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Unleashing the Importance of TQM and Knowledge Management for Organizational Sustainability in the Age of Circular Economy

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Abstract: Despite the growing importance of the concept of circular economy, the case of developing countries remains under-explored. Against this backdrop, the present research aims to examine the association between the constructs of total quality management (TQM) and organizational sustainability (OS) with the mediating effect of knowledge management (KM) from the perspective of a circular economy. The data were collected from the manufacturing sector of a developing economy (n = 510) to serve the purpose of the current research through a self-administered questionnaire (paper-pencil technique). Structural equation modeling (SEM) was employed for hypothesis testing of the current survey. Six TQM dimensions were drawn from the Malcolm Baldridge National Quality Award (MBNQA) model. OS is composed of economic, social, and environmental sustainability, and KM is composed of four dimensions including acquisition, creation, sharing, and application of knowledge. The empirical examination suggests that TQM positively relates to OS, with KM playing a partial mediation role between this association. This study provides important insights for the management of the manufacturing industry of Pakistan on how to ensure organizational sustainability in the age of a circular economy by using the constructs of TQM and KM.

Keywords: organizational sustainability; knowledge management; total quality management; sustainable development; circular economy; linear economy

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1. Introduction

Due to the technological, social, political, and environmental changes that emerged over the past few decades, sustaining a viable and competitive organization has become a real challenge [1]. These changes not only create more opportunities for consumers but also change their needs and wants patterns [2]. It also aims to reduce consumers' unnecessary usage of natural resources including, water, air, and soil [3], and encourage

companies to improve their environmental footprint through the use of environment-friendly activities. Currently, companies like to follow several methods simultaneously and continue to support their strategic guidelines to achieve sustainable development objectives [4].

According to a report by the United Nations Brundtland Commission, if businesses sense the requirements of upcoming generations without compromising their ability to fulfill their specific business needs, such businesses are referred to as "businesses with sustainable development practices" [5]. This information applies to individuals who value and share concerns for future generations, especially for the non-renewable natural resources, so that the goal of sustainable development may be achieved. Organizational sustainability (OS) is three-dimensional. That is, it comprises social stability, which implies a stable economy that focuses on people, society, a stable environment, i.e., the natural resources, and is also focused on the economic growth of the enterprises [6]. Previous studies have also used the term triple bottom line (TBL) for these measurements [6–8].

With the rise of sustainability concerns and sustainable development, the notion of a circular economy has been receiving a lot of attention from scholars and policymakers in recent years [9]. When businesses embrace the essence of circular economy, it benefits not only the environment but the organization as a whole, as reducing the level of wastage is one of the primary objectives of such an approach [10]. Perhaps this is the reason that in the current age, many corporations are striving to incorporate sustainability and practices relevant to the notion of a circular economy. Undoubtedly, embracing the concept of a circular economy not only benefits organizations by mitigating the level of waste but also helps an economy to improve its environmental footprint [11].

The words "reduce, reuse, and recycle" are at the heart of the philosophy of circular economy and sustainability [12]. This implies that corporations need to incorporate such strategies through which they can reduce not only their wastage but also can incorporate such practices that can enable them to reuse and even recycle their wastage for further manufacturing processes. Central to the concept of circular economy is the concern for waste reduction [13]. To do this, businesses are required to conduct a waste audit to identify defects in business operations that are producing more waste than necessary. In this scenario, the importance and relevance of total quality management (TQM) are self-explanatory as one of the basic concerns of TQM is cost reduction through waste reduction. Therefore, one of the objectives of the current research is to investigate the relationship of TQM and organizational sustainability (OS) from the perspective of circular economy.

Given the large business competitive market landscape, regulated environment, customer care, quality products, and authorized incentive, companies believe in well-established modeling methods including TQM and knowledge management (KM). TQM recognizes the method of improving organizational and individual performance to enhance competitiveness [14]. This not only improves business economic health but also increases customer and employee satisfaction [15]. The goal of TQM is to focus on sustainable performance, using the least resources to maintain a well-functioning working environment [16]. In addition, the effective implementation of TQM, a key component of sustainability, will have a significant influence on OS [17]. As Abbas, [18] noted, activity-focused companies (one of the critical factors of TQM) can offer an eco-friendly product or service.

Specifically, the implementation of the concept of circular economy is not an easy task as this includes a shift from a linear economy (the traditional one) to an iterative economy (circular) [19]. This requires specific capabilities and KM abilities of an organization. More specifically, from the perspective of a circular economy, a close knowledge-related collaboration from all stakeholders and continuous improvement in the specific business processes are preconditions for OS and for a circular flow of manufacturing processes [20]. Moreover, the process of circular value creation is imperative for improving ecosystems [21], implying that KM has a significant place in all these processes. Therefore, another objective of the current research is to investigate the mediating effect of KM between the relationship of TQM and OS from the perspective of a circular economy.

The proposed relationships were tested in the manufacturing sector of Pakistan. This sector was taken into consideration purposefully. Firstly, the majority of the manufacturing sector of Pakistan follows the linear economy pattern which results in an inefficient resource management approach [22,23]. The approach of circular economy is more holistic to extract value from the waste to achieve sustainability objectives [24]. In the current context, along with other issues, inefficient management, poor knowledge, and quality standards are the critical factors that restrict this sector's adoption of a circular economy. Thus, the findings of the current study will be helpful for this sector towards a circular economy by considering KM and TQM practices. Secondly, Pakistan produces approximately 90,000 tons of solid waste daily. The contribution of the industrial sector to this huge solid waste is critical [25]. To address this discouraging situation, an approach of the circular economy characterized by proper knowledge-based and quality management approaches may improve the current situation. Hassan and Daud [26] argue that the OS can be achieved through efficient KM activities. Despite the importance of these ideas, researchers have paid limited attention to the relationships between the "key operating structures" of TQM KM and OS.

