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Does quality management system help organizations in achieving environmental innovation and sustainability goals? A structural analysis

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ABSTRACT

The swift decline in the quantity and quality of natural resources and the public's increased awareness about it is putting steep pressure on manufacturing and services firms to follow eco-friendly practices. The United Nations has made it imperative for organizations to ensure sustainability in their operations. This study investigates whether the quality management system within an organization helps them achieve environmental innovation and sustainable development goals? It also examines does environmental innovation facilitates firms in achieving sustainable development goals? Six quality management practices are taken from the American 'Malcolm Baldrige National Quality Award'; environmental innovation includes product and process innovation, and corporate sustainability includes environmental, social, and economic dimensions. The authors followed the non-probability convenience sampling technique to collect data from the junior, middle, and senior managers from medium and large-size services and manufacturing firms from July 2019 to October 2019. The structural analysis indicated that quality management facilitates firms to achieve their environmental innovation and sustainability goals; environmental innovation significantly enables organizations to achieve sustainability goals. Dimensional analysis indicated that quality management significantly impacts all studied dimensions. However, environmental innovation is found to have an insignificant impact on social sustainability. The findings of this study provide valuable insights to the managers of the manufacturing and services firms concerning eco-innovation and sustainability goals and conclude by offering recommendations for future studies.

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1. Introduction

During the nineteenth century, businesses worldwide rapidly consumed huge natural resources to maximize their revenue (Ji et al., 2021; Shahzad et al., 2020; Umar et al., 2022). This trend has caused a sharp decline in natural resources reserves Goodwin et al. (2022), such as oil and gas but has also considerably damaged the natural environment in the form of air, water, and soil pollution (Wang, Mirza, et al., 2020). The ongoing campaign led by environmentalists to enrich public awareness regarding the diminishing resources and environmental deviations has received significant attention in the last decade (Bibi et al., 2021; Naseer et al., 2020; Su et al., 2021). This campaign has increased the public's awareness about the consumption of natural resources by businesses, particularly the manufacturing industries (Kumari et al., 2022). It has encouraged them to put significant pressure on businesses to follow environment-friendly practices and take measures to restructure their processes Wang, Xue, et al. (2020) so that the emissions of dangerous gases and liquids that cause air, soil and water pollution can be reduced (Xiao et al., 2022). Considering the environmental deterioration and public pressure, the European Union (EU) signed an agreement, i.e., the Paris Agreement, to reduce the emission of greenhouse gases by 40% by 2030 and bring it to zero by 2050 (Kulanovic & Nordensvärd, 2021).

During the late 20th century, total quality management (TQM) was popularized through the superior quality of Japanese products (Kumari, Abbas, et al., 2021). It is a well-established fact that TQM possesses the potential to enhance individual and organizational performance as its target is to ensure improvement in processes through efficient and effective use of resources (Li, Zhao, et al., 2018). It also provides footing to businesses in achieving a competitive edge (Tasleem et al., 2018). For this reason, dynamic firms take it as an integral part of their business strategy (Abbas & Kumari, 2021). Considering the intensification of stakeholders' pressure, several companies have started to link their principal business strategies with the subsequent strategies, such as knowledge management, sustainable development, quality management, etc. (Hwang et al., 2022). Corporate sustainable development (CSD) is a green strategy that integrates organizational development with environmental, social, and economic aspects of development (Karim et al., 2022). The ultimate objective of CSD is to develop a balance of resources not only between contemporary organizations and society but also for future generations and businesses (Abbas & Dogan, 2022). To achieve sustainable development (SD) goals, organizations must re-engineer their traditional operational processes and capitalize on the latest tools and technology to produce environment-friendly products/services (Kazmi & Abbas, 2021). In this regard, green innovation has critical importance.

Innovation refers to introducing something new (product or process/service) or making significant improvements to existing products or services (Awan, 2020). Environmental innovation, also known as green innovation, is a novel concept and has gained the spotlight in recent literature (Su, Li, et al., 2022). According to Xie et al. (2019), green or eco-innovation focuses on developing goods and services which enable firms to achieve corporate sustainability with a particular focus on environmental protection (Ielasi et al., 2018). It also enables the society and economy to develop through technological modernization (Fernando et al., 2019) as it is grounded on new technological knowledge. Technological advancement plays the most significant role in green growth (Al-Rahmi et al., 2020). However, innovation generally requires a considerable volume of time and money. For this reason, a fundamental question is can environmental innovation enable firms for SD?

(Fernando et al., 2019) analyzed the association between environmental innovation and business performance and said that ecological innovations have the potential to improve service innovation, leading to enhanced business performance (Dorfleitner & Grebler, 2022). On the contrary, Li, Jin, et al. (2018) said that environmental innovation activities hinder organizational and economic development activities in China (Su, Khan et al., 2022). The literature indicates disagreement on the relationship between environmental innovation and CSD. Moreover, the question, which is still inclusive and warrants exploration, is, can quality management systems (QMS) in organizations boost environmental innovation and SD activities?

Even though several academicians have examined QMS, organizational growth, and environmental management from diverse standpoints, the nexus of QMS, environmental innovation, and CSD is yet to be explored (Song et al., 2020; Zhang, Rong, et al., 2019). A few studies in the literature have adopted a multivariate statistical technique followed by structural equation modeling (SEM) to analyze whether QMS in organizations impacts their green innovation and SD activities or not? The researchers based their arguments on the United Nations Sustainable Development (UNSD) goals and the 'Green Theory' concepts as the foundation to investigate the link between the studied variables. Thus, this research aims to address the following questions;

RQ1: Does a quality management system facilitates organizations in achieving their environmental innovation goals?

