

Evaluation of Critical Success Factors in Total Quality Management Implementation and Prioritization with AHP - Case Study: Pars Oil and Gas Company

Alireza Yazdani, Mohammad Ali Soukhakian, Mohammad Reza Mozaffari

Department of Management, Science and Research Branch, Islamic Azad University, Fars, Iran

Abstract

Total Quality Management claiming superior results in the work has acquired a particular position among other different methods; however, despite all the positive features many organizations have not been successful in applying TQM. There are many reasons for this lack of success which can be either due to a lack of familiarity and attention to the critical success factors in the implementation of Total Quality Management. This research aims to answer two main questions: 1) what critical success factors in the implementation of Total Quality Management are proposed in Pars Oil and Gas Company based on the Malcolm Baldrige model? 2) What is the priority of critical success factors in the implementation of Total Quality Management based on different levels of management's perspective? The literature related to the first question was studied and the factors were classified into seven groups based on the Baldrige global model. Then, these factors were evaluated according to Baldrige check list based on which 47% of total 1000 points was acquired by the organization. Leadership 47%, Strategic Planning 54%, Customer Focus 41%, Measurement, Analysis and Knowledge Management 41%, Workforce Focus 38%, Operations Focus 46% and Results 51%. For second question, a questionnaire was made to prioritize critical success factors and the weight of each factor in relation to each other was evaluated according to subject's answers using AHP method by Expert choice software. Therefore, from the perspective of managers in different levels, the factors are prioritized as Leadership, Strategic Planning, Customer Focus, Operations Focus, Results, Measurement, Analysis and Knowledge Management,

Workforce Focus. In conclusion, shortcomings and required information for managers and organization were provided based on the results.

Keywords: Total Quality Management (TQM), Critical Success Factor (CSF), Malcolm Baldrige National Quality Award (MBNQA), Analytical Hierarchy Process (AHP), Evaluation, Prioritization.

Introduction

Quality has become one of the most important competitive strategic tools and many organizations have realized that it is a key to developing products and services that support continuing success. As competition increases and changes occur in the business world, we need to have a better understanding of quality. Quality concerns affect the entire organization in every competitive environment. Therefore, top managers need to understand and apply quality philosophies to achieve high performance levels in products and processes and to face the challenges of new global competition. There is an increasing focus on quality throughout the world. With increased competition, companies have recognized the importance of quality system (Oakland and John, 2000-2003).

Each part of the organization must work properly together towards the same goals, recognizing that each person and each activity affects and in turn, is affected by others. As competition increases and changes occur in the business world, the organizations look for a high level of effectiveness across all functions and process and chooses a total quality management (TQM) as a strategy to stay in the business (Badri *et al.*, 2006).

Corresponding author: Alireza Yazdani, Department of Management, Science and Research Branch, Islamic Azad University, Fars, Iran. E-mail: dirak117102@yahoo.com

In contemporary management, TQM has become the major business strategy in the 1990. The evolution of TQM into an all pervasive philosophy of management took sharp through the works of Crosby (1979), Deming (1982, 1986), Feigenbaum (1983), Ishikawa (1972), Juran (1988) and Taguchi (1982). The primary focus of TQM philosophy is on the hands and minds that employ the tools and techniques rather than the tools and techniques they (Farsi Abasabadi, 2002). Recent research has shown that many TQM-based failed to indicate a significant competitive improvement in business performance (Hides *et al.*, 2004). There are many reasons for this lack of success which can be either due to a lack of familiarity and attention to the critical success factors in the implementation of Total Quality Management. Companies, therefore, need to understand the TQM CSFs for the successful implementation of TQM (Antony *et al.*, 2002).

The increasing acceptance of TQM as a management philosophy for improving organizational competitiveness and effectiveness left the development of empirical search behind. This problem is much more apparent in the developing countries where the knowledge of TQM is in the very early stages (Bubshit, 2006). Hence, many managers do not fully understand what TQM is all about and the most important factors that drive the successful implantation of TQM in Iran industries.

Moreover, an investigation of critical success factors (CSFs) for TQM implementation in Iranian organizations is worthwhile to carry out. This paper aims to evaluate critical success factors based on Malcolm Baldrige National Quality Awards (MBNQA) and prioritize CSFs from different level management's perspective, so the Iranian organizations by concentration and investment on these factors could increase the likelihood of successful TQM implementation.

