Total quality management and sustainability in the public service sector: the mediating effect of service innovation

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Total quality management and sustainability in the public service sector: the mediating effect of service innovation

Abstract

Purpose: This study aims to critically investigate the structural relationships between total quality management (TQM), service innovation, and sustainability performance in the public service sector of the United Arab Emirates (UAE).

Design/methodology/approach: The study employed an online survey to collect data from 400 employees working in eight selected UAE public service sector organisations located in Abu Dhabi. The collected data were analysed using structural equation modelling (SEM) to empirically examine whether TQM practices improve service innovation and, subsequently, sustainability performance in the UAE's public service sector.

Findings: The results show that TQM has a significant impact on service innovation and sustainability performance in the UAE's public service sector. Additionally, service innovation partially mediates the relationship between TQM and sustainability performance.

Practical implications: The public service sector's TQM practices and service innovation in the UAE have a much greater impact on social and environmental sustainability than on economic sustainability performance. Adopting five dimensions of TQM [following the Abu Dhabi Award for Excellence in Government Performance (ADAEP) model] across the UAE's public organisations will enable government departments to deliver innovative services to its beneficiaries.

Originality: This study provides a substantial contribution by addressing the gaps in the literature. Very few studies have empirically investigated the possible association between TQM, service innovation, and sustainability performance in public sector organisations, particularly in developing countries such as the UAE, where the increasing efforts in TQM practices are still in their emerging stages, mainly targeting innovative service offerings and sustainable performance.

Keywords: Total quality management elements, Service innovation, Sustainability performance, Public service sector, Resource-based view.

Paper type: Research paper.

1. Introduction

Over the last few decades, organisations in the public sector have encountered unprecedented challenges (Burke and Martin, 2016). Issues such as budgetary pressures, the rising demand for financial accountability, and the lack of resources, combined with the dynamic and changing public expectations for services provided by the public sector (Mättö, 2019), as well as sustainability issues (Abbas, 2020; Tasleem *et al.*, 2019), require new, high-quality solutions that are different and innovative in nature (Mättö, 2019). Sustainability involves suitable response paradigms in respect to economic, social, and environmental responsibilities concerning products, services, processes, and organisational performance (Abbas, 2020; Adams *et al.*, 2014; Calabrese *et al.*, 2018). Improving sustainability performance has, however, been an area of concern for most organisations, including those in the public service sector, as their long-term sustainability has been threatened by various factors, encompassing economic, social, and environmental concerns. These include growing carbon footprints, waste generation, environmental pollution, diminishing water resources, and human rights issues (UAE Government, 2020).

Although both the public and private sectors are seeking to outsmart each other by undertaking various quality management initiatives, the private sector is considered to still be ahead in terms of total quality management (TQM) (Krishnan, 2016). Several studies have indicated the possible association between TQM and sustainability performance in the private sector. For example, the effective execution of TQM influences firms' green innovation significantly (Li *et al.*, 2018), which is a vital dimension of sustainability performance (Yu and Huo, 2019). Moreover, Xie *et al.* (2019) stated that firms can introduce environmentally friendly products and services by focusing on processes, which is one of the important components of TQM. In contrast, very few studies have shown the possible impact of TQM practices on sustainability performance in the public sector. Even though some studies in the public sector have been conducted in the felid of TQM and green practices, they have not scrutinised their potential effects on sustainability performance in the public sector. For example, Wynen *et al.* (2016) examined the determinants for the use of TQM techniques in the public sector and found that organisational autonomy and control of results lead to negative results. Further, Xie *et al.* (2019) recommended that the government sector effectively implement green technology innovation to improve financial performance. However, in line with experiences in private sector organisations, the result of these studies can be generalised to public-sector-related literature in terms of hypothesising that the efficient adoption of TQM and green environmental practices are crucial for improved public service delivery and sustainability performance (Wynen *et al.*, 2016; Xie *et al.*, 2019).

However, most empirical papers in the field of TQM and sustainability performance have only emphasised a single dimension of sustainable performance, namely the economic dimension. In this context, several empirical studies have examined the connection between TQM practices and financial performance or organisational performance (Dahlgaard *et al.*, 2019; Nawelwa *et al.*, 2015). In contrast, regarding the social dimension of sustainability, relatively few studies have examined the relationship between TQM applications and stakeholder benefits (Abbas, 2020; Lo and Chai, 2012). Concerning environmental performance, some empirical studies have found TQM's contribution toward environmental performance, such as green innovation (Li *et al.*, 2018; Zhu *et al.*, 2013). However, very few studies have empirically investigated the association of TQM and sustainability performance dimensions, such as economic, social, and environmental sustainability in public sector organisations, which reveals a gap that requires further study.

On the other hand, many quality management techniques are required to enhance existing services (Mättö, 2019), implying that TQM could be a better mechanism to produce service innovations. Service innovation is referred to as an innovation that can be seen in numerous scenarios within the service sector that are either developing completely new types of services or enhancing existing services (Tsai and Wang, 2017). As highlighted by Ng (2009), innovations and quality management are expected to be interrelated, although empirical studies on service innovation and TQM in both the private and public sectors are still lacking in the existing literature.

Regarding the above three constructs (TQM, service innovation, and sustainability performance), very few studies have empirically examined the possible impact of TQM and service innovation on sustainability performance in the public sector, either in developed or developing countries such as the United Arab Emirates (UAE). Extant TQM and innovation literature has highlighted the need to investigate methods for delivery enhancement in organisational efficiency in the public sector that synthesises quality improvement and a path towards innovation generation (Mättö, 2019; Tasleem *et al.*, 2019). One promising alternative could hence be a TQM method, accompanied by service innovation creation, which highlights the necessity of empirically investigating both applications in relation to sustainability in the public sector.

In the context of the UAE, the considerable substantiality issues (UAE Government, 2020) have raised the question of whether the country's public sector organisations are effectively improving their sustainability performance. However, alongside TQM efforts and service innovations in administrative development, the UAE government is also engaged in changing the organisational culture, ethos, and mindsets of public sector employees to prepare organisational environments for the adoption of quality management, innovations (Mansour and Jakka, 2013), and sustainability performance (UAE Government, 2020), both now and in the future. All these efforts in the UAE public sector are, however, in their emerging stages, thus requiring empirical investigation of how their TQM practices can lead to public service innovation and, subsequently, sustainability performance. The lack of empirical evidence in the extant literature also implies the necessity of conducting novel studies to simultaneously investigate the relationships between TQM, service innovation, and sustainability. The above discussions lead to questioning whether the UAE's public service sector organisations' efforts regarding the adoption of TQM practices actually improve their sustainability performance through service innovation. Hence, the present study seeks to answer the following three research questions:

> *RQ1:* Do TQM applications within the UAE's public sector significantly and positively affect sustainability performance?

> *RQ2:* Is TQM in the UAE's public sector a source of service innovation within the UAE's public sector organisations?

> *RQ3:* Does service innovation in the UAE's public sector mediate the relationship between TQM and sustainability performance?

The remainder of the paper is organised as follows. Section 2 details the relevant literature on TQM, service innovation, and sustainability performance, followed by theoretical and hypothesis development. Section 3 discusses the methodology, while the results are presented, analysed, and discussed in Section 4. Section 5 elaborates the contributions of the study, with theoretical and managerial implications provided in Section 6, and limitations and scope for further research discussed in Section 7.

2. Literature review and hypotheses development

2.1 TQM and sustainability performance

TQM as a management strategy aims to enhance customer satisfaction and organisational performance by providing high-quality products and services through the participation and collaboration of all stakeholders, teamwork, customer-driven quality, and continuously improving the performance of inputs and processes by applying quality management techniques and tools (Kristianto *et al.*, 2012; Kuei and Lu, 2013; Isaksson, 2006). Sustainability, on the other hand, is defined as the long-term maintenance of systems in accordance with economic, environmental, and social considerations [corporate social responsibilities (CSR)] (Abbas, 2020; Adams *et al.*, 2014; Partalidou *et al.*, 2020; Sangwan *et al.*, 2019). Theoretical foundations, such as the resource-based view (RBV), can be used to explain the association between TQM and sustainability performance (Kearney and Berman, 2018).

