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Research Article

The Impact of Total Quality Management on Productivity in Oil and Gas Manufacturing Industries: A Case Study from SME of Oman

Short Title: Impact of TQM on Productivity in Omani Oil & Gas SMEs

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ABSTRACT

This study explores the relationship between Total Quality Management (TQM) practices and productivity in Omani SMEs within the oil and gas manufacturing sector. Using a five-point Likert scale, the research examines TQM dimensions such as top management support, customer focus, employee motivation, and continuous improvement, and their impact on productivity, human capital investment, product quality, and production size. Results show a strong link between TQM practices and productivity, with top management support having the most significant impact (mean = 4.28, SD = 0.82). Other dimensions, including customer focus (mean = 4.08, SD = 0.86), employee motivation (mean = 3.96, SD = 0.96), and continuous improvement (mean = 4.09, SD = 0.88), also scored highly. Human capital investment (mean = 4.02, SD = 0.96) and its impact on productivity (mean = 4.11, SD = 1.00) were strongly correlated with productivity. Key productivity drivers were identified as product quality (mean = 4.23, SD = 0.85) and production size (mean = 4.26, SD = 0.84). Regression analysis revealed a strong positive relationship between TQM practices and productivity, with an R square value of 0.696, indicating that TQM accounts for nearly 70% of productivity variation. ANOVA confirmed the robustness of the model. While the sector shows high TQM implementation and productivity, improvements are needed in employee involvement and customer feedback collection, offering valuable insights for SMEs in Oman.

Keywords: Top management support, Customer focus, Motivating employees, Continuous improvement, Human capital investment.

INTRODUCTION

Total Quality Management (TQM) has been a popular topic in the field of business management for decades, and its framework allows manufacturing firms to become competitive. The TQM is a holistic approach to managing the quality of products and services, and it involves all aspects of an organization, including planning, design, production, and customer service (1). Manufacturing employment multipliers are demonstrably higher than in most other economic activities. Manufacturing creates large numbers of indirect and induced jobs with studies suggesting that for every job created in manufacturing, two to three additional jobs are created elsewhere. When looking into the employment impact of manufacturing, it is critical to consider its indirect impact as well to better gauge the sector's job generation potential. Direct manufacturing jobs could benefit the Sultanate of Oman's development in another respect. Manufacturing jobs tend to be high quality jobs with higher wages and more indirect benefits. The implementation of TQM has been linked to significant improvements in the manufacturing sector. TQM emphasizes the importance of continuous improvement, and this focus on improvement has been shown to improve production processes, reduce costs, and increase customer satisfaction (2). Studies have found that TQM can result in improved quality of products, reduced defects, and increased efficiency (3).

Research problem

The use of TQM in the manufacturing sector has been linked to better employee engagement and motivation. TQM involves the empowerment of employees to take ownership of the production process and to take responsibility for quality improvement. This empowerment has been shown to increase employee satisfaction, motivation, and productivity (4). The implementation of TQM has also been shown to have a positive impact on customer satisfaction. TQM emphasizes the importance of meeting customer needs and expectations. By focusing on customer needs and expectations, organizations can improve customer satisfaction and loyalty (2). In line with the goals and directions of the Government represented by Oman Vision 2040, which aims towards achieving economic diversification through the development and localisation of supply chains of goods and services, a number of new business opportunities were identified, and some were operationalised during 2020. These developments will be conducive to enhancing the ICV (In Country Value) targets of the government. Few of the products manufactured by Omani SMEs are flanges, Drill bits, face masks, flow pipes, fittings, casings (5). The broad objectives of these are Expansion of trade, Expansion of production of tradable goods and services, creation of employment opportunities for Omani people, securing greater market access for Omani goods, ensuring availability of goods and services at reasonable prices in the domestic market and such (6). Of the above objectives, TQM can be employed to improve quality and reduce costs of produce, so that Omani Products remain competitive. Various policies entail, among other things, competitive import substitution and export promotion. Manufacturing industries that could thrive in a competitive domestic market will export more. Export deepening will increase an improved competitive position of the manufacturing sector, foreign exchange earnings, and technological advancement.

In the larger GCC area, Oman is leading the race to grow its manufacturing sector, coming in last among GCC nations. As industrial businesses in Oman work to increase their performance and boost their competitiveness, TQM adoption has attracted a lot of interest in recent years. While TQM is increasingly being used in Oman's industrial sector, businesses still encounter a number of difficulties when putting it into practice. These difficulties include a limited comprehension of TQM concepts, organizational and cultural impediments, reluctance to change, and a lack of necessary resources for implementation (7). Lack of a uniform framework that can be readily applied to various sectors within the sector is one of the main obstacles to adopting TQM in Oman's manufacturing industry. Implementing TQM requires a considerable change in corporate culture and procedures, which may be difficult in some situations, such as the manufacturing industry in Oman (8). In addition, the manufacturing sector in Oman is made up of a variety of sectors with various structures, working methods, and cultural traditions, which might make it challenging to implement a uniform TQM framework across the industry. To optimize the impact of TQM adoption, it is crucial to find a framework that can be tailored to the various manufacturing sectors in Oman (9). The manufacturing industry of Oman has a number of important obstacles, including organizational reluctance to change. Implementing TQM requires a considerable shift in company culture, which may be met with opposition from both management and staff. Reluctance to adopt TQM may also result from a lack of knowledge of its guiding principles and the advantages it may provide for the business (10). So, it is crucial to come up with methods for overcoming opposition and encouraging a constructive outlook towards TQM adoption within Oman's industrial industry.

