Impact of TQM Philosophy on Business Sustainability, Mediated by Dynamic Capabilities and Green Practices, at Health Care Industry in Egypt

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Abstract

Background: Total quality management (TQM) philosophy is managerial approach illustrating pathway to achieve business excellence and objectives. There are many models for TQM implementation as Deming, European foundation of quality management (EFQM) and Malcolm Baldrige national quality award (MNBQA) models. Sustainable development goals (SDGs) demonstrated through social, environmental and economic pillars however, sustainable outcomes are preferred to be categorized as social, environmental and governance categories.

Purpose: The study focuses on impact of TQM implementation on business sustainability from its three pillars with demonstration the mediators as green practices and dynamic capabilities. The study was conducted in Egyptian healthcare sector.

Design: Online survey with quantitative and qualitative questions was conducted in August 2025. Purposive sample is taken from top and middle management in Egyptian private healthcare organizations. Quantitative data were analyzed through regression and mediation analysis and qualitative data are thematically analyzed.

Findings: 31 participants participated, results demonstrate strong direct relation between TQM implementation and business sustainability with significantly positive mediators' effects by dynamic capabilities and green practices.

Originality & Discussion: Unfortunately, studies are limited in merging between TQM implementation and sustainable outcomes especially in Egyptian healthcare industry, in addition to the limited researches on discussion the mediating factors. Green practices are representing the implementation of green innovations. Dynamic capabilities are representing ability of organization to change and respond toward external circumstances. Ultimately, TQM activities offer roadmap to accomplish sustainable outcomes.

Keywords: sustainability, dynamic capabilities, green practices, healthcare, TQM, MNBQA, EFQM, business sustainability, sustainable key indicators, social sustainability, environmental sustainability, governance sustainability

1. Introduction

Globally, 191 states of United Nations intend to achieve progress on 17 SDGs by 2030; one of the main targets is lowering global warming by 1.5º (C) Celsius degree comparing with pre-industrial era (UNFCC, 2015). Good health and well-being goal (SDG 3) has many targets including universal health coverage, health risk and well-being mortality rates (WHO, 2023). General reporting initiatives (GRI) and united national sustainable stock exchange initiatives (SSE) offer standards and models for sustainability evaluation and reporting; For instance, environmental initiatives as decreasing carbon footprint, energy & water consumption and waste management; social initiatives as equity, justice and wellness; governance initiatives as risk management program, long term financial goals and brand age &reputation (GRI, 2024) (SSE, 2015). TQM philosophy is integrating activities which relate to leadership, strategic planning, customer-oriented culture, human resource management, basic quality activities and continuous improvement concept (Luthra *et al.*, 2020). The research focuses on TQM implementation not the degree of service quality. Traditional quality activities include 4Q of quality planning, assurance, control and improvement. Recently, TQM activities have had serious modifications as representing in MBNQA and EFQM models. This paper demonstrates influence of

implementation internal quality management system on achieving business sustainability in private healthcare sector in Egypt through comprehensive analysis by using nine elements model (Elsafty, 2018).

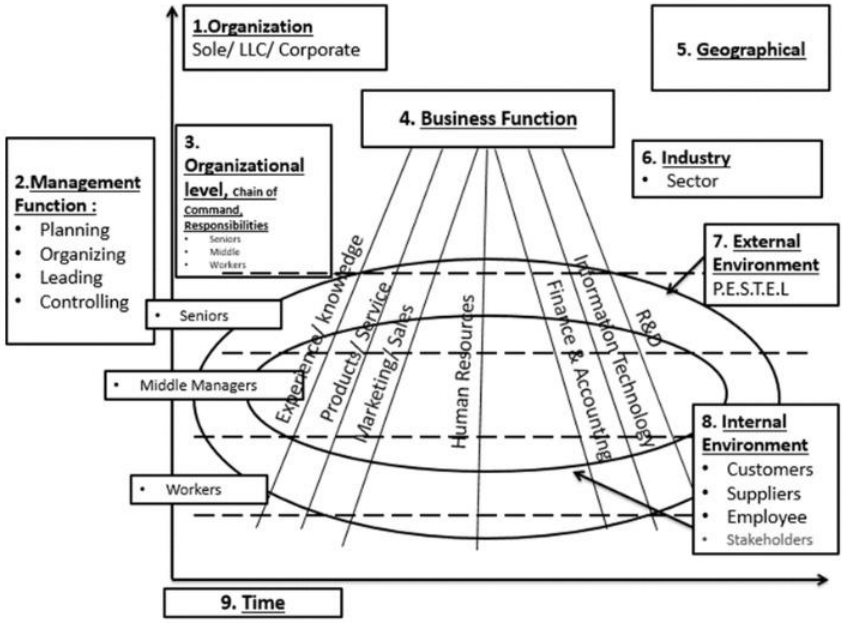

Figure 1. Business Anatomy Model 9-elements (Elsafty, 2018)

Egyptian sustainable strategies in healthcare industry are summarized in three main strategies including green transformation, digital transformation and universal health insurance (UHI) relating to various SDGs (SDS Egypt, 2023). All Egyptian healthcare organizations strive to implement internal quality management system to achieve general authority for healthcare accreditation and regulation (GAHAR) accreditation to enrol on UHI system relating to SDG 3.8 (WHO, 2023). This accreditation imposes various requirements not only to achieve high quality healthcare services but also to implement sustainable social and governance initiatives. Additionally, GAHAR formulated standards for green hospitals representing sustainable environmental initiatives (GAHAR, 2021). Egyptian universal health coverage is estimated 5.4 M in 2025 from 114 M with growth rate 1.7% (WHO, 2025). The industry has various sectors representing as public, private and parastatal sectors. Private organizations have to achieve long term financial goals to sustain their businesses. Clinics, primary care centres and hospitals are the main organizations providing healthcare services. According to Statista (2021), there are 664 public hospitals and 1145 private hospitals in Egypt with 10.79% growth rate for healthcare industry between 2023 to 2028. Additionally, World bank (2020) estimated that there is 1.13 bed per 1000 people in Egypt. Egyptian hospitals are struggling with marketing and business excellence functions. TQM activities are considered as roadmap to achieve various operational-departmental goals. Unfortunately, the gap between medical activities and business activities is considered obstacle to achieve sustainability in healthcare industry; however, it could be downsized through TQM activities as employee engagement & development and effective communication activities. Additionally, marketing activities are significantly influenced by social media. Consequently, it is influencing on patient behavioural and brand reputation. Financially, Healthcare industry has long cash conversion cycle, complicated cost management system including for instance infection control cost, waste management cost, hospitality cost and maintenance cost (Santerre and Neun , 2012). Consequently, healthcare organizations are struggling to balance between achieving high quality services and financial goals. On the other hand, SDG 3 c.1 target is increasing financing, recruitment, training and development of healthcare workforce. Egyptian 10000 population density per physician was decreasing from 7.6 in 2015 to 6.7 in 2023 comparing with 17.2 worldwide in 2022 (WHO, 2023). According to world bank (2023), female share in managerial levels indicators is increased from 7% in 2019 to 23% in 2023 relating to women empower sustainable goal. Economically, gross domestic product (GDP) per capita is 3338 USD in comparing with 13673 USD (world bank, 2023). This negatively reflects on out-of-pocket indicator in healthcare industry. Inflation rate was 33.9% in 2023 (world bank, 2023); additionally,