RBV asserts that an organisation's competitive advantage is derived from the internal resources and capabilities at its disposal. It argues that competitive advantages can be attained provided a firm's resources are valuable, rare, inimitable and non-substitutable (VRIN) (Nair and Markowski, 2016). RBV has become prevalent as a theoretical view of sustainability (Johnsen *et al.*, 2017). TQM, being a resource and a strategy, tends to enhance a firm's performance by encouraging the development of specific assets that are entrenched in the firm's culture by generating both knowledge and a socially multifaceted relationship (Maravilhas and Martins, 2019). Moreover, the ability to effectively respond to economic, social, and environmental responsibilities can be a resource or capability that can lead to a sustained competitive advantage (Hart, 1995) and, ultimately, sustainable performance. CSR practices embody the greatest opportunities presently available to organisations to achieve greater success through new products, services, and new technologies (McWilliams *et al.*, 2002; Xie *et al.*, 2019). Studies have shown that organisations with greater environmental performance also have improved financial performance (Russo and Fouts, 1997). Hence, these characteristics seem to be related to the fact that firms can achieve sustainability performance through TQM practices that are aligned with CSR.

As previously stated, most previous empirical papers in the field of TQM and sustainability performance have only emphasised a single dimension of sustainable performance (the economic dimension). Many empirical studies have examined the connection between TQM practices and financial performance or organisational performance (Kassem *et al.*, 2019). For example, several authors have theorised the possible impact of TQM on organisational performance in various ways (Hussain *et al.*, 2019; Mosadeghrad 2014; Nawelwa *et al.*, 2015). For example, Nawelwa *et al.* (2015) argued that TQM represents a firm's strategy to enhance organisational performance by delivering high-quality products, services, and processes. They found that TQM practices can help an organisation to improve its performance through teamwork, continuous improvement and training, commitment from management, and employee empowerment. Hussain *et al.* (2019) revealed that TQM practices are significantly connected with innovation and operational performance. Some studies have asserted that total productive management and TQM practices together can lead to operational performance and, therefore, organisational performance (Modgil and Sharma, 2016; Sharma and Modgil, 2019). By exploring the critical success factors for TQM, Mosadeghrad (2014) found that sufficient education and training, consistent top management support, supportive leadership, employee involvement, process management, customer focus, and the continuous improvement of processes are the key determinants of successful TQM implementation, thereby enhancing operational and organisational performance. These findings thus show that a high level of

organisational performance is expected to be achieved through TQM by improving customer-driven quality and focus, inputs and processes, teamwork, education and training, management support, and leadership. Suárez-Barraza and Alanedo-Rosas (2014) argued that, to preserve a quality environment within an organisation, amongst other aspects, benefits ought to be discovered at the levels of productivity improvement, quality improvement, and cost reductions. Accordingly, it can be argued that these characteristics relate to the conditions that enable firms to achieve sustainable development and competitive advantage (Abbas, 2020), and hence economic sustainability and TQM.

Although very few studies have empirically investigated the association between TQM and sustainability performance in relation to the economic, social, and environmental dimensions, the relationship between TQM and organisational performance has been widely investigated. However, while some studies have revealed a significant effect on organisational performance (Al-Dhaafri *et al.*, 2016; Dahlgaard-Park *et al.*, 2018; Gomes *et al.*, 2019; Hussain *et al.*, 2019; Mateos-Ronco and Mezquida, 2018; Mosadeghrad 2014; Nawelwa *et al.*, 2015), other studies have not found any such effect (Berman, 2015; Dahlgaard *et al.*, 2019; Kearney and Berman, 2018; Melkers and Willoughby, 2005; Wynen *et al.*, 2016). Further, Soltani *et al.* (2006) found that most organisations have not achieved any tangible results through TQM. Moreover, the existing literature also elucidates that only one-third of TQM programmes are successful, with the remainder failing owing mainly to the lack of an appropriate organisational culture (Gimenez-Espin *et al.*, 2013), thereby decreasing organisational performance. Previous studies have also found that the lack of organisational culture and organisational structure are the two major reasons for TQM failures (Talapatra and Uddin, 2019; Talapatra *et al.*, 2019). Some authors have also stressed that the lack of service innovation can also lead to TQM failure (Mättö, 2019). These studies suggest that organisational performance can be achieved through effective TQM practices.

On the other hand, regarding the social dimension of sustainability, many empirical studies have examined the relationship between TQM practices and various stakeholder-benefit aspects, including performance relating to customers, employees, and societies (e.g. customer support and service, customer satisfaction, employee relation, peoples' health and safety, etc.) (Lo and Chai, 2012; Mohanty and Lakhe, 2011; Pimentel and Major, 2016; Talapatra *et al.*, 2018). For example, by reviewing the core themes in TQM research, Lo and Chai (2012) argued that the main success factors for TQM implementation are customer satisfaction and service quality measurement, highlighting the implications for TQM on customer performance. Furthermore, to achieve business excellence and performance, organisations must establish top management and leadership support, following four key TQM principles [delighting the customer, people-based management, continuous improvement, and fact-based decision making (Pimentel and Major, 2016)], indicating that successful TQM implementation can provide customers and employees with social benefits. Moreover, Mohanty and Lakhe (2011) recognised four primary reasons for promoting TQM related to improving: market share and profitability; customer satisfaction; the quality of work (and reducing costs); and employee relations. Here, the first reason is related to economic sustainability and TQM, while the other three reasons are related to TQM and social sustainability in relation of customers and employees. Further, Talapatra *et al.* (2018) explained that integrated TQM systems, complying with ISO 9001, ISO 14001, OHSAS 180001, and SA 8000, meet the demands of all stakeholders (including customers, employees, and wider society) by embedding quality, employees' health and safety, social accountability, and environmental processes in a culture of continuous improvement.

Concerning environmental performance, some empirical studies have found that TQM contributes to environmental performance (Wiengarten and Pagell, 2012; Zhu *et al.*, 2013). Li *et al.* (2018) found that the effective TQM implementation affects firms' green innovation significantly. Empirical evidence shows that firms with TQM implementation in line with ISO 9001, linked with the ISO 14001environmental management system, obtain greater advantages compared to their competitors (Heras-Saizarbitoria and Boiral, 2013).

In contrast, TQM is also considered as a way to employ all the potential capabilities of employees and managers in performing their jobs and managing an organisation (Marefat and Faridfathi, 2015). According to Androwis *et al.* (2018), TQM practices represent the best way to improve organisational performance via competitive advantage dimensions, such as innovation, delivery and time to market, cost, and price. Thus, such improved competitive advantages can lead to optimal sustainability performance. Tasleem *et al.* (2019), on the other hand, asserted that TQM requires a new working culture to be created so that people can learn and share knowledge and provide contributions to sustainability performance. Despite some inconsistent results on the effect of TQM's critical success factors in relation to organisational performance and the lack of research concerning TQM and sustainability performance, existing literature indicates that the adoption of TQM applications can positively influence sustainability performance in the private sector (Abbas, 2020). Based on the above discussion regarding TQM and sustainability performance, the following hypothesis is posited:

> *H1:* TQM has a significant impact on sustainability performance in the public sector.

Regarding the elements of TQM, the Abu Dhabi Award for Excellence in Government Performance (ADAEP) model is applied in the current study to identify the effects of TQM on sustainability performance (Figure 1). The key reason for using this model is that the ADAEP model is identical to the European Foundation for Quality Management (EFQM) excellence model as both models describe leadership, people, policy and strategy, partnership and resources, and process as the key enablers of TQM in relation to organisational performance (Shafiq *et al.*, 2019). The EFQM model enabler dimensions are considered as the TQM framework, which have been empirically confirmed by Bou-Llusar *et al.* (2009). Another motivation for using this model is that it is the most widely used TQM model in the UAE's public/government sector (Public Sector Excellence, 2016), which highlights the importance of investigating how these elements can influence sustainability performance in the UAE's public sector.