RQ2: Does a quality management system facilitates organizations in achieving their sustainable development goals?

RQ3: Does organizational environmental innovation activities facilitate it in achieving its sustainable development goals?

In the present research, the QMS practices are based on the American 'Malcolm Baldrige National Quality Award' (MBNQA), namely leadership, customer focus, strategic planning, process management, HRM, and information and analysis. Environmental innovation is measured through the process and product innovation, while CS is measured via economic, social, and environmental aspects. The researcher took contextual factors, such as industry type (manufacturing and services) and organizational size (medium and large), as control variables so that the question of whether these factors play a significant part in the relationship among the studied variables or not, can be investigated. The findings of this study will benefit the industrialists, ecologists, governments, and other participants to understand how quality management activities in organizational operations help firms achieve environmental innovation and sustainability goals. It will also suggest measures to be taken by organizations of different sizes to capitalize on quality activities to comply with the United Nations' agenda for sustainable development.

2. Literature review

2.1. Sustainable development

The UNSD goals originate from the Brundtland Commission Report 'Our Common Future' presented in the United Nations General Assembly (UN, 1987). The report focuses on environmental issues caused by businesses' sharp consumption of natural resources to maximize their revenue (Su et al., 2020). The report defined SD as 'the development which fulfils the current generation's needs without compromising future generations' ability to satisfy their needs'. The United States Environmental Protection Agency (USEPA) defined SD as the ability to create and maintain an environment in which nature and humans can exist in harmony, and that satisfies the social and economic needs of the existing and future generations (EPA, 2003). Elkington (2018) proposed the word triple bottom line (TBL) for the three aspects of SD: economic, social and environmental development.

The environmental aspect concentrates on preserving the natural resources and environment, such as clean air, water, and soil, protection of forests and glaciers, and a special focus on minimum consumption of non-renewable resources (Su et al., 2020). In social sustainability, organizations concentrate on societal development and human well-being, such as achieving customer satisfaction through product and service quality, ensuring better working environments, training and development of people, social justice, and measures for the safety and health of employees. Finally, the economic aspect relates to organizational income and expenditures, such as the cost of production, sale, and profitability (Fu et al., 2022).

2.2. Green theory

The green theory is a multidisciplinary philosophy popularized by Eckersley (2010) with a special focus on globalization and environmental sustainability. It also focuses on governance, social responsibility, and human rights. Green theory aims to achieve international development by ensuring domestic, national, and international sustainability. It suggests that to build a sustainable society (Yang et al., 2022). There must be a limit to the growth rate since unprecedented economic growth during the preceding decades mainly relied on fossil fuel consumption (Ji & Zhang, 2019), resulting in environmental issues (Orzes & Sarkis, 2019). Ecologists have urged corporations to incorporate eco-friendly strategies in their operations, which positively impact environmental and economic sustainability (Xie et al., 2022). Moreover, the United Nations Global Compact (UNGC) announced that corporations must capitalize on green technology in their operations (UNGC, 2018).

With the evolution of green theory, environment-friendly processes, particularly environmental innovation, have recently been popularized. Environmental innovation is the creation of a novel idea or the improvement of existing products or processes that significantly improve the natural environment compared to other alternatives (Umar et al., 2020). Corporate sustainability is a broad concept and substantially relies on innovation (Khan & Abbas, 2022). In this scenario, eco-innovation can be a pivotal tool for achieving SD. Environmental innovations can enable corporations to manufacture high-quality, environment-friendly products by utilizing minimum resources, fulfilling customers' needs and enhancing their satisfaction and loyalty (Kumari, Ali, et al., 2021).

2.3. Quality management and environmental innovation

QMS has huge significance in organizational strategic competencies. The American Society for Quality (ASQ) defined quality as 'knowledge and skills for human welfare and development, and the promotion of safety, security, and reliability standards of products for public use' (ASQ, 2018). Based on this definition, two meanings of quality can be generated. Firstly, the traits of an invention, either a good or service, should be able to meet the public needs; secondly, it must not have any deficiency (Su et al., 2020). Since QMS aims to ensure continuous improvement via capitalizing on modern tools, techniques, and values (Deng et al., 2022), firms implement it to minimize operating costs and enhance productivity and quality, leading to enhanced customer satisfaction (Fatima et al., 2021) and improved organizational performance.

QMS has multiple core values in different models, known as Business Excellence Models (BEMs). The three most popular BEMs are the 'European Foundation for Quality Management' (EFQM), the 'Swedish Institute for Quality' (SIQ), and the 'Malcolm Baldrige National Quality Award' (MBNQA). The MBNQA is an American quality award and contains soft and hard elements of QMS (ASQ, 2018). The model has been acknowledged as a significant mechanism for several organizations (public and private) in transforming their administrative principles, operational efficiencies, and achieving competitive advantage. Considering the significance of the MBNQA model, in this study, researchers focused on its 6 aspects, specifically leadership, strategic planning, customer focus, process management, information and analysis, and human resource management (HRM). (Ooi, 2014; Prajogo & Cooper, 2010) also have studied these variables in their research. Figure 1 illustrates the relationship between QMS practices, environmental innovation, and CSD.

Considering the environmental deterioration and natural resources deterioration, environmental innovation and QMS has become critically important (Al-Rahmi et al., 2020; Zhang et al., 2022). As per y, environmental innovation mainly refers to technological advancement, specifically focusing on environmental protection and bringing essential reforms in production and operational processes. It generates a positive effect on the environment and leads to knowledge spill-over, resulting in a double externality effect (Wang, Mirza, et al., 2020). This makes firms consider alternative ways of investing in such technologies, such as government subsidies. (Zhang, Yao, et al., 2019) proposed that state provision is imperative to motivate firms to invest in green technologies and promote a green business environment.

