Effect of the Quality Costing System on Implementation and Execution of Optimum Total Quality Management

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Abstract

Today, quality has become the best considered issue for manufacturers and suppliers. Hence, understanding this concept and its execution – related costs in the organizational level is a substantial and vital principle for achieving this goal. To ensure the success of the total quality management process, creating an official structure relevant to this system and using suitable tools and techniques is necessary. Due to fierce national and international competition on one hand and fast change in technology on the other, analyzing, having a better recognition and applying proper discussions including total quality management (TQM) could prove useful and effective. With the importance of establishing a quality costing system for the efficiency of a total quality management system taken into account, the present research deals with studying the effect of the quality costing system helps an organization with regards to identify designing and prevention costs, appraisal costs, internal failure costs and external failure costs. This research is of applied type and was done as a case study at PARS KHAZAR INDUSTRIAL CO. In order to analyze the results, variance analysis (ANOVA) and Duncan tailed test were used. Research result showed that the higher the specifying level of the quality costing system in an organization, the more its effect on the optimum implementation of TQM.

Keywords: Quality, Total quality management, Cost of quality, Quality costing, Quality costing system

1. Introduction

Total quality management is often interpreted as a modern paradigm of management. In order to survive, to go through ups and down and to become whole, organizations have to produce continuously. On the other hand, by concealing organizational defects, moving on against the current flow of fierce competition would not be possible. Therefore, perhaps total quality management is one of the most common terms in business which has been used in all the attempts made in recent years for improving and increasing quality and is both a culture and a set of strategic principles for fundamentally showing the continual improvement of an organization. As a whole, being victorious in today's competitive markets requires several factors the most important of which is the continuous improvement of quality. In the meantime, previous scientific studies and researches show that increasing the quality level for meeting customer needs should be associated with reducing costs and also the cost of goods manufactured or sold. One of the factors which can result in reducing these product-related costs is reducing costs of quality .thus, recognizing, classifying and improving these costs have always been among the most important parts of quality in institution .for this reason, numerous studies have been conducted on the execution of total quality management and in the present study being different from them, the effect of quality management and execution of the total quality management (TQM) is discussed. Generally, quality- related costs

which are derived from quality costing system are divided into four groups (sower & charles, 2007.p.122: hardy, 2006, p.2) which are as follows:

A) prevention costs (costs of designing the quality system, costs of training , reporting, etc)

B) appraisal costs(controlling costs including inspecting and testing materials entering the production line, on-production materials, end products , etc)

C) internal failure costs(costs of not obtaining the desired quality in preventive processes)

D) external failure cost(costs related to products which after being delivered are returned to the company due to not satisfying customer needs.)

With consideration of the above-mentioned classification, which has been done based on the PAF model suggested by Joseph M.Juran and A. Feigenbaum, the analytical model of this research is given in figure 1.

