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A SURVEY STUDY OF SIZE FACTOR IMPACT ON TQM SUCCESS AND SUSTAINABILITY

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Abstract:

Total Quality Management (TQM) is a management approach to long–term success through customer satisfaction. There have been numerous studies devoted to TQM success and failures but relatively few took into account size factors. The objective of this study was to determine if size factors impacted TQM success and sustainability. In this study, the authors looked at three areas where size may impact TQM success: size of an organization, size of customer base, and size of the core TQM team. The authors developed a survey and measured the responses of 101 industry professionals with varying degrees of expertise in TQM to understand if size factors impacted the success and sustainability of TQM. The findings suggest that responses varied widely based on TQM expertise. General trends were evident with responses from select sub-groups. The study concluded that size factors play a contributor role but are not root causes to success or failure. This research is unique because it looks at customer base size and core TQM team size to determine if these factors impact TQM implementation and sustainability.

Keywords: TQM; Implementation; Survey; Size; Expertise.

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1. Introduction

There have been many terms used over the years to define Total Quality Management (TQM) including; business transformation, performance excellence, business excellence, and six sigma [5]. TQM is a dynamic management approach that focuses on improving all aspects of the organization to achieve greater customer satisfaction. Dale Bester field, et al. [1] defined Total Quality Management as both a "philosophy and a set of guiding principles that represent the foundation of a continuously improving organization". The guiding principles, or framework, can be broken down into six basic concepts shown in Figure 1.
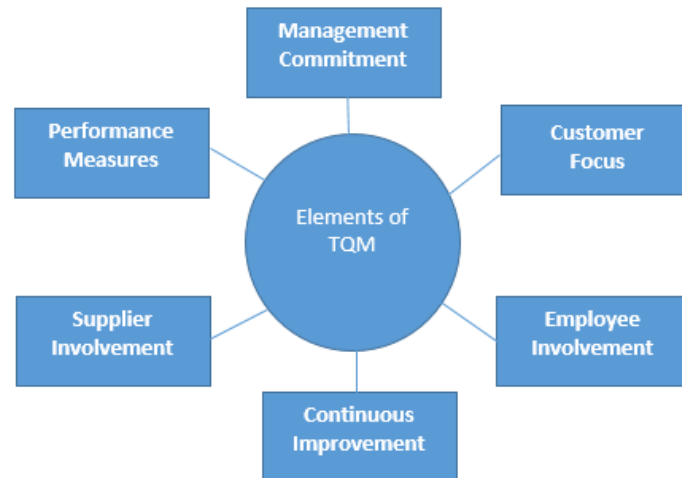
Figure 1: Elements of TQM

Committed Management

Management, at all levels of the organization, must be committed to leading the TQM program. Their involvement goes beyond being the face of the program. This hands-on management approach helps build camaraderie in teams and demonstrates commitment to the success of the program and the organization as a whole. Management can support TQM implementation in four distinctive ways [9]:

- allocating budgets and resources
- control through visibility
- monitoring progress; and
- planning for change

Customer Focus

Customers may be internal or external but the argument can be made that they are equally significant to the long term success of the organization. Listening to the "Voice of the Customer" (VOC) is essential to capturing customer requirements. Customer requirements can be developed through the Quality Function Deployment (QFD) method and implemented internally through the quality design process. Customer requirements are then prioritized, commonly through the analytical hierarchal process (AHP), to better define critical to quality (CTQ) characteristics to help ensure product conformance and customer satisfaction.

Employee Involvement

TQM is a company-wide commitment that starts at the top and is driven down throughout the organization. In order to effectively implement TQM, all employees must be trained in TQM and quality improvement skills. By gaining competency in these areas, all employees become assets to the TQM program. As employees become more involved in developing systems and processes to achieve quality objectives, the culture of the organization begins to change, which is critical to sustaining an effective TQM program.

Continuous Improvement

All progressive thinking organizations have strong continuous improvement programs in place. If an organization gets complacent and rests on their laurels, they set themselves up for failure. The

quality improvement team is responsible for identifying areas that are in need of improvement and developing action plans to address these areas, including integrating new technology. Quality improvement tools and statistical techniques are then used to correct, measure, and monitor the process.

Supplier Involvement

Suppliers are key partners in the TQM program. On average, 40% of sales dollars is purchased product or service [1]. Developing a strong partnership enables the organization to work with the supplier on delivering high quality products to their customers.

Performance Measures

Key Performance Indicators (KPI) should be developed to understand process performance and to take action when system variances are observed. Performance measures can be used to track scrap rate, downtime, productivity, and other vital areas of the process. As a rule of thumb, KPIs should be kept to ≤ 5 per functional unit.

