

# The Effects of Total Quality Management through Knowledge Management as a Mediator on Company Sustainability in Saudi Arabian Pharmaceutical Industry

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## Abstract

One of the most difficult problems in successful organizations is company sustainability, which is constantly one of the key worries of top managers. Total quality management (TQM), in particular, is regarded as one of the most crucial measures of sustainability, underscoring the significance of quality management in enterprises. Without also putting an emphasis on consumers, leadership, and process management, sustainability cannot fulfill its key sub-parameters—including "economic and social sustainability"—by relying just on the value of "knowledge creation and knowledge sharing". Accordingly, this study aims to examine the effects of TQM through Knowledge management (KM) as a mediator on company sustainability (CS) in various reputable pharmaceutical companies in Saudi Arabia. Data was gathered from managers, supervisors, and deputies of different departments from various organizational levels through a questionnaire. Applications of the software SPSS were used to analyze the data. The findings of this study verify KM and its sub-variables, including "knowledge creation and sharing" in addition to showing the beneficial benefits of TQM on businesses' sustainability. Additionally, they confirm that "knowledge creation and knowledge sharing" in organizations have a mediating role in the effects of TQM on the CS.

**Keywords:** total quality management, knowledge management, company sustainability, pharmaceutical companies, Saudi Arabia

## 1. Introduction

According to Karim et al. (2022) companies are required to follow tried-and-true strategies for TQM and KM in today's fiercely competitive business market because of strict international environmental protection regulations, increasing customer focus on product quality and characteristics, and fierce market competition. Business reform calls for improved understanding of business culture and effective human resource management through the adoption of new ideas to improve business performance over the short, middle, or long term (Qin et al., 2022). Business owners must pay close attention to evaluating and identifying these shifts in decision-making in order to avoid any unintended consequences that can cause firms to fail. Change management should be prioritized by managers in order to maintain business stability and growth because organizational changes can affect business culture, processes, human behavior, opportunities, growth, and overall business performance.

In terms of self-managed teams, team spirit, employee productivity, and morality, KM plays a critical role in fostering employee behavior and efficiency. In light of risks and changes in the global business environment, it also has a significant impact on firm growth, profitability, and business success (Abbas & Sagsan, 2019). TQM today is one of the basic requirements for pharmaceutical companies to develop strong business goals, strategies, culture, learning, information sharing, and knowledge creation and conversion among employees at all levels of the business structure (Wassan et al., 2022). Addition ally, combined with customer focus, it can eliminate waste, because quality raises customer satisfaction and improves competitive position (Zhang et al., 2021).

For the first time, this study examines how TQM affects company sustainability (CS) in Saudi Arabian pharmaceutical enterprises through KM, highlighting the importance of KM in this sector. There have been numerous studies in this area; for instance, Jabeen et al. (2014) presented their research on the benefits of TQM and KM on the performance of SMEs' businesses. The vital part that knowledge management methods play in

achieving sustainability in businesses was presented by Abbas & Sagsan in 2019. Abbas (2020) then carried out additional study to demonstrate how overall quality management affects corporate sustainability through the mediating role of knowledge management in Pakistan's industrial sector. In a related study, Zhang et al. (2021) used a different case study to illustrate the beneficial impacts of both TQM and KM on sustainability. Later, Qin et al. (2022) validated KM and its sub-variables, including knowledge creation and exchange, and demonstrated the beneficial benefits of TQM on enterprises' sustainability. Additionally, they confirm the mediating function of sub-variables in impacting the effects of TQM on the sustainability of businesses, including knowledge production and information sharing in organizations.

## 2. Literature Review

### 2.1 The Concept of TQM

The models that establish the requirements for putting TQM into practice and taking into account its essential value are the Malcolm Baldrige National Quality Award (MBNQA), the Swedish Quality Award (SIQ), (Qin et al., 2022) and the European Foundation for Quality Management (EFQM). In the USMBNQA paradigm, both soft and hard views of TQM are combined. This concept has demonstrated to be highly important and deserving in a number of contexts for improving operational and management structures. According to Yusr et al. (2017) and Ghasemi et al. (2020), the model consists of six components: leadership, strategy formulation, customer orientation, performance monitoring, employee participation, and knowledge and assessment. This study used this framework to investigate the relationships between TQM, KM, and CS, taking into consideration its scope and efficacy.

Following World War II, TQM was first implemented in Japan. It then made its way to the United States in the 1980s (Qin et al., 2022). It mainly spread among American manufacturers that competed with Japan (Sun, 2000). TQM has been demonstrated to have numerous advantages through full adoption and efficient procedures, including enhancements in worker engagement, effective communication, productivity, quality, and customer satisfaction, as well as a decrease in the expenses associated with subpar quality and rework (Zainal, 2020). TQM is a concept with numerous definitions. It is described as a strengthened competitive position where the production is decided by the customer, hence guaranteeing customer satisfaction (Manresa & Rivera, 2021). Exceeding customer expectations, enabling ongoing improvement, and long-term organizational successes are the main goals of TQM. Among them are techniques for disaster risk reduction, performance monitoring, group cooperative learning, quality, and improvement across all teams within the organization (Phan et al., 2019). According to Ghasemi et al. (2022) "innovative TQM literature contains TQM concepts such as customer satisfaction, cost reduction, leadership and senior management commitment, training and education, team management, and culture".