1.1 Total quality management (TQM)

In the traditional approach, the quality of products is evaluated with consideration of physical characteristics and features such as their solidity and reliability, however, nowadays; many companies have reconsidered the concept of quality. They have found out that the most desirable and successful product would not be considered ideal if it can not meet customer needs and expectations. In fact, the new meaning of quality requires new strategies for organizing, executing and controlling. Today, paying attention to quality is no longer the responsibly of a small group of people who monitor performances and remove defected products from the assembly line. Instead, all ranks and files are considered as effective elements of quality. Quality management is a philosophical-managerial perspective which is increasingly finding its place in societies and regards customer needs and innovations along with ways of providing services and improving quality as its principles of work. Paying such an attention to quality and the attempt to its permanent improvement plays a substantial and sign cant role in developing quality. It is noteworthy that in recent years, quality management improving systems have had a rapid evolution since the last two decades, simple inspection activities have been replaced or completed with quality control procedures, the quality assurance (QA) has been introduced and they have set out for completion, but now, continuous improvement of quality or total quality management (TQM) has replaced them all presenting patterns and theories related to the quality improvement of products and systems has become today is motto for organizations. more over, the outstanding successes of the Japanese during the past decades and a substantial change in their production and economic capacities along with providing prime quality products and services has been a main incentive for evolving management trends in order to reach a higher quality and methods which solve the complicated problems of modern organizations. Michael J.Stahl had defined TQM as a systematic approach to management with the elevation of customer's value through designing and continuous improvement of organizational processes and systems as its objective. Also, Stanly M.Cherkasky has defined it as creating a problem- solving process by applying quality management throughout an organizations with the purpose of improving products and services .as the TQM definition suggests, modern leaders and managers instead of officially monitoring and controlling staff ,are involved in managing systems and processes. What can say about processes is that they are a group of activities which receive data, add value to them and provide outputs for domestic and overseas customers [oriaku, 2008.p.36]. Innovations like TQM, presented especially by senior managers, are encouraged with a hope for improving performance. Although these managers choose TQM only because other companies have applied it, it understands and that how it should be used for improving a company is performance could be insufficient and this insufficient understanding would be followed by less commitment which will result in early abandoning TQM plans [beer, 2003 .p.626]. In today's exhausting competition, TQM is the least survival condition of the game. In fact, both the comparison of total quality in the current management idea and re-engineering consider increasing productivity through rethinking processes as their goal. In the long run, quality can only be achieved by involving the whole organization in a continuous improvement. Therefore, TQM needs changes in manager's leadership methods, communication between managers, Type of reward, decision- making and also recording and reporting costs of quality. so, in order to compete at global level in today's global industrial environment, companies are ever–increasingly emphasizing on quality and productivity and TQM in an attempt made in this regard and simply put, is a system for creating a competitive advantage so that an organization can focus on points which are important to customers [Denisia&Ghorghina, 2008, p, 1881].Elements and components of total quality management are shown in figure 2.

1.2 Quality costing system

Many organizations consider developing and improving quality as the best way for increasing customer satisfaction, reducing manufacturing costs and increasing productivity. Thus, in every serious attempt made to improve quality, costs related to it should be taken in to account. In addition, satisfying customer needs should be done with minimum costs and this is only possible by reducing costs required for obtaining quality. In fact, reducing these costs is only achievable when they are identified and measured. [Schiffauerova & Thomson, 2006, p.542].Thus, financial assessment is considered to be a suitable way for organizational performance and determining whether we have achieved our set goals or not .Moreover, reporting activities and the financial efficiency of the quality system is a vary important approach with regards to relating continuous improvement of the quality system to an organization's performance. The fact that the most conservative estimations can elevate the net interest of a company is an indication of the potential significance of quality costing [Shower & Quarles, 2007, p.122]. Generally, the quality costing system is one of quality management tools and techniques which an organization can use in introducing and developing quality. Therefore, those organizations that take benefits of using quality costing into account should evaluate the type of a costing system and its potential capability. In fact, there are several methods which may be applied for accumulating, classifying and assessing costs of quality. The traditional PAF method proposed by J.M.Juran (1951) and Feigenbaun (1956) classifies costs of quality into prevention, appraisal, problems and failures. Prevention costs are related to actives which are backed to guarantee the provision of services and quality products. Appraisal costs are those of assessing the level of quality obtained through a process and finally, failure costs refer to costs incurred to modify quality in products and services before (internal) or after (external) being delivered to customers [Schiffauerova & Thomson, 2006,p.543].

1.3 Role of quality costing in total quality management

During 1980's, many western organizations become aware of the importance of strategic total quality management in maintaining the well-being of their institutions. They fount out that TQM enabled them to act in domestic and international markets in a competitive manner. It was after this finding that the continuous process of quality improvement began, as a whole TQM is an organizational goal and the quality improvement process is the means for achieving it. In addition, quality costing is among the tools for improving the quality of goods and services.

Beside taking the quality of goods and services into account, it is necessary for companies to act competitively with regards to cost price and transporting materials and goods. Mainly retrenchment is necessary for many companies to keep on their activities. Most of the time, being aware of costs of quality prevents from potential loses to incur in the future and for this reason, quality costing is used by organizations as their internal quality performance index. In fact, this knowledge helps managers with the following (shariatzadeh, 2001, p.66).

1. Justifying investment in controlling quality
2. Evaluating the effectiveness of the measures taken

Quality costing expresses a company is qualitative performance in the language which is common between the board of directors and senior managers(i.e.money) Usually these individuals can not be impressed by quality costing-related information which are not financial ,however when this information is presented in the financial language, they will be forced to act .Quality costing is a useful efficient tool by relying on which managements would be able to reach the total quality management (TQM) frontier. Just as any other system, it is the management who decides whether this novel quality controlling tool should be used or not and if the answer is positive, it determines the limitation of using this tool.