Figure 1. The ADAEP model for public sector performance excellence.
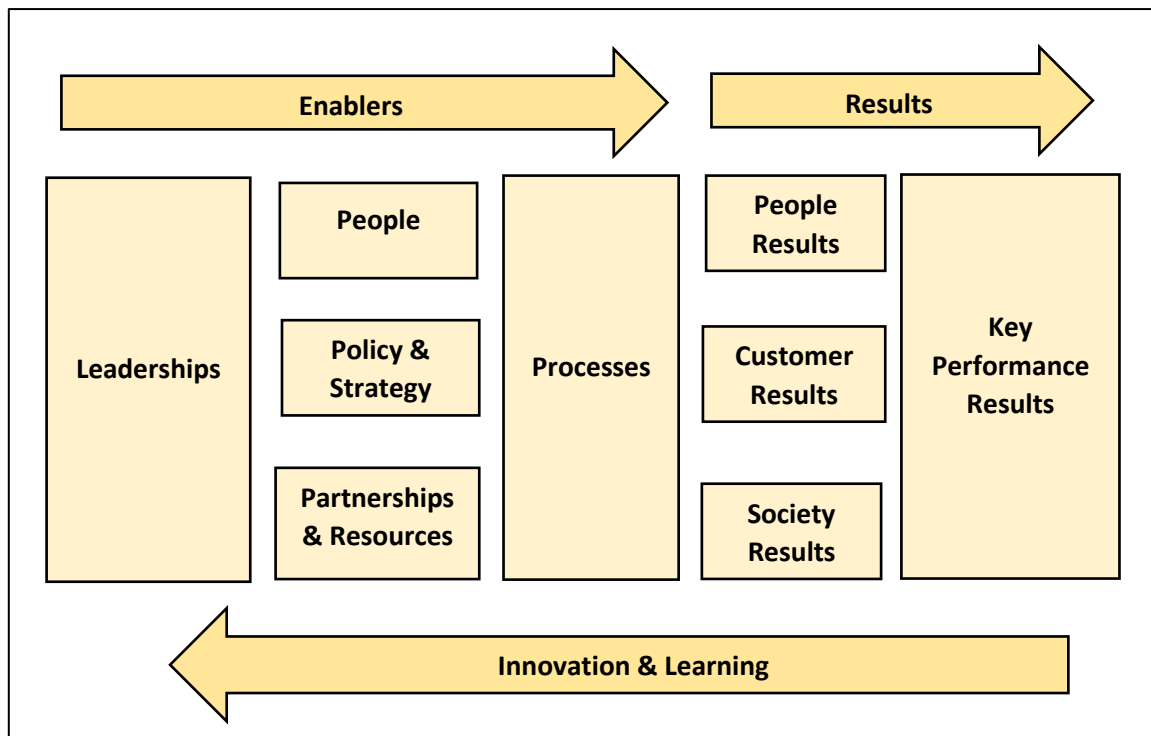
Source: ADAEP (2007).

As a TQM model, the ADAEP model consists of nine elements: five criteria facilitating the implementation of quality in Abu Dhabi's public sector organisations (leadership, people, policy and strategy, partnership and resources, process); and four measurement criteria assessing the results of TQM implementation (people results, society results, customer results, key performance results).

2.2 TQM and service innovation

Organisations should synthesise the enhancement of existing services with innovation to use ambidextrous capacity (Gieske *et al.*, 2016) as this subsequently increases organisational innovation capacity. Many quality management techniques are inevitably linked to enhancing existing services (Mättö, 2019). Service process innovations can be defined as: supporting the administrative core; expanding and supporting customer-interfacing processes; supporting functional processes; and supporting inter-organisational processes and operations (Lyytinen and Rose, 2003; Manohar *et al.*, 2019). Service innovations also include four dimensions: new service concepts (e.g. new types of public sector services, such as smart government services and smart transportation that increase residents' satisfaction); new client interfaces (e.g. more self-service options for customers/residents visiting various government departments, including, for example, water and electricity, the municipality, the road and transportation authority, and the health authority); new service-delivery systems; and new technological options (e.g. public transportation services and their associated metro cards facilitating transactions) (Hertog, 2000). Several empirical studies have investigated the association between TQM and service innovation, revealing that quality practices can improve service innovation (Khan and Naeem, 2018). However, very few studies have examined the links to the aspects of service innovation.

According to RBV theory, by implementing TQM practices, a firm can develop distinct resources (TQM as a corporate asset embedded in the organisational culture of the firm, TQM as product-design capability, and TQM as process-improvement capability), which are necessary to develop innovative services to overcome problems that the firm may encounter

(Silva *et al.*, 2014). Hence, it is argued that TQM recognises the quality-related problems existing in the organisational execution of quality-improvement methods and processes in the public sector as a way to generate ideas on how to address such problems via service innovations. Therefore, these ideas for improvement, developed by managers or employees, are considered in this study to be a potential type of service innovation that can cross intra-organisational boundaries through the involvement of employees from various professional domains.

A common denominator can also be recognised by investigating the underlying objectives for innovation and quality management (Gambi *et al.*, 2020; Georgiev and Ohtaki, 2019). Both can then be understood as strategies aiming to deliver superior customer value. Innovation concerns the creation of new values, whereas quality management concerns the constant delivery of these values. Quality assurance, as well as quality improvement, are the key aspects of quality management, whereas innovation denotes the creation of new services, processes, or products (Ng, 2009). Accordingly, we hypothesise:

> *H2:* TQM positively affects service innovation within public sector organisations.

2.3 Service innovation and sustainability performance

Various studies have investigated the issues related to services themselves, as well as new-service-development processes, such as customer participation and the importance of idea generation, screening, development, and initiation (Chen *et al.*, 2011). Overall, contemporary service firms, such as public sector organisations, are required to implement relevant service-innovation strategies and practices to develop scalar business models, monitor staff performance, manage customer experience, provide managerial process innovation (Tsai and Wang, 2017), and ultimately improve sustainability performance (Toivonen, 2016).

From the RBV perspective, innovation is regarded as playing a vital role in generating value and sustainable competitive advantages (Baregheh *et al.*, 2009). This study thus argues that a firm's service innovation, along with its CSR capabilities, can enhance its sustainability performance. Several direct impacts of service innovation can be seen at the organisational level. Service innovation can change internal organisational business processes, for example by enhancing service-delivery capacity (Aas and Pedersenb, 2010), thereby also enhancing economic (operational performance) and social sustainability (e.g. customer satisfaction resulting from swift service delivery). Service innovation has the ability to improve the financial performance of an organisation (e.g. improved operating results, reduced operational costs, improved productivity, and increased profitability), reflecting the economic dimension of sustainability (Aas and Pedersenb, 2010). It can also change innovative organisational internal capabilities. Moreover, the relationship between other stakeholders can be changed to positively affect customer value and employee relations (Lyons *et al.*, 2007) (e.g. customer satisfaction, customer focus, employee performance, and inventive mechanism), thereby improving social sustainability performance. Service innovation, on the other hand, could have an external impact, such as environmental effects (e.g. environmental thinking, environmental services), in improving environmental performance (environmental sustainability) (Horng *et al.*, 2016; Løvlie *et al.*, 2008). Nonetheless, studies specifically focusing on service innovation and sustainability performance are still scarce (Calabrese *et al.*, 2018). Based on the above discussion, we hypothesise:

> *H3:* Service innovation positively drives sustainability performance in the public sector.

2.4 TQM, service innovation, and sustainability performance

In this study, we argue that TQM applications in public sector organisations play a critical role in service innovativeness, and subsequently sustainability performance, through the promotion of new service concepts, new service-delivery systems, new client interfaces, and new technological solutions, which are considered the foremost types of service innovation within the public sector (Hertog, 2000).

According to the TQM and innovation literature, there is a need to investigate the methods for delivering enhancements in organisational efficiency in the public sector that synthesise quality improvement and a path for innovation generation (Mättö, 2019). One potentially effective approach to achieving this could hence be TQM accompanied by creating service innovation.

According to Akgün *et al*. (2014), the application of TQM has been related to increased business innovativeness and, ultimately, better financial performance (the economic dimension of sustainability). Androwis *et al.* (2018) stated that TQM practices are the most effective way to improve organisational performance via competitive advantage dimensions, such as innovation. A significant positive relationship between TQM and organisational innovation outcomes was found by Abu-Salim *et al.* (2019) in their survey of the UAE's manufacturing and service industries, although the study was limited to the private sector and ignored the service-innovation concept. Some authors have also stressed that the lack of service innovation can also lead to TQM failure, thereby decreasing organisational performance (Mättö, 2019) and sustainability performance.

Furthermore, TQM practices and applications help public sector organisations to understand the needs of their stakeholders (such as residents and government and non-governmental institutions), develop new market/network relationships, and benchmark customer and business solutions against customer- or stakeholder-related problems (Akgün *et al.*, 2014). These activities underpin the public sector's efforts to transform their organisational practices, substitute existing strategies with innovative strategies, and attain improved forms of sustainability in public sector organisations, thereby achieving improved sustainability performance. Accordingly, this study seeks to examine the effectiveness of TQM in the UAE's public sector as a potential source of service innovation, specifically aimed at enhancing its sustainability performance and mitigating problems related to organisational processes. The present study supports the notion that service innovations based on a quality-improvement method (TQM tools) can be further adapted to process improvements and sustainability, specifically in the public sector, which leads to the following hypothesis:

> *H4:* Service innovation mediates the relationship between the public sector's TQM applications and sustainability performance.

The proposed research framework is shown in Figure 2.