Process focus, system improvement, company-wide focus, customer focus, fact-based management, participation, employee development, cross-functional management, performance, supplier relationships, and overall quality are taken into account by TQM, according to Easton & Jarrell (1998). Management is seen as an important competitive tactic. "Instilling a culture of quality, quality chains, quality assurance, and commitment to continual improvement in upper management" is one of the tenets of TQM, according to Aquilani et al. (2016).

CS refers to a firm's ability to do little or no harm to both the company and society. It achieves this by making use of natural resources, particularly non-renewable ones (Davenport, 2019). Organizations can reach higher levels of accomplishment with the adoption of appropriate CS and business strategies (Farmanesh et al., 2019). This may inspire businesses to think about the effects of their choices across a wider time horizon (Cai & Li, 2018). Organizations are motivated to implement sustainable development strategies by a variety of considerations, including business, law, and ethics. Companies must also assign some tools for environmental and economic growth strategies due to the mounting pressure from stakeholder demands and customer assumptions (Shibli et al., 2021).

Companies are being forced to customize their actions to sustainability, cost reduction, and differentiation as a result of pressure from colleagues and the fiercely competitive company markets (Lucas, 2010). A company's capabilities are highlighted through the company and its resources in the resource-based view of a corporation. The resource-based perspective offers a foundation that makes the relationship between TQM and business operations clear (Li, 2018). It is believed that TQM tends to improve performance in businesses by promoting asset expansion, immersion in the culture of the organization, forging socially complex connections, and dispensing knowledge, particularly tangible information (Subiyakto & Sebastian, 2020). According to Green et al. (2019), the green aspects of sustainability reflect organizations' efforts to preserve the natural ecosystem for a stable world. Examples of these efforts include lowering air and water pollution, consuming natural resources more effectively, cutting costs associated with resource usage, and conserving natural resources. Conserving

energy and resources, especially non-renewable ones, is often necessary for environmental protection. For the continuation of life, these resources are crucial and highly valued (Ji & Zhang, 2019).

Businesses cannot ignore their spiritual responsibilities to the neighborhood, the community, and the environment. Customers, governments, and the general public want businesses to take an active role in initiatives to improve the environment and society in order to mitigate the negative effects of their business operations (Asrar-ul-Haq, 2017). Companies that value the environment typically have a beneficial impact on both employee and customer satisfaction. In contrast to economic sustainability, the social and environmental facets of sustainability are conceptual. The social component of sustainable development entails moral behavior on the part of businesses that puts the welfare of society ahead of their financial and business interests (Sibuea et al., 2021). Social welfare activities include giving to non-governmental organizations, taking part in social literacy programs, enhancing the reliability and accountability of goods and services, etc. (Guerrero-Villegas et al., 2018).

TQM is dedicated to continuous improvement, concentrating on obtaining effective resource management and, as a result, achieving permanence and durability. Many businesses place a high priority on TQM and service quality, and they understand the importance of their activities to both the service and industrial sectors (Cancino et al., 2018). As a result, many firms make the claim that they have updated their business practices to be more environmentally friendly and sustainable. Since TQM is regarded as a management system and has the objective of successfully supporting the company's activities and resources, it can be expanded to include all facets of sustainable development (Shafiq et al., 2019). Poor economic sustainability and resource waste are caused by inferior goods or services. As a result, environmental sustainability is impossible to attain (Abbas et al., 2014).

### *2.2 Development of Company Sustainability (CS)*

The importance of sustainability and the construction of it are perceptible in a variety of global changes from a diversity perspective. They used to concentrate on sustainable development and the numerous alterations documented in the literature (Yilmaz, 2022). The majority of research from the 1970s through the 1980s concentrated on social reporting; however, by the 1990s, the emphasis had shifted to environmental reporting (Asrar-ul-Haq et al., 2017). Initially, businesses alter vocabulary arbitrarily to reflect the language of corporate sustainability, then, the business process is reengineered as a kind of cost management to reduce water and energy expenses and boost financial efficiency, thirdly, businesses take into account consumer and staff loyalty when engaging with stakeholders. Interacting by creating corporate sustainability reports on these projects is the fourth phase (Qin et al., 2022).

The final level, sustainability, entails fundamental adjustments to corporate procedures as well as extensive process restructuring and reform. Given these circumstances, corporate sustainability seems to provide a bright future because its core addresses and encapsulates the most pressing social issues regarding the interaction between society and business. Sustainability in companies is tied to all of the involved departments, claim Khan et al. (2021). In other words, for the supply chain to operate at its best in terms of efficiency, the environment, and the economy, it must be committed to green behavior and practices. Suppliers, production, logistics, and energy usage are only a few of the many components that make up the supply chain (An et al., 2021). By assuring environmental stewardship, focusing on green energy consumption and minimizing employed energy improves the linked organization and, subsequently, society (Yan et al., 2021).

### *2.3 Definition of KM*

Knowledge is presented in a descriptive-to-functional spectrum with detailed-to-general boundaries because it is a difficult topic to define and quantify (Trentepohl et al., 2022; Qin et al., 2022). Information, data, opinions, truth, and human experiences can all be used to establish KM ideas (Mikovi'c et al., 2020). This research focus on identifying the component that most fully encapsulates knowledge. A fluid combination of framed experiences, values, contextual information, and expert insight, according to Anjaria & entropy (2020), defines knowledge and provides a framework for assessing and assimilating new experiences and information.