1. Of the most important researches conducted on TQM the following can be mentioned.
2. Harsneck, Ronald (2004) leadership for commitment and collaboration with the total quality management approach. Lolia University of technology.
3. Ochman, Johnson (2004) a pattern to execute total quality management in the African air force, university of South Africa.
4. Miamni, L. (2004) important factors of a successful execution of quality management improvement tools, University of Missouri.
5. Fries, Paul (2004) quality management as a systematic management philosophy, Copella University.
6. Nidem, Alam (2004) executive topic of guaranteeing quality in Canadian companies: A study of ISO 9001-2000, university of Concordia.

7. (2008) effect of total quality management on leadership. Elisabeth university.(This research was done as a case study and investes reasons for the inefficiency of TQM system in Nigerian organizations)

The primary goal of the research was to investigate the effect of the quality costing system in optimum implementation and execution of TQM. As said before, this system helps an organization with identifying four general groups of costs of quality the subgroups of which are discussed below and will be followed by research hypotheses.

A) Costs of Quality Designing, prevention and follow-ups

These costs include activities which are done to prevent defects and break down in products.

They cause break downs and defects of the manufactured products of different stages, from the arrival of row materials to the company to delivering end products, to be cut. Some of the existing subgroups of this main group which are also criteria for this type of costs used in questionnaires are as follows (Javaherdashti & Ahouei, 2002, p.7)

1. Costs of quality designing: these include costs of activities which are done in order to prepare quality designs for manufacturing various products, comprehensive quality designs in the company providing quality- related data. Testing the ability of meeting needs, etc.
2. Costs of education: costs of specifying educational needs, planning, preparation and implementing educational courses required for maintaining or promoting the quality of a company is products are included in this subgroup.
3. Costs of designing and process controlling: These include activities related to investigating capabilities and potentials of processes and inspections done in a production line along with activities which are carried out to ensure that steps of the production process are followed properly.
4. Costs of reporting: quality reporting, report of products' qualitative, conditions and negative points, reports relevant to customer polling results, inspection, testing and other reports required by middle and senior managers of company are the costs which should be placed in this subgroup. Here, apart from man hour costs, their administration costs must be considered as well.

B) Appraisal Costs

These costs are covered to specify whether or not a product is specification is consistent with the qualitative characteristics in mind, to measure them. The following entities should be taken into account (Javaher dashti & Ahouei, 2001, p.5)

1. Costs of evaluating subcontractors: Generally, subcontractors, materials / parts suppliers. Services and products used by a company must be evaluated before purchase so that their potentials and capabilities in meeting the company needs.
2. Cost of inspection and testing the inputs: All costs of the work force, equipment, materials used for doing experiments and destructive tests with the purpose of controlling items which are brought to the company are placed in this category.
3. Costs of inspection and testing the end product: These include costs of inspection and testing sets/ parts during a process to ensure their accuracy and precision.
4. Costs of inspection and testing the end product: These costs are those of inspections and tests which are done on an end product to determine its approval or disapproval and to specify its being appropriate to be offered to customers and include costs of work force, equipment and materials.
5. Costs of creating quality systems and their audits: Usually include costs of auditing activities of a product which are performed by a company is inspectors or those from outside to ensure the accuracy of inspections and tests, to control the proper performance and consistency of a process or tracing a product is characteristics. Such audits could be done with regards to input, semi-finished or end products. (e.g. SO. measuring NMPS indices, EFQM, other quality systems audits).
6. Costs of controlling inspection and measurement equipment: This group of costs includes costs of controlling inspection and measurement equipment and maintaining them in desired conditions so that values obtained by these devices would be reliable.
7. Costs of investigating inventories: If wholly purchased items are kept in unsuitable conditions of warehouses for long periods of time, it is probable that their quality would diminish. For this reason inventories are usually evaluated at different period of time.

