

# TQM IMPLEMENTATION AND ORGANIZATIONAL CHARACTERISTICS: A STUDY ON TRI-CITY REGION

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## Table of Contents

- Abstract
- Keywords
- Introduction
- Review of Literature
- Objectives
- Research Methodology
- Results & Analysis
- Conclusion
- References

## ABSTRACT

*Quality affects the level of trust of customers towards software services provided. TQM implementation has been instrumental in managing and enhancing quality thereby, increasing customer confidence. The purpose of this research is to explore the association between the organization characteristics, viz. size, age and the extent of Total Quality Management implementation in software development Industry. This study has been conducted for the organizations operating in Chandigarh, Panchkula, and Mohali. A total of 265 respondents were selected using convenient sampling. Descriptive statistics and t-test were used to find if there was any significant difference between TQM elements due to organization characteristics. Four TQM elements, viz. Total Management Commitment, Customer Focus, People Management and Continuous improvements were considered for this study. The results showed that the size and age have a mixed impact on the extent of TQM implementation in an organization, with some of TQM constructs showing positive association while other constructs were neutral to these organization characteristics.*

**KEYWORDS:** : TQM, Quality, Organization Characteristics, Total Management Commitment, People Management, Customer Focus, Continuous Improvement

## INTRODUCTION

### IT Industry

Recently, the Indian software companies have evolved from an orientation to low-cost programs abroad towards complex services of software development produced from India and delivered to overseas clients. In the context of a worldwide shortage of technical workforce, the investments of the Indian government in technical education resulted in the emergence of several high-quality technical and management institutes. Employees of Indian companies who could speak English well, trainable and aspiring for higher wages, traveled to the US to work onsite.

The world wide quality standards of a significant number of companies in India have been acknowledged through top certifications. The Indian Information Technology / Information Technology Enabled Services (IT-ITES) industry is now, one of the most active sectors in India's economy and is accountable for the worldwide recognition of India. The constant growth of the IT segment has created remarkable wealth, employment, exports and a large reservoir of highly skilled technocrats and knowledge workers. Most of the corporations among Fortune 500 and Global 2000 lists are sourcing IT-ITES from India. Indian IT companies have set up over 600 delivery centers across the world and are engaged in providing services in over 200 cities across 78 countries. In terms of the national GDP, the sector revenues have grown from 1.2% in FY1997-98 to nearly 9.3% in FY2015-16. India continues to maintain a leadership position in the global sourcing arena, accounting for almost 56% of the global sourcing market size in 2016 as compared to 52% in 2012 (Ministry of Electronics & Information Technology, Government of India, 2016).

Punjab used its IT policy and the incentives targeting the IT industry in order to become an attractive destination for the industry. An example of an IT and ITES hub in India is Mohali (India Brand Equity Foundation, 2017). Due to the establishment of Rajiv Gandhi Chandigarh Technology Park (RGCTP) in Chandigarh, the city has become a well-known destination both inside and outside India. Many companies, such as Infosys, Virsa, Net-Solutions, Taurus Agile, and IBM established their units here in only one year (Confederation of Indian Industry, 2009).

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## Total Quality Management

TQM has been effective in almost all types of industries in the past few decades. It has also been particularly implemented in service industries like banking, healthcare, hospitality, and information technology (IT) and information systems (ISs). While many professionals think that TQM is an old concept, various new continuous improvement ideas are based on TQM philosophies. TQM covers a number of different quality control and improvement initiatives. For example, Six Sigma, which is popular today, is a methodology within TQM, not an alternative to it (Klefsjo, Wiklund, & Edgeman, 2001; Pattanayak & Maddulety, 2011). TQM also embraces initiatives such as ISO 9000 and the Malcolm Baldrige National Quality Award (MBNQA). Regardless of the different perceptions, the fundamental theme shared in all frameworks is that TQM is based on a prevention work process that attempts to increase quality and efficiency, improve productivity, and enhance customer satisfaction (Waldman & Addae, 1995).

Focus on the customer is one of the priorities of quality management (TQM). Thus, its approach consists in fulfilling the customer requirements permanently (Attakora-Amaniampong, Salakpi, & Bonye, 2014; Stevenson, 2007), since the way in which a company responds to the needs of a customer affects its success. Price and Chen, (1993), define TQM as a management system, instead of a series of programs focused on profit at the expense of customer satisfaction. According to them, it integrates philosophies, tools, and processes by which the business objectives are accomplished while having delighted customers and happy employees.