Figure 2. The proposed research framework.
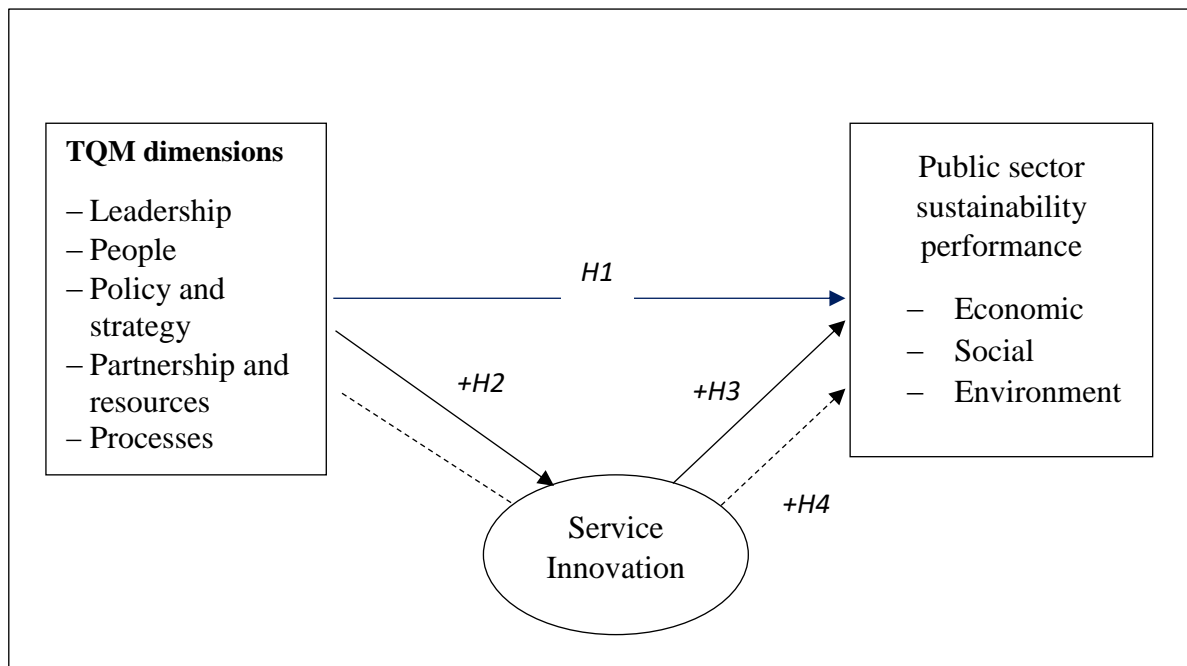
3. Research methodology

3.1 Sample and data collection

The population of the study is the UAE's service-based public organisations. Regarding public service organisations, there are currently 17 ministries and 32 independent government authorities in the UAE (Sarker and Al Athmay, 2017), which represent the population of the study. The study employed a random sampling technique for data collection. Since there are many governmental organisations across the seven emirates of the UAE, the employees of eight public sector service organisations located in Abu Dhabi were randomly selected for the online survey. The eight chosen public sector organisations operate in fields including the municipality, digital government, economics, tourism, finance, transport, police, and land and real estate. Using SurveyMonkey, an online questionnaire was delivered to the employees of the eight chosen public sector organisations until more than 400 responses were gathered. As a result, 430 responses were collected during April–May 2020. The sample size of 430 employees was determined as adequate for structural equation modelling (SEM) as 150–400 is the recommended sample size for SEM (Hair *et al.*, 2013).

3.2 Measurement and scales

A five-point Likert scale, ranging from "1" (strongly disagree) to "5" (strongly agree), was used to measure all the study constructs, pertaining to TQM, service innovation, and sustainability performance. Five constructs for TQM (leadership, people, process, strategy and policy, and partnership and resources) were adapted from Abbas (2020), ADAEP (2007), Androwis *et al.* (2018), Berman (2015), Fatima and Mahaboob, (2018), Ooi (2014), and Shafiq *et al.* (2017). Each of these constructs contained five items. Service innovation was measured through two constructs (product and process innovation, and organisational innovation) adapted from Aasa and Pedersen (2010). The three constructs for sustainability performance (environmental, social, economic sustainability performance) were adapted from Abbas (2020), Lu *et al.* (2011), Muhamad *et al.* (2014), Tsleem *et al.* (2020), Hollingworth and Valentine (2014), and Kang *et al.* (2015).

3.3 Data analysis

Various statistical methods were used for data analysis. First, exploratory factor analysis (EFA) was performed to produce the factor structure relating to the collected data reflecting the items for TQM, service innovation, and sustainability performance. Second, confirmatory factor analysis (CFA) was performed to test whether the measurement models agreed with both the theoretical and empirical data. Finally, SEM was used to analyse the structural relationships between the constructs (Hair *et al.*, 2014), i.e. TQM, service innovation, and sustainability performance (and their subconstructs). For EFA, IBM SPSS 23.0 was used, while for the CFA and SEM testing IBM AMOS 23.0 was employed. The data structuration process is shown in Figure 3.

Figure 3. Data structuration process.

Items and Sources	Sources	Sub factors	Factors
▪ Promotion and protection of natural resources and natural environment ▪ Waste management and cleaner production ▪ Reduced resources consumption and low carbon dioxide (CO_2) emission ▪ Less noise level inside and outside the workplace ▪ Compliance with environmental management system - ISO 14001	(Androwis et al., 2018; Hollingworth and Valentine, 2014; Kang et al., 2015; Tasleem et al., 2020)	Environmental Sustainability	Sustainability performance
▪ Social development programmes & contribution to non-profit organizations ▪ Reducing health and safety risks and incidents to workforce and community ▪ Workforce engagement and satisfaction to improve workforce capacities ▪ Improving customer relationship building, which will get more strengthened ▪ Improved organizational image and good practices amongst the community	(Androwis et al., 2018; Tasleem et al., 2020)	Social Sustainability	
▪ Improving measures & results related to capabilities, capacities & productivity ▪ Improving market performance, position or general market reputation ▪ Enhancing financial performance and results ▪ Attained various awards for bring excellent performance in its business practices.	(Androwis et al., 2018; Tasleem et al., 2020)	Economic Sustainability	
▪ Responsible for quality assurance and quality improvement efforts ▪ Focus on quality goals, efforts, and plans concerning time and cost. ▪ Views to improve quality as a way to increase sustainability performance ▪ Evaluation and improvement of management system and leading quality ▪ Arranging adequate resources for employee education and training	(Abbas, 2020, Yusr et al., 2017, Ooi, 2014; Androwis et al., 2018)	Leadership	TQM
▪ Formal processes (e.g., surveys) to realize employees' opinions and views ▪ Providing specific quality training to employees ▪ Encouraging to update employees' knowledge and skills ▪ Considering teamwork as a common practice within the organization ▪ Encouraging employee's opinions and suggestions to organizational activities ▪ Encouraging employee's opinions and suggestions to organizational activities	(Shafiq et al., 2017)	People	
▪ Clear division of process, ownership, and responsibility ▪ Ensuring the perfect product or service design, and process control ▪ Continuous improvement by self-inspection and automation ▪ Standardized process instruction given to employees ▪ Programmes to find waste time and cost amongst internal process	(Abbas, 2020; Braha and Wong, 2000; Rao, 2006)	Process	
▪ Vision and mission for quality ▪ Communicating vision and mission to stakeholders ▪ A structured planning process setting and reviewing short & long-term goals ▪ Incorporating all stakeholders' needs to organizational policies and objectives ▪ A written statement of strategy covering all business operations	(Abba, 2020; Prajogo and Sohal, 2006)	Strategy & Policy	
▪ Encouraging suppliers to develop long-term partnerships ▪ Quality over cost while making purchase agreements with suppliers ▪ Periodically evaluating performance of the suppliers ▪ Updated information and resources to all employees to perform their jobs ▪ Efforts to reduce the harmful effect of activities and resources on the	(Shafiq et al., 2017)	Partnership & Resources	
▪ Developing new services ▪ Developing new methods of manufacturing ▪ Introducing new logistics, delivery or distribution methods ▪ Introducing new supporting activities for processes	(Aasa and Pedersen, 2010)	Product & Process	Service Innovation
▪ Introducing new business practices for organizing work or procedures ▪ Developing new knowledge management systems ▪ Novel workplace organization for distributing responsibilities & decision making ▪ New methods of organizing external relations with other firms/institutions	(Aasa and Pedersen, 2010)	Organisational Innovation	

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4. Results

4.1 Exploratory factor analysis

Initially, the data collected were tested for common method bias and non-response bias. Harman's one-factor test showed that the one-factor solution of the study accounted for less than 50% (38.79%) of the total variation, indicating that common method bias is not an issue in the study. Also, non-response bias concerning the collected data was not observed, as the expected responses from the survey were received during the study's expected timeframe (April–May 2020).