According to (Xie et al., 2019), environmental innovation has two domains, i.e. process innovation and product innovation. Process innovation focuses on minimizing the usage of resources in the production and operations processes through which unprocessed material is transformed and converted into the final product or service (Khan et al., 2022). It also pays special attention to minimizing waste causing pollution in water and air, enabling a sophisticated switch from fossil energy to bioenergy

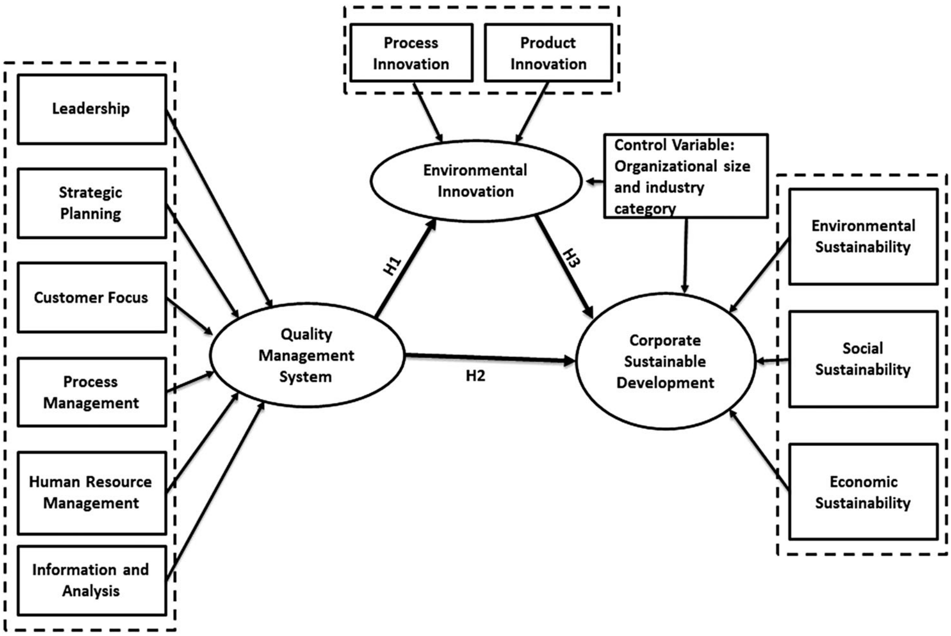

Figure 1. Research framework.
Source: Author's estimation.

and minimum utilization of non-renewable resources. It also brings a systematic improvement in operational processes, which leads to the proficient use of resources (Ahsan et al., 2020). Another uniqueness of process innovation is that it enables firms to improve the quality of a product or introduce a new product, which can help firms expand market share and increase their competitive advantage (Imran & Abbas, 2020).

The focus of product innovation is on improving the composition of existing products/services in a way that they consume biodegradable or materials that are not toxic or utilize a minimum of non-renewable resources (Calza et al., 2017). Thus, the product innovation aims to redesign the product in a way that involves environment-friendly inputs to counter hazardous elements and can be recycled (Yu & Huo, 2019). Eco-product innovation changes the view of the product lifecycle from product development to distribution and from consumption to recycling. (Abbas, 2020c) stated that eco-process innovation facilitates and provides a foundation for eco-product innovation. Organizations that capitalize on eco-products and processes tend to achieve a competitive advantage (Stucki, 2019). The literature provides multiple studies on the role of QMS in employees and organizational performance [such as (Psomas & Antony, 2017; Shafiq et al., 2017)]. It also sheds a brief light on the relationship between QMS and a firm's environmental management system [for example, a study by (Tasleem et al., 2018)]. However, it is yet to be explored whether organizational QMS impacts their eco-innovation activities. For this reason, the following hypothesis is proposed.

H_1: Organizational quality management system has a significant positive effect on environmental innovation

To examine the dimension-level relationship, the following sub-hypotheses are proposed.

H_1a: Quality management system possesses a significant positive effect on process innovation

H_1b: Quality management system possesses a significant positive effect on product innovation

2.4. Quality management and corporate sustainability

Firms complying with QMS can manage resources more effectively than others (Abbas, 2020c). Such organizations enable their employees to become more productive and competitive and enjoy more profitability, customer satisfaction, and trust (Mahmood et al., 2014, 2020). QMS and CSD can be associated with each other since QMS not only aims to enhance institutional performance through continuous improvement and customer satisfaction but also ensures that resources are not wasted, predominantly natural resources, which are the core objectives of SD (Safdar et al., 2020). Moreover, similar to SD, QMS also has a durable impact by considering how business activities impact society and firm productivity over a longer time (Lee, 2020). Abbas (2020c) stated that SD is a continuous process that exclusively focuses on integrating quality in ecological, social, and economic aspects. Therefore, organizations should ensure that the quality concept is applied from acquiring resources to delivering the product or service.

With the emergence of environmental deterioration and global warming, environment-friendly practices have become the most vital and popular concept in the last few years (Zhang, Rong, et al., 2019). In particular, industrial giants, such as China, which have deeply relied on natural resources for energy purposes, have started paying increased attention to green innovation, renewable energy methods, and recycling (Ji & Zhang, 2019). However, a key concern for organizations relating to green innovation is how it will affect their profitability. During the last ten years, because of economic reforms and business-friendly policies, multiple developing countries in the Asian region have experienced substantial economic growth; however, SD is a key concern for stakeholders. Like other regions, most developing countries in Asia have mainly relied on fossil energy, which has resulted in severe environmental issues, such as air and water pollution (Shahzad et al., 2020).