Organizations in Oman's industrial sector also struggle with a lack of resources for TQM implementation (9). The time, effort, and financial resources needed to execute TQM are considerable. Due to financial difficulties or resource limitations, several businesses in Oman's manufacturing industry could find it challenging to devote the required resources for TQM implementation. To execute TQM successfully with limited resources in Oman's industrial industry, firms must develop strategies (11). In light of this contextualization, the need for a standardized framework that can be tailored to Oman's various manufacturing industry, methods for overcoming resistance to change, and ways to help organizations implement TQM in Oman's manufacturing sector effectively while working with limited resources are all part of the problem statement. To reap the rewards of TQM adoption, firms in Oman's manufacturing sector must address these issues. Building upon all of this, this proposed work aims to respond to this need for a holistic and effective drive for improvement in the manufacturing industry yin Oman, specifically starting with the manufacturing of within the SME sector, by utilizing the tenets of TQM as its foundational framework. Despite the increasing recognition of TQM as an all-encompassing method for managing quality, there remains a gap in research regarding the implementation and effectiveness of TQM practices within Oman’s manufacturing sector. While TQM adoption has been explored in other countries, there is limited research focused on its application in Oman. Thus, further investigation into the deployment and outcomes of TQM practices in the Omani manufacturing

industry is essential. Such research would offer valuable insights for organizations in Oman and other developing nations looking to enhance their manufacturing processes and boost productivity through effective quality management strategies. Additionally, understanding the challenges and opportunities associated with TQM implementation in Oman would provide valuable input for policymaking aimed at fostering sustainable economic growth and industrial advancement. The proposed study seeks to examine Oman's manufacturing sector, specifically analysing the country's quality management practices and their relationship with productivity.

Research questions

Q1. What is the level of implementation of TQM and productively among Omani SME manufacturing sector?
Q2. How does the implementation of TQM impact the productivity of SME manufacturing companies in Oman?

Research Objectives

This research aims to achieve the following objectives:
1-Investigating the level of implementation of TQM and productively among Omani SME manufacturing sector.
2- Investigating the impact of implementation of TQM on the productivity of SME manufacturing companies in Oman?

REVIEW OF RELATED LITERATURE

The implementation of TQM has been increasingly popular as a method to enhance the performance of organizations and obtain a competitive advantage on a global scale. Although TQM is widely accepted, businesses continue to face a variety of challenges when attempting to put it into practice. A limited knowledge of TQM ideas, organizational and cultural barriers, resistance to change, and a lack of sufficient resources for execution are some of the challenges that are discussed in Aquilani et al. research project (12). TQM adoption on a global scale has a number of significant challenges, one of the most significant of which is the lack of a standardised framework that can be easily implemented across a wide range of industries and countries. The implementation of TQM necessitates a significant shift in the culture and practices of the firm, which may be challenging in many multinational environments. It is also possible that diverse cultural viewpoints on TQM principles and effective implementation tactics would emerge as a consequence. It is essential to locate a framework that is capable of being adaptable to a variety of organizational and cultural circumstances to maximize the impact of TQM adoption (13).

The implementation of TQM necessitates a significant shift in the culture of the organization, which may be greeted with resistance from both management and staff. The reluctance to implement TQM may also be the consequence of a lack of familiarity with the TQM's guiding principles and the potential benefits that it may offer to the company (14). Since this is the case, it is of the utmost importance to devise strategies for overcoming resistance and fostering a constructive attitude toward the implementation of TQM. There is a possibility that organizations will lack the resources necessary to successfully implement TQM. It takes a significant amount of time, effort, and financial resources to put TQM into action. The acquisition of the necessary cash for TQM implementation may prove to be difficult for small and medium-sized firms (SMEs). To successfully implement TQM with limited resources, it is vital to establish methodologies for small and medium-sized enterprises (SMEs) (15).

The Sultanate of Oman has demonstrated an increasing interest in the industrial sector. According to Way et al. (16), if they want to improve the amount of people who are interested in their manufacturing sector, they need to implement whole quality management in their company. The implementation of TQM is getting a lot of interest in Oman because industrial enterprises are striving to increase their competitive edge and boost their performance. Even at this late stage, there are still a number of challenges that manufacturing companies in the GCC region need to conquer to successfully apply TQM (17). According to Manochehri et al. (18), these challenges consist of a limited knowledge of TQM ideas, organizational and cultural obstacles, reluctance to change, and a lack of sufficient resources for implementation. TQM adoption in the GCC region is hampered by a number of factors, one of the most significant of which is the lack of a standardised framework that can be easily implemented across a variety of industrial industries and countries in the GCC.

Belitz et al. (19) suggest that each company defines productivity differently, leading to varying metrics for its measurement. Nevertheless, all companies consistently monitor productivity levels and make key decisions aimed at

improving them. As noted by Shi and Li (20), productivity can be viewed in terms of employee performance or human productivity, or it can be analyzed in terms of total output or manufacturing efficiency. Both perspectives are highly relevant in the manufacturing sector. In this study, productivity will be treated as a multifaceted concept, with respondents framing their understanding of it according to the perspectives relevant to their organizations. Given the varied interpretations of productivity within the manufacturing sector, the next step is to assess whether TQM has been shown to have an impact on productivity in prior studies. Sahoo (21) explored this relationship within the Indian manufacturing industry, finding that companies with higher levels of TQM implementation saw noticeable improvements in overall business performance and productivity. However, Sahoo also emphasized that firms with greater managerial commitment tended to adopt more integrated approaches to TQM, resulting in even greater productivity gains. Similarly, research by Agus and Selvaraj (22) in Malaysia revealed that productivity improvements linked to TQM were influenced by the balance between human and technical factors in the approach. Companies that prioritized both employee involvement and training were more successful in leveraging TQM for enhanced productivity. Abu-Mahfouz (23) adds another layer of complexity to this relationship. In a study conducted in Jordan's manufacturing sector, the researcher found that companies that fostered an innovative work environment and focused on employee engagement and empowerment through human resource policies were better positioned to maximize TQM's impact on productivity. These studies collectively illustrate that the connection between TQM and productivity is not straightforward, and several factors must be considered to fully understand this relationship.

Previous studies

A study by Zaidi and Ahmed (24) aimed to explore the connection between TQM practices and operational performance in the Malaysian manufacturing sector. They examined five TQM dimensions: organizational leadership, human resources focus, strategic planning and development, customer satisfaction and relationships, and supplier quality management. The research used a quantitative approach, with survey questionnaires distributed to 364 manufacturers in Johor, resulting in a 13.74% response rate. The data was analysed using the Statistical Package for Social Sciences (SPSS), including normality tests, descriptive analysis, and Spearman correlation analysis. The results indicated that both TQM practices and operational performance were at a high level, and all five TQM dimensions showed significant positive relationships with operational performance. The study suggests that implementing TQM practices is crucial for enhancing operational performance in manufacturing companies.