geopolitical circumstances negatively impact on sustainability of supply chain for all industries. Environmentally, Healthcare waste is classified to 8 categories according to WHO classification.15% of these wastes contribute in raising carbon dioxide (CO2) emissions through disposal methods as landfilling or burning. Egypt regulates waste management through various laws in addition to support green projects. CO2 emissions were estimated 2.2 tons per capita in 2023 in comparison with 4.7 worldwide however, it might be inaccurate due to immaturity in sustainability reporting (world bank, 2023). Recently, United States have insights on digital transformation as cornerstone in achieving sustainability consequently, Egypt implemented various technological strategies as electronic medical record and telemedicine. From business perspective, technologies and innovations achieve better efficiency even if it is costly. At highly competitive market as healthcare, the organizations struggle with complying with recent circumstances and achieving business sustainability. Ultimately, private hospitals have to achieve long term financial goals and align with sustainable Egyptian strategies to sustain their business.

2. Literature Review

2.1 Sustainability Measurements

Sustainability mainly has three hierarchy criteria social, environmental and economic. Sustainable outcomes could be customized according to objectives in different industries and countries. For instance, in Southeast Asia region Mehra and Sharma (2021) illustrated healthcare sustainable outcomes; environmentally sustainable outcomes categories are represented on circular practices, facilities design, waste management and sustainable supply chain; social outcomes are affordability, sustainable health, patient and employee satisfaction; economic outcomes are research& innovations, indigenous product, green growth and cost reduction. These indicators are represented to public sector especially indigenous product and research&innovations. In private sector, indicators could be changed; Wong *et al.* (2018) demonstrated 70 key performance indicators (KPIs) for sustainability in private sector with social, environmental and economic criteria. Brand reputation, market share and quality of service were added to economic pillar, however governance KPIs as number of penalties were missed (Wong *et al.,* 2018). Sustainability is categorized in another three macro-area social, environmental and organizational area (Brambilla, 2021) (Brambilla *et al.,* 2022). Organizational area discussed clinical indicators relating to patient safety and outcomes. Future proofing, empowerment and ergonomics are ranked with the highest importance in german healthcare industry (Brambilla *et al.,* 2022). Best practices of sustainability reporting in healthcare categorize sustainable outcomes to social, environmental and governance category as SSE recommendations (Messmann *et al.,* 2024). Systemic review fulfills gaps in past studies; it represents the reporting in various sub-criteria relating to costs, market conditions, clinical patient outcomes, organizational outcomes, transparency&certificates and quality of services (Messmann *et al.,* 2024). In Egyptian healthcare industry, Gohary (2023) added sustainable outcomes in criteria namely, social, environmental, economic and governance to balancescore card (Kaplan and Norton, 1992).

2.1.1 Environmental Sustainability

Environmentally, sustainable outcomes are represented on water, energy, food, waste, and emissions management in addition to sustainable procurement system and sustainable building (Messmann *et al.,* 2024). Sustainable building is concentrated on ergonomics and green construction (Sahamira and Zakaria, 2014) (Messmann *et al.,* 2024). In developed countries, studies demonstrated the importance of green buildings and savings in operation costs relating to power or waste management (Brambilla *et al.,* 2022). On the other hand, waste, emissions, energy and water management systems are considered the main intiatives in developing countries (Mehra and Sharma, 2021); (Wong *et al.,* 2018).

2.1.2 Social Sustainability

Social initiatives are represented on well-being, workforce, society, suppliers, patient & other stakeholders' satisfaction and management (Messmann *et al.,* 2024). Workforce management and society accessibility have more attention on governmental sector (Brambilla *et al.,* 2022) (Mehra and Sharma, 2021). On the other hand, suppliers' relationship, patient satisfaction and corporate social responsibilities program grasped more attention on private sector (Wong *et al.,* 2018) (Gohary, 2023).

2.1.3 Economic Sustainability Versus Governance Sustainability

Economic initiatives are demonstrated on savings on operation costs relating to utilities management, brand reputation, profitability and market share especially in private sector (Wong *et al.,* 2018); on the other hand, governmental sector has economic initiatives as research& innovations and production (Mehra and Sharma, 2021). From governance perspective, there are many missing intiatives on economic pillar for instance, compliance with laws& regulations, internal policies, number of penalties and hierarchy of the organizations (Messmann *et al.,* 2024); (Gohary, 2023). In

healthcare industry, patient safety and clinical outcomes are cornerstones in sustainability intiatives (Brambilla *et al.,* 2022) (Gohary, 2023) (Messmann *et al.,* 2024). Overall, sustainability intiaitves could be custamized according to obstacles in each country and sector.

2.2 Assessment of TQM Implementation

2.2.1 MBNQA & EFQM Models

Traditional TQM activities focus on quality planning & standardization, assurance, control and improvement, it is represented to Deming prize model (Crosby, 1979). Recently, assessment tools of TQM have kept up with changes on business environment for instance, EFQM and MBNQA through supporting criteria (Purba and Setiawan, 2021). MBNQA model divides criteria to inputs and outcomes; inputs criteria are representing to customer & employee satisfaction, leadership support, alignment with strategy, process maturity and information management however, outcome criteria isn't assigned (Easton, 1993). In healthcare industry, various studies have emphysised on positive relation between inputs and outcomes criteria (Sabella *et al.,* 2014); (Manjunath *et al.,* 2007); (Alanazi, 2020). Additionally, it is assumed that the strategy criteria has mediating role on relation between leadership criteria and other inputs criteria (Alanazi, 2020). On the other hand, EFQM has enablers and outcomes criteria (Shergold and Reed, 1996). Enablers criteria are representing leadership, policy & strategy, workforce, sources and process control; outcomes criteria are society, professionals, customers and business outcomes in addition to feedback loop criteria (Schoten *et al.,* 2015). EFQM tool have been modified several times in 2003, 2010, 2013 and 2020; however, version 2020 was modified to adapt current global agility and digital transformation (Mitsiou and Zafiropoulos, 2024). It is emphasised on positive relation between enablers and outcomes in various perspectives; however it is domenstrated that the criteria of improvement loop and creativitiy has negative correlation with outcomes criteria in the previous period (Schoten *et al.,* 2015). Overall, MBNQA tool is fulfilling the gap in EFQM tool of missing information management criteria. On the other hand, version 2020 of EFQM introduced new framework of business excellence to adapt with agility environment without measuring the level of implementation TQM (Mitsiou and Zafiropoulos, 2024).