Different countries have started projects to protect the natural environment and promote eco-friendly practices in their regions. For instance, the government of Pakistan initiated multiple projects to promote green development, such as the accomplishment of the ‘One Billion Tree Tsunami’ project in 2017 (WEF., 2018), the ongoing five-year project of ‘Ten Billion Tree Tsunami’ started in 2018 (Constable, 2018), and the ‘Punjab Green Development Program’ (World Bank, 2018). These projects are focused on improving the natural environment and promoting green innovation and development in the country. The government is taking significant initiatives to encourage businesses to follow green quality strategies in their processes.

The literature on the relationship between QMS and CSD presents inconsistent results. For example, Chaithanapat et al. (2022) studied the role of quality management practices in green organizational performance from Chinese manufacturing firms' perspectives and found an insignificant relationship between them. However, (Chaudhry et al., 2022) identified a positive relationship between these variables. Siva et al. (2016) conducted a literature review study on the link between quality and sustainability. They also mentioned inconsistent and contradictory findings between these variables. Thus, this phenomenon warrants further exploration. For this reason, the following hypothesis is proposed

H2: Quality management system has a significant positive effect on corporate sustainable development

To examine the dimension-level relationship, the following sub-hypotheses are proposed.

H2a: Quality management system possesses a significant positive effect on corporate environmental sustainability

H2b: Quality management system has a significant positive effect on corporate social sustainability

H2c: Quality management system possess a significant positive effect on corporate economic sustainability

2.5. Environmental innovation and sustainable development

All businesses across the world face three elementary issues in their operations, i.e., 1) inputs, 2) outputs, and 3) amount of wastage. These three aspects are linked, and their volume is determined by the quality of the processes (Abbas, 2020b). Low-quality products or services damage organizational reputation (Li, , Wang, et al., 2018) and cause waste of human efforts and natural resources, leading to poor economic and environmental performance (Habib et al., 2019). Crude oil and coal have largely been considered as one the major sources of energy for businesses across the world (Ji & Zhang, 2019). However, economic growth based on fossil fuels has several limitations since such energy channels are exhaustible and damage the environment through their by-products, such as carbon dioxide (Abbas, 2020a).

The increased social awareness about declined natural resources has caused significant pressure on businesses to follow environment-friendly practices (Rossiter & Smith, 2018). Moreover, after the UNGC call, organizations worldwide have begun to consider their responsibilities to human rights, labour, and social and environmental aspects (UNGC, 2018). Dynamic businesses are reshaping their operational processes by introducing eco-friendly products and processes and shifting from fossil fuel to renewable or biodegradable energy sources (Chaudhry et al., 2022). However, a key concern in such transformation is that it should ensure the protection and restoration of the natural environment and guarantee firms' economic development (Cai & Li, 2018).

Technological development is central to transforming organizations (Shakoor et al., 2021), especially shifting from traditional production and operation processes to green ones (Alamri et al., 2020). Environmental innovation allows organizations to develop new or improve existing products or processes so that their production and operations processes have zero or minimal impact on the natural environment (Song et al., 2020). It also enables firms to either use recyclable material as input or obtain the maximum output with minimum consumption of resources with minimal to zero waste and emissions causing air, water, soil, and other environmental pollution (Ahmad et al., 2020).

(Yuan & Xiang, 2018) emphasized that organizational development should be linked with eco-innovation as it facilitates the protection of the natural environment. However, firms will invest only in those activities that will help them enhance their financial performance (Zhang, Rong, et al., 2019). Therefore, environmental innovation and development activities should be compatible with firms' long-term goals. In this regard, the government must play its pivotal role by providing technical expertise and infrastructural support to firms, which act as the foundational slabs of eco-innovation and development.

Fernando et al. (2019) proposed that eco-innovation significantly influences corporate environmental sustainability in China. Moreover, through effective QMS and innovation strategies, firms can acquire a competitive advantage in the current competitive business environment (Li, Zhao, et al., 2018). Zeng et al. (2017) stated that QMS facilitates' innovation capabilities in Chinese firms which further leads to corporate sustainability. However, (Li, Jin, et al., 2018) found a negative link between QM practices and green innovation activities in the same country. The literature provides inadequate and conflicting answers to this question. Moreover, this relationship has rarely been explored outside China. Hence, the subsequent hypothesis is drawn.

H3: Environmental innovation possesses a significant positive effect on corporate sustainabledevelopment

To examine the dimension-level relationship, the following sub-hypotheses are proposed.

H3a: Environmental innovation has a significant positive influence on corporate environmental sustainability

H3b: Environmental innovation possesses a significant positive effect on corporate social sustainability

H3c: Environmental innovation possesses a significant positive effect on corporate economic sustainability

3. Methodology

This section contains information about the adopted methodology, including target population and sampling, followed by measurement instruments, a description of the control variables, data analysis, measurement, structural models' results, and hypotheses' results.

3.1. Target population and sampling procedure

The statistical data was collected from five major cities located in Pakistan named Karachi, Islamabad, Lahore, Sialkot, and Faisalabad. The researchers focused on firms registered with the Securities and Exchange Commission of Pakistan (SECP). SECP is the federal regulatory body for businesses and is the most inclusive database for organizations operating in the country. Organizations having ISO 9001 and 14001

Table 1. Demographic of respondents.