The four (4) primary objectives of TQM is to enhance customer satisfaction, empower employees, higher revenue, and lower costs, as shown in Figure 2 [5].
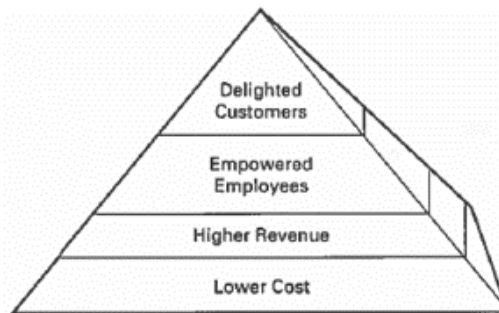

Figure 2: Results of Total Quality Management

1.1. History of TQM

TQM was founded on the principles of empowering employees, understanding customer needs, and measuring key processes to minimize variation. TQM has been implemented in nearly all industries, whether it be manufacturing or service based. The roots of TQM began in the 1950's by four of the leading pioneers of quality; Edwards Deming, Joseph Juran, Armand Feigenbaum, and Philp Crosby [2]. Each pioneer specialized and contributed to TQM in distinct areas of quality control, whether it be statistical analysis, continuous improvement, or management theory, each were instrumental in the rise of TQM in industry. In 1951, Armand Feigenbaum authored the book *Total Quality Control,* a forerunner for the present understanding of TQM [2]. However, TQM did not gain widespread attention until thelate 1980's and early 1990's, around the same time the ISO 9000 family was born [3]. Today, TQM continues to be a widely embraced business model.

1.2. Statement of the Problem

For one reason or another, TQM succeeds in some organizations and fails in others. In this study, we address the following problem statement and provide three (3) hypothesizes:

Question: Does sizes factors impact the success of TQM implementation and sustainability?

Hypothesis 1: The size of an organization may impact the success of TQM implementation and sustainability.

Hypothesis 2: The base customer size of the organization may impact the success of TQM implementation and sustainability.

Hypothesis 3: The size of the core TQM team in the organization may impact the success of TQM implementation and sustainability.

There have been numerous studies performed on factors that have led to success and failure of TQM programs in various industries. In many of the studies, failure has been tied to lack of management commitment, vague improvement goals, lack of developing and sustaining a quality-oriented culture, lack of employee motivation, participation and team work, to name a few [6]. When TQM gained momentum in the 1980's and 1990's, some organizations developed unrealistic expectations. Many looked at TQM as a quick-fix program that would yield immediate positive results [7]. In this study, we analyze size factors to determine what impact they have on TQM programs. Does size factors play a role in success or failure of implementing and sustaining TQM programs?

It's reasonable to assume that larger organizations may find it more challenging to successfully implement and sustain a successful TQM program than a smaller organization. A fundamental aspect of implementing any new program in an organization is to get buy-in from all levels of the organization. TQM is a top-down management approach that must instill quality principles, values, and objectives that must be realistic and consistent with the direction of the organization. This may, at times, include changing the culture of an organization at all levels. It's also reasonable to assume that the more employees an organization has, the higher the effort and resources are needed to change the culture. Generally speaking, when organizations implement large, culture changing programs, top management expects to see positive results within a set time period. If TQM efforts are not showing positive results, the program may be scrapped.

Organizations with a large (>250) customer base may also find it challenging to sustain TQM due to the assumption that a large amount of resources are required to keep customers satisfied on a continuous basis. This may be particularly true for organizations that produce a custom product or service that has several voices-of-the-customer.

Determining the size of a core TQM team, to operate in the most efficient and effective way possible, is a challenge that may plague an organization that is implementing TQM. Too many members may result in team conflict where ordinary decisions cannot be easily made. Too few members and the work load may be overwhelming for the group to handle.

1.3. Purpose of the Study

The purpose of this study is to examine how size factors impact TQM implementation and sustainability. In the ever changing and challenging business environment, organizations are looking for ways to become more profitable and sustainable. TQM is a proven business strategy that focuses on how the organization empowers its people and manages its processes, suppliers, and customers. Previous studies have identified factors that derail TQM efforts but few take into consideration organization size, customer base size, and TQM core team size. The objective of this

study is to gather and analyze primary and secondary data in order to draw conclusions on the impact these select size factors play on success and failure of TQM.