The current study offers some significant contributions to existing knowledge. To begin with, this is one of the pioneering studies from the perspective of developing economies that attempt to bring to focus the importance of circular economy. Specifically, the current study has a special focus on the manufacturing sector of Pakistan. Notably, the adoption of the concept of circular economy is still in its evolving stages in most manufacturing cases in the country [22]. To further aggravate the issue, the concept of a linear economy still prevails and the full potential of the concept of circular economy has yet to be analyzed [27–29]. Moreover, the bulk of literature on circular economy has largely focused on sectors from developed economies [9,11,30], whereas the case of developing countries is still underexplored, which clearly highlights the dire need to conduct more research in this area. Especially, in the case of Pakistan, almost every sector follows the concept of the linear economy (take → make → waste), rather than adapting to a circular economy. Given that there is no synergic approach between different industries for a cyclical sharing of resources. This has led Pakistan to a situation of scarce resources along with different environment-related issues. Poor waste management including unmanaged dumps has placed Pakistan on the list of the countries with high solid wastages. The country, on average, wastes more than 3 million rupees of plastic each year [31]. With the current approach of the linear economy, it will not be possible for Pakistan to achieve a sustainable future. Clearly, the circular economy model is at the heart of a sustainable approach. In this regard, the scientific knowledge-related capabilities and TQM practices may be helpful for enterprises of Pakistan to achieve sustainable manufacturing practices along with achieving the circular economy objectives.

Moreover, the current study also enriches the available literature by introducing KM as a mediator between the relationship of TQM and OS which has barely been discussed from the perspective of a circular economy in the context of developing countries, though there have been some studies highlighting the importance of KM from the perspective of a circular economy [32,33]. However, these studies did not consider developing economies. In this context, it is to be stated that, due to the environmental complexity which changes from sector to sector and region to region, it is not possible to generalize the findings of previous studies in the context of an emerging economy. In line with the above arguments, the current research study investigates the effect of TQM practices on OS with the intervening effect of KM practices in the manufacturing sector of Pakistan.

The remainder of the current work is divided into four major divisions. The coming section deals with the related theories, literature, and hypotheses followed by the methodology section in which we discuss the sample, data collection, and instrument-related discussion. The last two sections are relevant with the analysis of the data and discussion of the results along with the implications.

2. Literature and Hypotheses Development

The current research seeks support from the concepts of knowledge management, sustainability management, and the concept of TQM. The perspective of corporate sustainability management stresses how corporations and communities, together, can thrive environmentally and socioeconomically in the long run [34].

More specifically, this theory asserts that by embracing sustainability practices, corporations not only improve their environmental footprint but also can thrive with economic efficiency as at the heart of sustainability management is the use of the least resources to produce the greatest good. Meanwhile, in recent years, the importance of TQM has also been emphasized on all grounds. As a full-fledged organizational philosophy, TQM intends to grow across all departments of the organization [18]. This component is strongly associated with organizational stability [35]. The TQM spectrum can expand economies to a broad-based perspective ranging from a social to an environmental perspective. Likewise, to accomplish this objective, enterprises must accept the concept of quality management by selling valuables to consumers, even after the sale [36]. KM is generally regarded as a process of knowledge-creating, utilizing, sharing, storing, and managing by an organization in order to achieve its business objectives [37]. During the past couple of decades, different studies reported on the relevance of KM with sustainable development [38–40]. The general argument in this perspective is that contemporary organizations are likely to lose their competitive position if they do not incorporate sustainability into the core of their business operations. To this end, sustainability management requires an extensive and continuous learning orientation from organizations based on several trial and error interventions to prepare a solid organizational knowledge for decision making and problem-solving [41]. In a nutshell, all these perspectives seem helpful to develop the theoretical framework of the current research.

2.1. TQM and Organizational Sustainability (OS)

The European Foundation for Quality Management (EFQM), the Swedish Quality Award (SIQ), and the Malcolm Baldridge National Quality Award (MBNQA) describe the basic TQM based on its key themes. The American MBNQA model combines the strengths and weaknesses of TQM with a focus on regulatory governance in both public and private enterprises. The sample model includes six variables, i.e., strategic planning, leadership, process management, customer focus, information and analysis, and human resource focus [42]. Because of the integrity of this model, this study used it to examine the relationship between TQM, OS, and KM.

Manufacturing companies are quickly utilizing natural resources to increase their profits; they produce more products. Compared to the services sector, manufacturing organizations utilize more natural resources which cause environmental mutilation in the form of pollution, especially water and air contamination [43]. Such practices have now led to a constant increase in the temperature of the planet and a decrease in natural resources. In response to this problem, many environmentalists, including several international organizations and NGOs are attempting to raise awareness on environmental issues. Enterprises of the recent era focus on stability, diversity, and cost savings [44].

The natural resource-based view (NRBV) focuses on organizational resources and capabilities as a way of integrating its operations along with a sustainability perspective. Moreover, NRBV provides a basis for determining the relationship between TQM and organizational sustainability [35]. These characteristics are related to the conditions that allow companies to achieve sustainable development to attain a long-term sustainable competitive advantage, in line with NRBV. This method is similar in the manufacturing and service industries [45]. From the stand of green organizational practices, it is important to discuss the three dimensions of the survival of an organization [46]. Companies that invest in organizational sustainability perform better, sell more to their consumers, and are more competitive in their maneuvers [47]. The theme of a sustainable environment focuses on the steps taken by corporations to preserve nature for future generations. It also

examines the environmental effect of business activities, the utilization of natural resources, and preservation [48].