The employees, treated like internal customers, represent an essential part of TQM implementation and influence the extent to which a company is competitive. Usually, they acknowledge the customers' needs and identify quality problems for solutions. Their satisfaction is expressed in loyalty, and satisfied employee stay. The ambassadors of a company are its satisfied employees, loyal and productive, due to whom the companies increase their values (Attakora et al., 2014).

TQM as a managerial attitude acts as one of the most valued tool and technique for any organization as its benefits in making managerial decisions and supports the operational strategy of the organization. Many studies have shown that total quality management provides better/improved business practices that reduce costs, increase productivity and enhance quality which eventually satisfies the customers.

## Significance

The IT industry, especially software development, is still under infancy, in Tricity (Chandigarh, Mohali and Panchkula) region, as compared to other big cities of India like Bangalore, Hyderabad, New Delhi and few others. This study may throw a light on current relative TQM levels in this area and will relate these levels to the organization characteristics. The prevalent perception is that larger and older organizations are more capable of implementing TQM as larger organizations have got more resources in comparison to smaller ones and the older organizations have more matured processes. This study tries to verify and validate this perception. This study will provide an insight to senior management of smaller organizations whether TQM is really for larger and older organizations or the smaller and younger ones can also opt for it. The software development organizations in this area mostly comprise of smaller or mid-size companies, if measured in terms of employee strength, while there are only a handful of large-sized organizations. Senior management of smaller organizations who may be serious about improving quality to achieve competitive edge may re-think about implementing TQM after reviewing the results of this paper.

## REVIEW OF LITERATURE

Total quality management (TQM) is one of the quality-oriented methodologies that many establishments implement. TQM has attracted scholars because of the promising acceptance in the business world. Especially over the two decades, TQM is one of the most popular and durable management concepts (McLean, Lien, Yang, Wu, & Kuo, 2011; Zehira, Ertoşunb, Zehirc, & Müceldilli, 2012).

TQM is defined as a system which has components of core values, techniques, and tools with the aim to increase external and internal customer satisfaction with a reduced amount of resources (Attakora et al., 2014; Hellsten & Klefsjo, 2000). TQM is seen as a framework in which expectations of stakeholders are fulfilled (Ahmed, Aoieong, Tang, & Zheng, 2005; Lau & Tang, 2009).

On the contrary, Attakora et al., (2014) found that both construction firms, with or without a recognized TQM policy, are both customer and employee focused. Some studies have classified TQM components in two aspects: management tools and techniques (Hard) as well as management concepts and principles (Soft) (Psychogios & Priporas, 2007). Elements of soft TQM are fundamental, the extension of human resource management, like workforce commitment, training and

so on, while hard elements relate to continuous improvement or treat organization as total systems (Rahman & Bullock, 2005).

Rahman and Bullock (2005) explored the relationship between TQM practices and organizational performance. Their study utilized data from 261 Australian manufacturing companies. They created a model with 10 TQM elements: workforce commitment, shared vision, customer focus, use of teams, personnel training, cooperative supplier relations, computer-based technologies, just-in-time principles, technology utilization, and continuous improvement enablers. The first six elements were considered as the soft elements and the remaining four elements as the hard elements of TQM.

According to Dean and Bowen (1994), TQM is a management idea, or a methodology characterized by principles, practices, and techniques. They confirmed that three principles, that most quality frameworks, had following commonality - customer focus, continuous improvement, and teamwork. Each principle is applied through established practices, and these practices, in turn, are reinforced by a wide set of techniques.

Terziovski and Samson (1999) established that there were noteworthy differences in the relationship between TQM and organizational performance when the size of the organization was taken into consideration, specifically impacting the new product development. Larger companies were likely to benefit more from TQM than smaller firms. These findings are consistent with some other studies as well. However, Ahire and Golhar (2001) showed that there were no operational differences in TQM implementation which could be attributed to firm size and that small and large firms that produced high-quality products implemented TQM likewise.