EFA was then performed to produce the factor structure relating to the collected data reflecting the items of TQM, service innovation, and sustainability performance (and their subconstructs). With 48 questionnaire items, a ten-factor solution with a total variance of 66.95% was generated (see Appendix A). According to Nunnally and Bernstein (1994), if an item's factor loading is lower than 0.40 and the absolute difference among its cross-loadings is below 20%, this represents a poor and unclean loading. In view of this, four items (SCL1, SCL5, ECN5, and PDR1) were removed from the study as their loadings are lower than 0.40.

4.2 Measurement model

Reliability, convergent validity, and discriminant validity were tested to confirm construct reliability and validity. Reliability refers to the internal consistency of the scales, which can be determined through Cronbach's alpha. A Cronbach's alpha value in the excess of 0.70 can be regarded as statistically reliable (Hair *et al.*, 2014). Table I shows that the Cronbach's alpha values of all constructs exceeded 0.70, indicating that they are statistically reliable.

Table I. Construct reliability and convergent validity.

First-order construct	Second-order construct	Item	Factor loading	CR	AVE	Cronbach's alpha
Environmental sustainability (ENV)	Sustainability performance (SP)	ENV1	0.899	0.844	0.521	0.841
		ENV2	0.923			
		ENV3	0.876			
		ENV4	0.444			
		ENV5	0.544			
Social sustainability (SCL)		SCL2	0.592	0.715	0.462	0.741
		SCL3	0.666			
		SCL4	0.579			
Economic sustainability (ECN)		ECN1	0.979	0.786	0.479	0.806
		ECN2	0.978			
		ECN3	0.489			
		ECN4	0.417			
Leadership (LED)	Total quality management (TQM)	LED1	0.814	0.882	0.599	0.880
		LED2	0.879			
		LED3	0.819			
		LED4	0.838			
		LED5	0.702			
People (PPL)		PPL1	0.507	0.733	0.540	0.857
		PPL2	0.916			
		PPL3	0.816			

		PPL4	0.681			
		PPL5	0.752			
		PRS1	0.549			
Process (PRS)		PRS2	0.624	0.852	0.536	0.859
		PRS3	0.587			
		PRS4	0.514			
		PRS5	0.635			
Strategy and policy (SGP)		SGP1	0.757	0.896	0.634	0.896
		SGP2	0.813			
		SGP3	0.751			
		SGP4	0.728			
		SGP5	0.685			
Partnership and resources (PDR)		PDR2	0.510	0.732	0.538	0.905
		PDR3	0.714			
		PDR4	0.663			
		PDR5	0.817			
Product and process innovation (PPR)	Service innovation (SI)	PPR1	0.737	0.906	0.707	0.800
		PPR2	0.822			
		PPR3	0.810			
		PPR4	0.718			
Organisational innovation (INN)		INN1	0.502	0.856	0.600	0.850
		INN2	0.556			
		INN3	0.852			
		INN4	0.672			

Convergent validity is the degree to which multiple items adopted to measure the same construct are in agreement. Composite reliability (CR) and average variance extracted (AVE) were used to test the convergent validity (Hair *et al.*, 2010). A CR value in the excess of 0.70 can be considered as statistically significant, while the AVE should exceed 0.50 to be considered statistically significant (Zaiț and Bertea, 2011). The results of the measurement model (Table II) show that only two factors, SCL and ECN, had an AVE value below 0.50, violating the rule of thumb (see Table I for the definition of the factors and their acronyms). However, this was considered acceptable since Fornell and Larcker (1981) have argued that, if the value of AVE is lower than 0.50 while the CR exceeds 0.6, then the convergent validity can be deemed acceptable. Hence, the findings show that the measures adopted by this study are reliable and valid.

Table II. Discriminant validity.

	PDR	PPR	ENV	PPL	SGP	LED	ECN	PRS	INN	SCL
PDR	**0.734**									
PPR	0.711	**0.841**								
ENV	0.570	0.489	**0.722**							
PPL	0.704	0.591	0.604	**0.735**						
SGP	0.721	0.662	0.560	0.665	**0.796**					
LED	0.659	0.677	0.607	0.675	0.715	**0.890**				
ECN	0.609	0.630	0.715	0.707	0.579	0.683	**0.789**			
PRS	0.727	0.653	0.636	0.710	0.727	0.748	0.669	**0.853**		
INN	0.710	0.774	0.526	0.642	0.714	0.682	0.594	0.657	**0.774**	

| SCL | 0.600 | 0.499 | 0.563 | 0.569 | 0.643 | 0.649 | 0.630 | 0.582 | 0.646 | **0.679** |

Note: See Table I for the definition of constructs.

Discriminant validity testing was confirmed following the criterion of Fornell and Larcker (1981) that the square root of the AVE should be more than the squared correlation amongst the dimensions. Discriminant validity is the extent to which items vary between distinct concepts (Hair *et al.*, 2014). The results show that the values of each construct support discriminant validity (Table II); the square root of the AVE for each construct is higher than the squared inter-construct correlations. The comparison of the cross-loadings provided in Appendix B also indicates that each factor loading is higher than its respective cross-loadings for other constructs, thus establishing adequate discriminant validity.

In this study, the TQM, service innovation (SI), and sustainability performance (SP) constructs were conceptualised as second-order constructs. Byrne (2010) stated that first-order constructs should be explained adequately by the hypothesised second-order constructs while being distinct. Analysis of the squared multiple correlations (SMC), also known as R^2, revealed that all the first-order constructs range from 0.6 to 1, indicating that first-order constructs explain their respective second-order construct. Appendix B also shows that each construct is different from other constructs. Hence, the analysis confirmed that that first-order constructs (LED, PPL, PRS, SGP, and PDR) are adequately explained by the second-order construct, TQM. Similarly, other first-order constructs (ENV, SCL, and ECN for SP; and INN and PPR for SI) were also adequately explained.

4.3 Structural model and hypotheses testing

AMOS v.23 was used to test the structural models and hypotheses. To verify the model fit with empirical data, several goodness-of-fit indices were used. The results show that the actual value of all fit indices exceeded the acceptable value (Table III).

Table III. Model fit indices.

Model fit index	The threshold value	Actual value	Conclusion
Normed chi-squared test (X^2/df)	≤5 (Timothy, 2015)	2.405; p=0.00	Acceptable
Goodness-of-fit index (GFI)	Near to 1 is acceptable (Holmes-Smith *et al.*, 2006)	0.815	Acceptable
Comparative fit index (CFI)	≥0.70 (Timothy, 2015)	0.892	Acceptable
Root mean square error of approximation (RMSEA)	≤0.080 (Awang, 2012)	0.057	Acceptable
Tucker–Lewis index (TLI)	Near to 1 is acceptable (Holmes-Smith *et al.*, 2006)	0.885	Acceptable
Incremental fit index (IFI)	Near to 1 is acceptable (Holmes-Smith *et al.*, 2006)	0.892	Acceptable

Path analysis was conducted using the bootstrapping approach for 1,000 samples computed at 95% confidence (Hair *et al.*, 2014). Table IV and Figure 4 show the structural model analysis. The results show that the direct relationship between TQM and sustainability performance (SP) was significantly positive (β=0.566; *p*<0.05), thus supporting *H1*. Concerning the dimensions of sustainability performance, social (β=0.767; *p*<0.05) and environmental (β=0.780; *p*<0.05) performance were the significant dimensions relating to the UAE public service sector's

sustainability performance. This finding is line with those of Abbas (2020), Li *et al.* (2018), and Zhu *et al.* (2013), who found a strong impact of TQM on the social and environmental performance of private sector firms. The economic dimension of sustainability performance in the public sector was, however, revealed to be insignificant (β=0.882; *p*>0.05). This finding is consistent with those of Dahlgaard *et al.* (2019), Kearney and Berman (2018), and Wynen *et al.* (2016), while being inconsistent with those of Al-Dhaafri *et al.* (2016), Dahlgaard-Park *et al.* (2018), Hussain *et al.* (2019), and Gomes *et al.* (2019). However, the above studies, which are compared and contrasted in the current study, were conducted in the setting of the private sector, thus not providing empirical insights into the public sector's sustainability performance.

Table IV. The results of hypothesis testing.