Saving resources and energizing a sustainable environment is essential for the survival of future generations. Organizations cannot neglect their moral responsibilities for society and the environment in the current age. Thus, different stakeholders, particularly government, communities, and consumers expect enterprises to participate in society-environment-enhancing initiatives to balance the negative effect of their operations [49]. Companies that take steps to protect the environment have a constructive effect on their customers and a satisfied workforce as well. Unlike economic stability, which is more abstract and numeric, environmental and social stability are more theoretic and conceptual [50]. In the social landscape of sustainability, organizations have moral programs for social welfare that go beyond their financial and economic well-being [51], for example, organizations' contributions to community development programs, such as contributions to NGOs and participating in public awareness programs, including information on improving products and quality responsibilities [52].

This dimension of OS also takes into account the effect of the organization's social actions on social structures, health protection, work ethics, etc. [53]. In this context, TQM focuses on continuous improvement while striving for optimal performance; there is a long-standing association with longevity, which is important for OS. TQM and OS are one of the priorities of many organizations—their practice is crucial for the production and service businesses [54]. As a result, many companies claim their environment is kind and sustainable in their operations. Since TQM is a process, it can be lengthened to contain all aspects of the OS, as TQM aims not only to improve performance planning but also to make better use of resources. Poor products or services not only lower the economy but also deplete natural resources, resulting in an unsustainable environment. Therefore, we propose the following hypothesis.

Hypothesis 1 (H1). *TQM positively relates to organizational sustainability.*

2.2. Knowledge Management and Organizational Sustainability

Knowledge is an inimitable asset for enterprises to base their competitive position on a solid foundation. KM is the process of ensuring that a company's representatives have accurate information at the right time and place to make an efficient decision [18]. Companies based on KM foundations have a high level of quality and efficiency. Efficient management and understanding processes of new products rely heavily on the KM system [55]. As a result, KM has been considered as a solid foundation for companies to become more competitive in the various industries in the current age. Moreover, KM has every potential to improve the company's innovative potential which is a critical factor of competitive advantage for an organization. According to Zizakov et al. [56], for the ability of a company to develop new products, the process of workflow is highly dependent on efficient KM practices. Thus, KM creates a footing for enterprises to become more advanced and competitive in the market.

With the help of KM practices, organizations translate tacit knowledge into a clear idea so that it could move freely within the organization [57]. KM, through the knowledge workers, leads to knowledge-based economics and companies can receive knowledgeable insights to improve their process [58] and be able to produce new products and services. Commitment to leadership and organizational repute are key factors in shared knowledge. Enterprises can only use KM efficiently and effectively when they use knowledge from diverse foundations. The company should use the knowledge gained from customers, employees, and other shareholders to improve the overall operation of the company.

There are different research studies in which the relationship between TQM and KM has been established. For example, scholars like Stewart and Waddell [59] asserted that enriching the intervention of quality to a wide range of business process including product specifications, customer needs, and continuous improvement indicate a clear relationship

between TQM and KM. Moreover, KM practices of organization support in establishing a quality culture which is essential for an organization's success in a competitive landscape [60]. Likewise, the work of Lin and Wu [61] also indicated that there exists a positive relationship between TQM and KM. The study of Colurcio [62] showed that the TQM orientation of an organization positively influences the KM capabilities of an organization, especially for successful knowledge creation and dissemination. To sum, companies that successfully implement TQM include KM in their operations earn a high-profit share. Therefore, the following hypothesis is proposed.

Hypothesis 2 (H2). *TQM positively relates to knowledge management*.

2.3. TQM, Knowledge Management, and Organizational Sustainability

Relating KM with OS has become a critical business imperative for present organizations to achieve business goals and objectives effectively. Knowledge is essential for the development of an individual, an organization, and a nation. Ashraf [63] and Abbas [18] argue that KM is an important factor in the development of a sustainable organization. Knowledge-based companies are more innovative as compared to other organizations, as they can see new signs of organizational stability [64]. Companies that incorporate knowledge management activities into their business operations are responsible for sharing information with the community [65]. KM helps organizations to develop sustainable use of information resources, social considerations, and environmental and economic issues [66]. Organizations involved in KM activities encourage the sharing of information within and outside the organization. Organizational strengths focus on the efficient organization of KM across all organizational strategies to achieve sustainability in all areas [67]. KM activities support an organization in achieving its sustainability objectives. Thus, the following set of hypotheses is framed. Figure 1 shows the conceptual framework of the current study.