Particulars	Description	Value	Percentage
Total received responses	Medium organization	153	52.58%
	Large organization	138	47.42%
Job Position	Lower management	143	49.14%
	Middle management	111	38.14%
	Upper management	37	12.71%
Industry type	Manufacturing	171	58.76%
	Services	140	48.11%
Gender	Male	172	59.11%
	Female	114	39.18%
	I prefer not to disclose	5	1.72%
Years of Experience	Up to 5 years	63	21.65%
	6-10 years	116	39.86%
	11-15 years	79	27.15%
	More than 15	33	11.34%

Source: Author's Estimation.

certification or have applied for it or even intend to apply for ISO 14001 certification were approached. The authors collected data from managerial staff, including the frontline, middle and upper level of manufacturing and services firms, because they have the latest information regarding organizational practices and policies. Besides, their role is imperative as they are disseminators responsible for implementing policies within their teams. The data was collected from July 2019 to October 2019 by personal visit and e-mail correspondence. Yu et al. (2019) followed a similar approach in their studies. The researchers distributed 672 questionnaires, and 311 completed responses were received, out of which only 291 were used for the final analyses. Of this, 52.58% of responses were received from medium-size firms and 47.42% from large-sized firms. Furthermore, 58.76%, i.e., 171 responses were received from companies in the manufacturing sector, and 48.11%, i.e., 140, were received from services sector firms. Detailed demographic information is presented in Table 1.

3.2. The measurement instrument

The researchers divided the study instruments into three segments. The first section contained thirty-six items linked with the MBNQA model's six dimensions for QMS. Strategic planning was estimated via six items, leadership via five items, HRM via eight, customer focus by seven items, information and analysis via five items, and process management through five items. The constructs utilized for the first segment were withdrawn from Saraph et al. (1989), Kaynak (2003), Prajogo and Sohal (2006), and Fuentes et al. (2006). The second segment contained ten items for two dimensions of environmental innovation specifically; product innovation and process innovation (five items for each dimension), and the items were utilized by Amores-Salvadó et al. (2014) and Kam-sing Wong (2012). The final segment comprised fourteen items associated with three aspects of CSD such as economic, social, and environmental sustainability. Economic sustainability was measured via four items, whereas social and environmental sustainability via five items. The items were followed by (Turker, 2009; Wijethilake, 2017).

The data was collected on a five-point Likert scale (1 signified strongly disagree and 5 as strongly agree). (Hinkin, 1998) suggested that a pilot study was employed to check the validity and reliability of adopted constructs concerning Pakistan. The data was collected from 30 organizations (one person from each firm) situated in Lahore. According to Yurdugül (2008), a sample of 30-50 is enough for an initial survey. Out of 30, 21 were approached online, and 9 were self-administered. As suggested by Yurdugul, the reliability of collected data was checked using Cronbach's alpha test. The values for internal consistency of constructs ranged from 0.82 to 0.97, which is in harmony with Hair et al. (2010) minimum condition of 0.7 value. The researchers started the comprehensive survey based on the initial survey.

3.3. Description of control variables

This study comprises two control variables, specifically industry category and organizational size. The reason to incorporate organizational size as a control variable is that large corporations own more assets, resources, and infrastructure than small or medium-sized ones. The researchers followed Huo et al. (2014) suggestions and categorized organizations into medium and large sizes, keeping in mind the number of employees. Firms with fewer than 200 were considered medium size, and firms exceeding 200 employees were regarded as large size firms. Yu et al. (2019) also incorporated a similar approach in their research. The industry category is another control variable in this research, including services and manufacturing. The authors took the industry group as a control variable as the working style of the manufacturing industry is different, and the issues faced by this industry vary from the services industry.

4. Analysis of data

The SEM technique was employed to observe the relationship among variables i.e., QMS, environmental innovation, and CSD. The researchers used SPSS v.25 for statistical analyses and Amos v.25 for structural analyses. Prajogo and Cooper (2010) state that SEM practice can eradicate biases effect; these biases are caused by errors in measurement and form latent constructs hierarchy. (Lee, 2010) suggest that multivariate assumptions, like adequate sample size, evaluation of multi-collinearity, and unbusiness should be fulfilled to implement SEM. The appropriateness of the sample size was examined via the Kaiser-Meyer-Olkin (KMO) test and presented a 0.923 value. This value is in harmony with Kaiser and Rice (1974) minimum condition of 0.6 and signifies the adequacy of the sample size. Variance inflation factor (VIF) was employed to examine the multi-collinearity element with a value of 2.251, according to Hair et al. (2010) requirement of a value below 4, thus representing no existence of multi-collinearity. Schwarz et al. (2017) outlined common method bias (CMB) as a serious concern in quantitative research. The current research examined CMB via Harman's single factor test, which represents a value of 39.43%. Podsakoff et al. (2012) proposed that if the result of a single-factor is below 50% of overall variance, CMB does not impact results. Thus, we can state that there is no issue related to CMB in data. The empirical results indicate that the data fully meets the multivariate statistical assumptions for SEM.

4.1. Evaluation of the measurement and structural model

To analyse the association between latent variables and their factors via a measurement model, confirmatory factor analysis (CFA) was employed. According to Hinkin, CFA assures the unidimensional and fitness of the statistical model. The reliability of the data was examined through Cronbach alpha which highlighted the value of 0.903. This result is under Peterson's (1994) lowest condition of value of 0.8, along with Lance et al. (2006) requirement of 0.7. Thus, we can state that measurement possesses adequate reliability. The researchers further examined discriminant and convergent validity. Awang (2012) and (Hair et al., 2010) suggested that factor loading is utilized to analyze convergent validity, and the best loading value is above 0.6 for established items. Besides, according to Molina et al. (2007), the minimum value for average variance extracted (AVE), should be greater than 0.5 for all constructs. Additional details regarding quantity of items, their loading, AVE values and composite reliability is present in Table 2.