In the study by Alghamdi et al. (25), the focus was on investigating how TQM affects the manufacturing performance of Saudi SMEs and identifying which TQM practices most influence this performance. The study was based on TQM indicators derived from Crosby's model, and data were gathered from 327 managerial staff members. The findings revealed that training and employee involvement had no significant impact on Saudi manufacturing SMEs, while continuous quality improvement, management leadership, and organizational innovation positively affected performance. The study recommends validating the TQM model developed in this research across various business sectors.

Wassan et al. (26) conducted a study to propose a conceptual model examining the link between sustainability, TQM practices, and organizational performance, and to assess their impact on performance. The study used survey data from the manufacturing industry, with factor analysis and confirmatory factor analysis (CFA) as the analytical tools. The results showed that TQM and sustainability are critical for the success of manufacturing industries, positively influencing organizational performance. Based on these findings, a framework was developed illustrating the relationship between key TQM practices, sustainability, and performance. The study concludes that TQM can contribute to a sustainable competitive advantage.

A study of Ahmed (27) aimed to identify the role of TQM practices in improving supply chain performance in 11 manufacturing firms in Burg El-Arab city at Alexandria. For the purposes of the study, the 4 dimensions of quality principles (supplier relations management, strategic quality planning, customer focus and management commitment) were used to check their impact on supply chain performance from the perspectives of 36 managers from the studied firms. The multiple regression analysis is used to test the research hypotheses. The results showed that: The majority of respondents agreed that their companies' quality management systems are based on an effective communication platform to ensure constant communication with and guidance of various the supply chain performance is influenced by the strategic quality planning (Sig= 0.014), the supplier relations management (Sig=

0.005), the customer focus (Sig= 0.017) and the management commitment (Sig= 0.004). Thus, all 4 hypotheses of the research were accepted.

A study of Ali and Johl, (28) examines the impact of digital TQM or Quality 4.0 practices on the sustainable performance of small and medium-sized manufacturing enterprises (SMEs) in Malaysia. Based on an extensive literature review, a research model was developed, and hypotheses were formulated and tested using multiple regression analysis. Data was gathered from 73 managerial-level respondents in ISO 9000 certified SMEs in Malaysia, employing a stratified sampling approach. The findings reveal a positive and significant influence of soft TQM practices—such as top management commitment, customer focus, and employee training—on social, financial, and environmental performance, with R^2 values of 0.839, 0.739, and 0.656, respectively. Furthermore, the study highlights that hard TQM practices, including process management, quality information analysis, and advanced manufacturing technology, significantly improve financial (R^2 = 0.775), social (R^2 = 0.797), and environmental (R^2 = 0.712) sustainable performance. To successfully implement Quality 4.0 in SMEs, it is crucial for industry professionals to understand the distinct roles of both hard and soft TQM practices. SMEs must allocate resources to develop and integrate both types of TQM to optimize the overall effectiveness of their quality management system.

The objective of a study of Bale (29) is to explore the relationship between TQM implementation and the productivity of SMEs, and to examine how TQM affects their competitive advantage. To examine the relationship between Productivity and TQM implementation, the researchers analysed data from 38 selected manufacturing SMEs in the Mumbai region, focusing on production and TQM implementation. The correlation coefficient (R) between Productivity and TQM implementation was found to be 0.675, suggesting a positive relationship. Since Pearson's r is positive, it indicates that an increase in one variable corresponds with an increase in the other, reflecting a positive correlation. The p-value for this correlation coefficient was 0.002. Given that $p < 0.05$, the relationship between Productivity and TQM implementation is statistically significant. Therefore, it can be concluded that as TQM implementation increases, productivity also rises. The R^2 value represents the proportion of the total variation in the dependent variable, Competitive Advantage, that can be explained by the independent variable, TQM implementation. In this case, only 4.55% of the variation can be explained, which is relatively low. According to the ANOVA table, the test conducted to assess the dependence of the dependent variable on the independent variable is significant, as the alpha value is 0.010. This indicates that Competitive Advantage is influenced by TQM implementation in SMEs. The R^2 value of 0.455 shows that 45.5% of Competitive Advantage is dependent on TQM implementation in SMEs. Consequently, the null hypothesis is rejected, confirming that Competitive Advantage is indeed dependent on TQM implementation in SMEs.

RESEARCH METHODOLOGY

This study has employed the quantitative research approach to collect primary data from the research sample. The population is all the managers and employees of the small and medium enterprises industry in Oman. This study used the SPSS program to analyse the collected data.

Research population and sample.

The populations of the present research study are the managers and employees who are directly connected with the decision and function of both quality management and continuous improvement within the firms operating in the manufacturing sector of Oman. This study used a survey questionnaire to collect data from 235 employees and managers working in the Omani manufacturing SME sector.

Research instrument

For the current study, a questionnaire was utilized as the primary data collection instrument. The development of the questionnaire was informed by a review of various studies that address TQM and its associated dimensions. Specifically, the researcher drew upon the works of Ahmed (28), Alghamdi et al. (25), Othman et al. (30), Boyne and Walker (31), and Al-Sha'ar et al. (32) to construct the TQM variable. This variable encompasses four key dimensions: Top Management Support, Customer Focus, Employee Motivation, and Continuous Improvement. For the Productivity variable, the researcher referenced the studies of Ahmed (33), Belajouz et al. (34), and Pooja and Marwah (35). This variable consists of four dimensions: Investing in the Organization's Human Capital, The Impact of Human Capital Investment on Organizational Productivity, Product Quality, and Production Size. The research

sample was asked to complete the questionnaire using a Likert scale ranging from 1 to 5, with the following interpretation: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

The verification of the psychometric properties of study tools is a crucial step to ensure their quality and effectiveness in measuring what they are intended to measure. In this study, the psychometric properties focus on verifying the validity and reliability of the questionnaire. Through validity and reliability, it is ensured that the data collected from the questionnaire will be valid for use in research or in decision-making based on it. Below are some points that clarify the psychometric properties of the questionnaire:

Content validity

The questionnaire was reviewed by eight expert evaluators with specialized knowledge to assess the relevance of the statements to the constructs being measured, as well as the clarity of their wording. The results indicate that most of the evaluators agreed on the relevance of the statements to the respective constructs and the clarity of their language and phrasing. An approval rate of 100% was observed for all statements, except for: statement 7 in Customer Focus (My organization involves its customers in developing new services). The suggestion was to combined statements 6 and 7. Statement 7 in Investing in the organization's human capital (I receive assistance from my organization to develop my abilities). The suggestion was to combined statements 6 and 7. Statement 2 in Product quality (The employees of my organization show a desire to help those who request it). The suggestion was to combined statements 1 and 2. Statement 3 in Product size (My level of creative work completion improves if there is flexibility in work). The suggestion was to combined statements 2 and 3. Raters also suggested to reword slightly some statements.