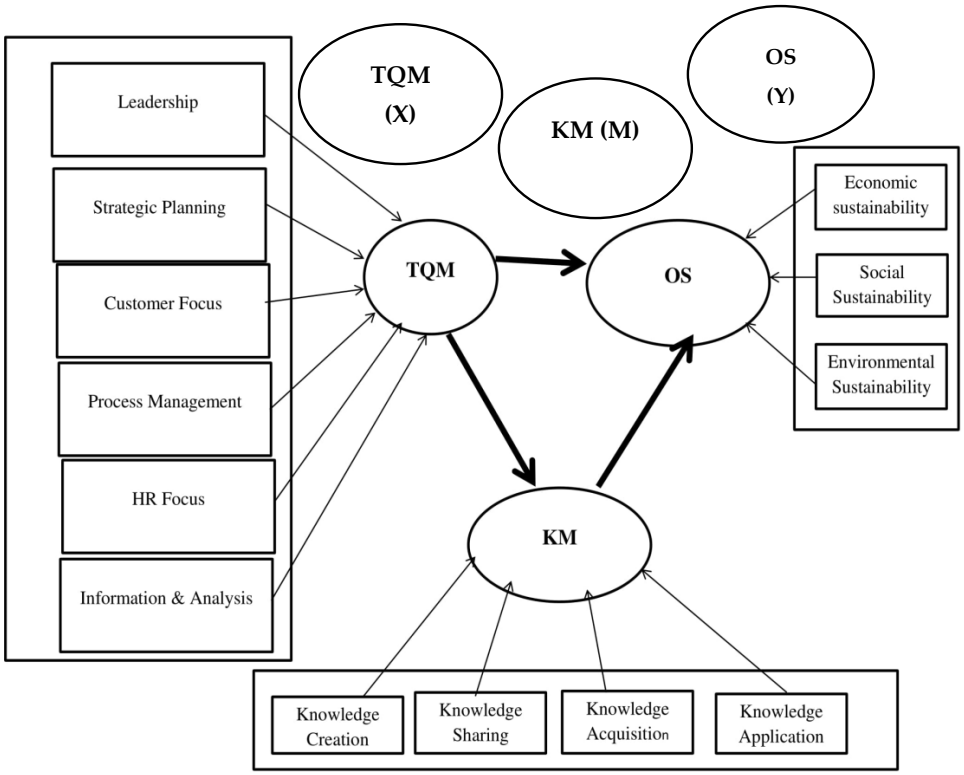

Figure 1. Research model of the current analysis: TQM (X) = the independent construct, OS (Y) = the outcome construct, KM (M) = the intervening construct.

Hypothesis 3 (H3). *KM positively relates to organizational sustainability.*

Hypothesis 4 (H4). *KM mediates the relationship between TQM and OS.*

3. Methodology

3.1. Data Collection

We collected the data from manufacturing organizations in Lahore city, Pakistan. It is to be mentioned here that Lahore city is the industrial hub of Pakistan which constitutes a population of several million. We intentionally selected this city to serve the purpose of the current survey. The specific reason for this intention lies in the fact that during recent years, the city has been declared more than one time as the most polluted city in the world [68]. In this regard, industrial malpractices have been regarded as one of the major reasons for this poor environmental situation [69,70]. Mainly, we visited the Quaid E Azam industrial estate and the Sunder industrial zone of Lahore to collect the data. We only contacted ISO-certified organizations because these ISO-certified organizations are ready to apply environmental certification and social responsibility (for example, ISO 14000 and 26000). In this regard, we formally contacted the selected organizations to support us in the data collection process in the larger interest of academia and the industry. After receiving their formal approval, we then planned a detailed schedule indicating the timing and frequency of our visits in different organizations.

We included low, middle, and senior executives in our dataset, as they responded positively to the survey. Not only did they understand their organizational policies, but they were able to understand different concepts like TQM, KM, and sustainability. Moreover, before starting the data collection phase, we ensured that the ethical guidelines given in the Helsinki Declaration [71] were met accordingly. For example, informed consent from each respondent was obtained to participate in the survey voluntarily. For this purpose, a separate sheet was attached with every questionnaire. Likewise, each respondent was given an equal opportunity to quit the survey at any stage if he/she felt uncomfortable disclosing the information during this process. The instrument for collecting the data was a questionnaire (self-administered) which was given to each participant. Initially, we distributed 800 questionnaires to different organizations. As happens in most data collections through surveys, we did not receive back in full what we distributed. Of those 800 (initial distribution), some questionnaires were incomplete, thus, we could not include them in the final dataset. In this regard, we received 510 valid responses that were processed to analyze the data. This method of data collected is also supported by different scholars [72,73]. The data were collected between December 2020 and March 2021.

3.2. Measures

The questionnaire consisted of three parts. The first part included 36 items based on six TQM dimensions adapted from the MBNQA model. Specifically, the items of TQM were taken from the studies of Saraph et al. [74], Samson and Terziovski [75], Kaynak [76], and Sila [77]. The second part included 14 OS-related items, taken from Turker [78] and Kaynak [76]. Finally, part 3 included 22 items of the KM construct which were taken from Darroch [79] and Lee and Wong [80]. All items were rated on a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. To confirm the reliability and validity of the questionnaire, we conducted a pilot study and collected 42 responses from companies located in Lahore. Preliminary analysis showed an internal consistency of 0.89 for TQM, 0.90 for OS, and 0.82 for KM, which met Hair et al. [81] guidelines of a 0.70 cut-off value.

4. Results

4.1. Common Method Bias

The general approach to detect a common method bias issue is suggested by Podsakoff et al. [82]. Thus, we followed several sequential steps. For instance, the respondent was told that the questions must be answered honestly and that there are no "good" or "bad"

answers. This strategy attempts to reduce the fear in practice and prevents them from giving important social responses. (2) The structure of the instrument was designed very carefully to avoid any possible ambiguity. This is why the instrument had short, simple, and straightforward questions. (3) The importance of the study and the responses from the respondents' participation were explained to them in details. We also initiated a single-factor analysis as recommended by Harman [83]. All items of the instrument were loaded on a single factor using exploratory factor analysis. The results confirmed that there is no single dominant factor that explains more than 50% variance which means there is no issue of common method bias. The above information shows that the general bias of our research does not indicate a major problem [84,85].

4.2. Structural Equation Modeling (SEM)

SEM is an advanced-level data analysis technique that has some significant advantages over conventional multivariate techniques. For example, SEM provides an explicit assessment measurement error. It also enables a researcher to estimate a latent variable through observed variables [86]. In addition, SEM helps an analyst carry out a simultaneous evaluation of the complex models, especially models with mediators or moderators, which was not possible through the conventional data analysis techniques. On a final note, a fully developed model can be tested against the data using SEM as a conceptual or theoretical structure or model and can be evaluated for the fit of the sample data. This is why researchers in the current age prefer to analyze the data by employing SEM [87–89]. According to Chin, Peterson, and Brown [85], SEM is suitable for analyzing the cause and effect analysis of complex models, as is the case with the current study. Similarly, SEM is useful when used to evaluate the implementation of multiple modeling, multiple paths, and/or multi-segment models for each structure. For these reasons, we felt SEM was a useful technique for data analysis of the present study.