Researchers executed a discriminant validity test to assure that all constructs are different from each other empirically. For discriminant validity, Fornell and Larcker (1981) suggested that the variance of constructs must be greater than others. Moreover, if the square root values of AVE possess a high correlation among pair indicators, it is also considered another important indicator of discriminant validity. Hair et al. (2010) state that the independent variables' pair correlation values should not exceed 0.9. All results presented in Table 3 follow Hair et al. (2010) and Fornell and Larcker (1981), and all constructs possess ample discriminant validity.

Kaynak (2003) emphasized checking out the goodness of fit of the statistical model by focusing on seven determinants, i.e. normative fit index (NFI), chi-square to the degree of freedom (χ^2/DF), root mean square error of approximation (RMSEA), the goodness of fit index (GFI), comparative fit index (CFI), adjusted goodness of fit index (AGFI), and standardized root mean squared residual (SRMR). The tucker-Lewis index (TLI) was further included in the study to assure the measurement and structural model fitness. The results display that the value of χ^2/DF is 1.152 and is clearly below 2 as suggested by Byrne (1989) and also is under Bagozzi and Yi (1988) condition to be less than 3. Moving on towards analysis of NFI, CFI, TLI, GFI, and AGFI, shows the value is pretty fine, above 0.9 as advised by McDonald and Marsh (1990), Bagozzi and Yi (1988), Bollen (1986), Bentler and Bonett (1980) and Byrne

Table 2. Reliability and validity of the instrument.

Construct	Items	Factor Loading Ranges	Composite Reliability[2]	AVE[1]
Leadership	5	0.541-0.931	0.902	0.641
Strategic Planning	6	0.722-0.878	0.856	0.609
Customer Focus	7	0.745-0.905	0.839	0.611
Process Management	5	0.742-0.868	0.877	0.631
Human Resource Management	8	0.658-0.912	0.913	0.629
Information & Analysis	5	0.723-0.914	0.886	0.658
Environmental Sustainability	5	0.715-0.912	0.823	0.602
Social Sustainability	5	0.748-0.911	0.879	0.619
Economic Sustainability	6	0.687-0.916	0.902	0.621
Process Innovation	5	0.732-0.897	0.867	0.669
Product Innovation	5	0.812-0.919	0.894	0.636

[1]Average variance extracted (AVE) value should be ≥0.5 (Molina et al., 2007).
[2]Composite reliability value should be ≥0.7 (Molina et al., 2007).
Source: Author's Estimation.

Table 3. Constructs' discriminant validity.

Construct	LD	SP	CF	PM	HRM	IA	ENS	SS	ECS	EPDI	EPCI
LD	***0.801***										
SP	0.469	***0.780***									
CF	0.512	0.532	***0.782***								
PM	0.521	0.523	0.513	***0.794***							
HRM	0.454	0.513	0.495	0.532	***0.793***						
IA	0.423	0.554	0.564	0.512	0.576	***0.812***					
ENS	0.523	0.572	0.569	0.487	0.562	0.564	***0.776***				
SS	0.495	0.511	0.512	0.523	0.495	0.474	0.579	***0.787***			
ECS	0.532	0.563	0.534	0.497	0.565	0.425	0.564	0.490	***0.788***		
EPDI	0.499	0.578	0.610	0.575	0.553	0.585	0.486	0.523	0.597	***0.818***	
EPCI	0.589	0.499	0.496	0.543	0.453	0.483	0.613	0.554	0.477	0.543	***0.797***

ECS = Economic Sustainability, SS = Social Sustainability, ENS = Environmental Sustainability, EPCI = Eco-process Innovation, EPDI = Eco-product Innovation, IA = Information & Analysis, HRM = Human Resource Management, PM = Process Management, CF = Customer Focus, SP = Strategic Planning, LD = Leadership; Bold and italic values are AVE square root value for each construct.
Source: Author's Estimation.

Table 4. Model fit measures.

Goodness of fit measures	CMIN/DF	NFI	GFI	AGFI	CFI	TLI	RMSEA	SRMR
Recommended value	≤3[1]	≥0.9[2]	≥0.9[2]	≥0.9[2]	≥0.9[2]	≥0.9[2]	≤0.08[3]	≤0.800
Measurement model	1.152	0.919	0.917	0.908	0.947	0.958	0.029	0.0366
Structural model	1.154	0.932	0.957	0.929	0.949	0.938	0.033	0.0337

1(Hu & Bentler, 1998) [2](Browne & Cudeck, 1992)[3](Bagozzi & Yi, 1988; Bollen, 1986; Byrne, 1989)[4](Bagozzi & Yi, 1988).
Source: Author's Estimation.

(1989). The value of RMSEA is 0.029, significantly below the maximum allowed value of 0.08, as (Browne & Cudeck, 1992) recommended. To end with, the SRMR value is 0.0366, fulfilling the 0.8 criteria proposed by Hu and Bentler (1998). After estimating the statistical model, the authors analyzed the structural model with results specifying a χ^2/DF value of 1.154. Additionally, the results of these fit indices i.e. NFI, CFI, GFI, AGFI, and TLI are beyond 0.9 value and are in harmony with McDonald and Marsh (1990) and Bagozzi and Yi (1988). The value of RMSEA is 0.033, which fulfills the condition of Browne and Cudeck (1992) Finally, the structural model's SRMR value is 0.0337, which is in accordance with Hu and Bentler (1998) (refer to Table 4 for further specifications). Keeping in view the outcomes further, we can state that the chosen structural models and their measurements perfectly fit with the data collected.