1.4. Significance of the Study

In the global market place, more so than ever, forward-thinking organizations are looking to achieve a competitive advantage over the competition. This study is significant because it provides a better understanding that, regardless of size factors within the organization, TQM can be a valuable business tool to promote customer satisfaction, growth, and process efficiency. It is reasonable to assume that management at large or small organizations may feel detracted from implementing TQM because it may not fit their business model due to added resources associated with implementation and sustainability. What they fail to realize is there is a measureable return on their TQM investment. At the same time, if TQM worked for every organization, it would be more widely used in all industries. Since this isn't the case, we look at factors that seem to have been ignored in similar research studies.

1.5. Delimitations of Study

Sample Selection
The sample survey was sent out to 223 colleagues of ours with affiliation to professional quality and regulatory organizations. A similar survey approach was discovered during the literature review of Jayaram et al. (2010) where the research team targeted quality professionals in the manufacturing sector to complete the survey. It was decided to limit the survey to colleagues based on the probability of having a higher return rate than other avenues. In part, we made this decision after reviewing related literature on survey response rates. One such research journal article found that surveys used in research studies had an average response rate of 52.7 percent with a standard deviation of 20.4 [8]. Additionally, we wanted to ensure a significant portion of responses came from individuals with experience in quality systems, who understood the concept and methodology of TQM, even if they had not been directly involved with a formal TQM program.

The survey volunteers were permitted to self-assess their proficiency level in TQM, however, assessment guidelines were not included in the survey. We also decided against using an online survey software company, such as Survey Monkey, as a means of capturing a greater sample population. This option was not feasible due to the limited number of quality professionals that were available to take part in the survey, which could potentially invalidate the research results.

Sample Size
The survey was a relatively small sample size but the results did give us a window of knowledge and understanding of the influence of size factors relative to TQM failure and success. The sample population was limited in size due to the survey research methodology we selected to give us the greatest return rate of individuals with quality systems and TQM knowledge and experience.

Research Terminology
The literature review and survey research focused on the terminology Total Quality Management. As with most on-going business improvement initiatives, new ideas have been spun off of TQM over the past few decades that take the basic principles of TQM and add a twist to them. These

"newer" programs, such as Six Sigma, have strikingly similar attributes of TQM, with respect to operational efficiency and reduce scrap and defects, however; they were not analyzed as part of this research study.

2. Literature Review

2.1. Identification of Common TQM Failure Types

Total Quality Management is a business approach to long-term success through customer satisfaction [2]. However, recent studies have put the success rate of TQM programs just around 50%. Naturally, the topic of determining what factors have led to failure has been explored in numerous studies. As we discussed in the introduction, there are six basic concepts that an organization must pay particular attention to if TQM is to be truly sustainable. When those concepts are overlooked, failure is almost certainly guaranteed.

In this literature review, we look at three key factors that have led to the demise of TQM in various industries and organizations. A wealth of knowledge was gained as a result of this literature review that analyzed several factors and developed true root causes as to why TQM programs fail.

2.2. Importance of Management Commitment

Arguably the single most important concept in any business transformation is management commitment. Management commitment goes above and beyond lip service. It requires a hands-on management approach to leadership that establishes the direction of the organization. Jaideep Motwani (2009) performed a comparative analysis of six empirical studies and found that top management support was the leading critical factor of TQM. Indeed, a study published in the Medical Laboratory Observer (MLO) [4] asked laboratory personnel how often upper management supported the practice of TQM, only 14% of respondents said "all the time". In addition, a majority of the respondents believed that TQM was "effective in identifying problems in the workplace"; however, the concept failed to produce significant improvements in quality. Although this study is merely a small example of the effects of inadequate management commitment, it supports the theory that commitment from top management is essential to creating and sustaining an environment of continuous improvement through strategic management from the top down.

Management commitment is more than direct or indirect involvement in TQM base activities. Jayaram et. al. (2010) research found, with mixed results, the contingency influence of TQM duration in small and large firms [11]. Duration can be directly tied to management commitment based on providing ample time for the program to launch, function, and measure results. The study was broken down into two constructs: culture and quality system design. Their study used organizational-learning theory that argued more time (i.e. duration) equals a better understanding of drivers that impact TQM success, such as; Top management Commitment (TMC), Customer Focus (CF), Trust (TST),Design Management (DM), and Training (TR) to name a few. The results showed a moderating effect on firm size on some of the path relationships. However, the research also indicated that the direction of the correlation between path relationships were not in a consistent direction. The results of their hypothesis concluded that: "of the twelve total effects linking culture to outcomes, seven were moderated by firm size, and of the eighteen total effects

linking quality system design to outcomes, twelve were moderated by firm size". Although more research can be done to understand the effects of firm size in relation to cultural and quality system design paradigms, Jayaram et. al. provides baseline model that can be replicated to expand in the research area.