The idea of KM has not been agreed upon. According to one definition of KM, it is "a systematic, explicit, deliberate building, renewal, and application of knowledge to maximize an enterprise's knowledge-related effectiveness and returns from its knowledge assets" (Bahadori et al., 2020). According to another definition, KM is "the method of recognizing a company's cumulative skill and spreading it as far as possible to capitalize on it" (Adam et al., 2022). Tiwana (2000) defined KM as "managing knowledge from the initial knowledge to its application to achieve market principles and cause an increase in competitive advantages". According to Ghasemi et al. (2017), the word "KM refers to the creation, location, and management of the flow of information and data inside an organization to include knowledge that is successfully and effectively employed to meet company goals over the long term.

As a result, KM is a strategy for disseminating accurate information and experiences to the appropriate people in order to facilitate their sharing and use of that information. Numerous academics and researchers have examined the change of local entrepreneurship from the viewpoint of talent training goals and the core of higher education, and they have talked about the fundamentals. Additionally, they valued direction and fundamental conditions for the development and transformation of neighborhood colleges and universities. From the perspectives of school management, resource allocation, operational procedures, and enrollment system reform, some academics have looked into this in a number of nations. From the views of economics and sociology, other academics have looked into and examined the internal motivating factors and interest, offering a fresh research angle.

2.4 The Linkages between TQM, KM, and CS

Poorly made goods or services not only contribute to weak economic sustainability, but they can also waste natural resources, preventing the creation of a sustainable environment (Abbas, 2020). In light of this, total quality management significantly and favorably affects company sustainability (Qin et al., 2022). The TQM philosophy clearly relates to durability as one of the CS assumptions because its main goals are continual improvement and long-term resource efficiency. Organizations place a high priority on TQM and CS, and they have significant consequences for all service and manufacturing sectors. As a result, organizations should accomplish their aims using sustainable development and environmentally beneficial approaches (Cancino et al., 2018).

It should be highlighted that TQM is a management system, thus it may be implemented in a way that incorporates all aspects of sustainable development because its goal is to improve organizational performance while also ensuring the efficient use of resources (Shafiq et al., 2019). Poor product or service quality can result in resource waste, a lack of economic sustainability (Abbas, 2020) and, consequently, a lack of environmental sustainability. TQM thus has a favorable and considerable impact on the long-term viability of an organization (Sun, 2000; Qin et al., 2022).

Sustainability is understood to be centered on three primary elements: natural ecosystems, sustainable growth, and individual responsibility as they relate to social and economic challenges (Jermstipparsert, 2021). Realizing the sustainable fulfillment of human needs is a fundamental tenet of sustainable development. Natural resources and human-produced resources are required for fulfillment. Integration of KM with sustainable development is essential for society's knowledge. Mardani et al. (2018) claim that knowledge is an important factor in growth. According to Abukhait et al. (2019), KM is also a key element in bettering economic operations. Knowledge-based firms strive for new approaches to sustainable development in addition to being innovative. According to environmental, social, and economic considerations, KM makes it easier for the knowledge market to develop sustainably (Imran & Abbas, 2019). Knowledge-sharing is encouraged both inside and outside of businesses by KM corporations. Coordination of KM initiatives and holistic management plans for all facets of sustainable development is highly valued by institutions. The research model is shown in Figure 1 based on the explanation above.

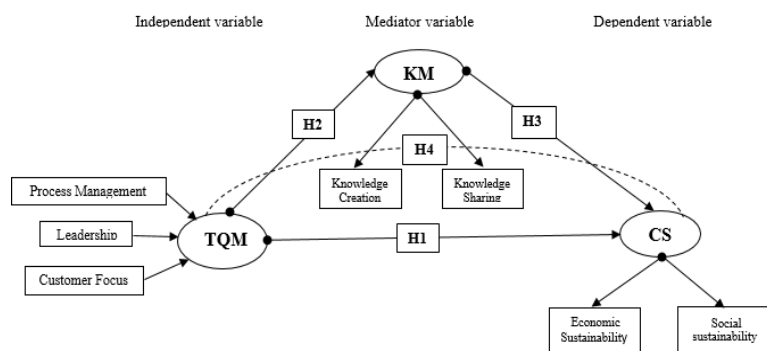


Figure 1. Research Model

2.5 Sustainability and TQM Roles in the Pharmaceutical Industry

According to Alshehri et al. (2023) the pharmaceutical industry is a multibillion dollar global enterprise that has a large economic influence and affects people's health and well-being greatly. Indeed, the pharmaceutical industry works to create and enhance goods to raise the standard of living (Taylor, 2015).

In the Saudi Arabia, pharmaceuticals now account for 20% of all healthcare spending (Alshehri et al., 2023). The major causes of this increase are the emergence of chronic diseases and the high cost of manufacturing drugs including vaccines, antibiotics, and anticancer medicines (Tawfik et al., 2022). Maintaining a continuous

pharmaceutical manufacturing process to suit all medical needs is a significant task for any pharmaceutical company. For this reason, practically every nation works to localize the manufacturing of drugs and the components used in them on its soil (Alrasheedy, 2020). Only 20-25% of the overall pharmaceutical consumption of delivered medicines is covered by the more than 40 recognized pharmaceutical enterprises in the Saudi Arabia (Tawfik et al., 2022).