2.2.2 Impact TQM Implementation on Sustainability Performance

TQM has direct positive effect on social perspectives and indirect effect on environmental and economic through the mediating green practices impact in organizations with fully implementation of TQM approach (Fok *et al.,* 2023). Green practices as mediator variable is representing to innovations solutions toward sustainability as waste management and eco-friendly products consumption. Moreover, organization culture is representing quality concerns, innovations and risk management (Fok *et al.,* 2023). TQM constructs are demonstrated through the advanced tools as statistical process control, six sigma and internal audit; the author implied that these hard aspects could accurately meusure the level of TQM implementation. The author emphysized on the importance of TQM practices and organization culture on sustainability performance (Fok *et al.,* 2023).

The Integration between EFQM categories and sustainable outcomes was studied in longitudinual study for 14 years; the study emphysised on positive relation between EFQM categories and sustainable outcomes (Menezes *et al.,* 2022). Wassan *et al.* (2022) demonstrated the positve influence of TQM variables as top management commitment, customer focus and emplyee empowerment on sustainability and organizational performance.

Various systemic reviews implied that positive relation between TQM, business performance and sustainability performance could be mediated by dynamic capabilities representing on integrating, learning, sensing and coordinating capabilities of workforce (Aichouni *et al.,* 2022) (Aichouni *et al.,* 2024). In addition, Many studies measured level TQM implementation through modified versions of MBNQA or EFQM and their influence on sustainability performance in its three perspectives namely, social, environmental and economic. Studies demonstrate that TQM level has positive impact on social and environmental sustainable outcomes however, it is assumed that TQM don't have impact on economic sustainable outcomes (Zaid *et al.,* 2024) (AlShehail *et al.,* 2021).

2.3 Dynamic Capabilities

Dynamic capabilities are identified as ability of organization to modify and change the work environment and processes toward external circumstances; it could be considered as extension for resource-based theory (Teece, 2007); (Zahra *et al.,* 2006). Dynamic capabilities are classified to scanning, sensing and re-configuring capabilities (Karman and Savanevičienė, 2020). Singh *et al.* (2021) classified green dynamic capabilities to green strategic, green innovation and green management capabilities to customize scanning, sensing and reconfiguring capabilities on manufacturing sector. The importance of dynamic capabilities is demonstrated on implementation green improvement projects (Langholf and Wilkens, 2021). The authors implied that dynamic capabilities have positive effect on sustainability

practices and innovations (Yousaf, 2021); (Singh *et al.,* 2021). Dynamic capabilities act as supporting factors for implementation TQM (Otieno, 2025).

3. Methodology

This study focuses on Egyptian healthcare industry. Quantitative and qualitative analysis technique are applied to analyse the relations between variables by utilizing questionnaire survey. Hard aspects of TQM are used to assess level of TQM implementation from Fok *et al.* (2023) model with adding measurements representing to leadership and strategic criteria (Ziad *et al.,*2024). Green practices variable is used as mediator for interrelation between TQM and sustainability performance (Fok *et al*,. 2023). Dynamic capabilities variable is used as mediator variable for relation between TQM and sustainability (Aichouni *et al.,* 2024). The measurements are custamized from Yousaf (2021) model. Additionally, three pillars environmental, social and governance are representing business sustainability (Fok *et al.,* 2023); (Messmann *et al*., 2024); (Ziad *et al.,* 2024).

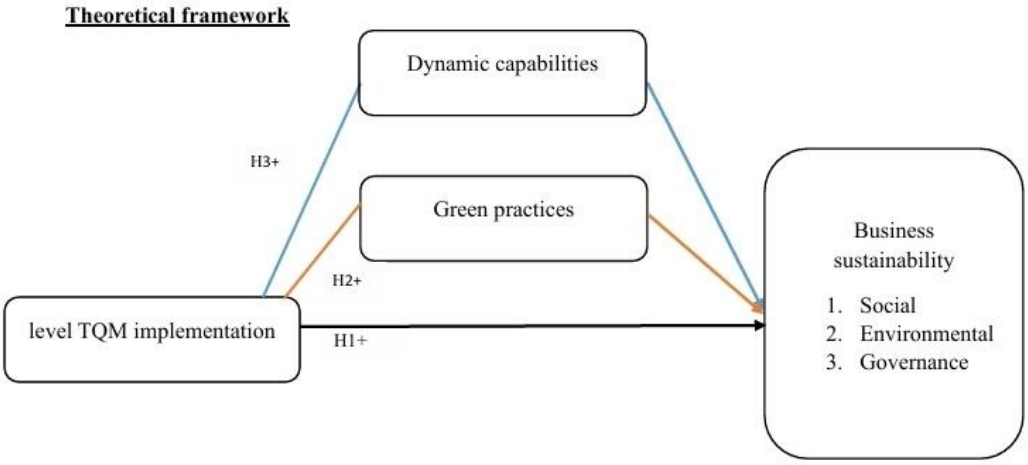

Figure 2. Theoretical framework

3.1 Hypotheses

Hº: TQM philosophy implementation has negative impact on business sustainability.

H1: TQM philosophy implementation has positive impact on business sustainability performance.

H2: green practices variable is mediating the positive relation between TQM and business sustainability.

H3: dynamic capabilities are mediating relation between TQM and sustainability performance.

3.2 Sampling

Healthcare workers were estimated 330000 persons in public sector however, it was implied that the number of healthcare workers in private sector is more than public sector; unfortunately, there wasn't approved data (Fayed *et al.,* 2021). There are many private Egyptian hospitals that haven't implemented internal quality management system (QMS) yet. Top & middle managers are oriented with various activities and the holistic view of QMS (Wassan *et al.,* 2022); (Zaid *et al.,* 2024). It was estimated that the range number of board members is between 2 and 20 in private sector organizations (Fayed *et al.,* 2021). Purposive- judgemental sample was taken with criteria of working on hospital implementing the internal QMS once time (Sekaran and Bougie, 2016); (Elsafty, 2020). The result of difficulties in data collection phase as rejection to share data; additionally, privacy of contacts data in hospitals from legal institutions. Sample size was 31 healthcare professionals on top and middle managers in private hospitals with internal QMS. the confidence level is 90% and margin of error is 15%.