2.3. Importance of Customer Focus

Joseph Juran defined quality as 'a product that meets customer needs leading to customer satisfaction" [5]. Making customers a priority and understanding their wants and needs is essential to a successful TQM program. Time again, organizations fail to build robust relationships with customers, which results in negative impact to the business. Nilsson et. al [10] deployed a survey of 482 companies in Sweden to determine what internal quality practices impacted customer satisfaction the most in product and service organizations. The study used partial least square regression (PLS), an estimation process that integrates aspects of principal components analysis with multiple regression. The results of the study found that the key to achieve organizational success in the product and service sectors was the ability interpret voice of the customer (VOC)requirements into voice of the business requirements. The author suggests Quality Function Deployment (QFD) as a necessary quality tool to fully understand the voice of the customer. The study also found that not only is bridging VOC and VOB important, these process must evolve with the environment since customer requirements may frequently change.

2.4. Importance of Employee Involvement

Recent studies have suggested that employee involvement ranks at or near the top in terms of importance to TQM success. Mosadeghrad (2014) categorized employee involvement as the number two most critical factor from a human resources barrier perspective. Employees on all levels of the organization must have a common understanding of quality [12]. Motwani (2001) expands on this concept by way of a meta-analysis by comparing critical factors of TQM in six empirical studies. The study defines high-focus areas that organizations must consider when it comes to employee involvement. In addition to having a solid understanding of quality, employees must be keyed into the organizations commitment to never-ending improvement. Indeed, this may seem daunting to some employees in the beginning stages of implementing TQM. However, this concept is integrated into the culture through proper training of the organization's operations, quality goals, and product quality specifications [9]. Just as important, employees must feel as though they are part of a team and that their suggestions of quality improvement are taken into consideration.

3. Research Design and Methodology

3.1. Research Design

In this study, we use explanatory design method to compile and analyze data to better understand the impact of size factors. Quality professionals in health care, manufacturing, logistics, consulting, and education are surveyed using a 5-point Likert Scale that includes questions related to three focal themes:
   1) Organization Size

2) Base Customer Size
3) TQM Core Team Size

In addition to numerical values generated from the survey, the respondents are asked open ended follow-up questions after each focal theme. The purpose of the follow-up question is to help provide a better understanding of their thought process with regards to each focal theme. This gives us greater substance and meaning to the numerical values.

The survey takes into account the proficiency level of the respondent with selections from novice to expert, as well as their current title in their respective organizations. By creating designed sub-groups, we were able to interpret the data in a more meaningful way by grouping respondents based on TQM proficiency.

We minimize bias in the data collection stage by omitting the respondents name and any follow-up questions pertaining to the survey. We believe doing so would help ensure the respondent was not swayed in their decision making process.

3.2. Research Methodology

A descriptive research approach was used in this study by means of research survey and literature review. We chose this method due to limited studies having been performed on size factors that impact TQM implementation and sustainability. The objective was to gather new data with respect to size factors and TQM.

3.3. Survey Instrument

The survey consisted of four sections that were pertinent to the research study. The first section gathered relevant background information of the respondent including; current industry, job title, quantity of employees in the organization, quantity of external customers, TQM program (Y/N), certified QMS (Y/N), and expertise level. The remaining sections were questions related to potential barriers to TQM success, including; organization size, base customer size, and core TQM team size. In order to get a better understanding of the respondents' thought process, an open-ended follow-up question was asked after each potential barrier section to understand why they felt a certain way about the question. This helped provide clarity, as well as additional data to fully understand the extent size factors have on TQM success. Prior to administering the survey, volunteers from the ASQ Toledo section reviewed and provided feedback on the survey. All feedback was taken into consideration and the necessary revisions were made.

3.4. Sample Selection

Data from this study were gathered from a 5-point Likert scale survey. The subjects of the questionnaire were selected from a directory of colleagues based on professional affiliations to the American Society for Quality (ASQ), Regulatory Affairs Professionals Society (RAPS), Association for the Advancement of Medical Instrumentation (AAMI), and the Society of Reliability Engineers (SRE). In total, 223 questionnaires were sent out via email to the survey volunteers. Respondents comprised of individuals from both service and manufacturing based

firms in the areas of healthcare, manufacturing, logistics, consulting, and education. For the sake of continuity, surveys were sent to individuals employed domestically in the United States. To ensure anonymity and limit bias in study, the name of the person completing the survey was omitted. Additionally, no follow-up correspondence was made for surveys that were found to be incomplete or ambiguous. Incomplete and ambiguous surveys were discarded and not used within the study.