In this regard, the paper is organized as follows: Section two describes the research literature on the various TQM CSFs. Section three describes the methodology employed for conducting the survey follows. Section four analyses the CSFs. Finally, Section five reports the findings and provides conclusions.

Literature review

Total Quality Management (TQM)

TQM is a managerial system to improve an organization's competitiveness. Kanji & Asher (1993) said that 'TQM is about continuous performance improvement of individuals of groups and of organizations'. As long as TQM is adopting fully and

practiced effectively in an organization, many advantages will be delivered. It will strengthen the organizational business performance and competitive advantage (Lin and Chang, 2006). The successful implementation of TQM will result in:

- Improved employee involvement. TQM ensure everyone within the organization should have a clear understanding of what is required and how their processes relate to the business as a whole. Through the practice of TQM, teamwork is employed and employees are motivated and encouraged to control, manage, and improve the processes, which are within their responsibility.

- Improved communication. A better communication can be accomplished through the effective implementation of TQM principles in any organization. More open and frequent communication among people will be found, and they will view and treat one another as customers and suppliers.

- Increased productivity. Sriparavastu and Gupta (1997) approved that the implementation of both TQM strategy contributes most to increased productivity, employee involvement, management commitment, and supplier participation, enhancement in quality and reduction in costs. TQM changes the organizational culture and created a happy working environment. Due to the effective delegation, empowerment and total staff involvement, problems are identified and solved at lower levels. The working process will become more efficient. Consequently, productivity can be increased by reducing the cycle time.

- Improved quality and less rework. Deming has been instrumental in helping the Japanese understand that quality and productivity are compatible. He believes that improving quality leads to decreases in cost because of less rework, fewer mistakes, delays, and better use of machine and materials. In TQM implementation, work processes and improvement are focused. Employees will place more emphasis on the elimination of the root causes rather than correction of problem. Problems will be identified and tackled at lower levels, by the people close to the work who are empowered to deal with the problems. As a result, the quality of the products and services will be improved and product rework will be reduced.

- Improved customer satisfaction. Through open communication among employees, customers, and suppliers, the true voice of customers can be more readily understood. Since the quality operations also focus more on the work process and improvement, the organizations will provide a better product/service to the market. Therefore enhanced customer satisfaction is achieved.

- Reduced costs of poor quality. Effective implementation of TQM will lead to significant the competitive advantage of an organization to survive in the market. If TQM is successfully implemented, this will result in better customer satisfaction and quality product/services provided with lower prices. This can lead to increased sales to achieve the profit objectives and business growth. Moreover, quality costing is one measurement technique that has often been used to help justify the adoption of quality improvement efforts to senior managers (Oakland and John, 2000-2003).

Quality Awards

An extensive literature survey has been carried out to select TQM frameworks for this study. The five online journal databases: www.Emeraldinsight.com, www.Ebsco.com, www.Infotrac.com, www.ProQuest.com and www.Sciencedirect.com were searched. In addition to articles related to TQM surveyed by

Bubshit *et al.* (2006), Demirbag *et al.* (2006), Farsi Abasabadi (2002), Hossam (2005), Ishikawa (2001), Joiner (2007), Kadash (2002), Lewis *et al.* (2005), Lin *et al.* (2006) and Zairi (2002) were reviewed and identified. The relevant literature has revealed that different countries have adopted similar TQM frameworks in the form of quality awards with a different title. Today, there are more than a hundred quality awards existing in different countries. However, all these quality awards are basically derived from three basic and prestigious awards (Malcolm Baldrige National Quality Award, 2012). the Malcolm Baldrige National Quality Award (MBNQA), the European Quality Award (EQA) and the Deming Prize. This study, therefore, includes only Malcolm Baldrige National Quality Award (MBNQA) as TQM frameworks for the purpose of evaluating TQM CSFs for the selected Company. Baldrige Criteria for Performance Excellence Framework is presented in Fig. 1 (2011, 2012 Business Nonprofit Criteria):



Figure 1. Criteria for Performance Excellence (2012)

Critical Success Factors

In accordance with Malcolm Baldrige Model, the requirements of the Criteria for Performance Excellence are embodied in seven categories, as follows (Malcolm Baldrige National Quality Award, 2012):

- Leadership
- Strategic Planning
- Customer Focus
- Measurement, Analysis, and Knowledge Management

Management

- Workforce Focus
- Operations Focus

- Results

Leadership (120 pts.): The Leadership category examines how your organization's senior leaders' personal actions guide and sustain your organization. Also examined are your organization's governance system and how your organization fulfills its legal, ethical, and societal responsibilities and supports its key communities.