Construct Validity

The results from Table 1 show that all correlations between the variables are very high, suggesting that these elements of TQM are strongly interrelated. Specifically, the relationships between Top Management Support, Customer Focus, Motivating Employees, and Continuous Improvement are statistically significant, as indicated by the correlation coefficients and their significance at the 0.01 level (2-tailed). The correlation coefficients range between 0.910 and 0.944. This reinforces the critical role these factors play in the successful implementation of TQM. The high correlation values suggest that improvements in one area (such as top management support or motivating employees) are likely to positively influence the other areas, contributing to overall effectiveness in TQM practices. These findings emphasize the importance of a holistic approach to TQM, where these elements work together to drive continuous improvement within an organization.

Table 1: Matrix of correlation coefficients between the sub-dimensions of Total Quality Management.

	Customer Focus	Motivating Employees	Continuous Improvement
Top Management Support	.941**	.910**	.942**
Customer Focus		.938**	.940**
Motivating Employees			.944**

** **Correlation is significant at the 0.01 level (2-tailed).**

The results from Table 2 indicate that all correlations between the sub-dimensions of productivity are very high, suggesting that these factors are strongly interconnected. Specifically, the relationships between Investing in the Organization's Human Capital, The Impact of Human Capital Investment on Organizational Productivity, Product Quality, and Production Size are statistically significant, as shown by the correlation coefficients and their significance at the 0.01 level (2-tailed). The correlation coefficients range between 0.864 and 0.920. This further highlights the critical role these factors play in enhancing organizational productivity. The high correlation values suggest that improvements in one area (such as investing in human capital or enhancing product quality) are likely to positively influence other areas, contributing to overall productivity. These findings underscore the importance of a holistic approach, where these factors work in tandem to drive continuous improvements within the organization, particularly in terms of **product quality** and **production size**.

Table 2: Matrix of correlation coefficients between the sub-dimensions of Productivity

	The Impact of Human Capital Investment on Organizational Productivity	Product Quality	Production Size
Investing in the Organization's Human Capital	.909**	.864**	.885**
The Impact of Human Capital Investment on Organizational Productivity		.865**	.917**
Product Quality			.920**

** **Correlation is significant at the 0.01 level (2-tailed).**

Reliability

Table 3 presents the reliability coefficients and discriminative ability values for the sub-dimensions of TQM. The data indicate high reliability and strong discriminative power for each sub-dimension, affirming their validity for the purposes of this study. The Cronbach's alpha values for the sub-dimensions range from 0.969 to 0.972, indicating excellent reliability. The overall reliability coefficient for all 32 items of TQM is 0.991, which is exceptionally high, confirming the robustness of the scale in measuring the constructs of Total Quality Management. Additionally, the discriminative ability of each dimension is well within the acceptable range, further supporting that all dimensions are valid for the purposes of the current research.

Table 3: Reliability Coefficients for the Sub-dimensions of Total Quality Management

Dimension	Number of Items	Reliability Coefficient	Discriminative Ability
Top Management Support	8	0.97	0.814 - 0.948
Customer Focus	8	0.972	0.831 - 0.959
Motivating Employees	8	0.969	0.778 - 0.949
Continuous Improvement	8	0.971	0.818 - 0.936
TQM (All Items)	32	0.991	0.801 - 0.932

Table 4 presents the reliability coefficients and discriminative ability values for the sub-dimensions of Productivity. The results indicate strong reliability and high discriminative power for each sub-dimension, supporting their validity for the research context. The Cronbach's alpha values for the sub-dimensions range from 0.967 to 0.989, reflecting excellent reliability across all dimensions. The overall reliability coefficient for all 25 items measuring Productivity is 0.992, which indicates an extremely high level of reliability. Additionally, the discriminative ability values for each dimension fall within the acceptable range, further validating the measurement scale. These findings demonstrate that the items reliably capture the key aspects of Productivity in the organizational context.

Table 4: Reliability Coefficients for the Sub-dimensions of Productivity

Dimension	Number of Items	Reliability Coefficient	Discriminative Ability
Investing in the Organization's Human Capital	8	0.984	0.823 - 0.970
The Impact of Human Capital Investment on Organizational Productivity	7	0.989	0.931 - 0.981
Product Quality	5	0.976	0.902 - 0.955
Production Size	5	0.967	0.872 - 0.942
Productivity (All Items)	25	0.992	0.776 - 0.997

RESULTS AND DISCUSSION

Demographic characteristics of the participants

The study sample, consisting of 243 participants from the Omani SME manufacturing sector, was categorized based on several demographic variables, including gender, nationality, educational qualifications, and years of experience. In terms of gender, the sample included 193 males (79.4%) and 50 females (20.6%). Regarding nationality, a

significant majority of the participants were Omani, with 185 individuals (76.1%), while 58 participants (23.9%) were non-Omani.

When considering educational qualifications, the largest group of participants, 83 individuals (34.2%), held a Bachelor's degree. This was followed by 77 participants (31.7%) with a Higher Diploma, and 63 participants (25.9%) possessing a General Education Diploma. Only 20 participants (8.2%) had completed a Master's or PhD.

In terms of years of experience, 137 participants (56.4%) had 16 or more years of experience, indicating that the majority of the sample had significant professional experience. Additionally, 55 participants (22.6%) had between 11 and 15 years of experience, while 51 participants (21%) had between 6 and 10 years of experience.