4. Presentation and Analysis of Data

4.1. Data Collection

A total of 223 surveys were sent to potential respondents of the 223 surveys sent, 147 responses (70%) were received back and 101 surveys (45%) were reviewed and deemed acceptable. There were 46 surveys that were not usable due to being incomplete or ambiguous.

The histogram shown in Figure 3below provides a visual representation of the proficiency level of the respondents that completed the survey. The proficiency rating was self-assessed by the respondent based on their current knowledge and previous experience with TQM. There were no guidelines provided to the respondents for this self-appraisal, as noted in the delimitations section. Of the 101 acceptable responses, 83% of the respondents assessed themselves to be average to experts in TQM.

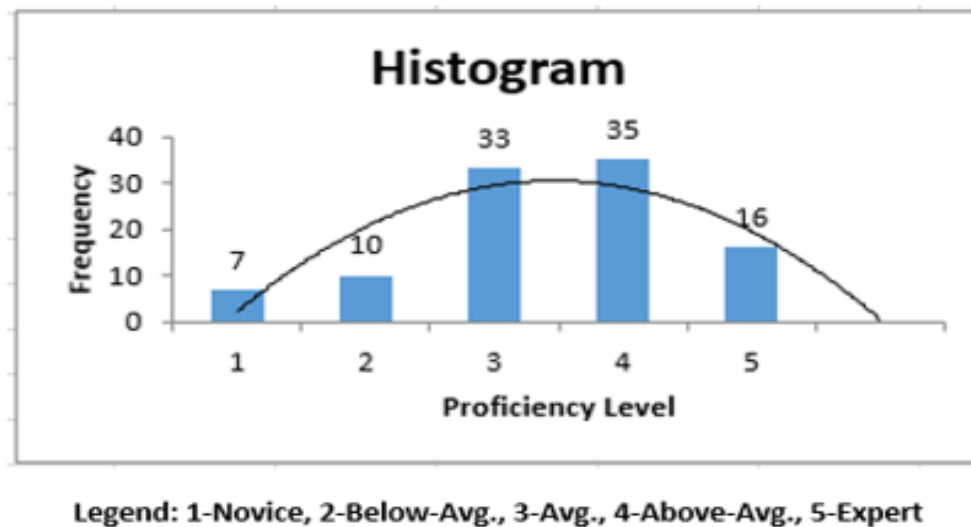Legend: 1-Novice, 2-Below-Avg., 3-Avg., 4-Above-Avg., 5-Expert

Figure 3: Respondent Proficiency Histogram

The survey respondents all held full-time positions in one of the five industries shown below in Table 1. Respondents from the healthcare sector included; hospitals, clinics, and corporate offices of medical device and pharmaceutical firms. The healthcare sector accounted for 23% of acceptable responses. Respondents from manufacturing sector included; medical device, pharmaceutical, electronics, elevators, and automotive and accounted for 45% of acceptable responses. Respondents from the logistics sector were predominantly supply chain and distribution and accounted for 19% of acceptable responses. The bottom two outliers were consulting and education, which accounted 5% and 4%, respectively.

Table 1 – Survey Response by Industry

Industry	Total Responses	Acceptable Responses	Unacceptable Responses	% Acceptable
Healthcare	33	24	9	72.7
Manufacturing	68	46	22	67.6
Logistics	33	20	13	60.6
Consulting	8	6	2	75.0
Education	5	5	0	100.0

Table 2 below is used to show the job title held by each respondent. One of the primary goals of the research was to obtain a high quantity of responses from individuals in a leadership role. As shown below, 67% of respondents hold management level positions.

Table 2 – Survey Response by Title

Title	Total Responses	% of Total Responses
Vice President	4	3.9
Director	12	11.8
Manager	30	29.7
Supervisor	22	21.8
Engineer	9	8.9
Technician / Analyst	12	11.8
Other: Administration	1	0.9
Other: Specialist	6	5.9
Other: Principal	2	1.9
Other: Educator	3	2.9

Tables 3 and 4 represent a breakdown of the organization size and customer size of the respondents. Similar research recently performed has organizational size categorized by revenue. However, since employee participation is a key aspect of TQM, we decided to develop a scale based on the quantity of employees in the organization. The scale was developed in part from the guidelines of the U.S Small Business Administration (SBA). The SBA has categorized organizations under 500 employees to be considered small businesses since the 1950's [12]. Due to the recent surge in small business start-ups, we decided to break this number down further to capture a more accurate size of these organizations.