Hypothesis		Estimate	S.E.	*p*-value	Conclusion
H1	TQM→SP	0.566	0.020	0.002	Accepted
H2	TQM→SI	0.619	0.031	0.003	Accepted
H3	SI→SP	0.325	0.020	0.002	Accepted
H4	TQM→SI→SP	0.350	–	0.020	Accepted

Note: See Table I for the definition of constructs.

Figure 4. Structural model of total quality management (TQM), service innovation (SI), and sustainability performance (SP).
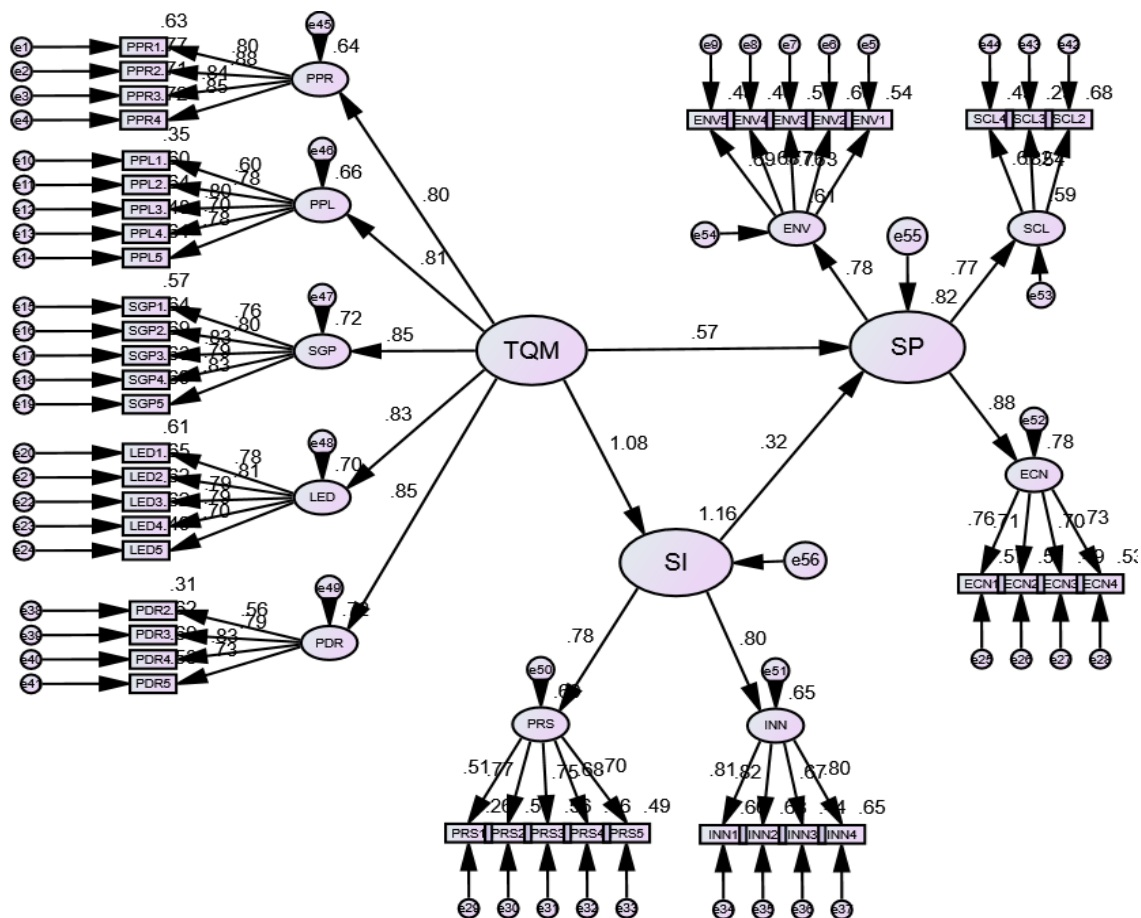
Concerning the elements of TQM, the study found that leadership (β=0.798; *p*<0.05), people (β=0.810; *p*<0.05), process (β=0.850; *p*<0.05), and partnership and resources (β=0.834; *p*<0.05) were the most significant elements of the ADAEP quality management model

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affecting the UAE's public sector's sustainability performance, while strategy and policy (β=0.846; *p*>0.05) was revealed to be insignificant.

The results further revealed that the association between TQM and service innovation is significantly positive (β=0.619; *p*<0.05), thus supporting *H2*. A similar relationship between TQM and innovation outcomes was found by Abu-Salim *et al.* (2019) in the UAE's private manufacturing and service firms. However, the current study's finding contributes to addressing the lack of studies relating to how TQM can affect service innovation in the public sector.

Additionally, the results revealed that service innovation significantly and positively impacts sustainability performance in the UAE's public sector (β=0.325; *p*<0.05), hence supporting *H3*. This finding is consistent with those of studies conducted in the context of the private sector. For example, Aas and Pedersenb (2010) found that innovation can improve financial performance (economic sustainability performance), Lyons *et al.* (2007) stated that innovation improves customer value (social sustainability performance), and Løvlie *et al.* (2008) found that innovation has positive environmental effects (environmental sustainability performance).

To examine the mediating effect of SI on the relationship between TQM and SP, the direct and indirect effect was explored using SEM with the bootstrapping method for 1,000 re-samples. The results show that SI partially mediates (β=0.350; *p*<0.05) the association between TQM and SP (Table V), thus supporting *H4*. Hence, this study concludes that TQM applications in the UAE's public sector organisations play a partial role in improving sustainability performance through the promotion of service innovation. Therefore, organisational innovation, as well as product and process innovation, are equally critical for service innovation in the public sector.

Table V. The mediating effect of SI on the relationship between TQM and SP.

	Direct effect	**Indirect effect**	**Full effect**
Estimate	0.566	0.350	0.916
p-value	0.02	0.02	0.02

5. Discussion

5.1 TQM practices

This paper makes several contributions regarding the lack of extant TQM and sustainability performance literature by examining the impact of TQM practices on service innovation and sustainability performance, specifically in the context of the public sector organisations in the UAE. First, this paper provides empirical evidence explaining the association between TQM and three facets of the sustainability performance of the public sector. Although several studies have shown the significant impact of a single aspect of sustainability performance (economic, social, or environmental), they have been in the private sector context (Abbas 2020, Dahlgaard *et al.*, 2019; Kearney and Berman, 2018, Li *et al.*, 2018). The present paper's findings confirm that the social and environmental dimensions are highly significant for the public sector's sustainability performance in relation to TQM and service innovation, whereas the economic dimension was found to be insignificant. The public sector's prioritisation of social and environmental performance over economic performance is thus implied. This theoretical implication could be based on the difference between the private (profit-oriented) and public (public-service-oriented) sector in relation to setting and achieving their goals.

Further, empirical analysis showed that five of the TQM practices included in the model (leadership, people, process, and partnership, and resources) play a substantial role in enhancing sustainability performance in the public sector. Further, the results revealed the above TQM elements as a latent construct consisting of these four dimensions, which clearly demonstrates that TQM is a robust construct to measure the public sector's effectiveness in relation to quality management.

5.2 Service innovation

The findings also reveal the relationship between TQM and service innovation performance in the public sector, which has not yet been significantly studied in the extant literature. Some studies regarding the association between quality improvements and innovation do exist; Matto (2019) and Gambi *et al.* (2020), for example, stressed that the lack of service innovation can lead to TQM failure. A similar relationship between TQM and innovation outcomes was found by Abu-Salim *et al.* (2019) in the UAE's private manufacturing and service firms. However, the current paper's finding contribute to addressing the lack of studies relating to how TQM can affect service innovation in the public sector. The present paper's findings imply that successful TQM implementation could lead to successful service innovation in the UAE's public sector. Organisational innovation, as well as product and process innovation, are equally critical for service innovation.

5.3 Sustainability performance

This paper also addresses the gap in the literature regarding how service innovation can mediate the relationship between TQM and sustainability performance in the public sector. It provides empirical evidence suggesting that service innovation partially mediates the above-mentioned relationship. Our findings thus extend current understanding regarding how TQM influences sustainability performance and further explains the mechanism by which TQM can encourage service innovation which, in turn, enhances the public sector's sustainability performance.

6. Implications of research

6.1 Theoretical implications

This paper contributes to the lack of extant TQM and sustainability performance literature by examining the impact of TQM practices, which are being practised in the UAE's public sector (following the ADAEP model), on service innovation and sustainability performance. First, this paper contributes to the lack of empirical evidence in explaining the association between TQM and three facets of the public sector's sustainability performance. Although a few studies have shown the significant impact of a single dimension of sustainability performance (economic, social, or environmental), they have been undertaken in the private sector context (Abbas, 2020; Dahlgaard *et al.*, 2019; Hussain *et al.*, 2019; Li *et al.*, 2018). However, the present study's findings confirm that the social and environmental dimensions are the most significant in relation to the public sector's sustainability performance in relation to TQM and service innovation, whereas the economic dimension was found to be insignificant. The public sector's prioritisation of social and environmental performance over economic performance is thus implied. This theoretical implication is likely based on the difference between the private (profit-oriented) and the public (public-service-oriented) the public sector in the setting and achieving of goals.