Haar and Spell (2008) in their study concluded that firms with higher level of workplace independence, use of performance standards, use of teams, and use of group problem solving were more likely to adopt TQM, and this was more expected for larger companies than smaller companies. These findings established that although most small firms have some weaknesses such as limited markets, scarce resources and lack of managerial expertise, they still had advantages in flexibility and innovation that could allow them to implement TQM as effectively as large firms. Large companies showed a higher implementation rate in most of quality management practices except for teamwork and open organization when compared to small- and medium-sized companies (Hoang et al.,

2010).

Brah, Tee, and Rao (2002) in their study concluded that the size of the company and the adoption of TQM are two factors that correlate significantly with a more rigorous quality management implementation and a higher level of quality performance. The analysis shows that the length (or duration) of implementation of TQM program effects quality performance. Experienced TQM firms execute quality constructs considered for that study, more rigorously than less experienced TQM firms. The concepts of quality management are applied more in large companies than in small companies. It supports the argument that TQM is a long-term campaign requiring a significant input of financial, technical, and human resource investments over several years before payoffs from TQM can be realized. Brahet al. (2000) did not find any substantial difference between the rigors of implementation of experienced TQM firms in comparison to less experienced firms. Thus, more experienced TQM firms do not essentially perform better than lesser experienced ones.

Ahire and Golhar (1996), found no differences between experienced TQM firms and less experienced TQM firms in the rigor of TQM implementation, with the exception of employee involvement and concludes that it is possible for a firm to achieve a high operational performance within a shorter TQM time frame compared to firms that had longer TQM experience

Abusa (2011) anticipated that the extent of TQM implementation among large companies would be more innovative and better established than among the S&M companies, but the outcomes were not in line with its expectation. His results indicated that there was no significant difference between the S&M companies and large companies' mean of TQM elements at the 0.05 significant levels. In addition, the mean of TQM elements in S&M sized companies is, on average, a bit better than the mean of TQM elements among large companies.

TQM practices led to increased levels of quality awareness, teamwork and reduced level of scrap and client complaints. (Swamy, 2007)

Chandravathi (2013) found that leadership style, training, development systems quality and quality of resource management improved after implementation of TQM in banking sector.

Gupta<sup>1</sup> & Belokar<sup>2</sup> (2014) found TQM as a strategic tool which can be implemented by an organization to remain competitive. Everyone's including management, employees and customer's involvement is required for TQM implementation.

Shiroya (2015) highlighted that TQM improves organization performance in terms of employee morale and skill levels, inter departmental communication and reduces chances of accidents, in a study conducted for ISO certified manufacturing facilities in Gujrat.

Jain (2010) in his study on Indian software industry concluded that TQM practices have significant impact on employee's attitude towards their jobs and organization. Some of the TQM practices considered were Employee Empowerment, Teamwork, Communication and Organization culture.

Talib and Rahman (2014) ranked the TQM practices in ICT (Information and Communication Technology) industry. They found that Top Management Commitment was ranked first followed by Customer Focus and Training & Education.

**OBJECTIVES**

This study measures TQM implementation on the basis of soft aspects or elements of TQM mainly Top Management Commitment, People Management (PM), Customer Focus (CF) and Continuous Improvement (CI).

**RESEARCH METHODOLOGY**

**TQM elements**

These elements have been derived from the literature reviewed.

**Hypotheses Formulation**

1. To explore if there is any significant association between the size of an organization and TQM implementation level.
2. To explore if there is any association between the duration of organization's existence and the extent of TQM implementation.

**Research Design**

Present work uses a descriptive cross-sectional study design. It is in line with the studies on Total Quality Management performed by Talib, Rahman, & Qureshi, (2012a); Kumar et al., 2011; Salaheldin, 2009 as cited in (Talib & Rahman, 2015). The study used electronic (e-mail) survey method as a means of data gathering which is commonly adopted in such types of work.

The questionnaire was designed based on previous studies (Abusa, 2011; Attakora et al., 2014; Oluwatoyin & Oluseun, 2008). A set of items, composed of approximately an equal number of favorable and unfavorable statements concerning the attitude object, is given to a group of subjects. They are asked to respond to each statement in terms of their degree of agreement or disagreement. Typically, they are

instructed to select one of five responses: strongly agree, agree, not sure, disagree, or strongly disagree. The specific responses to the items are combined so that individuals with the most favorable attitudes will have the highest scores while individuals with the least favorable (or unfavorable) attitudes will have the lowest scores.