The size of the Saudi Arabian pharmaceutical market is predicted to grow from 14 billion Saudi Riyal (SAR) in 2012 to 28 billion SAR in 2016 and 40 billion SAR in 2023 (Alshehri et al., 2023). This market size could be seen as a strain on the Kingdom's annual budget. The Kingdom is expected to account for nearly 25% of all medicine sales in the Middle East and North Africa (MENA) regions by the end of 2021, with annual drug sales exceeding 30 billion SARs (The Report, 2018). By 2022, practically all Saudis will have their medical expenses covered by the Saudi government. In the Saudi Arabia, medication expenses account for around 44% of the entire cost value of the healthcare process (Tawfik et al., 2022).

Despite having a sizable domestic pharmaceutical sector, the Saudi Arabia still imports over 70% of its pharmaceutical products from Europe, China, India, and the USA combined. A small percentage of branded medicine production accounts for just about 30% of the overall Saudi Arabia pharmaceuticals market (Alrasheedy, 2020; Alzahrani & Harris, 2021). Previous research indicates that although there are more than 40 licensed pharmaceutical companies in the Saudi Arabia, only 20-25% of the country's prescription drug needs are met by them. Maintaining a steady supply of various pharmaceutical goods to satisfy the rising demand is one of the most important difficulties facing the pharmaceutical sector and the healthcare system (Festa et al., 2022).

In many nations today, efforts are being made to transfer information and technology from academic institutions so that the value produced in academia can increase industrial units' productivity and efficiency, which will ultimately contribute to economic development. Additionally, education institutions are approaching their role in the expansion and development of the economy with greater seriousness. Industries have realized that in order to develop strategies to lower opportunity costs, they must engage in positive academic exchanges. There is no escaping competition in the complex world of today since it serves as the basis for building sustainable value. Pharmaceutical companies in Saudi Arabia are not different, and in order to maintain sustainability, they must use a variety of quality and KM strategies.

The expense of disposing of pharmaceutical sector trash is usually considerable due to the toxicity of the materials employed in their production. Furthermore, the rate of drug damage is now significantly higher, particularly in light of the COVID-19 pandemic. Therefore, these waste products pose grave risks to the sustainability of the environment. Additionally, the pharmaceutical industry has a negative impact on the lives and health of local residents who live close to drug manufacturers and wastewater treatment facilities, and it is impossible to ignore the destructive effects of waste and pharmaceutical products on aquatic animals in polluted waters or animals nearby.

Quality is the most important concern in the pharmaceutical sector, and there are numerous laws, rules, and controls in place to make sure of this. Consequently, a quality management system that incorporates all pertinent organizational units and employees is required in order to attain this goal. Different quality management-related tasks and their connections are valued in the pharmaceutical industry. Every organization's policy for implementing quality is centered on quality management. In the manufacture of drugs, the caliber of the raw ingredients and packaging is crucial. To guarantee that the medicine is packaged to the highest standards and will retain its quality over time, numerous tests are carried out, including checks on the materials and form of the packaging, the number of medications in each package in accordance with consumption dosage, stability tests on packaging under controlled conditions, such as temperature and humidity. The basic function of quality in the pharmaceutical sector was indicated in a study by Haleem et al. (2015). Another study by Mehralian et al. (2016) used the analysis of questionnaires provided to Iranian pharmaceutical businesses to demonstrate the core function of TQM. Saudi Arabia was noted as having the world's first fully developed pharmaceutical sector with governance, transparency, and control systems (Alshehri et al., 2023).

### **3. Methodology**

#### *3.1 Hypothesis Development*

Numerous hypotheses were developed and evaluated in accordance with the study's questions in order to address the problem and aims. The major inquiry of the study was on the impact of TQM on CS through KM as a mediator in Saudi Arabian pharmaceutical firms. The following were the primary hypotheses proposed to address main question:

**Hypothesis One (H1):** TQM has a positive effect on CS and its sub-variables (economic sustainability and social sustainability) in Saudi Arabian pharmaceutical companies.

**H1a:** There is a positive impact of TQM on the economic sustainability of pharmaceutical firms in Saudi Arabia.

**H1b:** There is a positive impact of TQM on the social sustainability of pharmaceutical firms in Saudi Arabia.

**Hypothesis Two (H2):** There is a positive impact of TQM on KM and its sub-variables (knowledge creation and knowledge sharing) in pharmaceutical firms in Saudi Arabia.

**H2a:** There is a positive impact of TQM on the knowledge creation of pharmaceutical firms in Saudi Arabia.

**H2b:** There is a positive impact of TQM on the knowledge sharing of pharmaceutical firms in Saudi Arabia.

**Hypothesis Three (H3):** There is a positive impact of KM on CS and its sub-variables (economic sustainability and social sustainability) in pharmaceutical firms in Saudi Arabia.

**H3a:** There is a positive impact of KM on the economic sustainability of pharmaceutical firms in Saudi Arabia.

**H3b:** There is a positive impact of KM on the social sustainability of pharmaceutical firms in Saudi Arabia.

**Hypothesis Four (H4):** There is a mediation impact of KM on the relationship between TQM and CS in pharmaceutical firms in Saudi Arabia.