Table 5 Distribution of the study sample (Omani SME manufacturing sector) gender, nationality, educational qualifications, Years of experience

Demographic variable	Category	Sample size= 243	
		Frequency	Percent
Gender	Male	193	79.4
	Female	50	20.6
Nationality	Omani	185	76.1
	Non-Omani	58	23.9
Qualification	General Education Diploma	63	25.9
	Higher Diploma	77	31.7
	Bachelor's	83	34.2
	Masters / PhD	20	8.2
Years of Experience	(6- 10) years	51	21
	(11- 15) years	55	22.6
	16 years and above	137	56.4

Q1. What is the level of implementation of TQM and productively among Omani SME manufacturing sector?

To find descriptive statistics for the study variables, the researcher used the Weighted average interpretations of five-point Likert scale results (Refer Table 6).

Table 6 Weighted Averages for 5-Point Likert Scale

Weighted Average	**Result**
1-1.79	Very low
1.80-2.59	Low
2.60-3.39	Moderate
3.40-4.19	High
4.20-5	Very high

The results shown in Table 7 present the means and standard deviations of the dimensions of TQM in the Omani SME manufacturing sector. The “Top management support” section received the highest mean score of 4.28, with a standard deviation of 0.82, indicating a very high level of support from top management in TQM practices. This suggests that respondents perceive the involvement and commitment of top management to be a critical factor for the success of TQM initiatives in the sector.

Other dimensions such as "Customer focus," "Motivating employees," and "Continuous improvement" all received high ratings, with mean scores of 4.08, 3.96, and 4.09, respectively. The standard deviations for these dimensions ranged from 0.86 to 0.96, reflecting some variation in respondents' perceptions, but still indicating a high level of attention to these areas within the sector. The overall mean of 4.10, with a standard deviation of 0.83, further supports the conclusion that the overall TQM practices in the Omani SME manufacturing sector are considered high.

These results suggest that the sector is performing well in terms of Total Quality Management, with particular emphasis on top management support, customer focus, employee motivation, and continuous improvement. However, the slight variations in the standard deviations highlight areas where there may be room for greater consistency in TQM practices across different companies within the sector.

Table 7 Means and standard deviation of the dimensions of TQM among Omani SME manufacturing sector

Dimension	Mean	Std. Deviation	Level
Top management support	4.28	0.82	very high
Customer focus	4.08	0.86	high
Motivating employees	3.96	0.96	high
Continuous improvement	4.09	0.88	high
overall mean	4.10	0.83	high

For more details, Table 8 provide the means and standard deviations of statements related to TQM within the Omani SME manufacturing sector, organized in descending order of mean scores. The statement "The top management of my organization is keen to build a good reputation for the organization with customers" had the highest mean score of 4.41 with a standard deviation of 0.94, indicating a very high perception of management's focus on customer reputation. Several other statements related to top management support also received high ratings, such as the importance placed on quality as a priority (mean = 4.28, SD = 0.97) and the support for a clear plan on quality (mean = 4.28, SD = 0.96). These results suggest that top management in the Omani SME manufacturing sector demonstrates a strong commitment to quality and customer satisfaction.

In terms of customer focus, statements such as "The top management of my organization focuses on customer satisfaction and succeeds in understanding their expectations" (mean = 4.26, SD = 0.94) received high ratings, while other statements like "My organization conducts periodic surveys to determine the extent of customer satisfaction" (mean = 3.99, SD = 1.09) showed slightly lower mean scores. This indicates that while there is a clear focus on customer satisfaction, there is potential for further improvement in systematically gathering customer feedback. Regarding motivating employees, the highest-rated statement was "My organization trains employees to solve problems" (mean = 4.03, SD = 1.08), reflecting a commitment to employee development. However, the statement "My organization is keen to increase employee participation in decision-making" received a relatively lower mean score of 3.89, suggesting that there may be room for improvement in involving employees more actively in organizational decisions.

Finally, regarding continuous improvement, the statement "My organization considers continuous improvement in work as part of the quality requirements" received the highest mean score in this dimension (mean = 4.23, SD = 0.98), indicating a strong commitment to ongoing improvement in organizational practices. However, there was slightly more variation in responses for other statements, such as "My organization uses the latest technology in implementing the comprehensive quality strategy" (mean = 3.99, SD = 1.06), highlighting a potential area for development in the adoption of advanced technologies for quality improvement. Overall, the results show that while there is a strong focus on top management support, customer satisfaction, employee motivation, and continuous improvement, there are specific areas where the organization can enhance its practices further.

Table 8 Means and standard deviation of the statements of TQM among Omani SME manufacturing sector in descending order

Statements	Mean	Std. Deviation
Top management support		
The top management of my organization is keen to build a good reputation for the organization with customers	4.41	0.94
The top management of my organization is keen to ensure that the organization's services are of high quality	4.34	0.93

The top management of my organization supports the existence of a clear plan on quality	4.28	0.97
The top management of my organization supports efforts to spread the culture of quality among employees and departments of the organization	4.28	0.96
The top management of my organization attaches utmost importance to quality as one of its most important priorities	4.28	0.97
The top management of my organization supports all initiatives to improve quality	4.24	0.95
The top management of my organization is concerned with providing the requirements for implementing total quality management	4.21	0.95
The top management of my organization contributes to finding solutions to the problems facing the various departments	4.19	0.99
Customer focus		
The top management of my organization focuses on customer satisfaction and succeeds in understanding their expectations	4.26	0.94
My organization continuously meets customer requirements	4.17	0.98
My organization seeks to design services in a way that fulfills the desires of its customers	4.12	0.97
My organization follows up on customer complaints to find appropriate solutions for them	4.09	0.99
My organization develops the quality of its services by utilizing the evaluation results	4.05	1.02
My organization conducts periodic surveys to determine the extent of customer satisfaction	3.99	1.09
My organization involves its customers in developing new services	3.99	1.03
My organization is keen to organize periodic meetings with the aim of strengthening the relationship with customers	3.98	1.03
Motivating employees		
My organization trains employees to solve problems	4.03	1.08
Employees in my organization have the opportunity to discuss and explain the reasons for the decline in quality	4.01	1.05
Employees in my organization participate in preparing strategic plans to improve quality	3.98	1.10
My organization holds continuous group meetings with employees to discuss matters related to quality improvement	3.97	1.09
My organization delegates powers to employees to speed up the decision-making process	3.95	1.12
My organization makes information available to all employees without exception	3.93	1.15
My organization is keen to continuously develop the capabilities of employees by hosting experts	3.92	1.15
My organization is keen to increase employee participation in decision-making	3.89	1.06
Continuous improvement		
My organization considers continuous improvement in work as part of the quality requirements	4.23	0.98
My organization considers continuous improvement the responsibility of its various administrative levels	4.17	1.00
My organization ensures the principle of continuous improvement in all its policies	4.14	1.03
My organization is interested in research and development to continuously improve its services	4.1	1.03
My organization is keen to reduce the time it takes to provide service to the customer	4.07	0.95