- Senior Leadership: How do your senior leaders lead? (70 pts.)

- Governance and Social Responsibilities: How do you govern and fulfill your societal responsibilities? (50 pts.)

Strategic Planning (85 pts.): The Strategic Planning category examines how your organization develops strategic objectives and action plans. Also examined are how your chosen strategic objectives and action plans are implemented and changed if circumstances require, and how progress is measured.

- Strategy Development: How do you develop your strategy? (40 pts.)

- Strategy Implementation: How do you implement your strategy? (45 pts.)

Customer Focus (85 pts.): The Customer Focus category examines how your organization engages its customers for long-term marketplace success. This engagement strategy includes how your organization listens to the voice of its customers, builds customer relationships, and uses customer information to improve and identify opportunities for innovation.

- Voice of the Customer: How do you obtain information from your customers? (45 pts.)

- Customer Engagement: How do you engage customers to serve their needs and build relationships? (40 pts.)

Measurement, Analysis, and Knowledge Management (90 pts.): The Measurement, Analysis, and Knowledge Management category examines how your organization selects, gathers, analyzes, manages, and improves its data, information, and knowledge assets and how it manages its information technology. The category also examines how your organization uses review findings to improve its performance.

- Measurement, Analysis, and Improvement of Organizational Performance: How do you measure, analyze, and then improve organizational performance? (45 pts.)

- Management of Information, Knowledge, and Information Technology: How do you manage your information, organizational knowledge, and information technology? (45 pts.)

Workforce Focus (85 pts.): The Workforce Focus category examines your ability to assess workforce capability and capacity needs and build a workforce environment conducive to high performance. The category also examines how your organization engages, manages, and develops your workforce to utilize its full potential in alignment with your organization's overall mission, strategy, and action plans.

- Workforce Environment: How do you build an effective and supportive workforce environment? (40 pts.)

- Workforce Engagement: How do you engage your workforce to achieve organizational and personal success? (45 pts.)

Operations Focus (85 pts.): The operations focus category examines how your organization designs, manages, and improves its work systems and work processes to deliver customer value and achieve organizational success and sustainability. Also examined is your readiness for emergencies.

- Work Systems: How do you design, manage, and improve your work systems? (45 pts.)

- Work Processes: How do you design, manage, and improve your key work processes? (40 pts.)

Results (450 pts.): The results category examines your organization's performance and improvement in all key areas—product and process outcomes, customer-focused outcomes, workforce-focused outcomes, leadership and governance outcomes, and financial and market outcomes. Performance levels are examined relative to those of competitors and other organizations with similar product offerings.

- Product and Process Outcomes: What are your product performance and process effectiveness results? (120 pts.)

- Customer-Focused Outcomes: What are your customer-focused performance results? (90 pts.)

- Workforce-Focused Outcomes: What are your workforce-focused performance results? (80 pts.)

- Leadership and Governance Outcomes: What are your senior leadership and governance results? (80 pts.)

- Financial and Market Outcomes: What are your financial and marketplace performance results? (80 pts.)

Analytic Hierarchy Process (AHP)

First, Decision making is one of the main characteristics of human being and every individual has to make several decisions within his life time. Contrary to some decisions, a number of them have significant importance. Decision making becomes more importance as the responsibility increases. The world is full of multi-criteria problems that should be solved. Therefore, some criteria should be employed so as to examine different decisions (Bayazit and Karpak, 2007).

Since proper and in time decision making may have significant effect on the people's life, the necessity of a robust technique in this relation is completely evident. And as such, one of the most

efficient methods is Analytical Hierarchy Process (AHP) proposed for the first time by Thomas L. Saaty in 1970. This method is based on the pair-wise comparisons and is capable to examine different conditions. Since AHP is simple and comprehensive, it is the subject of current research and development efforts (Saaty, 1991).