### 3.2 Data Collection

The original data collection technique was used in this investigation. The first-hand information was provided through a questionnaire. In this study, the main data were collected by questionnaire. Due to the ability to track and interpret the outcomes of survey questions into predictions, this approach was picked as the preferable one for gathering actual data. "Snowball techniques" were used to collect the study questionnaire. Employees from four different pharmaceutical companies in Saudi Arabia were sent the questionnaire. Electronic surveys made it possible to collect data quickly and analyze it quickly. Between May 2023 and July 2023, data were collected. Finally, statistical analysis methods were used to process all of the statistical data that had been gathered. The questionnaire is divided into two sections: the first asks respondents about their demographics (gender, age, education, and years of work experience), while the second has 33 questions about the study variables. These data were evaluated and examined statistically. Data collection's main goal was to test the theories put forward in the literature and by past studies.

### 3.3 Sampling and Population

In order to increase data collecting efficiency and guarantee that the sample accurately represents the population, sampling techniques are essential. The amount of data that should be collected is thought to be reduced through sampling, and conclusions about the entire population are produced. Examining the positive effects of TQM and CS in pharmaceutical firms through KM was the goal of this study. Pharmaceutical firms in Saudi Arabia were the study's intended audience. For the pilot study, the research questionnaire was distributed to Saudi Arabian pharmaceutical company employees utilizing the "snowball method" of data collection. Electronic surveys made it possible to collect data quickly and analyze it quickly. As a result, the researchers were able to quickly gather a substantial amount of data from responders. To reach findings, all statistical data were analyzed using statistical analysis methods.

### 3.4 Sample Data Analysis

The study sample was given a questionnaire that covered all the study's factors. A five point Likert scale was used to distribute the respondents' responses. Subsequent testing was carried out to assess the questionnaire's dependability. To determine the validity of the questionnaire as a tool for gathering the required data, tested the questions' internal consistency using "Cronbach's alpha" coefficient method was applied. The research was started by using convenience sampling and taking into account whether the managers working for pharmaceutical firms in Jeddah City would be available to explain the goal of the study. The management gave their consent for the employees of various functional areas and departments involved with the study's chosen variable to get the survey link.

## 4. Results and Discussions

In Jeddah, four pharmaceutical companies consented to take part. All managers, directors, and assistants of these Saudi pharmaceutical enterprises received a total of 150 questionnaires. 132 surveys were ultimately located. As a result, 132 questionnaires were included in the sample for statistical analysis. The survey respondents' demographic data are shown in Table 1, which shows that male made up the majority of the sample with 91 respondents, or 68.94% of the whole sample, while female made up just 41 respondents, or 31.06% of the sample

as a whole. The sample age was primarily between 30 and 40 years old, with 51 respondents, or (38.64%) of the sample; 25 respondents were under 30 years old, or (18.94%); 38 respondents were between 40 and 50 years old, or (28.79%); and 18 respondents were over 50 years old, or (13.63%), of the total study sample.

The results for education show that a bachelor's degree was most frequently held, with a total of 74 respondents, or 56.06%; 13 respondents held a diploma degree, or 9.85%; 35 respondents held a master's degree, or 26.52%; and 10 respondents had a PhD, or 7.57% of the total study sample. In terms of years of experience, 25 respondents had less than 10 years of experience, which represents 18.94% of the total study population. In contrast, 70 respondents each had years of experience between 10 and 20, which represents 53.03%. Finally, 37 respondents had more than 20 years of experience, which represents 28.03% of the total study sample.

Table 1. Respondent's profile

Variable	Category	Frequency	Percentage
Gender	Male	91	68.94 %
	Female	41	31.06 %
	Total	132	100 %
Age	Less than 30 years	25	18.94 %
	30 - less than 40 years	51	38.64 %
	40 - less than 50	38	28.79 %
	50 years and over	18	13.63 %
	Total	132	100 %
Education Level	Diploma	13	9.85 %
	Bachelor's	74	56.06 %
	Master's	35	26.52 %
	PHD	10	7.57 %
	Total	132	100 %
Experience years	Less than 10 years	25	18.94 %
	10 - less than 20 years	70	53.03 %
	More than 20 years	37	28.03 %
	Total	132	100 %

#### 4.1 Study Variables Reliability and Consistency

A number of procedures to ensure the reliability of the research instrument used to measure every variable in the study were performed. For a "pilot study," the study tool was distributed to seven academics at Saudi Arabian public universities who have a background in scientific research. The accuracy and dependability of the surveys were evaluated using Cronbach's alpha ( $\alpha$ ) analysis. The test results are displayed in the following table. Table 2 shows that the Cronbach's alpha coefficient for TQM overall was 0.91, for the dependent variable (CS), 0.82, and the mediator variable (KM), 0.83, all of which are greater than 0.70, suggesting the validity of the instrument to meet the goals of the study.

Table 2. Cronbach's alpha coefficients of the study's variables

No.	Dimensions	Cronbach's $\alpha$ Coefficients
1	Knowledge creation (KC)	0.73
	Knowledge Sharing (KS)	0.78
	KM	0.83
2	Customer focus	0.81
	Process management	0.82
	Leadership	0.85
	TQM	0.91
3	Corporate social sustainability	0.74
	Corporate economic sustainability	0.72
	CS	0.82

#### 4.2 Descriptive Statistical Analysis

Along with the overall results, Table 3 shows the arithmetic ranges and percentage points of the sample results for each sub-variable of the study's independent variables.

