21(2), 193-203.
- Mahanti, R., & Antony, J. (2006). Six Sigma in software industries: Some case studies and observations. *International Journal of Six Sigma and Competitive Advantage*, 2(3), 263-290.
- Montgomery, D. C., & Woodall, W. H. (2008). An overview of six sigma. *International Statistical Review*, 76(3), 329-346.
- Parast, M. M. (2011). The effect of Six Sigma projects on innovation and firm performance. *International Journal of Project Management*, 29(1), 45-55.
- Rostami, M., Goudarzi, A., & Madanchi Z. M. (2015). Defining Balanced Scorecard Aspects in Banking Industry Using FAHP Approach. *International Journal of Economics and Business Administration*, 1(1), 25-38.
- Sadrabadi, A., Ebrahimzade, Pezeshki, R., Abolghasemi, M., & Ahmadi, S. (2015). Six Sigma approach to assessing the quality of services. *Quarterly Journal of Business Administration exploration*, 5(10), 71-96.
- Snee, R. D. (2004). Six-Sigma: the evolution of 100 years of business improvement methodology. *International Journal of Six Sigma and Competitive Advantage*, 1(1), 4-20.
- Wu, H. Y., Tzeng, G. H., & Chen, Y. H. (2009). A fuzzy MCDM approach for evaluating banking performance based on Balanced Scorecard. *Expert Systems with Applications*, 36(6), 10135-10147.
- Yalcin, N., Bayrakdaroglu, A., & Kahraman, C. (2012). Application of fuzzy multi-criteria decision making methods for financial performance evaluation of Turkish manufacturing industries. *Expert Systems with Applications*, 39(1), 350-364.

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