AHP is a multi-criteria decision-making method that uses a hierarchical structure to solve complicated, unstructured decision problems, especially in situations where there are important qualitative aspects that must be considered in conjunction with various measurable quantitative factors. The AHP is aimed at integrating different measures into a single overall score for ranking decision alternatives. AHP has been applied in different fields such as management, engineering, industry, education, etc. AHP also has widely been used in the engineering and construction management. As recent applications, it can be mentioned to procedure for multi-criteria selection of building assemblies, Decision support system for selecting the proper project delivery method, advanced automation or conventional construction process, multi-criteria assessment of the probability of winning in the competitive bidding process and contractor pre-qualification model (Kamal and Al-Harbi, 2001).

The widespread use of AHP may be assigned to its simplicity and flexibility. According to the literature review, it has been realized that AHP has been recently employed along with other methods like mathematical programming to consider not only quantitative and qualitative factors, but also limitations similar to real world. Integrated AHP presents more promising and reliable results. Therefore, integrated AHP has been the focus of a significant amount of studies in recent years. The reason of integrating AHP with different tools may be assigned to the wide application and success in the decision making (Vaidya *et al.*, 2006).

Methodology

This research is a descriptive-survey it means that the researcher has conducted the research without changing the conditions for the study and has described the subject and survey instruments have been used to collect data. As the research purposes are:

Evaluating the CSFs in implementation of TQM in Oil and Gas Company.

Prioritizing the CSFs from the perspective of managers in different levels in Oil and Gas Company.

This research has occurred in two stages. At the first stage, CSFs were evaluated which included reviewing the resources and grouping the factors into seven factors. In the second stage, prioritizing of each factor happened through using AHP technique. In this stage, a model making and pair comparison happened among factors by using Expert Choice program and then ranking happened.

Algorithm of the First Research Stage

- Reviewing the resources related to the purpose
- Extracting the proposed factors based on Malcolm Baldrige National Quality Award
- Collecting and evaluating data from 5 Top Managers

Second Stage Research Algorithm

- Distributing of design questionnaire to the 51 Managers to collect data
- Conducting paired comparisons
- Prioritizing the factors based on collected data and presenting the results

In the first stage of the research, considering the review of literature and based on Malcolm Baldrige National Quality Award (2012), 7 factors were evaluated as the CSFs of TQM in Oil and Gas Company. In this regard, researcher conducted interview with five Top Managers and review the all concrete documents for indication points to each Sub-criteria in order to evaluate CSFs from Management's perspective. At next stage, prioritizing the factors happened through using AHP of data. In this regard, Expert Choice is utilized for prioritization.

Survey Design

- *Orientation:* The study is directed to firm that had already implemented a TQM. Specifically, the survey was administered to managers who were in charge of the implementation process, to consultants, and to IT professionals, in this order of priority. All of them were highly involved in the implementation process, with positions such as Managing Director, Assistant Project Director, main consultant, Commercial Manager, and Project leader.

- *Questionnaire Design:* From the review of previous research focused on CSFs in TQM implementation, a list of 7 CSFs was defined. The process of selection and the list of these 7 CSFs were discussed

in section B. A questionnaire was designed with items for each one of these 7 selected factors. For each factor, a question assesses the level of importance that it has in the implementation process.

Sample

The population of this study included all levels of managers working in Pars Oil and Gas Company (POGC) that have implemented a TQM system. It took the researchers 1 week to get the participation of this sample.

Data analysis

Overview

This research was a descriptive study. The qualitative analysis of population was described then the Company performance with respect to the Baldrige criteria was evaluated. And at the last seven critical success factors in implementation of TQM were prioritized from different level of management's perspective.

Data gathering tools in this research were international and standard checklist of Malcolm Baldrige Model in business performance excellence (2012 Edition). These checklists are accessible through the mentioned organization. The environment of this research was Pars Oil and Gas Company. The program utilized for this research was Expert Choice for prioritizing of CSFs of TQM.

Qualitative Analysis of Population

The total number of population for this study was 51 Managers from different level of management in Pars Oil and Gas Company conducted TQM in his organization.