3.3 Questionnaire

- Survey consists of five parts; first part is measured level of TQM implementation in healthcare organizations customized from (Fok et al., 2023) model. It is represented mean of 10 items on TQM practices. The second part

is discussed green practices represented through mean of 11 items for green practices (Fok et al., 2023). The third part is related to dynamic capabilities represented through mean of 7 items on sensing, learning, and innovation abilities (Yousaf, 2021).The fourth part is demonstrated to the impact of TQM implementation on business sustainability in its three pillars social, environmental and governances (Zaid et al., 2024); (Wong et al., 2018). The fifth part is demographic data as below. By using Likert scale (1 -5) to rate all variables on hospitals (1: very limited extent 2: small extent 3: moderate extent 4: large extent 5: extremely large extent).

3.4 Quantitative Analysis

3.4.1 Participants and Procedure

A total of 31 managers and professionals participated in this survey from Egyptian healthcare organizations. Most were team leaders or heads of section (77.4%). Experience ranged from 0–5 to over 20 years, with all participant from private hospitals in Egypt.

3.4.2 Measures

Composite variable reliability (Cronbach's alpha) is reported below.

Table 1. Measurements

Variable	Measurements	Reference	Modifications
TQM implementation	1. Quality management awareness program	(Fok *et al*., 2023)	Add improvement projects to seventh measurement.
	2. Quality improvement teams and quality circles		
	3. Quality checking tools as SPC & acceptance level		
	4. Internal quality audit		
	5. Quality cost-benefit analysis		
	6. Quality improvement according to benchmarking measures		
	7. Six sigma programs and improvement projects		
	8. Quality improvement is a commitment of top management across all levels	(Zaid *et al.,* 2024)	None
	9. The emphasis on quality is more significant than cost for top management.		
	10. The hospital's strategies and plans are primarily geared toward enhancing quality		
Green practices	1. Design environmentally friendly services	(Fok et al., 2023)	Origin M2: Use recycles materials and reduce waste
	2. Implement effective plan for dealing with hazard materials.		
	3. Uses less environmentally harmful materials and reduce waste in services		
	4. Implement sustainable waste segregation and management system		Origin M4: Re-use or safely dispose of supplies
	5. Use environmentally friendly and energy-saving technology		
	6. Implement requirements that mitigate harm impact on environment as X-ray & CT services		Origin M6: Eliminate business practice that harm the environment
	7. Promote environmentally friendly activities as the safe disposal of waste and water saving		
	8. Lead and support green activities inside and outside		Origin M7: Promote environmentally friendly products and services
	9. Allocate sufficient financial resources for green practices		
	10. Create healthy culture work environment		
	11. Measure effectiveness of green practices		

Dynamic capabilities	1. The hospital has the ability that can fast monitor environment to identify green opportunity 2. The hospital has routine to identify and develop green knowledge 3. The hospital has ability to develop new green process and procedures 4. The hospital has ability to assimilate, learn, generate, combine, share, transform and apply new green knowledge 5. The hospital has ability to integrate and manage specialized green knowledge within the hospital 6. The hospital has ability to successfully coordinate employees to develop green process 7. The hospital has ability to successfully allocate resource to develop green innovations	(Yousaf, 2021)	Change green technology to green process and procedures
Business sustainability	**Environmental sustainability** 1. Reducing direct and indirect toxic waste from the hospital. 2. They are reducing and recycling hospital waste. 3. Increasing the purchase rate of environmentally friendly products. 4. Reducing accidents such as medical waste, poisoning, or radioactive emissions.	(Zaid *et al.,* 2024)	
	Social sustainability 1. Enhancing employee satisfaction rate. 2. Enhancing Patient satisfaction rate. 3. Growing awareness of the regulations preserving workers' health and safety 4. Reduce negative impact of hospital waste on local community 5. Participate on social responsibility initiatives (own work)	(Wong et al., 2018); (Zaid *et al.,* 2024)	
	Governance sustainability 1. Cost reduction of waste management. 2. Cost reduction in energy usage. 3. increasing market share 4. increasing growth rate related to reduction cost of waste & energy. 5. Decreasing sentinel events and adverse events. 6. Enhancing patient safety KPIs. 7. enhancing brand reputation 8. Decreasing on number of penalties. 9. Increasing on awareness and adherence of code of ethics & conduct.		Modification: measurements of brand reputation and adherence of code of ethics are added to governance pillar instead of social pillar according to Egyptian exchange recommendations,

3.4.3 Results

3.4.3.1 Descriptive Statistics

3.4.3.1.1 Demographic

The study sample comprised 31 participants, with 18 males (58.1%) and 13 females (41.9%). The distribution of participants' professional experience reveals a diverse and balanced sample across career stages. The largest proportion (about 35%) have between 11 and 15 years of experience, suggesting a strong mid-career representation in the surveyed group. Another 26% fall within the 16–20 years category, indicating significant expertise and tenure. Early-career

professionals (0–5 years) make up a smaller portion of the sample (approximately 6%), while those with 6–10 years and more than 20 years of experience account for about 16% each. The majority of participants in the study (nearly 80%) hold the roles of team leader or section head, indicating that the perspectives chiefly represent operational and middle management within the healthcare organizations surveyed. A smaller percentage, about 12-13%, are senior-level professionals, and an even smaller group are top executives, such as CEOs or directors. This distribution suggests that the sample is weighted toward those most directly involved in daily management, quality initiatives, and team leadership.

3.4.3.1.2 Composite Variables Descriptive (Table 2)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
TQM_Mean	31	2.20	5.00	4.1677	.65949	-1.164	.421	1.457	.821
GP_Mean	31	2.09	5.00	3.9179	.84186	-.657	.421	-.159	.821
DC_Mean	31	1.29	5.00	3.6728	1.20723	-.174	.421	-1.410	.821
SUS_Mean	31	2.28	5.00	4.0681	.80197	-.615	.421	-.687	.821
Valid N (listwise)	31								

Descriptive analysis of the study's composite variables reveals high levels of TQM, green practices, dynamic capabilities, and sustainability among participating healthcare organizations. TQM_Mean exhibited a high average score (M = 4.17, SD = 0.66) with a minimum of 2.20 and a maximum of 5.00, and a negatively skewed distribution (skewness = -1.16), indicating that most respondents rated their organizations' quality practices toward the higher end of the scale. Green practices (GP_Mean) were similarly strong (M = 3.92, SD = 0.84), also negatively skewed, but displaying a nearly normal kurtosis, reflecting both consistency and some diversity in environmental practices. Dynamic capabilities (DC_Mean) showed the broadest range (M = 3.67, SD = 1.21, min = 1.29, max = 5.00) and were fairly normally distributed (skewness = -0.17), though with lighter tails (kurtosis = -1.41). Sustainability (SUS_Mean) received the highest mean rating (M = 4.07, SD = 0.80), again showing a moderate negative skew and a relatively normal curve shape. Overall, these results suggest a sample characterized by strong performance in quality management and sustainability, supporting the suitability of the data for advanced parametric analyses such as regression and mediation (Field, 2018).