The questionnaire developed consists of two sections. The first section contains the demographic information of the respondents which also gathers the data related to the size of employees and age of the organization. The second section collects information on the identification of Total Quality Management elements as well as their adoption by listing four key Total Quality Management practices, namely TMC, PM, CF, and CI.

We tried to base this on studies such as Brah, Tee, and Rao (2002) by Dawson and Patrickson (1991), and Griffin (1988), who suggest that it takes at least three years for TQM to produce consistent performance advantages. But because of the sample size limitations, we have considered this cut off duration as 5 years, based on which we divided the organizations into 'Young' and 'Mature.'

The questionnaire was initially validated through a pilot study before it was finally used for primary data collection. Cronbach's alpha values, the standard of reliability for survey instruments, of the all four Total Quality Management element constructs exceeded 0.70, which is acceptable (see Jung, & Wang, 2006; George, & Mallery, 2003).

Below table 1 represent the Cronbach Alpha values for different Total Quality Management constructs.

**Table 1:** Cronbach Alpha Values for Different Total Quality Management Constructs

Cronbach Alpha	
TMC	0.73
PM	0.93
CF	0.74
CI	0.9

**Sample Size and Sampling Method**

The sampling frame of this survey is composed of all organizations with type "IT" published by (Glassdoor, 2017) for location Chandigarh, Panchkula, and Mohali. The sampling frame of IT organizations came to be of 280 in number. The sample size of 165 was arrived at, assuming 5% confidence interval and 95% confidence level.

The survey questionnaire was forwarded to 165 organizations and responses were received from 61 organizations with a response rate for of more than 36% which is quite acceptable as recommended by Brah and Rao, 2000; Kureshi, Qureshi, and Sajid, (2010).

### Data Collection/Questionnaire Administration and Responses

The target respondents to this survey were from middle management layer (mostly Technical leads/Project managers) whose main focus is to manage and maintain Quality of deliverables and follow processes for their specific project as defined for the whole organization. The other types of respondents were those who belong to QA function of the organization. These people ensure that a project follows established processes and meet minimum Quality criteria.

**Table 2:** Descriptive Statistics of Total Quality Management Practices

	TMC (TMC)	Customer Focus (CF)	People Management (PM)	CI (CI)
Min	18	32	20	17
Mean	24.93	41.95	45.92	22.69
Max	30	50	60	30
SD	3.1	4.45	8.39	3.44

### Data Analysis

The responses of the 61 participating companies were further classified into two groups: one with a high-level and the other with a low-level Total Quality Management implementation as explained below. This study used a technique similar to that used by Abusa, (2011); Chapman and Al-Khawaldeh, (2002) who categorized the respondent companies into two groups: those companies with a high-level of TQM implementation and those with a low-level.

The companies were ordered based on all 4 elements of TQM considered for this study. In relation to overall TQM, the classification was based on all 34 items (1 to 34) in the survey questionnaire.

**Table 3:** Number of High and Low TQM Organizations as per Primary Elements

TQM Elements	High	Low
TMC	52	9
CF	56	5
PM	41	20
CI	37	24
TQM	24	37

It is observed that the scores for TMC and CF are high

and almost all organizations scored higher in this aspect of TQM. The real difference lies in PM and CI aspect of TQM. These two aspects came out to be a tiebreaker among High and Low-level TQM implementation in organizations. One of the reasons for this is that while all organizations and their top management focus on quality (of services and products) and customer satisfaction, not all focus on employee encouragement and management to achieve this goal. Also, continuous improvement is not something all organizations aim for while looking for customer satisfaction. CI requires special focus and resources which some organizations might feel like an unnecessary cost.

### RESULTS & ANALYSIS

This section provides details of data analysis for each objective and the corresponding conclusions.

**Objective 1.** To explore if there is any significant association between the size of an organization and TQM implementation.

Below is the summary of data received from TQM and size of the organizations. The study divided the organizations into two categories of sizes. One, with more than 700 employees (Large size), and less than 700 employees. The variables exhibited a relatively normal distribution with the values of skewness and kurtosis not exceeding the absolute value of 1 as considered by Hoang, Igelb, and Laosirihongthong, (2010); Jaiswal and Jain (1988) and Essalam, Mabrouk, & Samia, (2010).