To test the hypothesized model, we used a two-step SEM analysis, for all parameter estimations, we used the maximum likelihood method using AMOS. Similarly, to measure the modeled constructs and evaluation, we used confirmatory factor analysis (CFA). With the help of CFA, we were able to examine convergent and discriminant validities along with a reliability analysis of the measurement model. The values of average variance extracted (AVE) were examined to assess convergent validity and composite reliability (CR) values were analyzed to evaluate the reliability of the instrument. Similarly, the discriminant validity was established by taking the square root of AVE. The results of AVE and CR are presented in Table 1, and the results of discriminant validity are shown in Table 2. According to these results all variables have acceptable CR values greater than 0.6. Similarly, the values of AVEs were also within the acceptable range as each construct showed a variance greater than 50%, which means that captured variance by the variable is greater as a result of measurement error [90]. All these results indicate that our proposed model has good internal validity and reliability. As a matter of fact, convergent validity is a measure of association between two observed factors measuring the same construct. Factor loadings more than 0.5 are considered significant loading in the context of convergent validity [90]. In this regard, all factor loadings in our final measurement model exceeded the cut-off level of 0.5. We had to delete some standardized factor loadings due to their weak loading on the respective latent construct. Finally, we examined the discriminant validity of our data by observing square root values of each construct and comparing them to correlation values among other constructs. The rule of thumb is that if the square root of AVE exceeds the correlational values, it means there is evidence of discriminant validity. These results are shown in Table 2.

Table 1. Convergent validity and reliability.

Variable	Items	FL [b] (Min–Max)	T-Value [b] (Min–Max)	α [b]	CR [b]	AVE [b]
TQM second order CFA	6	0.77–0.94	12.06–18.56	0.92	0.96	0.69
Customer focus	4	0.91–0.96	23.49–31.57	0.84	0.86	0.86
Strategic planning	3	0.74–0.82	13.76–17.91	0.88	0.90	0.61
Process management	6	0.75–0.94	11.24–19.78	0.82	0.85	0.69
HR focus (HR)	4	0.75–0.86	14.52–18.86	0.88	0.91	0.65
Information and analysis	4	0.73–0.90	17.94–23.55	0.87	0.89	0.67
Leadership	7	0.76–0.91	16.39–22.82	0.81	0.84	0.67
OS second order CFA	3	0.71–0.95	13.97–21.25	0.89	0.93	0.64
Economic sustainability	3	0.74–0.87	12.84–17.11	0.84	0.87	0.65
Social sustainability	4	0.71–0.95	13.91–19.54	0.92	0.95	0.70
Environmental sustainability	3	0.73–0.84	15.79–20.66	0.86	0.89	0.57
KM second order CFA	4	0.58–0.97	14.48–22.47	0.79	0.82	0.74
Knowledge application	4	0.78–0.96	15.34–21.77	0.91	0.93	0.76
Knowledge creation	4	0.76–0.90	15.92–20.09	0.87	0.90	0.73
Knowledge acquisition	5	0.78–0.94	10.54–16.98	0.80	0.83	0.71
Knowledge sharing	4	0.81–0.90	19.80–24.74	0.92	0.94	0.75

Note: [b] FL, factor- loading; α, Cronbach's α coefficient; CR, composite reliability; AVE, average variance extracted.

Table 2. Discriminant validities and correlations.

	CF	SP	PM	HR	IN	LD	KP	KS	KC	KA	ES	SS	EN
CF	0.93												
SP	0.49 **	0.88											
PM	0.53 **	0.66 **	0.87										
HR	0.41 **	0.48 **	0.56 **	0.81									
IN	0.33 **	0.39 **	0.53 **	0.59 **	0.81								
LD	0.48 **	0.33 **	0.47 **	0.62 **	0.54 **	0.84							
KP	0.50 **	0.47 **	0.51 **	0.46 **	0.60 **	0.64 **	0.92						
KS	0.49 **	0.45 **	0.59 **	0.47 **	0.52 **	0.53 **	0.58 **	0.88					
KC	0.54 **	0.48 **	0.54 **	0.53 **	0.56 **	0.51 **	0.49 **	0.41 **	0.84				
KA	0.49 **	0.39 **	0.51 **	0.59 **	0.59 **	0.53 **	0.43 **	0.48 **	0.65 **	0.87			
ES	0.57 **	0.52 **	0.58 **	0.42 **	0.58 **	0.45 **	0.31 **	0.34 **	0.61 **	0.47 **	0.81		
SS	0.56 **	0.44 **	0.50 **	0.54 **	0.35 **	0.54 **	0.52 **	0.36 **	0.57 **	0.61 **	0.54 **	0.80	
EN	0.42 **	0.48 **	0.53 **	0.58 **	0.59 **	0.47 **	0.32 **	0.48 **	0.64 **	0.48 **	0.49 **	0.56 **	0.77

Note: **, significant at 95 % level. CF = customer focus, SP = strategic planning, PM = process management, HR = HR focus, IN = information and analysis, LD = leadership, KP = knowledge process, KS = knowledge sharing, KC = knowledge creation, KA = knowledge application, ES = economic sustainability, SS = social sustainability, EN = environmental sustainability.

4.3. Hypotheses Testing and Measurement Model

We tested the hypotheses of the present study using the maximum likelihood method in AMOS. Firstly, we tested our measurement model for data fit. For this purpose, we examined different model fit indices such as CFI, IFI, GFI, RMSEA, NFI, and AGFI. All values of model fit indices showed statistical evidence of a better model fitting to the data. We also tested the χ^2/df ratio for less than 5 in order to accept the model for data fit. The findings are shown in Table 3.