4.2. Analysis of hypotheses

The hypotheses were analyzed following the SEM technique using AMOS v. 25 software. The structural analysis exhibits that QMS possesses a significant positive effect on environmental innovation with β and p-values of 0.228 and 0.032; therefore, $H_{1,}$ i.e., Quality management system has a significant positive effect on environmental innovation, is accepted. QMS also showed a significant positive effect on CSD with a β value of 0.217 and a p-value of 0.019, leading to the acceptance of $H_{2,}$ i.e., a quality management system has a significant positive effect on corporate sustainable development. Finally, environmental innovation also depicts a significant influence on CSD with β and p-values of 0.299 and 0.004, respectively. Hence, all the principal hypotheses, i.e., H_1, H_2, and $H_{3,}$ are accepted. However, the dimensional analysis presented

Table 5. Results of hypothesis testing.

Hypothesis	Constructs	Coefficient	Critical ratio	p-Value	Decision
H1	QMS → EI	0.228	2.209	0.032*	Supported
H1a	QMS → EPCI	0.213	2.261	0.013*	Supported
H1b	QMS → EPDI	0.191	2.219	0.021*	Supported
H2	QMS→ CSD	0.217	2.275	0.019*	Supported
H2a	QMS → ENS	0.221	2.325	0.009*	Supported
H2b	QMS → SOS	0.161	1.204	0.041	Supported
H2c	QMS → ECS	0.273	2.483	0.006*	Supported
H3	EI→ CSD	0.299	3.373	0.004*	Supported
H3a	EI → ENS	0.357	4.173	0.001**	Supported
H3b	EI → SOS	0.138	1.794	0.063	Not supported
H3c	EI → ECS	0.218	2.113	0.039	Supported
Control Variables					
Firm size	FS → EI	0.029	0.910	0.291	Insignificant
	FS → CSD	0.031	0.887	0.574	Insignificant
	FS → EPCI	0.069	0.994	0.392	Insignificant
	FS → EPDI	0.049	0.826	0.403	Insignificant
	FS → ENS	0.084	0.110	0.121	Insignificant
	FS → SOS	0.081	1.244	0.048*	Significant
	FS → ECS	0.041	0.532	0.601	Insignificant
Industry type	Ind-Typ → EI	0.093	1.539	0.037*	Significant
	Ind-Typ → CSD	0.042	0.278	0.045*	Significant
	Ind-Typ → EPCI	0.048	0.834	0.042*	Significant
	Ind-Typ → EPDI	0.042	0.643	0.038*	Significant
	Ind. Typ → ENS	0.091	1.473	0.039*	Significant
	Ind. Typ → SOS	0.037	0.527	0.665	Insignificant
	Ind. Typ → ECS	0.058	.738	0.293	Insignificant

* $p \leq 0.05$; ** $p \leq 0.01$; Ind. Typ = industry type, FS = firm size, ECS = economic sustainability, SOS = social sustainability, ENS = environmental sustainability, CSD = corporate sustainable development, EPDI = eco-product innovation, EPCI = eco-green process innovation, EI = Environmental innovation, QMS = quality management system.
Source: Author's Estimation.

mixed results. Environmental innovation revealed an insignificant effect on corporate social sustainability with β and p-values of 0.138 and 0.063. Therefore, the sub-hypothesis $H_{3b,}$ i.e., environmental innovation's significant and positive effect on corporate social sustainability, stands rejected. All the other-dimensional analyses showed a significant positive impact, resulting in the acceptance of sub-hypotheses H_{1a}, H_{1b}, H_{2a}, H_{2b}, H_{2c}, H_{3a}, and H_{3c}. The detailed results of these hypotheses are given in Table 5.

5. Discussing the results

This research is conducted to study the influence of QMS on environmental innovation and CSD. The data was collected from the junior, middle, and senior managers of medium and large-sized manufacturing and services firms. As per the results, QMS significantly positively affects environmental innovation. This finding corresponds to (Abbas, 2020a) study that TQM expands the process innovation capabilities of businesses. But, it contradicts Li, Zhao, et al.'s (2018) finding that quality management program negatively affects green technology and green management innovation in Chinese manufacturing organizations.

QMS involves several processes, including continuous improvement, customer focus, efficient utilization of resources, and information and analysis. Dynamic organizations tend to ensure improvement in their operations through innovation to fulfil customers' and stakeholders' requirements and comply with environmentally-friendly regulations. Quality committed organizations to try to capitalize on available resources to foster innovation capabilities and provide a breakthrough in green products and processes. The results indicate that the firms that participated in the study are proficiently benefiting from QMS within their setup concerning eco-innovation, and it can be said that senior managers in these firms are demonstrating a strong commitment to quality and eco-friendly practices, as Tideman et al. (2013) proposes leadership commitment has critical importance in achieving organizational objectives. Moreover, environmental protection through green technology and innovation and related regulation by the government of Pakistan has encouraged businesses to link quality management practices with eco-friendly technology.

The results also point out that QMS positively and significantly affects CSD. This finding complies with Usrof and Elmorsey (2016) work implying that TQM positively affects organizational and economic sustainability. This also further supports Tasleem et al. (2018) finding that quality committed organizations experience better financial sustainability than those with an inadequate focus on quality assurance. This result indicates that QMS in the sampled firms significantly enables them to achieve SD goals. When a firm aims for SD, along with a comprehensive system such as QMS that facilitates workers to improve their performance through customer focus, updated information, analysis, etc., this will empower organizations to manufacture the finest products with minimal input of resources enabling firms to achieve SD objectives.