Evaluation of CSFs

The data gathering approach was that of presenting at Pars Oil and Gas Company, the performance of Company based on criteria of Baldrige model on 'Performance Excellence' branch, by interviewing Top Managers of Company, studying the records and documents in each criterion and separately supplementing the checklist related to performance excellence, after receiving objective evidences, were evaluated. After comparing the company's performance with criteria contained in model, points to fit and finally the rates were determined. The data obtained from all phases were analyzed qualitatively. Descriptive statistics were applied for analyses. As can be seen in chart 1 and table 1, this Company obtained 473 of 1000 scores of Malcolm Baldrige's model in the Business field. Regarding the below table, it can be observed that within major criteria, the highest score was related to the Strategic Planning with 46 points, 54% of the total score of this model. On the other hand, Workforce obtained the lowest score. Since, this Company obtained a total of 32 points equals to 38% of above criteria score.

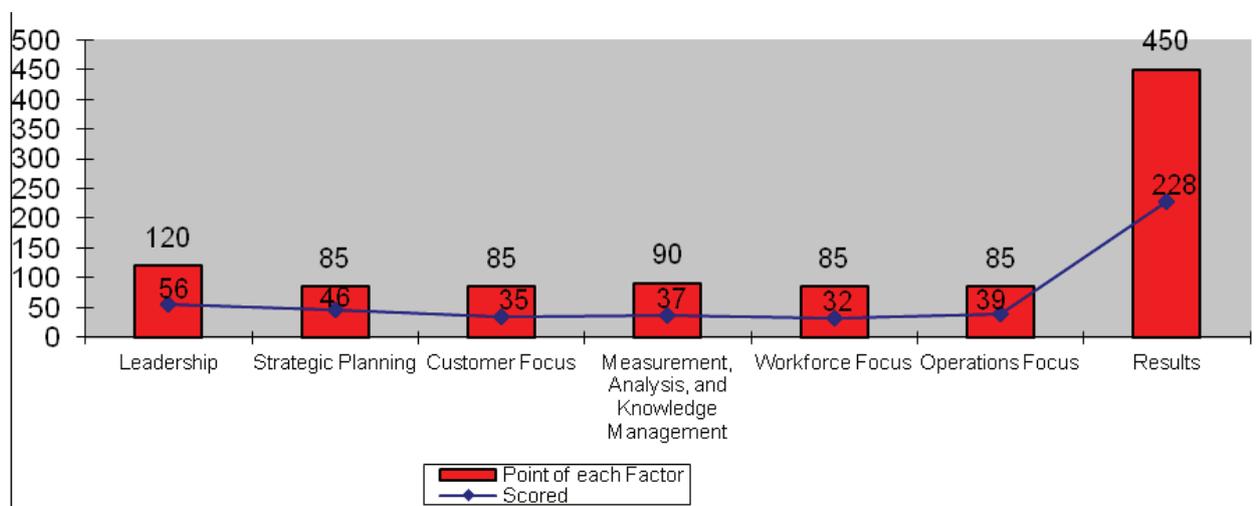


Figure 2. Distribution of POGC performance based on process and organizational performance results criteria in the Business area, 2012

Prioritizing of CSFs

After collecting the questionnaires, the compatibility of criteria has been investigated. The Pair-wise Comparison Matrix with inconsistency rate lower than 0.1 was accepted. The obtained results from accepted questionnaires were referred to individuals and consequently the Pair-wise com-

parison matrix with maximum rate of 0.09 was obtained.

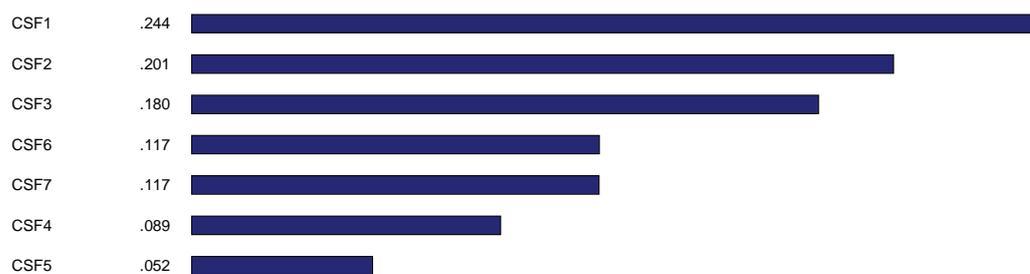
As can be seen clearly from fig. 2, TQM CSFs were prioritized from Manager's perspective with inconsistency ratio equal to 0.05. The inconsistency rate less than 0.1 indicated the accuracy of the prioritization (Jha and Kumar, 2010).