Table 3 – Survey Response by Organization Size

Organization Size	Total Responses	% of Total Responses
≤ 99 Employees	40	39.6
>100 - <499 Employees	13	12.8
≥ 500 Employees	48	47.5

Table 4 – Survey Response by Base Customer Size

Base Customer Size	Total Responses	% of Total Responses
≤ 99 Customers	7	6.9
>100 - < 250 Customer	40	39.6
≥ 250 Customers	54	53.4

4.2. Data Analysis

The survey data was analyzed by pairing the respondents into groups based on expertise level to identify trends in their responses. Pairing by expertise groups also allowed us to better understand how big of a factor TQM proficiency played in the overall results of the study.

Figure 4 below provides a breakdown of responses to the survey questions regarding organization size by TQM proficiency level. We calculated the mean value of all respondents and plotted the corresponding value in the stratification diagram to show patterns within the groups. The data seems to suggest that the more experience a person has in TQM, the stronger the null hypothesis is supported. Meaning, the data shows the mean drifts downwards, numerically, as proficiency increases. The results also seem to support previous research that concludes TQM training is imperative to success. The response gap between novice and expert is significant, which suggests a higher proficiency level relates to a better understanding that organization size does not TQM success and sustainability.

The second part to the series of questions was an opened-ended question to gather qualitative data on why the respondents selected their answers. In analyzing the open ended questions for sub-groups 4 and 5, we found that a majority (57%) identified management or leadership as being the key driver to implementing and sustaining a TQM program.
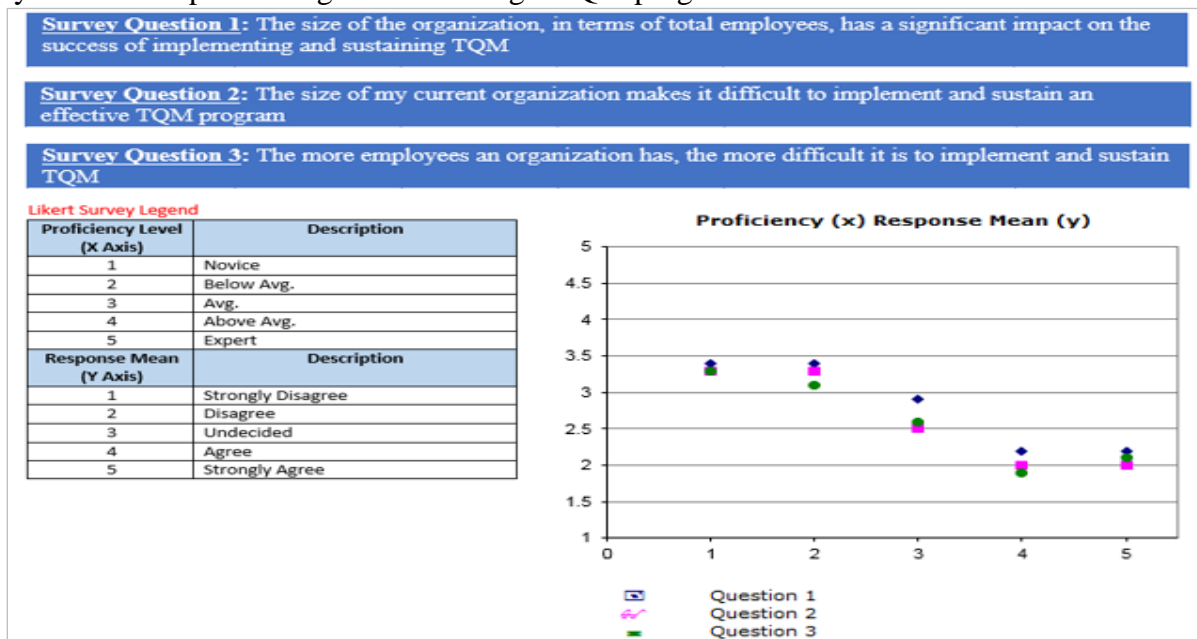