Table 3. Model fit indices.

Indicators		Acceptable Range	TQM	OS	KM
Absolute fit index	χ^2/df	1~5	1.89 *	1.30 *	2.53 *
	GFI	>0.9	0.93 *	0.93 *	0.91 *
	AGFI	>0.9	0.96 *	0.94 *	0.90 *
	RMR	<0.08	0.050 *	0.031 *	0.022 *
	RMSEA	<0.08	0.061	0.042 *	0.038 *
Comparative fit index	NFI	>0.9	0.90 *	0.93 *	0.90 *
	CFI	>0.9	0.92 *	0.97 *	0.95 *
	IFI	>0.9	0.94 *	0.96 *	0.95 *
Parsimony-adjusted measures	PNFI	>0.5	0.72 *	0.76 *	0.68 *

* within the acceptable range.

4.4. Structural Model Testing

In order to take the analysis to a further level, we tested our hypothesized relations through SEM in AMOS software with the help of beta values and associated *p*-values. The results are shown in Table 4. According to these results, all hypotheses of the present study showed significant results, which means that all hypotheses were in an acceptable range. From the statistical results, it is evident that TQM significantly predicts KM (beta = 0.351, $p < 0.05$) and KM significantly predicts OS (beta = 0.47, $p < 0.05$); therefore, H2 and H3 are accepted.

Furthermore, we tested the mediation effect of KM in the relationship of TQM and OS with the help of Bootstrapping option in AMOS. The results showed that the indirect effect is 0.166, $p < 0.05$. BootLLCI = 0.127 and BootULCI = 0.439. Neither ULCI nor LLCI include zero, which means zero falls outside of ULCI and LLCI which means the indirect effect is significant and positive. Hence, KM is a significant mediator in the relationship between TQM and OS, so H4 is supported. Similarly, the direct effect of TQM on OS is also significant and positive 0.493, $p < 0.05$, which means that TQM significantly predicts OS, implying that H1 is also accepted. It is notable that the effect size is reduced (direct effect-C) from 0.493 to 0.166 (indirect effect -C') but remained significant which is indicative of the fact that KM is a partial mediator in the relationship of TQM and OS. On a final note, the mediation effect explains more than 25% of the total variance in OS. This effect can be calculated from the formula given in Equation (1). The structural relationships are shown in Figure 2.

$$\text{Proportion of mediation} = \frac{\text{Indirect effects}}{\text{Total effect}} \quad (1)$$

Table 4. Hypotheses testing.

Hypotheses	Path	Relationship	Beta Value ($p < 0.05$)	LLCI/ULCI	Decision
H1	TQM → OS	+	0.493 ***	0.183/0.392	Supported
H2	TQM → KM	+	0.351 ***	0.762/1.138	Supported
H3	KM → OS	+	0.473 ***	0.199/0.537	Supported
H4	TQM → TL → SCA	+	0.166 ***	0.127/0.439	Supported

Note: *** $p < 0.000$.

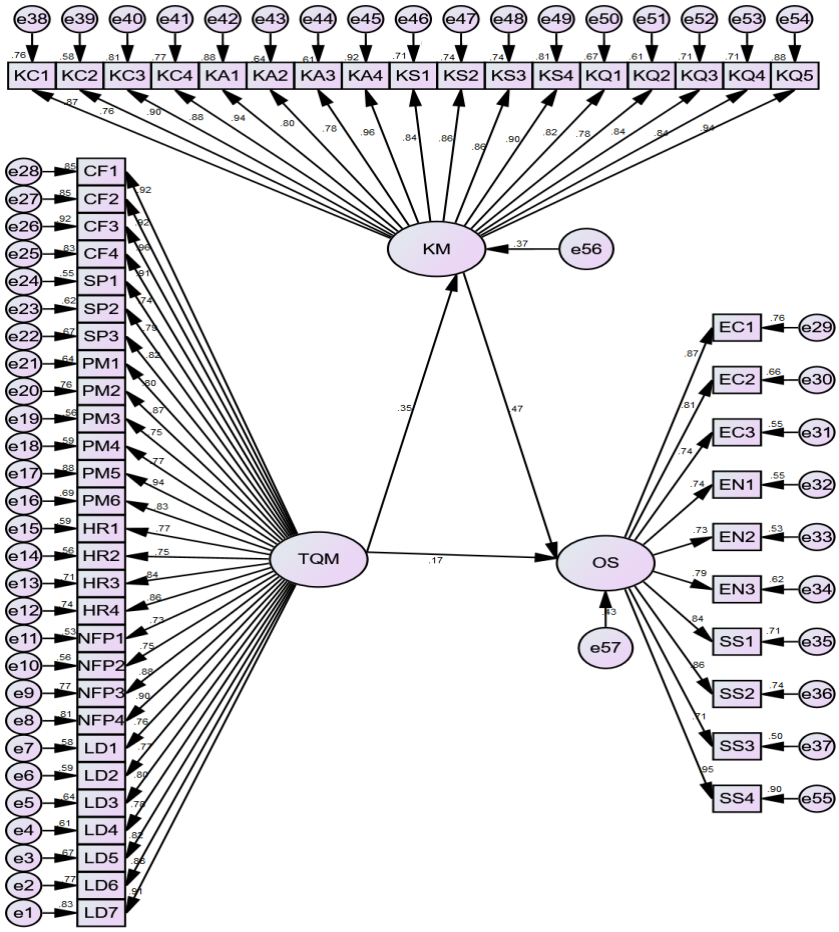

Figure 2. The structural model.