Levene's test aimed to check the equality of variance for two samples. The evidence does not demonstrate that the variances were different between the two samples.

**Table 4:** TQM Levels vs Size of Organizations

TQM vs SIZE		Size	
		Large	Small
TQM	High	18	6
	Low	20	17

t-Test for two independent samples was performed for all 4 constructs of TQM.

Top Management Commitment (TMC)

The following hypotheses were tested.

$H_0$ : There is no difference in the extent of Total Quality Management (TQM) implementation between large and small size organizations

$H_a$ : There is difference in the extent of Total Quality Management (TQM) implementation between large and

**Table 5:** Data Analysis: TMC Levels vs. Size

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Small	23.98	3.22	39	59	1.7581	0.0839
Large	25.46	3.04	22			

small size organizations

P value is significant alpha level of 0.1

**Customer Focus (CF)**

The following hypotheses were tested.

**H<sub>0</sub>:** There is no difference in the extent of Total Quality Management (CF) implementation between large and small size organizations

**H<sub>a</sub>:** There is no difference in the extent of Total Quality Management (CF) implementation between large and small size organizations

**Table 6:** Data Analysis: CF Levels vs. Size

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Small	41.5	4.78	39	59	1.1951	0.2368
Large	42.9	3.59	22			

**People Management (PM)**

The following hypotheses were tested.

**H<sub>0</sub>:** There is no difference in the extent of Total Quality Management (PM) implementation between large and small size organizations

**H<sub>a</sub>:** There is difference in the extent of Total Quality Management (PM) implementation between large and small size organizations

**Table 7:** Data Analysis: PM Levels vs. Size

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Small	46.56	8.93	39	59	1.3461	0.1834
Large	43.46	8.08	22			

**Continuous Improvement (CI)**

The following hypotheses were tested.

**H<sub>0</sub>:** There is no difference in the extent of Total Quality Management (CI) implementation between large and small size organizations

**H<sub>a</sub>:** There is difference in the extent of Total Quality Management (CI) implementation between large and small size organizations

**Table 8:** Data Analysis: CI Levels vs. Size

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Small	20.5	3.28	39	59	2.0733	0.0425
Large	22.5	4.16	22			

\*\*P value is significant at alpha level of .05

**DISCUSSION**

Means of TQM elements of large organizations scored higher in all TQM constructs except People Management where mean of PM score was higher for small size organizations than the larger ones. P value is significant at alpha of 0.1 for TMC and alpha of 0.05 for CI. The results seem to be in line with Dybå, (2003); Ghobadian and Gallear, (1997) who found that large organizations reported a significantly greater extent of involved leadership (t = 1.79, p < 0.1) than small organizations. As has been reviewed in literature, TQM implementation requires a lot of resources over a long span of time. In line with its implementation, the actual realization of benefits also takes time. Top management has more leverage in terms of resources and hence may be keener towards continuous improvements in quality and may have a more strategic vision for the same. Large organizations by nature have got more divisions and standardization leading to the specialization of certain skills and hence can focus more on continuous improvement. In small organizations, documentation of process and procedure are rarely encouraged. This feature is directly against continuous improvement.

Hoang et al. (2010), also found that large companies showed a higher implementation rate in almost all quality management practices except for teamwork and open organization in comparison to small- and medium-sized companies.

The results are in contrast with Ahire and Golhar (1996) who observed that there are no operational differences in TQM implementation owing to company size, with the exception of customer focus and SPC usage. P values for the PM and CF constructs of TQM indicate that there is no significant difference in these two elements of TQM in the large and small organization. This is aligned with Tore Dyba's (2003) observations. In fact, this study found that small organizations implement significantly greater extent of employee participation (t = -1.75, p < 0.1) than large organizations. The data in the current study have also shown a higher mean for small organizations for PM construct.

Employees of SMEs have a closer contact with the firm's products and customers, which increased their

responsibility and market awareness. Since in a small business most employees are connected to external customers, the benefits of the company increase proportionally with the employees' motivation to provide the best service available.