C) Costs of internal failure (inside-organization)

such costs include those of problems which occur during different stages prior to delivering a product to customers and through various methods such as inspections and tests performed by the staff of the quality control unit or outside inspectors, an organization finds these defects and takes measures to remove them, some of the relevant subgroups being used as a means of measuring this group of costs are as follows (Javaher dashyi & Ahouei, 2001, p.3)

1. Scrapped or junk costs: Usually, products and items which due to not being consistent with the defined engineering specifications are not suitable to be offered to customers or to have other applications are considered as Scraps or junks.
2. Costs of maintenance and duplication of the manufactured products: Those products which are manufactured in a company and because of not being consistent with the required specifications are not usable, in some cases through repeating some modifications or repairs become usable and costs of such production activities should be segmented and considered in the costs of quality heading.
3. Cost of failure analysis: All the costs related to investigation and expert analysis of the occurrence of defects in products along with finding ways to solve the problem and prevent it from recurring are included in this subgroup.
4. Costs of repairing and modifying received defected items: These include costs of preparing items received by suppliers which due to not observing the required features by the supplier are not usable in their present condition and thus should be repaired or modified.
5. Costs of unsuitable preservation of raw materials: All the costs incurred by improper storing which has resulted in damages made to items are included in this subgroup .Usually ,all items whose quality is affected by climatic conditions are placed in this subgroup.
6. Costs of retesting the modified items :If a product has been repaired, modified or duplicated ,it surely require inspection and testing so that its being placed in a acceptable tolerance range is ensured.
7. Costs of classifying products quality under the acceptable level: Costs resulting from selling products at a lower price due to their specifications not being consistent with standard products are included in this subgroup.

D) Costs of External Failure (outside-organization)

Such costs include those which incur after a product is delivered to customers without being specified not until the product is used by customers. Some elements is this group are (Javaher dashti & Ahouei, 2002, p.4)

1 Costs of guarantee: This subgroup includes replacement costs, maintenance and product replacement .Freight and reinstallation costs.

2 Costs of returning the product by customers and their complaints: These include costs of activities which are performed with the purpose of accountability to complaining customers and satisfying them and covered by the company itself. Costs of making telephone calls, man hours needed for polling forms to be filled in by customers, customer voice projects and in some cases making restitution to customers can be mentioned in this category.

3 Costs of modifying the products delivered to customers: All replacement, repairing or replacing costs which a company covers are placed in this subgroup.

4 With the above-mentioned groups and subgroups taken into consideration, research hypotheses are formulated as follows.

1.1 Specifying costs of quality designing, prevention is efficient at optimum implementation and execution of TQM.

1.2 Specifying costs of quality appraisal (inspection) is efficient at optimum implementation and execution of TQM.

1.3 Specifying costs of internal failure is efficient at optimum implementation and execution of TQM.

1.4 Specifying costs of external failure is efficient at optimum implementation and execution of TQM.

2. Methodology

The method of the present research was descriptive- analytical which was done as a case study. With consideration of the topic, suitability of the place needed for doing research and consistency of the company's

conditions with research hypotheses and principles, PARS KHAZAR CO. was chosen. Then necessary records and documents were collected. To collect data, a questionnaire was used. This questionnaire had 41 questions with Likert's five-point spectrum .Its validity and stability was calculated by Delphi and Chronbach's coefficient Alpha methods, respectively. Chronbach's coefficient Alpha for each variable is given in table 1.

Managers and supervisors of PARS KHASAR INDUSTRIAL CO. (active in total quality management) were the statistical population of this research. To choose the study sample, at first a list of these managers and supervisors was made. Then, through random sampling, members of the target sample were chosen. About 200 individuals of the managerial personnel of the said company received necessary educations with regards to TQM from which 70 people were chosen as a research sample. To test research hypotheses, first ANOVA method and then, Duncan is tailed test was used.

3. Conclusion

With the results obtained from testing the studied hypotheses by using ANOVA taken into account, a significant difference between different levels of specifying the quality costing system and optimum execution of TQM was observed.

The Duncan test results given in table 3 indicate that there is a significant difference between. Different levels of specifying quality costing system and optimum execution of total quality management. The higher the specifying level of the quality costing system, the more its effect on optimum execution of TQM. To determine the effect of quality costing system on the optimum execution of TQM in accordance with each one of the PAF model variables similar tests were used the results which are given below.