5. Discussion

The current study was carried out to serve two main objectives. Firstly, the study intended to investigate the relationship between TQM and OS from the perspective of a circular economy. To this end, the results of the current study validated that there is a direct relationship between TQM and OS. Successful use of TQM practices in an organization can lead to an enhanced level of OS. These results are in line with the study by Abbas [18], which found a significant impact of TQM on corporate sustainability. However, our results show a contradiction with the findings of Li et al. [91] in the context of Chinese enterprises, in which they indicated TQM does not affect the green performance of the organization. It can now be argued that the basis of TQM is a set of action strategies related to the sustainable development of enterprises.

Altogether, TQM not only reduces economic inefficiency but also protects the environment and nature by transporting them to the environmental permanence of the organization. Improving the level of customer satisfaction, reducing the error rate, and improving key performance indicators of the TQM program can be directly linked to the economic sustainability of enterprises.

The enterprises that are more aware of the impact of their work on the environment seem to be more interested in incorporating the TQM orientation in their business operations [92]. As TQM and environmental management share the same landscape, as they both focus on the efficient use of resources to reduce the level of waste during the value creation processes of a business; they are similar in terms of philosophy. In order to improve its environmental footprint, an organization should implement a TQM program core to its business operations. By combining quality with a competitive environment, a sustainable organization focuses on sustainable development. Moreover, TQM strengthens not only

the organizational environmental initiatives but also boosts organizational repute and market share value which ultimately enhances the overall performance of the organization. Additionally, by applying the TQM approach to a wide range, companies can ensure the impact of green systems, such as low levels of harmful gases and minimal use of natural resources in order to be environmentally friendly. According to the results of Kang et al. [93], TQM had a significant and positive impact on a sustainable social environment. However, compared to economic and environmental sustainability, many companies have neglected social stability in their policies due to the low stability of the triple bottom line (TBL) model [94]. To sum, socially sustainable organizations aim to recognize the impact of their actions on society and the environment in order to take steps, to improve their environmental footprint, and to improve their community. Although social sustainability is complex to understand, it is easy to detect. Thus, the enterprises that understand the importance of social sustainability give prime importance to the initiatives that can reduce their negative impact on the environment. These results are in line with the findings of Andrade Arteaga, Rodríguez-Rodríguez, Alfaro-Saiz, and Verdecho [16], Chen et al. [95], and [96].

Another objective of the current survey was to investigate the mediating effect of KM between the relationship of TQM and OS. In this regard, the statistical findings of the current survey validated the mediating role of KM in the proposed relationship of TQM and OS. It is stated that if organizations implement the TQM program effectively, they will improve their performance of KM and this will also have a significant impact on OS. Moreover, our study confirmed that TQM leads to a higher level of KM activity in the organization. Intelligent organizations see TQM and KM as elements of collaboration, emphasizing the importance of individual employees for knowledge sharing, acquisition, and dissemination in an organization. The results have shown the efficacy of KM to enhance OS, i.e., social, environmental, and economic well-being. The analysis of the mediation role of KM between TQM and OS yielded significant implications and shows that the inclusion of KM in the proposed model is imperative to enhance the overall sustainability performance of an organization. On a further note, both TQM and KM share the same values in many ways; for example, one of the core value of TQM is continuous improvement for which the knowledge repository of an organization is of utmost importance. Likewise, to reduce the error rate, the role of the knowledge worker of an organization is critical. This line of reasoning can be seen in the work of Mendes [97]. In brief, our study brings it to the fore that to attain OS, the role of KM is of paramount importance, as our results proved that when KM is introduced in the model, it explained a significant amount (more than 25%) of the total variation in OS. Thus, the mediating role of KM between the relationship of TQM and OS is proven as per the statistical findings of the current survey.

Implications

TQM and environmental management have a common orientation for long-term goals as both of these concepts emphasize reducing resource utilization, reducing waste, and improving customer satisfaction. To achieve such long-term goals, organizations must focus on integrating good standards of quality system management and environmental management. By combining quality with the environment, a capable organization will be able to induce its continuous improvement in all three areas of sustainability (environmental, social, and economic). As TQM promotes environmental management practices, it can strengthen the organizational image and market share. In addition, by following TQM practices in a broader context, organizations can ensure the benefits of green manufacturing practices, such as low greenhouse gas emissions and wastewater and low consumption of energy and natural resources, making it a more environmentally friendly organization. These results are also in line with the findings of Green et al. [98] and Sriyakul et al. [99].

Similar to the sustainable environment, TQM has shown significant and positive effects on social sustainability in previous studies [93,100]. However, in comparison to the economy and the environment, many organizations have neglected social stability in their

policies, due to the low level of stability in the TBL model. Smart organizations continue to recognize the impact of their actions on society, both positive and negative, and take steps to improve the quality of interaction with primary and secondary partners. Although it is difficult to classify activities for social care, they are easy to identify. Some of the generalizations develop a general policy for workers, consumer rights and workers' rights, rest of employment, volunteering, living standards, health and safety, welfare, community involvement, contributions, or participating in public development programs. Organizations that understand customer experience and relationships recognize the importance of maintaining relationships and being part of their business plans. Thus, a well-planned TQM philosophy not only considers environmental sustainability but also takes care of the social aspect of sustainability.

Our findings also show a positive relation between TQM and economic sustainability. These findings are consistent with various studies, such as García-Alcaraz et al. [101]. According to the results, TQM practices are also helpful in improving the economic health of an organization as the philosophy of TQM stresses efficient management of resources at each level which undoubtedly improves the overall economic efficiency of an organization. One of the main reasons for these results is that both TQM and KM systems improve company performance, such as time management, efficient use of equipment, training, and development, which has an impact on employees and customer satisfaction. Another important reason for improving the economic efficiency of organizations through TQM is that TQM systems reduce the cost of operations and inefficiency of operations, resulting in better and more stable services. While the quality of a product or service can build a brand and competition, firms need to ensure the quality of their operations and services. It is important to note that TQM practices are interdependent, and in order to receive the maximum benefit from them, organizations must supplement the entire process with proper knowledge management practices. In this regard, leadership can play an important strategic role, as leaders have a responsibility to plan and implement organizational plans.