My organization is constantly developing its organizational structure to facilitate administrative procedures	4.04	1.05
My organization responds to technological and technical changes or developments	4.01	1.02
My organization uses the latest technology in implementing the comprehensive quality strategy	3.99	1.06

The results presented in the Table 9 show the means and standard deviations for various dimensions of productivity in the Omani SME manufacturing sector. The dimension "Investing in the Organization's Human Capital" has a mean of 4.02 with a standard deviation of 0.96, indicating a high level of investment in human capital within these organizations. Similarly, the dimension "The Impact of Human Capital Investment on Organizational Productivity" has a mean of 4.11 and a standard deviation of 1.00, also reflecting a high level of perceived impact on productivity due to human capital investment.

In contrast, the dimensions related to product quality and production size are rated even higher. "Product Quality" has a mean of 4.23 with a standard deviation of 0.85, suggesting a very high level of emphasis on maintaining high product quality. "Production Size" shows the highest mean at 4.26 with a standard deviation of 0.84, indicating that production scale is also a critical factor in driving productivity within the sector. These results collectively demonstrate that both human capital investment and operational factors such as product quality and production size are seen as key drivers of productivity in Omani SME manufacturing. These results are consistent with the study of Zaidi and Ahmed (24), which the findings showed that the level of TQM practices is at high level. They are also consistent with the study of Ahmed (27). Which showed that: The majority of respondents agreed that their companies' quality management systems are based on an effective communication platform to ensure constant communication with and guidance of various the supply chain performance is influenced by the strategic quality planning.

Table 9 Means and standard deviation of the dimensions of productively among Omani SME manufacturing sector

Dimension	Mean	Std. Deviation	level
Investing in the Organization's Human Capital	4.02	0.96	high
The Impact of Human Capital Investment on Organizational Productivity	4.11	1.00	high
Product Quality	4.23	0.85	very high
Production Size	4.26	0.84	very high

Table 10 presents the means and standard deviations of various statements related to productivity among Omani SME manufacturing sectors, ranked in descending order. The statements under the dimension "Investing in the Organization's Human Capital" show that employees perceive a high level of support from their organizations.

The highest-rated statement, "I receive attention and respect from top management and colleagues," has a mean of 4.15 and a standard deviation of 1.00, indicating a high level of attention and respect towards employees. Other statements such as "My organization considers the human element as its source of strength" (mean = 4.11, std. deviation = 1.09) and "I receive assistance from my organization to renew my professional knowledge" (mean = 4.00, std. deviation = 1.11) further emphasize the value placed on human resources and employee development within the organization.

The second dimension, "The Impact of Human Capital Investment on Organizational Productivity," also shows high ratings, with the statement "My understanding of work plans increased after I received the appropriate training" receiving the highest mean of 4.17 and a standard deviation of 1.00. This indicates that training significantly improves employees' understanding of their roles. Other statements, such as "The training increased my desire to work" (mean = 4.15, std. deviation = 1.11) and "The training courses increased my level of work productivity in the institution" (mean = 3.99, std. deviation = 1.18), highlight the positive impact of training on motivation and productivity.

The "Product Quality" dimension reveals that employees are committed to high standards of work, with the statement "I am keen to make an effort to complete the work in the best possible way" having the highest mean of 4.36 and a

standard deviation of 0.96. Lastly, the "Production Size" dimension reflects a strong relationship between work flexibility and productivity, with statements such as "My level of creative work completion improves if there is flexibility in work" (mean = 4.40, std. deviation = 0.91) and "My work completion rate increases if there is flexibility in work" (mean = 4.34, std. deviation = 0.92), indicating that flexible working conditions significantly enhance productivity.

Table 10 Means and standard deviation of the statements of productively among Omani SME manufacturing sector in descending order

Statements	Mean	Std. Deviation
Investing in the Organization's Human Capital		
I receive attention and respect from top management and colleagues in the organization I work for	4.15	1.00
My organization considers the human element as its source of strength	4.11	1.09
My organization considers human resources as its most important resource	4.09	1.09
I receive assistance from my organization to renew my professional knowledge	4	1.11
I receive assistance from my organization to develop my abilities	3.99	1.10
My organization cares about my abilities and always tries to develop them	3.97	1.11
My organization cares about all its human resources and maintains them	3.96	1.07
My organization works to meet the desires of employees and take care of their affairs	3.92	1.07
The Impact of Human Capital Investment on Organizational Productivity		
My understanding of work plans increased after I received the appropriate training	4.17	1.00
The training increased my desire to work	4.15	1.11
The quality of production in my work improved after I joined the training courses that fit the nature of my work	4.12	1.08
My self-confidence increased after benefiting from the training process	4.12	1.09
The training courses made me more prepared to carry out new tasks	4.11	1.08
The work in the institution I work for developed after the training process	4.08	1.06
The training courses increased my level of work productivity in the institution	3.99	1.18
Product Quality		
I am keen on to make an effort to complete the work in the best possible way	4.36	0.96
The level of accuracy in providing services in My organization increases as a result of follow-up and auditing	4.24	0.95
The employees of My organization show a desire to provide assistance to those who request it	4.22	0.94
The employees of My organization follow up on the procedures related to clients from the time the service is requested until its completion	4.19	0.96
he administrative staff of My organization are professionals and trained to provide the service in the shortest time and with the least possible effort	4.15	1.00
Production Size		
My level of creative work completion improves if there is flexibility in work	4.4	0.91
My work completion rate increases if there is flexibility in work	4.34	0.92
My rate of response to the requirements of the leaders at work, their implementation and delivery increases if there is flexibility in work	4.3	0.95
My organization sets a plan for the levels of productivity that need to be achieved	4.14	1.00
My organization provides advanced production equipment	4.1	0.94

Q2. How does the implementation of TQM impact the productivity of SME manufacturing companies in Oman?