- Specifying prevention costs (variable): test results show there is a significant difference between different levels of specifying prevention costs and optimum execution of quality management and more effect of higher levels of specifying the said costs in the optimum execution of TQM.
- Costs of quality appraisal (variable): with consideration of the results of testing the hypothesis relevant to this variable, there is a significant difference between different levels of specifying the cost of quality appraisal and optimum execution of TQM. Thus, the higher this level, the more effective it would be in optimum execution of TQM.
- Cost of internal failure (variable): investing the effect of the level of specifying the quality costing system on optimum execution of TQM with regards to the specifying level of internal failure suggests higher levels of specifying this variable being more effective in optimum execution of TQM.
- External failure (variable): investing the effect of the level of specifying the quality costing system on optimum execution of TQM with regards to the costs of external failure variable shows that higher levels of specifying these costs are more effective in optimum execution of TQM.

Since considering quality without paying attention to its relevant costs can not ensure an organization's survival ,the necessity of the presence of a useful quality costing system which deals with recording and reporting costs of quality to determine their effectiveness seems obvious. In fact, quality costing is a simple and at the some time advanced method that by providing detailed information, makes a more desirable controlling, playing and decision-making possible for management.

By investigating the effect of different levels of specifying the quality costing system in optimum execution of total quality management, the existence of difference between low, medium and high levels of specifying the quality costing system in optimum execution of TQM and the more effect of its higher levels was discovered. Also, bused on the investigation of various levels of specifying the PAF models is components for optimum execution of TQM, it was found that higher levels of specifying each one of the said components would result in better execution of TQM.

4. Discussion

Investigating the effect of different levels of specifying the quality costing system on optimum execution of the total quality management showed differences between low, medium and high levels of specifying the said system for optimum execution of TQM and its being more effective in higher levels of specification. Based on the results obtained from studying different levels of specifying the quality costing system and other components of the PAF model for optimum execution of TQM, it is suggested that by establishing this system and identifying costs of quality, a company can move towards reducing these costs so that such a system, as a tool for improving services and product quality, would help a company to improve the quality process and total quality management. It is not worthy that extreme attempts mode with the purpose of reducing costs of quality would not always result

in higher income and interest rates for a company because in some cases ,especially regarding planning and prevention costs of course with consideration of the importance which specifying these costs can have in reducing other costs, proper and sufficient allocation of budget to them regardless of instant reduction of financial resources could pave the way for having a successful production with higher quality and financial benefits in the future. Also, analyzing the mean value of experts answers in the questionnaire showed that paying more attention to providing those groups of received items from suppliers which are not usable in their current condition is necessary because only in this case reduction of internal failure costs could be possible. On the other hand, by enjoying consultation services, a company can be ensured of the accuracy and preciseness of the received sets and parts which would lead to the reduction of evaluation costs. And finally, using experienced individuals and experts in the field of transporting and installing defected items for a second time should result in reducing costs of external failures.

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Table 1. Chronbach's coefficient Alpha of variables

No. of Questions	Chronbach's Alpha	variable
8	0.745	Specifying costs of internal failure
4	0.741	Specifying costs of external failure
10	0.819	Specifying costs of quality failure
4	0.744	Specifying costs of designing and prevention
15	0.838	Optimum implementation and execution of TQM

Table 2. Table of the ANOVA test of the quality costing system and optimum execution of TQM

Optimum TQM	Sum of Squares	df	Mean Square	F	Sig
Between Group	2642.887	2	1321.444	45.231	0.000
Within Groups	1957.413	67	29.215		
Total	4600.3	69			

Reference: Research findings

Table 3. Table of applying Duncan test to the quality costing system and optimum execution of TQM

Quality Costing System	N	Subset for alpha=0.05		
		1	2	3
Low	24	42.8750		
Medium	24		46.4545	
High	24			57.1667
Sig.		1.000	1.000	1.000

Means for groups in homogeneous are dips lay.

a. Uses Harmonic Mean Sample Size=23.294

b. The group sizes are unequal.