Employees of such a company are more aware of its profitability and more determined to contribute to its improvement. Such a culture provides more chances for a larger group of employees to work collaboratively with the customer and give them a sense of customer pain areas, thus increasing focus towards customer needs. Customer focus is one such element which is essential for the survival of any organization, and hence small and large organizations may equally focus on this element. This may be the reason that the customer focus and people management does not exhibit any significant difference in implementation between large and small organizations.

**Objective 2.** To explore if there is an association between the duration of organization's existence and the extent of TQM implementation.

Below is the summary of data received for TQM and age of the organizations. As stated earlier, the study divided the organizations into two types: Young (less than 5 years of existence) and Mature (more than 5 years into existence). A relatively normal distribution of the variables can be observed, just as in the previous objective. In addition, the results of Levene's test were used in order to check the equality of variance for two samples.

T-Test for two independent samples ('Young' and 'Mature' types of organizations) was performed for all 4 constructs of TQM.

**Top Management Commitment (TMC).** The following hypotheses were tested.

$H_0$ : There is no difference in the extent of Total Quality Management (TMC) implementation between Mature and Young organizations

$H_a$ : There is difference in the extent of Total Quality Management (TMC) implementation between Mature and Young organizations

**Table 9:** Data Analysis: TMC Levels vs.

Organization Age

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Mature	25.48	2.84	33	59	1.8499	0.0693
Young	24	3.41	28			

\*P value is significant alpha level of 0.1

**Customer Focus (CF).** The following hypotheses were tested.

$H_0$ : There is no difference in the extent of Total Quality Management (CF) implementation between Mature and Young organizations

$H_a$ : There is no difference in the extent of Total Quality Management (CF) implementation between Mature and Young organizations.

**Table 10:** Data Analysis: CF Levels vs. Organization Age

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Mature	41.95	4.123	33	59	0.1128	0.9106
Young	41.82	4.88	28			

**People Management (PM).** The following hypotheses were tested.

$H_0$ : There is no difference in the extent of Total Quality Management (PM) implementation between Mature and Young organizations

$H_a$ : There is difference in the extent of Total Quality Management (PM) implementation between Mature and Young organizations

**Table 11:** Data Analysis: PM Levels vs. Organization Age

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Mature	44.43	9.63639	33	59	1.073	0.2877
Young	46.82	7.37564	28			

**Continuous Improvement (CI).** The following hypotheses were tested.

$H_0$ : There is no difference in the extent of Total Quality Management (CI) implementation between Mature and Young organizations

$H_a$ : There is difference in the extent of Total Quality Management (CI) implementation between Mature and Young organizations

**Table 12:** Data Analysis: CI Levels vs. Organization Age

Organization	Mean	SD	N	Df	t stat	P(T<=t) two-tail
Mature	22.43	3.96989	33	59	0.273	0.7858
Young	22.68	3.03809	28			

## DISCUSSION

The mean for TMC Mature organizations is more than mean of corresponding Young Organizations. CI and CF means are almost same, but PM mean is more for

Young than a Mature organization, but this difference is not found significant.

One would expect that more experienced firms would implement each element of TQM more rigorously than less experienced ones, but this does not turn out to be true as per the results. But the results of this study are almost in line with the study of Brahet et. al., (2002) and with Ahire (1996) as well, with only exception that Top Management Commitment seems to be significantly different (alpha level of 0.1) between 'Young' and 'Mature' organization. This suggests believing that the top management in a newly formed organization is in the process of making and they get more focused towards TQM implementation as the time passes by and they start believing in the benefits of TQM as the organization matures.

### CONCLUSION

Implementation of TMC to some extent and CI elements were found, significantly higher on large size organizations as compared to smaller organizations. TMC (at alpha level of 0.1) was found significantly higher in mature organizations than the younger ones.

### Managerial Implications:

1. Senior management in software development organizations will get an awareness of TQM implementation levels in the same industry in and around Chandigarh.
2. Management may introspect as per their size and age and review the TQM implementation in their organization.
3. Doubts related to size, age, and TQM implementation may get clarified.

### Scope for further study

There are several other elements of TQM which may be studied and analyzed with size and age of organization. Same way, other organization characteristics may be refined further, and more levels of size and age can be considered for the study. Based on available resources, a larger region could be studied and analyzed for the similar study.

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