Top Management Support

The regression analysis results presented in the "Model Summary" Table 11 indicate a strong positive relationship between Top Management Support and productivity in Omani SME manufacturing companies, as indicated by the high R value of 0.834. The R-squared value of 0.696 suggests that approximately 69.6% of the variance in productivity can be explained by the implementation of Top Management Support. The adjusted R-square value of 0.691 accounts for the number of predictors in the model and still reflects a significant portion of variance explained. The standard error of the estimate is 0.458, indicating a relatively small error in predicting the productivity scores based on the model.

Table 11: Regression Model Summary of the impact of implementation of (Top Management Support) on productivity of SME manufacturing companies in Oman

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.834	0.696	0.691	0.458

Table 12 further supports the significance of this regression model, with an F-statistic of 136.328 and a p-value of 0.000, which is well below the 0.05 significance level. This indicates that the model is statistically significant, and the variables included in the regression contribute meaningfully to explaining productivity. In the regression results Table 13, (Top Management Support) shows significant positive relationships with "Investing in the Organization's Human Capital" (B = 0.271, p < 0.001), "Product Quality" (B = 0.317, p < 0.001), and "Production Size" (B = 0.312, p < 0.001). However, the (Top Management Support) does not significantly affect the "Impact of Human Capital Investment on Organizational Productivity" variable (B = -0.073, p = 0.176), suggesting that this factor may not play as important a role as the others in influencing productivity in the context of Top Management Support.

Table 12: Anova results of the impact of implementation of (Top Management Support) on productivity of SME manufacturing companies in Oman

	Sum of Squares	df	Mean Square	F	Sig.
Regression	114.599	4	28.65	136.328	< 0.001*
Residual	50.017	238	0.21		

*Significant at the 0.05 level

Table 13: Regression results of the impact of implementation of (Top Management Support) on productivity of SME manufacturing companies in Oman

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
(Top Management Support	B	Std. Error	Beta		
Constant	0.814	0.156		5.231	< 0.001*
Investing in the Organization's Human Capital	0.271	0.061	0.317	4.423	< 0.001*
The Impact of Human Capital Investment on Organizational Productivity	-.073-	0.053	-.088-	-1.358-	0.176
Product Quality	0.317	0.084	0.327	3.785	< 0.001*
Production Size	0.312	0.083	0.317	3.758	< 0.001*

* significant at the 0.05 level

Customer Focus

The regression analysis results presented in the "Model Summary" Table 14 reveal a strong and positive relationship between Customer Focus and productivity in Omani SME manufacturing companies, as indicated by the high R value of 0.846. The R-squared value of 0.716 indicates that approximately 71.6% of the variance in productivity can be explained by the implementation of Customer Focus. Additionally, the adjusted R-squared value of 0.711, which accounts for the number of predictors in the model, confirms that the model is robust in explaining the variation in productivity. The standard error of the estimate is 0.463, suggesting that the error in predicting productivity based on this model is relatively low.

Table 14: Regression Model Summary of the impact of implementation of (Customer Focus) on productivity of SME manufacturing companies in Oman

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.846	0.716	0.711	0.463

Table 15 further supports the model's significance, with an F-statistic of 149.876 and a p-value of less than 0.001, indicating that the overall regression model is statistically significant. The regression coefficients in Table 16 indicate that (Customer Focus) has a significant positive impact on "Investing in the Organization's Human Capital" (B = 0.311, p < 0.001) and "Product Quality" (B = 0.366, p < 0.001). However, the (Customer Focus) does not significantly affect the "Impact of Human Capital Investment on Organizational Productivity" variable (B = 0.059, p = 0.273), suggesting that this factor is not as influential in this model. Additionally, while "Production Size" (B = 0.129, p = 0.125) shows a positive relationship, it is not statistically significant at the 0.05 level, indicating that (Customer Focus) does not contribute significantly to explaining productivity in this context.

Table 15: Anova results of the impact of implementation of (Customer Focus) on productivity of SME manufacturing companies in Oman

	Sum of Squares	df	Mean Square	F	Sig.
Regression	128.62	4	32.155	149.876	< 0.001*
Residual	51.061	238	0.215		

Table 16: Regression results of the impact of implementation of (Customer Focus) on productivity of SME manufacturing companies in Oman

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Customer Focus	B	Std. Error	Beta		
Constant	0.487	0.157		3.098	0.002*
Investing in the Organization's Human Capital	0.311	0.062	0.348	5.023	< 0.001*
The Impact of Human Capital Investment on Organizational Productivity	0.059	0.054	0.069	1.099	0.273
Product Quality	0.366	0.085	0.361	4.32	< 0.001*
Production Size	0.129	0.084	0.126	1.541	0.125

* Significant at the 0.05 level

Motivating Employees

The regression analysis results, as presented in the "Model Summary" Table 17, reveal a strong positive relationship between "Motivating Employees" and productivity in Omani SME manufacturing companies. The R-value of 0.869

suggests a very strong correlation, and the R-squared value of 0.755 indicates that approximately 75.5% of the variation in productivity can be explained by the implementation of employee motivation strategies. The adjusted R-squared value of 0.751 further confirms the robustness of the model, accounting for the number of predictors. The standard error of the estimate is 0.480, indicating a relatively low prediction error in estimating productivity based on this model.

Table 17: Regression Model Summary of the impact of implementation of (Motivating Employees) on productivity of SME manufacturing companies in Oman

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.869	0.755	0.751	0.480

Table 18 shows that the regression model is statistically significant with an F-statistic of 183.196 and a p-value of less than 0.001, confirming the overall effectiveness of employee motivation in enhancing productivity. Examining the regression coefficients in Table 18 reveals that (Motivating Employees) has a significant positive impact on "Investing in the Organization's Human Capital" (B = 0.572, p < 0.001) and "The Impact of Human Capital Investment on Organizational Productivity" (B = 0.189, p = 0.001), suggesting that (Motivating Employees) is crucial in improving human capital investment. "Product Quality" (B = 0.223, p = 0.012) also contributes positively to productivity. However, (Motivating Employees) does not have a statistically significant effect on "Production Size" (B = -0.060, p = 0.491), indicating that it does not contribute meaningfully to productivity in the context of this model.