The study has some important social implications, which we will explain one by one. For example, the findings of the current study highlight the importance of TQM and KM in achieving sustainability objectives. Specifically, the study unveils the importance of TQM and KM from the perspective of a circular economy. The notion of circular economy is at the heart of sustainable manufacturing in different developed countries. However, the situation in the context of the developing countries is very different because most of the developing countries (including Pakistan) do not have sufficient resources and knowledge to properly execute the crux of a circular economy. In this context, the current study adds to the discussion of a circular economy by arguing that a well-planned TQM approach supplemented by KM practices may be helpful for sustainable manufacturing. More specifically, the current study adds to the findings of Perey, et al. [102], who acknowledged the usefulness of TQM for waste management and sustainable practices but ignored the importance of KM in this process. Thus, the leadership and management of businesses should increase their commitment to implement TQM programs in the enterprises to ensure not only the achievement of financial stability but also the social and sustainable environment in line with the concept of TBL.

Moreover, it is central to implement the TQM mechanism in all enterprises that can adhere to one of the standard benchmarks such as MBNQA, EFQM, and SQA. However, in Pakistan, many ISO-certified companies only have Lean Manufacturing, Kaizen, Juran Training, and other quality management standards that do not properly acknowledge the philosophy of sustainable development and circular economy. The policymakers of the enterprises have to realize that in the absence of a comprehensive TQM program, achieving organizational sustainability will be a difficult task. The current study supports the basic fundamentals of the MBNQA model and leads to improved quality in organizational decision-making. The results show that TQM practices are important in the manufacturing sector; this study provides a guideline that the TQM philosophy along with KM

should be fully applied in the manufacturing sector of Pakistan in order to get better and sustainable results.

Especially from the perspective of a circular economy, the findings of the current survey have some specific implications. To begin with, it is to be noted that the current pattern in most of the manufacturing organizations in Pakistan is a linear production pattern that follows the philosophy of 'take, make, and waste' without any significant consideration of the concept of a circular economy which is an antonym of linear economy. Although some organizations are striving to incorporate the concept of the circular economy into their business operations, up until now, such organizations could not reap the full benefits of a circular economy. For such organizations, realizing the importance of TQM and KM from the perspective of a circular economy is of utmost importance. More specifically, Pakistan is one of the nations in the world that is ranked high for waste production, as the country has been reported to generate more than 70,000 tons of solid waste on daily basis. In the given scenario, if the manufacturing sector of Pakistan assumes its responsibility and makes it a priority to follow the essence of a circular economy, there is every possibility to think of a better and sustainable future for the country. To that end, the findings of the current survey may be helpful as currently, several industries in Pakistan are ISO certified, but there is a need to shift the way the current organizations follow TQM philosophy in order to think of it as an enabler for a circular economy.

6. Conclusions

The current study is helpful for the manufacturing sector of Pakistan to achieve the sustainability perspective, especially from a viewpoint of a circular economy. It is to be noted that economic transformation is not an overnight process, nor does it depend solely on industrial restructuring. It is, in reality, a change in the mindset, behavior, and priorities of all the concerned stakeholders. Further, to achieve sustainable manufacturing, the circular economy is a way forward for Pakistani businesses. This view can also be seen in some recent studies. For example, the studies of Rahman and Kim [29] and Umer and Abid [103] are some relevant cases in this regard. Furthermore, the industries in Pakistan have to realize the potential of TQM to achieve sustainability and for a transition from a linear economy to a circular economy. Presently, different businesses in Pakistan have ISO standards (14000, 26000, and others); however, most businesses follow such standards to satisfy state laws or as a requirement imposed by the client organization. This is the time to assume TQM from a proactive approach, as the full potential of TQM is not just to satisfy state laws or clients, but beyond that, it can place an organization in a better competitive position through circular production. Similarly, the businesses in Pakistan need to realize the importance of a knowledge resource for achieving a successful transition towards a circular economy. More specifically, proper creation and acquisition of knowledge are critical for its successful application from the perspective of a circular economy [21]. There are some theoretical considerations of the present study as well; first, it enriches the gap between TQM and OS, especially in manufacturing companies of Pakistan. This supports TQM's position that effective implementation of TQM activities can significantly improve an organization's sustainable performance. This study emphasizes the importance of the KM role in the relationship between TQM and CS and confirms KM's principle that good governance not only has a positive impact on personal and organizational activities but also increases their ability to excel in a competitive landscape.

In sum, we have to think green before we can act green and ultimately go green. It is high time to start reimagining the relationship between resources in both our daily lives and the corporate sector and, as a result, reimagine the future we are creating for our next generations. On a final note, our study may generate the same findings in similar economies such as India and Bangladesh. However, in other economies, due consideration and care are necessary before implementing the findings of the current survey.

There are some limitations to the current research. First, the information collected does not include any operational staff. Their opinion may add important insights to the

present research study, so future researchers are required to include operational staff as well in order to get better insights.

In addition, the information was based on the understanding of the participants and not on the financial statements provided in organizational documents, so the actual performance was not measured in the present study. Therefore, in addition to self-understanding, the real data of the organization, such as annual reports, may also provide other evidence of the impact of TQM activity on OS. Data were only collected from industries located in the Quaid E Azam industrial state and Sundar industrial zone of Lahore so the generalizability of the present study is under question. In order to better address the issue, future researchers are required to include more cities in Pakistan.

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