Table 3. TQM sub-variables: Means (M), Standard Deviation (SD) and Relative Importance (RI)

No.	Variables	M	SD	RI	Degree of Significance
1	Customer focus	4.193	0.480	1	High
2	Process management	4.122	0.694	3	High
3	Leadership	4.130	0.516	2	High
4	TQM	4.093	0.453		High

Table 3 indicates that the overall arithmetic mean of the variable as a whole was 4.093, with a high estimate, and the mean dimensionality of the dependent variable "TQM" was between 4.193 and 4.122. This means that the administrations of the pharmaceutical companies in Saudi Arabia are keen to share knowledge with their employees to keep them aware and well-organized for any job development, so as to help themselves to handle job tasks, job capabilities, and job responsibilities efficiently.

Table 4. KM sub-variables: Means (M), Standard Deviation (SD) and Relative Importance (RI)

No.	Variables	Mean	Standard Deviation	Rank	Degree of Significance
1	Knowledge creation	4.093	0.453	1	High
2	Knowledge sharing	3.980	0.465	2	High
3	KM	4.037	0.406		High

Table 4 indicates that the arithmetic mean of the variable as a whole was 4.093 with a high degree of appreciation. The range of the mediator variable "KM"'s mean values was 3.980 to 4.093. In order to improve the workplace environment and achieve CS both socially and economically, the administrations of the pharmaceutical companies in Saudi Arabia are therefore attempting to create and share knowledge among their employees. This is done in order to meet the market's demand for competition.

Table 5. CS sub-variables: Means (M), Standard Deviation (SD) and Relative Importance (RI)

No.	Variables	M	SD	RI	Degree of Significance
1	Economic sustainability	4.103	0.500	1	High
2	Social sustainability	4.096	0.599	2	High
3	CS	3.928	0.387		High

Table 5 indicates that the "CS"'s mean value ranged from 4.96 to 4.103, and overall mean is 3.928, which is very appreciative. This indicates that the management of the pharmaceutical companies in Saudi Arabia is keen to practice "social and economic sustainability" through staff members through teamwork to ensure the creation and sharing of knowledge among employees, in order to pass on knowledge crucial for managing company activities while effectively utilizing the impact of TQM and its dimensions (i.e., customer focus, leadership, and process management).

#### 4.3 Hypothesis Tests

To test the study's hypotheses, several statistical methods were used, including multiple and simple regression, a path method analysis, and variance analysis. The results were as follows:

**Hypothesis One (H1):** There is a positive impact of TQM on CS and its sub-variables (economic sustainability and social sustainability) in Saudi Arabian pharmaceutical companies.



Table 6. Analysis of Multiple regression of the effect of TQM on CS

Variable	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig	B	Standard Error	t	Significance	
CS	0.929	0.863	300.565	0.000	(Constant)	0.028	0.351	2.917	0.003
					Customer focus	-0.085	0.102	-0.835	0.403
					Process Management	0.380	0.050	7.679	0.000
					Leadership	0.113	0.045	2.520	0.000

Table 6 indicates that the explained variance was 0.863; that is, the independent variables combined (customer focus, process management, and leadership) accounted for 86.3 % of the CS in Saudi Arabian pharmaceutical companies. In addition, the following results were found: There was a statistically significant positive impact of process management on CS in Saudi Arabian pharmaceutical companies, as the value of t was 7.679, with a statistical significance of 0.000. There was a statistically significant positive impact of leadership on CS in Saudi Arabian pharmaceutical companies, as the value of t was 2.520, with a statistical significance of 0.000. There was no statistically significant positive impact of customer focus on CS in Saudi Arabian pharmaceutical companies, as the value of the test statistic was - 0.835, with a statistical significance of 0.403.

**H1a:** There is a positive impact of TQM on the economic sustainability of Saudi Arabian pharmaceutical companies.

Table 7. Analysis of Simple regression of the effect of TQM on company economic sustainability

Variable	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig	B	Standard Error	t	Significance	
Company Economic Sustainability	0.589	0.346	66.791	0.000	(Constant)	1.371	0.336	4.064	0.000
					TQM	0.667	0.081	8.234	0.000

According to Table 7, the explained variance was 0.346, which means that the independent variable TQM was responsible for 34.6% of the economic sustainability of Saudi Arabian pharmaceutical businesses. Additionally, it was discovered that TQM had a statistically significant beneficial impact on CS sustainability in Saudi Arabian pharmaceutical businesses, with a value of t of 8.232 and a statistical significance of 0.000.

**H1b:** There is a positive impact of TQM on the social sustainability of Saudi Arabian pharmaceutical companies.

Table 8. Analysis of Simple regression of the effect of TQM on company social sustainability

Department	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig	B	Standard Error	t	Significance	
Company Economic Sustainability	0.499	0.249	41.749	0.000	(Constant)	1.371	0.336	4.064	0.000
					TQM	0.55	0.87	6.382	0.000

The explained variance in Table 8 is 0.249, indicating that 24.9 % of the corporate social sustainability in Saudi Arabian pharmaceutical businesses was accounted for by the independent variable TQM. Additionally, it was discovered that TQM had a statistically significant positive effect on the company social sustainability of the pharmaceutical industry.

**Hypothesis Two (H2):** There is a positive impact of TQM on KM and its sub-variables (knowledge creation and knowledge sharing) in Saudi Arabian pharmaceutical companies.