The result shows that environmental innovation has a significant positive relationship with CSD. This complies with Xie et al. (2019) study, which indicated that green innovation influences organizational financial performance positively. It also relates to (Abbas, 2020c) finding that eco-innovation and organizational performance are positively related. However, it contradicts Li, Jin, et al. (2018) finding that organizational green innovation activities hinder financial growth. According to sustainable development theory and green theory, green innovation activities allow firms to gain the trust of customers, suppliers, society, government, and other stakeholders. Pakistan is a developing country where industries have relied heavily on natural resources to produce products and services, thus causing severe damage to the natural environment. Over the last decade, the government of Pakistan has taken multiple initiatives to protect the natural environment, such as Punjab Green Development Program (World Bank, 2018), the 'Ten Billion Tree Tsunami' started in 2018 (Constable, 2018), the 'One Billion Tree Tsunami' project completed in 2017 (WEF., 2018), etc. The government of Pakistan is also encouraging businesses to invest in environmentally friendly technologies. Moreover, the rigorous environmental regulations and significant penalties for non-compliance have motivated corporations to invest in environment-friendly technology and achieve SD goals through ecological innovation.

The dimensional analysis indicated that QMS substantially positively affects environmental product and process innovation. It also strongly impacted the environmental, social, and economic dimensions of sustainability. This demonstrates the sampled firms are adequately complying with their socio-environmental responsibilities. Environmental innovation highlighted a significant positive impact on environmental and economic sustainability. However, it displays an insignificant influence on social sustainability. Hence, it can be said that the sampled firms need to pay adequate attention to their social responsibilities. Multiple scholars, such as (Guerrero-Villegas et al., 2018) and (Asrar-ul-Haq et al., 2017), have stated that organizational social activities significantly enhance performance. Therefore, it is recommended that the sampled firms link their business strategies with quality and social activities to acquire the benefits as reaped by socially responsible firms.

Considering the contextual effect, the current study also involves two control variables: organizational size (medium and large) and industry category (manufacturing and services). The inclusion of firm size as a control variable significantly affected social activities. This means that firm size significantly regulates the organizational level of social participation, and large organizations are more likely to participate in social development activities than small ones. The insignificant impact of firm size linked with green innovation, CSD, and their other dimensions indicates that QMS is similarly imperative for firms of all sizes to accomplish green innovation and QM goals. This means that if firms, irrespective of their size, implement QMS programs in their operations, medium and large-size firms can enjoy the benefits of QMS from CSD and innovation perspectives.

The analysis of the industry category also indicated a significant impact on environmental innovation and CSD. It also exhibited significant results for eco-product and process innovation and environmental sustainability dimensions. These significant results indicate that industry type substantially controls the effect of environmental innovation and CSD. It also highlights that the significance of environmental process, product innovation, and corporate environmental sustainability varies from industry. Manufacturing industries are more likely to implement QMS to enhance their performance in earlier mentioned areas than services industries. One of the key reasons could be the differences in the operations of both industries. The insignificant result of industry type with social and economic sustainability indicates that regardless of the industry type, it is QMS that enables firms to achieve social and economic sustainability.

5.1. Research implications and limitations

The current research's findings indicate the imperativeness of institutionalizing QMS in corporations. It also accords with the supporters of QMS's claims that the efficient execution of QMS has the potential to strongly flourish an organization's capabilities to be an environmentally friendly organization and achieve SD goals. Hence, to obtain the maximum benefits from QMS, top management should ensure that its practices are being implemented in their organizations in the true spirit. This research also holds up with ideas of the MBNQA model, i.e., quality operations in an organization lead to excellent outcomes. Therefore, it is recommended that organizations should go along with EFQM, MBNQA, and SQA quality models and associate them with business strategies to accomplish green innovation and SD goals. This study further enlightens the role of QMS that manufacturing firms must achieve green innovation and CSD goals than services. One of the key reasons could be the heavy reliance of manufacturing firms on using natural resources as raw materials, which are converted into the final product. Regardless a firm is medium-sized or large, QMS is just as important. So, this research delivers a sense of belief to the managerial staff of medium-size firms in case they implement the QMS in its true spirit. It will contribute to their firms equally to large firms. The constructive results of QMS in environmental innovation and CSD in organizations located in Pakistan direct towards if organizations apply and properly execute QMS practices, regardless of a nation's development level, that will enhance their innovation and SD capabilities.

Comparable to other studies, this research also comprises a few limitations. The researchers collected the data by contacting managers and requested them to operationalize the research instrument, keeping in view the corporation's achievements and productivity; therefore, collected information is based on managers' perceptions and may have caused biases in data. Other researchers should engage non-managerial staff in their studies as well. Even though the CMB test is analyzed properly, the likelihood of bias can't be completely eradicated. Hence, along with opinion, the hard data of corporations, specifically annual financial reports, exhibits further indication regarding the role of QMS in CSD and environmental innovation.

Moreover, the sample was generated from the front line, middle, and upper-level managers and didn't include the operational staff, though their opinion may help with further insights. Thus, in prospective studies, researchers may involve them in further unravelling aspects of the subject matter. It is further suggested that prospective researchers should include other countries, as well as the present study, which is limited to different cities of Pakistan.

6. Conclusion

The present study examines the nexus of QMS, CSD, and environmental innovation through SEM from Pakistani manufacturing and services firms' perspectives. The researchers examined the influence of QMS on CSD and environmental innovation, trailed by the impact of environmental innovation on CSD. Results illustrate that QMS facilitates firms for ecological innovation and CSD. Eco-innovation further strengthens firms to attain SD goals. According to the contextual analysis, QMS is similarly imperative as environmental innovation and SD are for organizations, specifically medium and large firms. However, manufacturing firms need to pay more attention to eco-innovation and SD activities than services firms.

Disclosure statement

No potential conflict of interest was reported by the authors.

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