3.4.3.2 Reliability Analysis

The internal consistency of the survey instrument was assessed using Cronbach's alpha. The result ($\alpha = .968$ for 46 items) indicates excellent reliability across all items and composite scales. This extremely high value demonstrates that the items consistently measure the intended all constructs within the sample. The slightly lower (but still excellent) alpha based on standardized items ($\alpha = .967$) confirms this finding. Such high reliability supports the validity and robustness of the composite scores used in subsequent analyses (Nunnally & Bernstein, 1994).

3.4.3.3 Correlation Analysis

Table 3. Sustainability variables single & composite correlation analysis

		Correlations						Composite SUS
		ES_mean	SS_mean	GS_mean	TQM_Mean	GP_Mean	DC_Mean	SUS_Mean
ES_mean	Pearson Correlation	1	.665***	.708***	.676***	.729***	.607***	
	Sig. (2-tailed)		.000	.000	.000	.000	.000	
	N	31	31	31	31	31	31	
SS_mean	Pearson Correlation	.665***	1	.863***	.734***	.742***	.735***	
	Sig. (2-tailed)	.000		.000	.000	.000	.000	
	N	31	31	31	31	31	31	
GS_mean	Pearson Correlation	.708***	.863***	1	.700***	.735***	.708***	
	Sig. (2-tailed)	.000	.000		.000	.000	.000	
	N	31	31	31	31	31	31	
TQM_Mean	Pearson Correlation	.676***	.734***	.700***	1	.573***	.737***	.762***
	Sig. (2-tailed)	.000	.000	.000		.001	.000	.000
	N	31	31	31	31	31	31	31
GP_Mean	Pearson Correlation	.729***	.742***	.735***	.573***	1	.764***	.794***
	Sig. (2-tailed)	.000	.000	.000	.001		.000	.000
	N	31	31	31	31	31	31	31
DC_Mean	Pearson Correlation	.607***	.735***	.708***	.737***	.764***	1	.752***
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	31	31	31	31	31	31	31
SUS_Mean	Pearson Correlation							1
	Sig. (2-tailed)							
	N							31

***. Correlation at 0.001(2-tailed)

i. Sustainability Variables single Correlation (Environmental, Social, Governance)

Pearson Correlations

This correlation shows that each sustainability dimension environmental (ES_mean), social (SS_mean), and governance (GS_mean) is strong positively related to the overall sustainability composite (SUS_Mean) and to the key predictors TQM_Mean, GP_Mean, and DC_Mean. ES_mean is highly correlated with SS_mean (r = .67) and GS_mean (r = .71), indicating that hospitals performing well environmentally also tend to perform well socially and in governance. ES_mean is also strongly associated with TQM_Mean (r = .68), GP_Mean (r = .73), and DC_Mean (r = .61), suggesting that higher levels of TQM, green practices, and dynamic capabilities are consistently linked with stronger environmental sustainability. Similarly, SS_mean and GS_mean exhibit very strong intercorrelations (r = .86) and strong correlations with TQM_Mean (r = .73–.70), GP_Mean (r = .74–.74), and DC_Mean (r = .74–.71), all significant at $p < .001$. These patterns confirm that the three sustainability pillars move together and are systematically associated with the TQM system and its mediating mechanisms, providing a solid empirical basis for the subsequent regression and mediation analyses.

ii. Composite Variables Correlation

Pearson correlation analysis indicated significant and strong positive relationships between all core variables: (TQM_Mean), (GP_Mean), (DC_Mean), and (SUS_Mean). All correlations are statistically significant at the 0.001 level. Notably, TQM_Mean is strongly associated with sustainability (r = .762), indicating that higher implementation of TQM is closely linked to better sustainability outcomes. Similarly, TQM_Mean's correlations with green practices (r = .573) and dynamic capabilities (r = .737) highlight substantial overlap among these organizational competencies. The highest correlation observed is between green practices and sustainability (r = .794), suggesting that environmental initiatives are particularly influential in driving overall sustainability. The consistent strength and significance of these correlations support the theoretical model, justifying subsequent regression and mediation analyses to further examine these relationships (Field, 2018).

3.4.3.4 Regression Analysis Between TQM & Sustainability Variables Single/ TQM & Composite Sustainability (Table 4)

Variables Entered/Removed[a]

Models	Variables Entered	Variables Removed	Method
TQM→ES	TQM_Mean[b]	.	Enter
TQM→SS	TQM_Mean[b]		Enter
TQM→GS	TQM_Mean[b]		Enter
TQM→SUS	TQM_Mean[b]		Enter

Model Summary

Models	R	R Square	Adjusted R Square	Std. Error of the Estimate
TQM→ES	.676a	.456	.438	.56846
TQM→SS	.734a	.539	.523	.71843
TQM→GS	.700a	.490	.472	.59228
TQM→SUS	.762a	.581	.566	.52822

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
TQM→ES	Regression	7.871	1	7.871	24.357	.000b
	Residual	9.371	29	.323		
	Total	17.242	30			
TQM→SS	Regression	17.499	1	17.499	33.903	.000b
	Residual	14.968	29	.516		
	Total	32.467	30			
TQM→GS	Regression	9.755	1	9.755	27.810	.000b
	Residual	10.173	29	.351		
	Total	19.928	30			
TQM→SUS	Regression	11.203	1	11.203	40.153	<.001b
	Residual	8.091	29	.279		
	Total	19.295	30			

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.