Figure 4: Organization Size Stratification Diagram

Figure 5, nearly identical to Figure 4 above, provides a breakdown of responses to the survey questions regarding base customer size by TQM proficiency level. The data seems to suggest that the high the proficiency level a person has with TQM, the stronger the null hypothesis is supported. Meaning, the data shows the mean drifts downwards, numerically, as proficiency increases. Respondents in proficiency group 4 (above avg.) appear to have a stronger opinion than proficiency group 5 (expert) that a large customer base should not impact TQM implementation and sustainability.
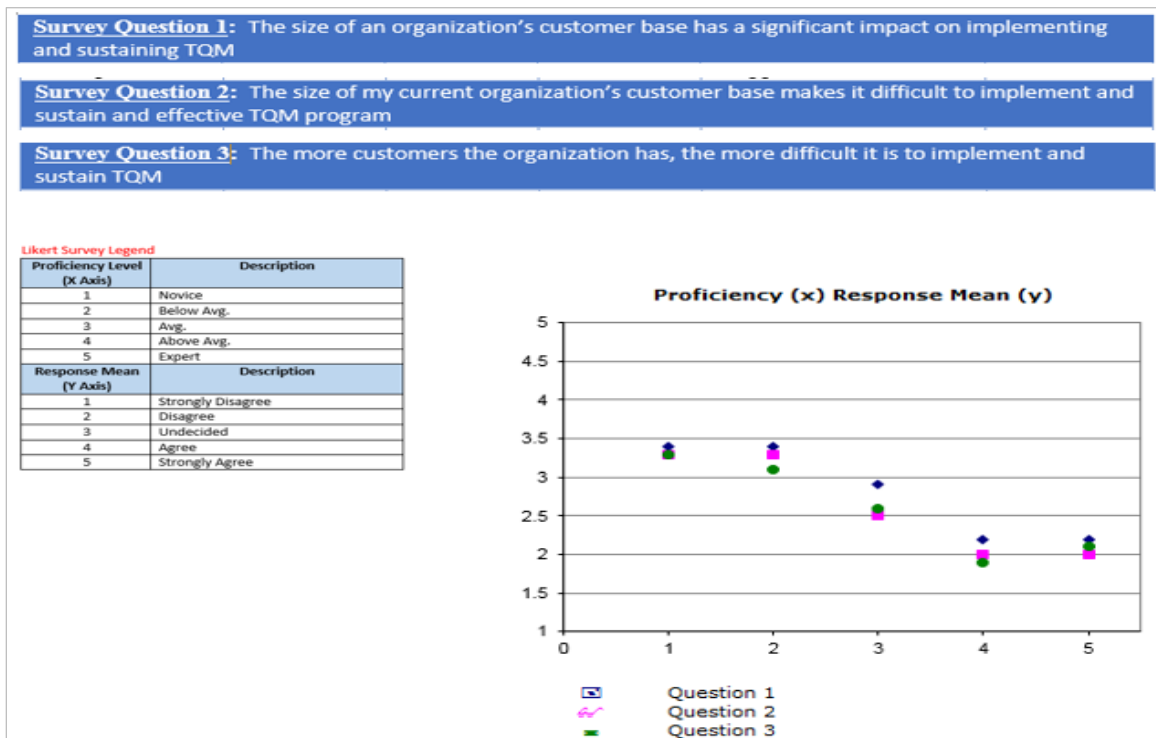

Figure 5: Base Customer Size Stratification Diagram

Analysis of the qualitative data from the open ended question supports the finding of the survey results. A strong majority (63%) felt base customer size has no or very little impact on TQM implementation and success. A strong quality system and quality culture were expressed as having a greater influence addressing the voice of the customer. However, it was noted that 17% of respondents, with various proficiency levels, did acknowledge that base customer size could impact TQM success in the service industries due to an increase amount of customer requirements.