Table 17: Anova results of the impact of implementation of (Motivating Employees) on productivity of SME manufacturing companies in Oman

	Sum of Squares	df	Mean Square	F	Sig.
Regression	168.576	4	42.144	183.196	< 0.001*
Residual	54.752	238	0.23		

Table 18: Regression results of the impact of implementation of (Motivating Employees) on productivity of SME manufacturing companies in Oman

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Motivating Employees	B	Std. Error	Beta		
Constant	0.193	0.163		1.189	0.236
Investing in the Organization's Human Capital	0.572	0.064	0.574	8.93	< 0.001*
The Impact of Human Capital Investment on Organizational Productivity	0.189	0.056	0.197	3.376	0.001
Product Quality	0.223	0.088	0.197	2.543	0.012
Production Size	-.060	0.087	-.052	-.690	0.491

* Significant at the 0.05 level

Continuous improvement

The regression model summary indicates a strong relationship between the implementation of "Continuous Improvement" and the productivity of SME manufacturing companies in Oman. With an R-value of 0.890, the analysis suggests a very strong correlation, and the R-squared value of 0.793 indicates that approximately 79.3% of the variance in productivity can be explained by the implementation of continuous improvement practices. The adjusted R-squared value of 0.789 confirms the robustness of the model, accounting for the number of predictors, while the standard error of the estimate (0.404) shows a relatively low level of prediction error.

Table 19: Regression Model Summary of the impact of implementation of (Continuous Improvement) on productivity of SME manufacturing companies in Oman

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.890	0.793	0.789	0.404

Table 20 provides further evidence of the model's significance, with an F-statistic of 227.721 and a p-value less than 0.001, suggesting that continuous improvement has a statistically significant impact on productivity. The regression coefficients reveal that (Continuous Improvement) is significantly associated with several factors of productivity. Such as "Investing in the Organization's Human Capital" (B = 0.467, p < 0.001) has the most substantial positive effect, followed by "The Impact of Human Capital Investment on Organizational Productivity" (B = 0.121, p = 0.011) and "Product Quality" (B = 0.198, p = 0.008). However, Continuous Improvement) does not significantly affect "Production Size" (B = 0.117, p = 0.11), indicating that it is not a critical factor in this context. These findings highlight the importance of continuous improvement practices in enhancing productivity within SMEs.

Table 20: Anova results of the impact of implementation of (Continuous Improvement) on productivity of SME manufacturing companies in Oman

	Sum of Squares	df	Mean Square	F	Sig.
Regression	148.988	4	37.247	227.721	< 0.001*
Residual	38.928	238	0.164		

Table 21: Regression results of the impact of implementation of (Continuous Improvement) on productivity of SME manufacturing companies in Oman

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Continuous Improvement	B	Std. Error	Beta		
Constant	0.38	0.137		2.768	0.006
Investing in the Organization's Human Capital	0.467	0.054	0.511	8.639	< 0.001*
The Impact of Human Capital Investment on Organizational Productivity	0.121	0.047	0.137	2.559	0.011
Product Quality	0.198	0.074	0.191	2.68	0.008
Production Size	0.117	0.073	0.112	1.604	0.11

* Significant at the 0.05 level

These results are consistent with the study of Bale (29), the results show that the correlation coefficient (R) between Productivity and TQM implementation was found to be 0.675, suggesting a positive relationship. The results are also consistent with the study of Ali and Johl, (28). The findings reveal a positive and significant influence of soft TQM practices—such as customer focus, top management commitment, and employee training—on financial, social, and environmental performance, with R^2 values of 0.839, 0.739, and 0.656, respectively. Furthermore, the study highlights that hard TQM practices, including quality information analysis, process management, and advanced manufacturing technology, significantly improve financial (R^2 = 0.775), social (R^2 = 0.797), and environmental (R^2 = 0.712) sustainable performance. It also is consistent with the study of Alghamdi et al (25). The findings of this study revealed that the rest of the TQM dimension, namely continuous quality improvement, management leadership, and organizational innovation, have a significant and positive impact on Saudi manufacturing SMEs' performance

CONCLUSION

This study aimed to investigate the dimensions of TQM and productivity within the Omani SME manufacturing sector, with a specific focus on factors such as top management support, customer focus, motivating employees,

continuous improvement, human capital investment, product quality, and production size. The results indicate that the sector exhibits a strong commitment to implementing TQM practices, with particularly high levels of support from top management, an emphasis on customer focus, and ongoing efforts to motivate employees and promote continuous improvement. Productivity is closely linked to human capital investment, product quality, and production size, with high ratings across all dimensions. While the overall results reflect a positive outlook for TQM and productivity in Omani SMEs, slight variations in perceptions suggest room for improvement, particularly in areas such as employee involvement in decision-making and systematic customer feedback collection.

RECOMMENDATIONS

SMEs should focus on increasing employee involvement in decision-making, fostering a sense of ownership and motivation to enhance organizational performance. Strengthening customer feedback systems through structured surveys and satisfaction metrics can help identify areas for service improvement. Promoting flexible work arrangements will boost productivity and employee satisfaction, while investing in technology is crucial for continuous improvement and staying competitive. Future studies could examine the long-term impact of TQM on productivity, compare its implementation across sectors, explore the role of technological innovation, investigate cultural factors affecting TQM adoption, and analyse how motivational factors influence employee engagement in SMEs.

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CONFLICT OF INTEREST
Authors declare no conflict of interest

AUTHOR CONTRIBUTIONS
Khalid Said Ali AL Zawamri: Data curation, Formal Analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, **Azmi Ahmad:** Conceptualization, Formal Analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing, **Chong Seng Tong:** Writing – review & editing, **Kee Shyuan Loh:** Writing – review & editing

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