TQM→ES	(Constant)	.747	.664		1.125	.270
	TQM_Mean	.777	.157	.676	4.935	.000
TQM→SS	(Constant)	-.736	.839		-.878	.387
	TQM_Mean	1.158	.199	.734	5.823	.000
TQM→GS	(Constant)	.489	.692		.708	.485
	TQM_Mean	.865	.164	.700	5.273	.000
TQM→SUS	(Constant)	.206	.617		.334	.741
	TQM_Mean	.927	.146	.762	6.337	<.001

a. Dependent Variable: ES_mean/ SS_mean/ GS_mean/SUS_mean

b. All requested variables entered.

c. Predictors: (Constant), TQM_Mean

i. Environmental Sustainability

This regression examines whether TQM implementation predicts the environmental sustainability dimension (ES_mean). The overall model is statistically significant, $F(1, 29) = 24.36$, $p < .001$, indicating that TQM_Mean explains a substantial proportion of variance in environmental sustainability scores. The model accounts for about 46% of the variance in ES_mean ($R^2 = .456$, Adjusted $R^2 = .438$), which is a large effect in organizational research terms. The unstandardized coefficient for TQM_Mean ($B = 0.78$, $SE = 0.16$, $p < .001$) shows that a one-unit increase in perceived TQM implementation is associated with an average increase of approximately 0.78 units in environmental sustainability, holding other factors constant. The standardized beta ($\beta = .68$) confirms a strong positive relationship. The intercept is not statistically significant ($p = .27$), which is common and not substantively important, as a TQM score of zero is outside the realistic range of the scale. Overall, these results demonstrate that stronger TQM practices have strong positive effect on environmental sustainability performance.

ii. Social Sustainability

This regression assesses whether TQM implementation predicts the social sustainability dimension (SS_mean). The model is statistically significant, $F(1, 29) = 33.90$, $p < .001$, indicating that TQM_Mean reliably explains variance in social sustainability scores. The coefficient of determination shows that TQM accounts for approximately 54% of the variance in SS_mean ($R^2 = .539$; Adjusted $R^2 = .523$), which is a large effect. The unstandardized regression coefficient for TQM_Mean ($B = 1.16$, $SE = 0.20$, $p < .001$) indicates that a one-unit increase in perceived TQM implementation is associated with an average increase of about 1.16 units in social sustainability, and the standardized beta ($\beta = .73$) confirms a strong positive relationship. The intercept is not statistically significant ($p = .39$), which is not substantively important because a TQM score of zero is unrealistic in practice. Overall, these results demonstrate the positive influence of TQM practices on social sustainability outcomes.

iii. Governance Sustainability

This regression tests whether TQM implementation predicts the governance sustainability dimension (GS_mean). The model is statistically significant, $F(1, 29) = 27.81$, $p < .001$, meaning that TQM_Mean reliably explains variation in governance sustainability practices. The coefficient of determination indicates that TQM accounts for approximately 49% of the variance in GS_mean ($R^2 = .490$; Adjusted $R^2 = .472$), which represents a large effect size in this context. The unstandardized regression coefficient for TQM_Mean ($B = 0.87$, $SE = 0.16$, $p < .001$) shows that, on average, a one-unit increase in TQM implementation is associated with an increase of about 0.87 units in governance sustainability scores, while the standardized beta ($\beta = .70$) confirms a strong positive relationship. The constant is non-significant ($p = .49$), which is expected because a true TQM score of zero is outside the realistic range. Overall, these results indicate that TQM practices have strong positive impact on governance sustainability.

iv. Regression Analysis Composite variables

A simple linear regression was conducted among TQM implementation (TQM_Mean) and sustainability performance (SUS_Mean). The model was highly significant ($F = 40.15$, $p < .001$), explaining approximately 58% of the variance in sustainability scores ($R^2 = .581$). The standardized regression coefficient for TQM_Mean was very strong ($\beta = .76$, $p < .001$), and the unstandardized coefficient ($B = 0.93$, $SE = 0.15$) indicates that each one-unit increase in TQM_Mean is associated with nearly a one-unit increase in SUS_Mean, holding all else constant.

The model's adjusted R^2 (.566) confirms the stability and robustness of this relationship. The non-significant constant (intercept, p = .741) indicates that the baseline sustainability score for organizations with TQM_Mean at zero is not statistically different from zero, though this value is not practically interpretable since TQM_Mean scores do not realistically approach zero . **These results provide strong empirical support for Hypothesis 1 (H_1)** by demonstrating a statistically significant positive relationship between TQM and business sustainability.

3.4.3.5 Mediation Analyses (PROCESS MACRO, Model 4)

i. Mediation analysis Interpretation (TQM → GP → SUS) (Table 5)

Model: 4

Y: SUS_Mean

X: TQM_Mean

M: GP_Mean

Sample Size: 31

OUTCOME VARIABLE:

GP_Mean

Model Summary

R	R-sq	MSE	F	df1	df2	p
.5725	.3278	.4928	14.1414	1.0000	29.0000	.0008

Model

	coeff	se	t	p	LLCI	ULCI
constant	.8719	.8198	1.0635	.2963	-.8047	2.5485
TQM_Mean	.7309	.1944	3.7605	.0008	.3334	1.1284

****

OUTCOME VARIABLE:

SUS_Mean

Model Summary

R	R-sq	MSE	F	df1	df2	p
.8781	.7710	.1578	47.1460	2.0000	28.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-.2358	.4728	-.4988	.6218	-1.2043	.7326
TQM_Mean	.5561	.1341	4.1461	.0003	.2814	.8308
GP_Mean	.5070	.1051	4.8254	.0000	.2918	.7222

********** DIRECT AND INDIRECT EFFECTS OF X ON Y **********

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI
.5561	.1341	4.1461	.0003	.2814	.8308

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI

GP_Mean	.3705	.1271	.1568	.6564

********** ANALYSIS NOTES AND ERRORS **********

Level of confidence for all confidence intervals in output:

95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:

5000

PROCESS macro mediation analysis (Model 4) demonstrated that TQM implementation exerts both direct (B = 0.556, $p < .001$) and indirect effects on business sustainability via green practices (indirect effect = 0.371, 95% CI [0.157, 0.656]). Both paths were statistically significant, supporting hypotheses H_1 and H_2. This shows that TQM increases sustainability in part by strengthening green practices within organizations, and also has effects above and beyond environmental strategies. The final model explained 77% of the variance in sustainability outcomes (Hayes, 2022). These findings support H1 and H2.

ii. Mediation Analysis Interpretation (TQM → DC → SUS) (Table VI)

Model: 4

Y: SUS_Mean

X: TQM_Mean

M: DC_Mean

Sample Size: 31

OUTCOME VARIABLE:

DC_Mean

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7369	.5431	.6889	34.4671	1.0000	29.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-1.9495	.9692	-2.0114	.0537	-3.9317	.0327
TQM_Mean	1.3490	.2298	5.8709	.0000	.8790	1.8189

****

OUTCOME VARIABLE:

SUS_Mean

Model Summary

R	R-sq	MSE	F	df1	df2	p
.8124	.6600	.2343	27.1793	2.0000	28.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	.7460	.6033	1.2364	.2266	-.4899	1.9818