Figure 6 provides a breakdown of responses to the survey questions regarding TQM core team size by TQM proficiency level. There is a general consensus with respect to question 1 that TQM core team size should not be small in size (≤ 5 associates). Respondents for question 2 appear to range from undecided to agree that TQM core team size should be kept moderate in size ($\geq 6 < 10$ associates). For question 3, with the exception to the novice sub-group, the general consensus is that TQM core team size should not be large (>10 associates). The data suggests that if a set quantity of employees are to be allocated to a TQM team, a moderate size would be the most efficient and effective path.
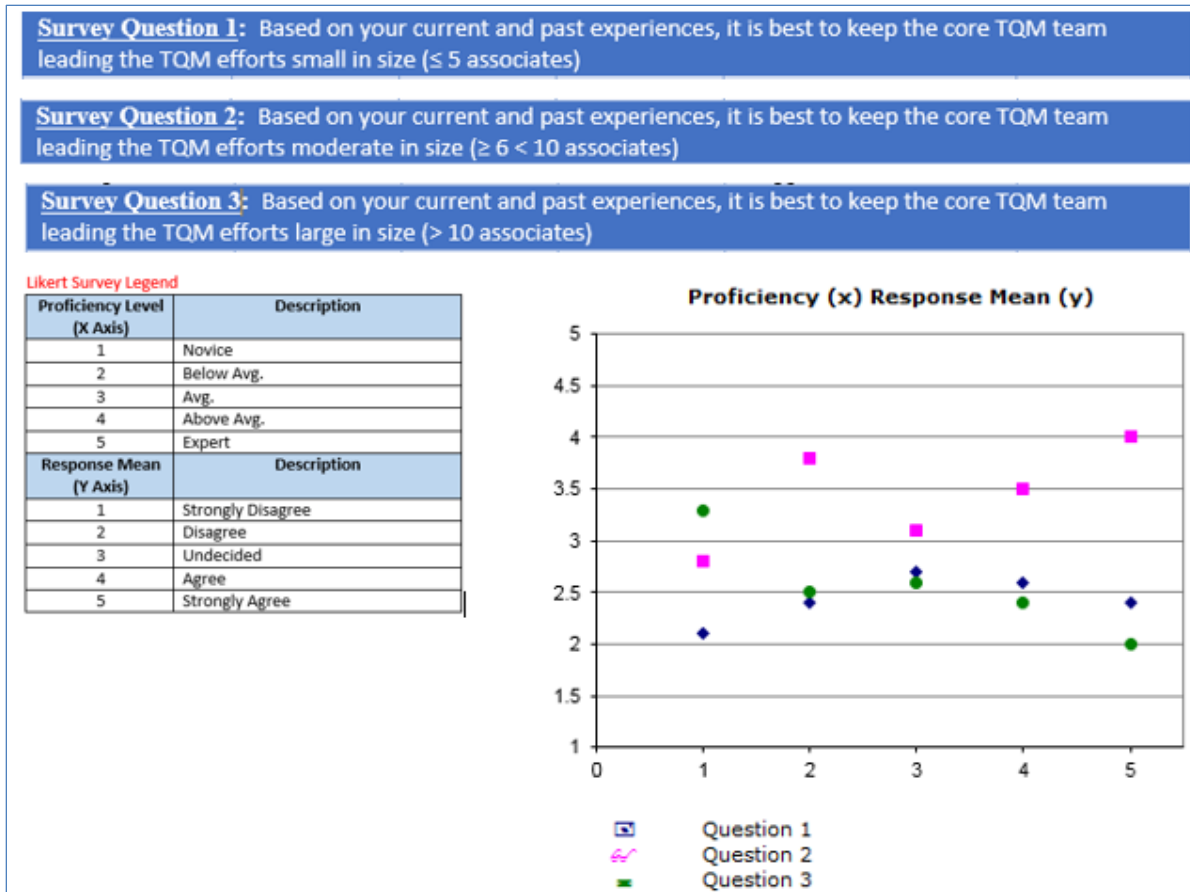
Figure 6: TQM Core Team Size Stratification Diagram

Qualitative data gathered from the open-ended question regarding TQM team size found a strong correlation amongst all sub-groups, in that, the TQM team size should be dependent on the organizational structure and not an arbitrary number. Most respondents agreed that the original size of the team is less important and can be adjusted as business needs arise. Qualitative feedback correlation was strongest against large team size due to the potential inability to come to agreement on basic business decisions.

5. Summary and Conclusion

This survey-based research on the impact size factors have on implementing and sustaining TQM complements previous research because it provides a new perspective on size factors that could entice management teams into implementing TQM at their respective organizations, regardless of size.

The data collected during this research study and the subsequent analysis show that the higher the proficiency level in TQM, the more it is agreed that size factors do not impact TQM implementation and sustainability. This is evident by the mean response rate of above-average and expert responses to the questions regarding organization size and size of customer base. In each set of questions, the mean response is below 2.3. Respondents with average or below average knowledge of TQM felt these factors do in fact impact TQM programs. The results are telling

because a key aspect of TQM is that the entire organization is adequately trained on the principles of TQM. When TQM is not fully understood, it creates an uncertain workplace environment where quality goals and process improvement is not fully implicit. Additionally, management teams that are not familiar with TQM could feel the same and decide to not implement TQM at all.

Based on the results of the data analysis, we can make the argument that the null hypothesis is supported. This is concluded based on the overwhelmingly strong response from higher TQM proficiency sub-groups, 4 and 5, that size factors do not impact TQM implementation and sustainability. A strong majority of responses from groups 4 and 5 revealed real-life application of TQM in various size organizations. Although there were outliers within each sub-group, the open-ended questions provided and greater understating of their response and many included current or past experience with TQM. We can also conclude that lower proficiency sub-groups lack knowledge, training, and understanding of TQM application in today's business environment. Further studies on this subject may be conducted in different industry sectors and under different background of TQM applications.

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