Further, the findings show that four of the TQM practices included in the ADAEP model (leadership, people, process, and partnership and resources) play a substantial role in enhancing

sustainability performance in the public sector. The findings also reveal the validity of the above TQM elements as a latent construct consisting of these four dimensions, clearly showing that TQM is a robust construct for measuring the public sector's quality management effectiveness.

The findings also support the relationship between TQM and service innovation performance in the public sector, which has not yet been significantly studied in the extant literature, despite some studies showing that an association between quality improvements and innovation exists (Gambi *et al.*, 2020; Mättö, 2019); these authors also stressed that a lack of service innovation can lead to TQM failure. A similar relationship between TQM and innovation outcomes was found by Abu-Salim *et al.* (2019) in the UAE's private manufacturing and service firms. However, the current study's findings contribute to addressing the lack of studies relating to how TQM can affect service innovation in the public sector. This study's findings imply that the successful TQM implementation enables successful service innovation in the UAE's public sector. Organisational innovation, as well as product and process innovation, are equally critical for service innovation.

This paper also addresses the gap in the literature regarding how service innovation mediates the relationship between TQM and sustainability performance in the public sector. It provides empirical evidence suggesting that service innovation partially mediates this relationship. Our findings thus extend current understanding concerning how TQM influences sustainability performance and further explains the mechanism through which TQM can encourage service innovation, which in turn enhances sustainability performance in the public sector.

6.2 Practical implications

The findings suggest that the public service sector's TQM practices and service innovation in the UAE have a profound impact on social and environmental sustainability rather than economic sustainability. This implies that the public sector in the UAE sees quality as a fundamental goal for the public services provided by the government (Wynen *et al.*, 2016). Unlike the private sector, the main goal of any public sector organisation is to meet the needs of its societies/users within the constraints of available budget and abilities. Moreover, drawing on the concept of TQM elements, this study both supports policymakers and the managers of public sector organisations, particularly in developing Middle Eastern countries, such as the UAE, in making their strategic decisions in relation to TQM. Adopting the five dimensions of TQM (ADAEP model) across the UAE's public organisations will enable government departments to deliver innovative services to their beneficiaries, thereby enhancing environmental, social, and economic sustainability dimensions.

Given the current uncertainties regarding supply chains, TQM will have a critical role to play, while innovative ideas should facilitate sustainable strategies (Jiménez-Jiménez *et al.*, 2019). Unforeseeable disruptions (such as COVID-19) in the market may call for technical innovations regarding the development and distribution of new services to maintain quality and sustainability in the market (Volberda *et al.*, 2013). Moreover, TQM practices may lead to various innovative changes in terms of organisational structure, marketing strategies, and information management (Walker *et al.*, 2015). Although this paper's findings predominantly reflect the public sector, organisations in the private sector also need constant support from the authorities to survive in today's competitive market.

In this context, this paper makes the following contributions to the extant literature:
- Based on RBV, this paper develops an empirical model to relate TQM practices to service innovation and sustainability performance in the public sector.

- With the help of the latest literature on the subject, a measurement instrument is developed to support the empirical model.
- The findings signify the priority of social and environmental performance over economic performance in the public sector.
- The analysis highlights how successful TQM efforts facilitate service innovations in achieving sustainability performance.
- The findings help quality managers in making strategic decision pertaining to service innovations and sustainability.

7. Limitations and future research

Undoubtedly, this study has some limitations. For example, the study sample was limited to 430 employees from eight public sector organisations located in the Emirate of Abu Dhabi in the UAE. Public sector organisations more representative of those existing across the entire country could be further examined to improve the generalisability of the findings.

Further, more dimensions of TQM practices could be integrated into the current measurement model (ADAEP model) used in this study. For instance, the ADAEP model does not comprise other vital facets reflecting effective TQM practices, such as customer focus, knowledge management, and culture, which can enhance the sustainability performance of organisations (Elshaer and Augustyn, 2016; Fatima and Mahaboob, 2018; Lau *et al.*, 2004). Hence, researchers and scholars are encouraged to conduct further empirical investigations into the association between TQM, service innovation, and sustainability performance in the public sector by increasing the number of samples from among public organisations in the UAE and other developing countries and by integrating other elements into the current study's TQM construct, such as customer focus, culture, and knowledge management.

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Appendix A. Questionnaire

"Total Quality Management, Service Innovation, and Sustainability Performance in the UAE's public sector"

Please indicate the extent to which you agree or disagree with the following statements by circling one of the numbers from 1 to 5 using the scale below

Strongly disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly agree (5)

SECTION 1 SUSTAINABILITY PERFORMANCE
How do you agree to the fact that the following factors (Environmental, Social, Economic factors) have an impact on sustainability performance?

Sustainability copes with suitable response paradigms in respect of economic, social and environmental responsibilities in relation to products, services, processes, and organisational performance

How do you agree to the fact that the following Environmental Sustainability factors have an impact on public sector's sustainability performance?					
Promotion and protection of natural resources and natural environment	1	2	3	4	5
Waste management and cleaner production	1	2	3	4	5
Reduced resources consumption and low carbon dioxide (CO_2) emission	1	2	3	4	5
Less noise level inside and outside the workplace	1	2	3	4	5
Compliance with environmental management system - ISO 14001	1	2	3	4	5
How do you agree to the fact that the following Social factors have an impact on public sector's sustainability performance?					
Social development programmes & contribution to non-profit organizations	1	2	3	4	5
Reducing health and safety risks and incidents to workforce and community	1	2	3	4	5
Workforce engagement and satisfaction to improve workforce capacities					
Improving customer relationship building, which will get more strengthened	1	2	3	4	5
Improved organizational image reflecting good practices amongst the community	1	2	3	4	5
How do you agree to the fact that the following Economic factors have an impact on public sector's sustainability performance?					
Improving measures and results related to capabilities, capacities and productivity	1	2	3	4	5
Improving market performance, position or general market reputation	1	2	3	4	5
Enhancing financial performance and results	1	2	3	4	5
Attained various awards for bring excellent performance in its business practices.	1	2	3	4	5
The organizational status is more stable, competitive and sustainable as a result	1	2	3	4	5

SECTION 2: TOTAL QUALITY MANAGEMENT (TQM)
How do you agree to the fact that following TQM factors *(Leadership, People, Process, Strategy & Policy, Partnership & Resources)* have an impact on sustainability performance?

TQM is an approach to do business attempting to maximise an organisation's competitiveness via the continual improvement in respect of the quality of its products, services, processes, people, and environments

How do you agree to the fact that the Leadership has an impact on sustainability performance?					
Responsible for quality assurance and quality improvement efforts	1	2	3	4	5
Focus on quality goals, efforts, and plans concerning time and cost.	1	2	3	4	5
Views to improve quality as a way to increase sustainability performance	1	2	3	4	5

Evaluation and improvement of management system and leading quality drivers	1	2	3	4	5
Arranging adequate resources for employee education and training	1	2	3	4	5

How do you agree to the fact that People has an impact on sustainability performance?

Formal processes (e.g. surveys) to realize employees' opinions and views	1	2	3	4	5
Providing specific quality training to employees	1	2	3	4	5
Encouraging to update employees' knowledge and skills	1	2	3	4	5
Considering teamwork as a common practice within the organization	1	2	3	4	5
Encouraging employee's opinions and suggestions to organizational activities	1	2	3	4	5

How do you agree to the fact that Process has an impact on sustainability performance?

Clear division of process, ownership, and responsibility	1	2	3	4	5
Ensuring the perfect product or service design, and process control	1	2	3	4	5
Continuous improvement by self-inspection and automation	1	2	3	4	5
Standardized process instruction given to employees	1	2	3	4	5
Programmes to find waste time and cost amongst internal process	1	2	3	4	5

How do you agree to the fact that Strategy & Policy has an impact on sustainability performance?

Vision and mission for quality	1	2	3	4	5
Communicating vision and mission to stakeholders	1	2	3	4	5
A structured planning process setting and reviewing short and long-term goals	1	2	3	4	5
Incorporating all stakeholders' needs to organizational policies and objectives	1	2	3	4	5
A written statement of strategy covering all business operations	1	2	3	4	5

How do you agree to the fact that the following Partnership & Resources has an impact on sustainability performance?