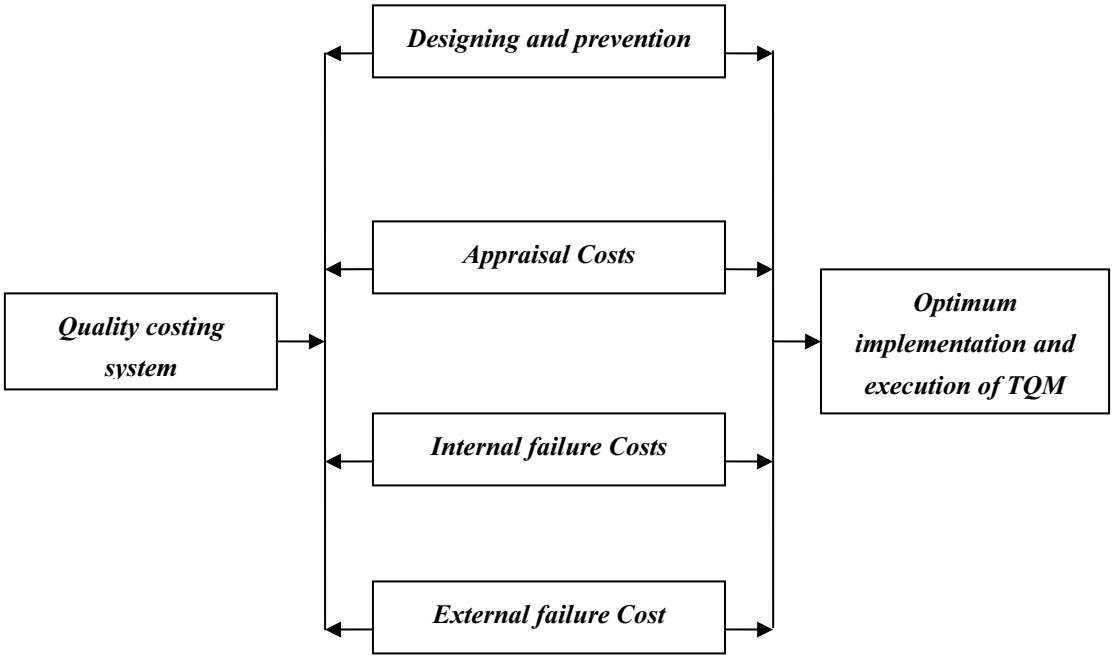

Figure 1. Analytical model of the research

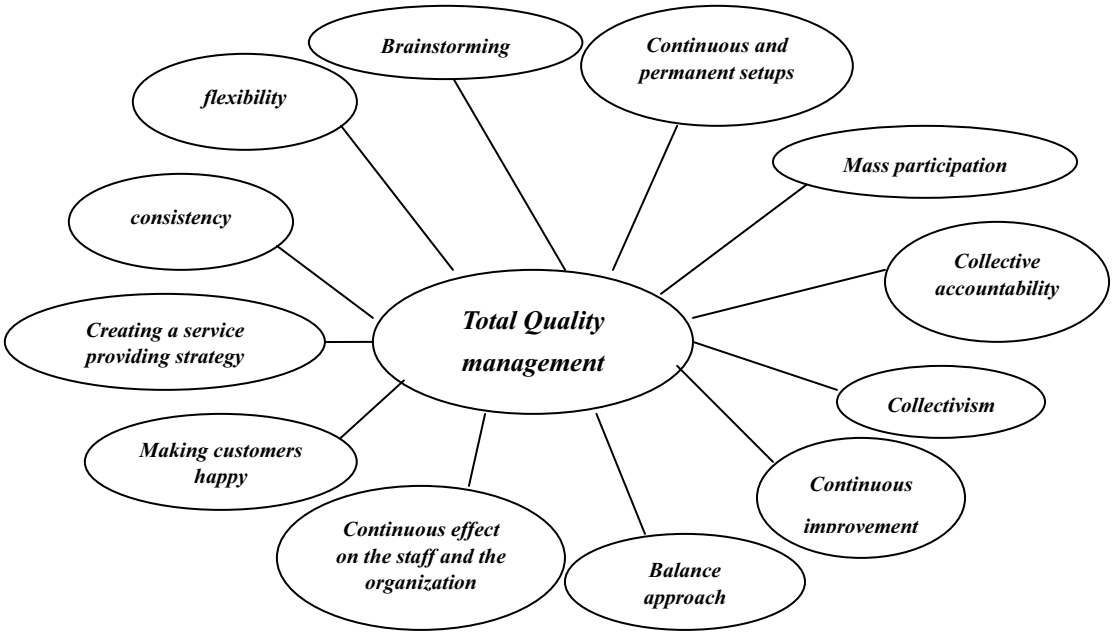

Figure 2. Components of the total quality management [Soltani, 2001, p.50]

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