Synthesis of Leaf Nodes with respect to GOAL

Distributive Mode

OVERALL INCONSISTENCY INDEX = 0.05

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
HLM =.717				
	CSF1 =.209			
	CSF2 =.139			
	CSF3 =.121			
	CSF7 =.080			
	CSF6 =.077			
	CSF4 =.064			
	CSF5 =.027			
MLM =.195				
	CSF2 =.050			
	CSF3 =.040			
	CSF6 =.030			
	CSF7 =.025			
	CSF1 =.020			
	CSF4 =.017			
	CSF5 =.011			
LLM =.088				
	CSF3 =.018			
	CSF1 =.015			
	CSF5 =.014			
	CSF7 =.012			
	CSF2 =.012			
	CSF6 =.010			
	CSF4 =.008			



Abbreviation	Definition
GOAL	
CSF1	Leadership
CSF2	Strategic Planning
CSF3	Customer Focus
CSF4	Measurement, Analysis, and Knowledge Management
CSF5	Workforce Focus
CSF6	Operations Focus
CSF7	Results
HLM	High Level Management's Perspective
LLM	Low Level Management's Perspective
MLM	Middle Level Management's Perspective

Figure 3. Priority of TQM CSFs from Manager's perspectives

Table 1. Distribution of POGC Performance Based on Process and Organizational Performance Results Criteria in The Business Area, 2012

No.	Critical Success Factor Score			
	Critical Success Factors (CSFs)	Maximum Baldrige Score	Sample Score	Percentage Score
1	Leadership	120	56	47%
-	Senior Leadership	70	35	50%
-	Governance & Social Responsibility	50	21	42%
2	Strategic Planning	85	46	54%
-	Strategy Development	40	23	58%
-	Strategy Implementation	45	23	51%
3	Customer Focus	85	35	41%
-	Voice of the Customer	45	21	47%
-	Customer Engagement	40	14	35%
4	Measurement, Analysis, and Knowledge Management	90	37	41%
-	Measurement, Analysis, and Improvement of Organization Performance	45	20	44%
-	Management of Information, Knowledge, and Information Technology	45	17	38%
5	Workforce Focus	85	32	38%
-	Workforce Environment	40	16	40%
-	Workforce Engagement	45	16	36%
6	Operation Focus	85	39	46%
-	Work Systems	45	20	44%
-	Work Processes	40	19	48%
7	Results	450	228	51%
-	Product and Process Outcomes	120	63	53%
-	Customer-Focused Outcomes	90	54	60%
-	Workforce-Focused Outcomes	80	34	43%
-	Leadership and Governance Outcomes	80	38	48%
-	Financial and Market Outcomes	80	39	49%
Total Point		1000	473	47%

Conclusions

The overall result is that Pars Oil and Gas Company quality management experts treat the inputs (leadership, strategic planning and customer focus with scores 56, 46 and 35 respectively) as much more important than the outputs (results) with 228 value points instead of 450 value points suggested by MBNQA. These findings show that the practitioners of the Oil and Gas Industry need to focus more on leading criteria or inputs rather than the lagging criteria (results), albeit they are also important, in improving the quality problems in the Oil and Gas industry.

Considering the results obtained in the current study, it can be concluded that the Malcolm Baldrige model includes many features to evaluate the performance of business organizations. According to the results of this survey, Malcolm Baldrige can be used as a comprehensive model to evaluate the performance of business organizations. With the use of this model, the organizations' weaknesses and strengths would be clear to the authorities, and they can take steps towards the improvement and the growing promotion of their organization by using these data. By utilizing the above check lists, the performance of business organizations could be evaluated extensively, and lead to the improvement of their performance (Oger and Platt, 2002).

It is hoped that the important facts addressed in this paper will be a means whereby managers and researchers will be able to investigate the TQM problem in Iranian Oil and Gas Industry with better awareness. Future studies could look into the possible inclusion of few other critical success factors of total quality management such as communication (Black and Porter, 1995), as an important factor in relation to quality improvement and firm performance (Hernandez *et al.*, 2005).

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