Encouraging suppliers to develop long-term partnerships with the organization	1	2	3	4	5
Preference to quality over cost while making purchase agreements with suppliers	1	2	3	4	5
Periodically evaluating performance of the suppliers	1	2	3	4	5
Updated information and resources to all employees to perform their jobs	1	2	3	4	5
Efforts to reduce the harmful effect of activities and resources on the environment	1	2	3	4	5

SECTION 3 SERVICE INNOVATION

How do you agree to the fact that the following factors (Product & Process Innovation, Organizational Innovation) have an impact on sustainability performance?

Service innovation can be seen in numerous scenarios within service sector that develop completely a new type of services or improving existing services

How do you agree to the fact that the following Product & Process Innovation factors have an impact on public sector's sustainability performance?					
Developing new services	1	2	3	4	5
Developing new methods of manufacturing	1	2	3	4	5
Introducing new logistics, delivery or distribution methods	1	2	3	4	5
Introducing new supporting activities for processes	1	2	3	4	5
How do you agree to the fact that the following Organizational Innovation factors have an impact on public sector's sustainability performance?					
Introducing new business practices for organizing work or procedures	1	2	3	4	5

Developing new knowledge management systems	1	2	3	4	5
Novel workplace organization for distributing responsibilities and decision making	1	2	3	4	5
New methods of organizing external relations with other firms/institutions	1	2	3	4	5

SECTION 4:   DEMOGRAPHICS

1.   Gender

☐ Male   ☐ Female

2.   Your profession/occupation

☐ Officer / Engineer   ☐ Supervisor/Senior engineer   ☐ Team Leader/Head of Section

☐ Manager/Director   ☐ Vice President   ☐Senior Vice President   ☐ President / CEO

3.   Highest level of education attained

☐ High school   ☐ College diploma   ☐ Bachelor's degree   ☐ Postgraduate degree (MA/MSc/Ph.D.)

4.   Number of years of experience

☐ 0 to 5 years   ☐ 6 to 10 years   ☐ 11 to 15 years   ☐ 16 to 20 years   ☐ Above 20 years

Appendix B. Cross-loadings of the factors

Item	ENV	SCL	ECN	LED	PPL	PRS	SGP	PDR	PPR	INN
ENV1	**0.899**	–0.056	–0.075	0.002	–0.091	0.002	0.046	–0.039	0.030	0.027
ENV2	**0.923**	–0.012	–0.096	–0.053	–0.069	0.128	0.010	–0.077	0.046	0.026
ENV3	**0.876**	–0.003	0.005	–0.035	–0.060	0.003	0.054	–0.022	0.039	–0.083
ENV4	**0.444**	–0.005	0.162	0.051	0.118	0.060	–0.088	0.272	–0.133	–0.049
ENV5	**0.544**	0.182	–0.055	–0.077	0.125	0.047	0.027	0.103	–0.164	0.179
SCL1	0.290	0.043	0.338	0.052	–0.164	0.022	–0.084	0.227	–0.096	0.194
SCL2	–0.007	**0.592**	0.188	0.190	–0.051	–0.126	–0.042	0.065	–0.097	0.234
SCL3	0.012	**0.666**	–0.066	–0.043	0.089	0.067	0.041	0.092	0.198	–0.154
SCL4	–0.035	**0.579**	–0.096	0.122	0.093	–0.087	0.075	–0.165	–0.183	0.494
SCL5	0.092	0.046	0.345	0.093	0.397	–0.180	–0.086	0.024	0.027	0.093
ECN1	–0.070	–0.013	**0.979**	–0.124	–0.078	0.071	0.132	–0.019	0.040	–0.175
ECN2	–0.117	0.020	**0.978**	–0.087	–0.119	0.204	0.095	–0.131	0.049	–0.093
ECN3	0.076	0.134	**0.489**	0.033	0.162	–0.052	–0.049	–0.102	0.088	0.034
ECN4	0.077	–0.007	**0.417**	0.040	0.392	–0.153	–0.016	0.058	0.124	–0.075
ECN5	0.288	–0.048	0.305	0.109	0.175	–0.043	–0.117	–0.019	0.095	0.033
LED1	0.173	–0.006	–0.072	**0.814**	0.005	0.059	0.046	–0.230	0.157	–0.097
LED2	–0.037	0.063	–0.092	**0.879**	0.046	0.019	0.061	–0.038	0.070	–0.124
LED3	–0.104	0.039	–0.044	**0.819**	–0.185	0.111	0.006	0.102	0.091	0.044
LED4	0.021	–0.032	0.102	**0.838**	–0.151	0.165	–0.041	0.103	–0.100	–0.035
LED5	–0.137	–0.002	–0.147	**0.702**	0.307	–0.053	0.021	0.144	0.061	–0.144
PPL1	0.060	0.257	0.035	–0.049	**0.507**	0.189	0.040	–0.250	–0.011	0.062
PPL2	0.011	0.094	–0.046	–0.039	**0.916**	0.013	0.001	–0.028	0.049	–0.159
PPL3	–0.087	0.094	–0.145	–0.039	**0.816**	–0.002	0.089	0.235	–0.004	–0.085
PPL4	–0.145	–0.066	0.089	–0.102	**0.681**	0.320	–0.053	–0.105	–0.038	0.228
PPL5	–0.037	–0.160	–0.069	0.012	**0.752**	0.232	–0.016	0.007	–0.077	0.199
PRS1	–0.112	–0.072	0.242	0.115	0.243	**0.549**	–0.041	0.116	–0.132	0.009
PRS2	0.055	0.072	0.180	0.118	0.130	**0.624**	–0.008	–0.106	0.064	–0.084
PRS3	0.069	0.055	0.028	–0.003	0.023	**0.587**	0.015	0.034	0.177	0.034
PRS4	0.080	0.048	–0.142	0.066	0.160	**0.514**	0.122	0.080	–0.087	0.070
PRS5	0.103	–0.093	0.020	0.099	–0.024	**0.635**	–0.037	0.136	–0.026	0.103
SGP1	–0.050	0.031	0.175	0.162	–0.135	–0.013	**0.757**	–0.098	–0.152	0.199
SGP2	–0.088	–0.042	0.185	–0.035	–0.020	–0.054	**0.813**	0.101	–0.102	0.156
SGP3	0.084	–0.047	0.051	–0.071	0.099	–0.014	**0.751**	0.058	0.063	–0.010

SGP4	0.123	0.044	–0.083	0.031	0.040	0.060	**0.728**	0.039	0.081	–0.142
SGP5	0.039	0.064	–0.036	0.031	0.052	0.041	**0.685**	0.052	0.125	–0.060
PDR1	0.231	–0.188	0.352	0.089	0.319	–0.172	0.090	0.061	0.019	–0.036
PDR2	–0.065	0.477	0.186	–0.168	–0.139	0.142	–0.073	**0.510**	0.162	–0.137
PDR3	–0.008	–0.077	–0.046	0.059	0.055	0.045	0.063	**0.714**	0.101	–0.038
PDR4	–0.060	0.001	–0.078	–0.006	0.177	–0.039	0.093	**0.663**	0.093	0.096
PDR5	0.041	0.081	–0.103	0.030	–0.060	0.083	0.038	**0.817**	–0.139	0.093
PPR1	0.020	0.046	0.032	0.055	–0.022	–0.105	–0.009	0.034	**0.737**	0.128
PPR2	0.023	0.059	–0.005	0.043	0.069	–0.021	–0.063	–0.003	**0.822**	0.065
PPR3	–0.033	–0.013	0.110	0.059	–0.015	0.047	–0.017	–0.081	**0.810**	0.084
PPR4	0.029	–0.033	0.071	0.053	–0.048	0.083	0.042	–0.024	**0.718**	0.141
INN1	–0.039	–0.069	–0.019	0.032	–0.032	0.033	0.073	0.075	0.389	**0.502**
INN2	–0.049	0.015	0.003	–0.023	–0.013	0.001	0.059	0.083	0.362	**0.556**
INN3	0.055	–0.002	–0.152	–0.191	0.017	0.096	0.020	0.007	0.127	**0.852**
INN4	–0.006	0.042	–0.087	–0.032	–0.018	–0.009	–0.015	0.093	0.359	**0.672**

Notes: Extraction method: principal component analysis. Rotation method: Promax with Kaiser normalization. Bold values are loadings for each item that are above the recommended value of 0.4; an item's loadings on its own variable are higher than all of its cross-loadings with other variables.