TQM_Mean	.5531	.1982	2.7902	.0094	.1470	.9592
DC_Mean	.2769	.1083	2.5569	.0163	.0551	.4987

********** DIRECT AND INDIRECT EFFECTS OF X ON Y **********

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI
.5531	.1982	2.7902	.0094	.1470	.9592

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
DC_Mean	.3735	.2124	.0288	.8528

********** ANALYSIS NOTES AND ERRORS **********

Level of confidence for all confidence intervals in output:

95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:

5000

Mediation analysis using PROCESS macro-Model 4 revealed both direct and indirect effects of TQM on business sustainability, mediated through dynamic capabilities (DC_Mean). The direct effect of TQM_Mean on sustainability was significant (B = .5531, p = .009), and the indirect effect through DC_Mean was also significant (B = .3735, 95% CI [.029, .853]), supporting hypothesis H_3. This suggests that TQM's impact on sustainability is amplified by improvements in the hospital's capacity for sensing, learning, and strategic adjustment. The model explained 66% of the variance in sustainability outcomes (Hayes, 2022). These findings support H1 and H3.

3.4.4 Quantitative Analysis Conclusion

The quantitative analysis of 31 healthcare organizations provides compelling evidence that TQM implementation is a strong and consistent predictor of business sustainability performance. Regression results revealed that TQM accounts for over half of the observed variance in sustainability outcomes, with a robust, statistically significant effect size ($\beta = .76$, $p < .001$). This finding directly supports the central hypothesis that advancing quality management philosophies leads to substantial gains in organizational sustainability.

Mediation analysis further elucidated the pathways through which this effect occurs. Green practices were shown to serve as a statistically significant mediator, meaning that a part of TQM's positive impact on sustainability is achieved by encouraging the adoption of environmentally responsible behaviors and systems. Dynamic capabilities also contributed to the explained variance, but were less consistently significant as mediators when considered alongside green practices in a parallel mediation model.

The reliability and strength of results are underscored by high explanatory power (e.g., R^2 values consistently above .58) and tight confidence intervals. Together, these findings highlight not only the critical role of TQM in promoting sustainability, but also the importance of cultivating green operational practices and organizational capabilities.

3.5 Integration of Qualitative Insights With Quantitative Findings

Several open-ended qualitative questions were included in the survey. Thematic analysis of responses provides practitioner perspectives that both enrich and support the statistical results.

Table 7. Thematic Analysis

Theme or Question	QUAN Link	Supported Hypothesis	Example Quote 1	Example Quote 2	Explanation/Interpretation
Obstacles to TQM: Human resources, resistance, mindset	TQM_Mean, SUS_Mean	H_1	"the main problem is the human resource… awareness of change."	"Mindset of coworkers and top management concerns for cost over quality."	Explains variance TQM scores: staff buy-in and culture are critical for TQM success, paralleling variance in QUAN implementation data.
Top management support, resources, policy	TQM_Mean, DC_Mean	H_1, H_3	"Leadership and policy commitment, and resource allocation, are essential."	"Top management support is the key driver for sustainable change."	Matches strong TQM–sustainability and mediation findings: without leadership or resources, both TQM and outcomes suffer.
Communication, planning, measurement	TQM_Mean, DC_Mean	H_1, H_3	"Strategic planning, performance measurement… essential for driving quality."	"Communication between management and staff is vital for implementing improvements."	Shows that clear planning/metrics underlie strong TQM/Capabilities, supporting robust mediation in the quantitative models.
Green practices: energy, waste, renewables	GP_Mean, SUS_Mean	H_2	"Renewable energy, saving electricity, waste segregation, social responsibility events."	"Switching to LED lighting, running green awareness campaigns."	Supports why Green Practices mediate between TQM and sustainability—concrete actions boost both Green Practices and Sustainability
Accreditation/compliance/campaigns	GP_Mean, SUS_Mean	H_2	"Accredited as green hospital, regular waste management campaigns."	"Participation in environmental audits and sustainability certification."	Institutions active in green certification score higher on related quantitative scales and show stronger mediation.
Capabilities: culture, leadership, learning	DC_Mean	H_3	"Organizational culture change, leadership, and continual staff learning are vital."	"Strong leadership and continuous improvement are key capabilities."	Explains why dynamic capabilities enhances the effect of TQM on sustainability in mediation models.
Pathway: integrate economic/social/env., continuous improvement	All composites	H_1, H_2, H_3	"Integrate sustainability into operations; focus on continuous improvement."	"Sustainability is achieved by aligning all departments and goals with quality management."	Universal alignment: broad action across constructs links to the highest quantitative scores and strongest hypothesis support.
QMS impact: productivity, waste, engagement	TQM_Mean, SUS_Mean	H_1	"A QMS helps reduce waste, improve productivity, engage employees."	"Quality management creates a culture of accountability and high performance."	Mechanisms by which TQM boosts Sustainiablity—productivity and culture are central to statistical effect.
Measurement, best practices, collaboration	DC_Mean	H_3	"Use performance metrics and best practices sharing to improve."	"Collaboration and data-driven learning are essential for adapting to new sustainability requirements."	The reason why dynamic capabilities, measured quantitatively, are pivotal for sustained improvement and mediation in the model.

3.5.1 Analysis Conclusion

The joint analysis confirms that practitioner insights—particularly around leadership, culture, resource allocation, and specific green practices—closely mirror and explain the strongest relationships found in the quantitative analysis. Barriers such as resistance to change and lack of resources account for some variance in TQM and outcomes, while leadership, continuous improvement, and strategic planning emerge as universal enablers, corresponding to mediation effects seen for Green Practices and Dynamic Capabilities. The integration of numeric and narrative data provides comprehensive, real-world validation of hypotheses (H_1, H_2, H_3).

3.5.2 Practical Implications

The study suggests that TQM implementation can significantly impact on business sustainability in Egyptian healthcare industry. TQM can add competitive edge and strengthen hospital's image in the market. Additionally, it highlights potential environmental improvement incorporating into their operations. The complementary connections with mediating effects can help executives to highlight obstacles to enhance on their organizations for instance, strategic consensus and human resource issues.

Healthcare organizations hesitate to deploy TQM and sustainable initiatives especially environmental and social initiatives because of their short-term objectives and high investment cost. However, the practical findings demonstrate that TQM directly benefit on long term goals and governance KPIs as brand reputation and operation costs.