Table 9 indicates that the explained variance was 0.458; that is, the independent variables combined (customer focus, process management, and leadership) accounted for 45.8 % of the KM in pharmaceutical companies in Saudi Arabia. In addition, the following results were obtained:

Table 9. Analysis of multiple regression analysis of the effect of TQM on KM

Variable	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig	B	Standard Error	t	Significance	
KM	0.677	0.458	34.315	0.000	(Constant)	1.073	0.310	3.451	0.001
					Customer focus	0.101	0.092	1.120	0.264
					Process Management	0.231	0.075	3.021	0.002
					Leadership	0.366	0.072	5.003	0.000

Given that the value of t was 3.021, with a statistical significance of 0.002, also, table 9 shows that process management had a statistically significant beneficial impact on KM in Saudi pharmaceutical firms. The value of t was 5.003 with a statistical significance of 0.000, indicating a statistically significant positive influence of leadership on KM in Saudi Arabian pharmaceutical enterprises. The value of the t test statistic was 1.120, with a statistical significance of 0.264, indicating that there was no statistically significant positive impact of customer focus on KM in pharmaceutical enterprises in Saudi Arabia.

**H2a:** There is a positive impact of TQM on the knowledge creation of Saudi Arabian pharmaceutical companies.

Table 10a. Analysis of Simple regression of the effect of TQM on knowledge creation

Variable	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig	B	Standard Error	t	Significance	
Knowledge Creation	0.479	0.229	37.144	0.000	(Constant)	2.082	0.324	6.393	0.000
					TQM	0.482	0.076	6.174	0.000

According to Table 10a, the independent variable TQM was responsible for 22.9 % of knowledge development in Saudi Arabian pharmaceutical businesses, as indicated by the explained variance of 0.229. Furthermore, the value of t was 6.174 with a statistical significance of 0.000, indicating that TQM had a statistically significant beneficial impact on knowledge creation in Saudi Arabian pharmaceutical businesses.

**H2b:** There is a positive impact of TQM on the knowledge sharing of pharmaceutical firms in Saudi Arabia.

Table 10b. Analysis of Simple regression of the effect of TQM on knowledge sharing

Variable	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig	B	Standard Error	t	Significance	
Knowledge Sharing	0.595	0.354	69.263	0.000	(Constant)	1.041	0.339	3.056	0.002
					TQM	0.686	0.081	8.380	0.000

The explained variance in Table 10b is 0.354, indicating that 35.4% of knowledge sharing in Saudi Arabian pharmaceutical enterprises was accounted for by the independent variable TQM. Furthermore, it was discovered that TQM had a statistically significant beneficial impact on knowledge sharing in Saudi Arabian pharmaceutical firms, with a value of t of 8.380 and a statistical significance of 0.000.

**Hypothesis Three (H3):** There is a positive impact of KM on CS and its sub-variables (economic sustainability and social sustainability) in pharmaceutical firms in Saudi Arabia.

Table 11. Analysis of multiple regression of the effect of KM on CS

Department	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig		B	Standard Error	t	Significance
					(Constant)	1.983	0.245	8.022	0.000
CS	0.589	0.346	66.52	0.000	KM	0.493	0.059	8.216	0.000

The "explained variance" in Table 11 was 0.346, indicating that the independent variable of KM was responsible for 34.6% of the CS of Saudi Arabian pharmaceutical enterprises. Furthermore, given that the value of t was 8.216 and the statistical significance was 0.000, we discovered that KM had a statistically significant beneficial impact on the CS of pharmaceutical businesses in Saudi Arabia.

**H3a.** There is a positive impact of KM on the economic sustainability of pharmaceutical firms in Saudi Arabia.

Table 12. Analysis of Simple regression analysis of the impact of KM on the company economic sustainability

Variable	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig		B	Standard Error	t	Significance
					(Constant)	2.170	0.241	9.001	0.000
company economic Sustainability	0.559	0.312	55.35	0.000	KM	0.435	0.056	7.505	0.000

The explained variance in Table 12 is 0.312, indicating that KM accounted for 31.2% of the economic sustainability of Saudi Arabian pharmaceutical enterprises. The value of t was 7.507, with a statistical significance of 0.000, and we also discovered that KM had a statistically significant positive impact on corporate economic sustainability in Saudi pharmaceutical businesses.

**H3b.** There is a positive impact of KM on the social sustainability of pharmaceutical firms in Saudi Arabia.

Table 13. Analysis of Simple regression analysis of the impact of KM on the company social sustainability

Department	Model Summary		ANOVA		Coefficient				
	R	R <sup>2</sup>	F	Sig		B	Standard Error	t	Significance
					(Constant)	2.462	0.239	10.294	0.000
Company social Sustainability	0.496	0.246	42.18	0.000	KM	0.385	0.059	6.495	0.000

The explained variance in Table 12 is 0.246, which means that the independent variable of KM accounted for 24.6% of the corporate social sustainability in Saudi Arabian pharmaceutical businesses. The value of t was 6.495, with a statistical significance of 0.000, and it is discovered that KM had a statistically significant beneficial impact on the corporate social sustainability in Saudi Arabian pharmaceutical businesses.

**Hypothesis Four (H4):** There is a mediation impact of KM on the relationship between TQM and CS in pharmaceutical firms in Saudi Arabia.

To test this hypothesis, path analysis was used to verify the presence of the indirect effect of KM as a mediating role in the relationship between TQM with its dimensions and CS with its dimensions combined. The following table (12) shows the results of the model fit test.

Table 13. Model fit Summary

$\chi^2$	GFI	CFI	AGFI	RMSEA	Sig.
42.611	0.927	0.953	0.055	0.123	0.000

According to table 13, the "goodness-of-fit index" (GFI) value achieved 0.928, or almost a perfect fit. The "comparative fit index" had a value of CFI=0.953, which is almost a perfect fit. The "adjusted goodness-of-fit index" has a score of AGFI=0.055. The RMSEA was 0.123, which is close to zero. The model's fitness is supported

by all of the aforementioned characteristics. If the results of the statistical analysis indicate that the KM has a statistically significant impact on the CS through the KM with the computed value of Chi2 ( $\chi^2 = 42.614$ ). Table 14 shows the Path analysis results for this hypothesis.

Table 14. Results of Path analysis

Path	Direct Effects	Indirect effects	t	Sig
TQM → KM	0.66	0.68	7.24	0.000
KM → CS	0.70		7.85	0.000

It can be seen that the TQM has an impact on KM because its direct effect on KM was 0.66. As a result, the KM shows a favorable reflection of the TQM interest. Additionally, the KM had a 0.70 direct influence on the CS, showing that the KM had an impact on the CS. Furthermore, the mediator's indirect effect of the TQM on the CS was 0.68. For the TQM and the KM, the "test statistic value" of the path analysis was 7.24, but the value for the KM and the CS was 7.85. Based on ( $P < 0.05$ ), both values demonstrate the significance of the test. These findings suggest that KM has a mediating effect on the link between TQM and CS at a level of 0.05. All of the hypotheses showed significant and positive associations based on the results, which validate the model that was developed.

## 5. Conclusions and Recommendations

One of the main goals of the present study was to comprehend the fundamental importance of knowledge, the attitude of Saudi Arabian pharmaceutical businesses toward TQM, and their readiness to face obstacles at work and sustain higher performance. To ensure that knowledge is accessible and used, Saudi Arabian pharmaceutical companies' administrations make sure that TQM and its components—including "leadership, customer focus, process management" from internal and external sources, employees' creative ideas, work-unbalancing processes, competitors and market trends, and training programs—are regarded as fundamental sources of quality.

Their staff members develop their leadership qualities and unique task-performer abilities based on the idea of sustainability. Additionally, it is strongly advised that businesses view their employees as partners in task direction and support them in managing and responding in accordance with their professional expertise and capacity to handle TQM effectively. In order to overcome functional hurdles like confusion, job delays, and negative behavior, Saudi Arabia pharmaceutical businesses also make sure that producing and sharing information with employees at all levels is one of the fundamental elements of the company's policy toward workflow.

Therefore, knowledge sharing is essential to management and administrative processes, coupled with the high level of professionalism displayed by employees when carrying out their duties. Employees should also be able to rely on one another and work as a team without needing to consult management about specific tasks. Pharmaceutical firms in Saudi Arabia have attested to the fact that TQM improves workers' productivity. As a result, their management is working to create an organizational culture that is characterized by excellence by educating their staff and professionally managing it for the good of the business. They are also lowering the risks and expenses associated with the work by correctly applying TQM.

The current research findings are supported by a number of investigations. For instance, Jabeen et al. (2014) highlighted the benefits of TQM and KM on the operational efficiency of SMEs. More recently, it was discovered (Abbas & Sagsan, 2019; karim et al., 2022; Qin et al., 2022) that KM techniques and TQM play critical roles in the "sustainability" of enterprises. Surprisingly, however, Abbas (2020) claimed that TQM and KM have negligible connections to "knowledge creation" and environmental sustainability, respectively. These findings could provide managers with information regarding the practical effects of the industry, management style, organizational structure, and culture. However, Zhang et al., (2021) has revealed findings that are comparable to those of the current investigation. The significance of adapting methods for each construct—or at least for the key ones, namely, TQM, KM, and sustainability—is demonstrated by different results based on geographic context. Professional management places a greater emphasis on adding value to businesses than on the amount of time, money, effort, or breadth of the labor involved. How managers carry out these activities in the setting of each organization is the key area of interest.

This study underlines the crucial function of TQM in four pharmaceutical businesses with regard to the "managerial implications". Its usefulness to managers working in this sector was highlighted by showing how it affects firm sustainability, which includes "economic and social sustainability". The outcomes also demonstrated the benefits of TQM and the dedication of all managerial levels in this sector to the importance of knowledge. This

study made a solid case for the importance of "knowledge creation and knowledge sharing" in all businesses, particularly pharmaceutical firms. Furthermore, managers will be able to attain organizational sustainability on various fronts, specifically, "economic and social sustainability," thanks to the favorable direct and indirect consequences of implementing KM techniques.

In conclusion, using KM techniques helps enhance TQM performance and market sustainability. As with any study, the present one has several limitations. One of these restrictions is that no operational workers, only managers, leaders, and assistants of Saudi pharmaceutical businesses received the surveys. Additionally, rather than being based on any records in pharmaceutical businesses in Saudi Arabia, the results were examined based on the managers' interpretations of the data. Additionally, more pharmaceutical firms ought to be looked into in this area. The length of time that the companies have been operating in the pharmaceutical sector can also be thought of as a potential influencing element on the TQM in such research. This study did not look at the maturity of the organization, which is an important component in such studies. Through the pivotal function of KM, the impact of TQM on firm sustainability—including both economic and social sustainability—could be investigated in different industries in Saudi Arabia. Additionally, managerial assistance might be looked at as a moderator variable in future research instead of knowledge management to see how it might boost the aforementioned benefits in other industries.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### **Data sharing statement**

No additional data are available.

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