3.5.3 Study Limitations and Further Research

There are several limitations to this paper for instance, the sample size was restricted to 31 participants from Egyptian healthcare industry. A bigger sample size would have been advantageous in generalizability, even though it was sufficient for the study. Further empirical research should explore the relation between TQM level and sustainability across diverse sectors including governmental sector. Such studies could also investigate across various industries and countries.

3.5.4 Conclusion

This study demonstrates several theoretical insights worth considering. Achieving sustainability through TQM philosophy is one of these findings. Additionally, a few studies have focused on the role of mediators' green practices and dynamic capabilities particularly on healthcare industry of developing country.

Moreover, this study fills gap in previous literature by analyzing the mediating effect on dynamic capabilities and green practices which add theoretical contribution in achieving the sustainability. The main purpose of this study is demonstrating framework for business sustainability through TQM. The data collection was gathered from private Egyptian hospitals through online and off lines surveys. The results are crucial for private hospitals to consider as they seek to business sustainability. The findings present that TQM has significant positive impact on business sustainability. Additionally, green practices and dynamic capabilities are positively mediating the relation between TQM and business sustainability.

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Authors' contributions

Ashraf Elsafty was responsible for full supervision, guidance, reviews throughout paper development, originality, conceptualization, methodology development, validation, data revisions, and project administration.

Reham Elgazar was responsible for paper development, writing/editing, literature review, data curation, data collection, data analysis, visualization, discussion, conclusions, and paper formatting with references needed.

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Data sharing statement

No additional data are available.

References

Aichouni, M., Ferreira, L. P., & Silva, F. J. G. (2022). *Total quality management philosophy within the fourth industrial revolution towards sustainability: a state-of-the-art literature review and a proposed protocol for further research'.* Braga, Portugal, university of Minho, pp. 14-15.

Aichouni, M., Silva, F. J. G., & Ferreira, L. P. (2024). A systematic literature review of the integration of total quality management and industry 4.0: enhancing sustainability performance through dynamic capabilities. *Sustainability, 16*(20), 9108. https://doi.org/10.3390/su16209108

Alanazi, M. (2020). The mediating role of primary TQM factors and strategy in the relationship between supportive TQM factors and organisational results: an empirical assessment using the MBNQA model. *Cogent Business & Management, 7*(1), 1771074. https://doi.org/10.1080/23311975.2020.1771074

Al-Shdaifat, E. (2015). Implementationof total quality management in hospitals. *Journalof Taibah University Medical Sciences, 10*(4), 461-466. https://doi.org/10.1016/j.jtumed.2015.05.004

AlShehail, A. S., Khan, M., & Ajmal, M. M. (2021). Total quality management and sustainability in public service sector. *Benchmarking: An International Journal, 29*(2), 382-410. https://doi.org/10.1108/BIJ-08-2020-0449

Brambilla. (2021). *Evidence informed hospital assessment-implementation, weight, and test of a multiple criteria tool for social, environmental and organizational quality assessment of hospital buildings.* Milan, Politecnico di Milano.

Brambilla, A., Apel, K., Schmidt-Ross, W., Buffoli, M., & Capolongo, S. (2022). Testing of a multiple criteria assessment tool for healthcare facilities quality and sustainability: the case of german hospitals. *Sustainability, 14*(24), 16742. https://doi.org/10.3390/su142416742

Crosby, P. (1979). *Quality is Free: the Art of Making Quality Certain.* New York: McGraw Hill.

Easton, G. (1993). The state of US total quality management: a Baldrige examiners perspectiv. *California Management Review, 35*(3), 32-54. https://doi.org/10.2307/41166742

Elsafty, A. (2018). *business anatomy: the 9 Elements Model proposed by Elsafty.* Retrieved from https://www.researchgate.net/figure/Business-Anatomy-The-9-Elements-Model-Proposed-by-Elsafty-2018_fig2_342528388

Elsafty, A. (2020). *Lecture.sampling 2/4. definitions & sampling Frame.* Retrieved from https://www.youtube.com/watch?v=VEBFDnTN8bQ

Fayed, A. A. M. S., Elshoura, S. M. Y., & Mosallam, R. A. (2021). Governance structures and practices in for-profit and not-for profit hospitals in Egypt. *Int J Health Plann Mgmt., 36*(4), 1069-1080. https://doi.org/10.1002/hpm.3152

Field, A. P. (2018). *Discovering statistics using IBM SPSS statistics* (5 ed.). London: Sage.

Fok, L. Y., Morgan, J. P., Zee, S. M., & Mock, L. (2023). The impact of organizational culture and total quality management on the relationship between green practices and sustainability performance. *International Journal of Quality & Reliability Management, 40*(6), 1564-1586. https://doi.org/10.1108/IJQRM-12-2021-0450

GAHAR. (2021). *Accreditation Standards.* Retrieved from https://www.gahar.gov.eg/page/p/%D9%85%D8%AA%D8%B7%D9%84%D8%A8%D8%A7%D8%AA-%D8%A7%D9%84%D8%A7%D8%B9%D8%AA%D9%85%D8%A7%D8%AF

Gohary, M. (2023). Developing a sustainable balanced scorecard (SBSC) model by integrating EESG (Economic, Environmental, Social, and Governance) performance indicators for private hospitals in Egypt. *International Journal of Accounting and Management Scienc,* 2(1), pp. 264-297.

GRI. (2024). *Download GRI the standards.* Retrieved from https://www.globalreporting.org/standards/download-the-standards/

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: a regression-based approach* (3 ed.). New York: Guilford Press.

Hill, R. (1998). What sample size is "enough" in internet survey research. *Interpersonal Computing and Technology Journal, 6*(3/4), 3-4.

Kaplan and Norton. (1992). The balanced scorecard: measures that drive performance. *Harvard Business Review, 70*(1), 71-79.

Karman, A., & Savanevičienė, A. (2020). Enhancing dynamic capabilities to improve sustainable competitiveness: insights from research on organisations of the Baltic region. *Baltic Journal of Management, 15*(3), 318-341. https://doi.org/10.1108/BJM-08-2020-0287

Langholf, T., & Wilkens, U. (2021). Agile project management, new leadership roles and dynamic capabilities – insight from a case study analysis. *Journal of Competences, Strategy & Management, 11*, 1-18.

Manjunath, U., Metri, B. A., & Ramachandran, S. (2007). Quality management in a healthcare organisation: a case of South Indian hospital. *The TQM Magazine, 19*(2), 129-139. https://doi.org/10.1108/09544780710729971

Mehra, A., & Sharma, R. (2021). Sustainability analytics and modeling 1. *Measures of sustainability in healthcare, 1*, 100001. https://doi.org/10.1016/j.samod.2021.100001

Menezes, L. M., Tena, A. B., & Bou-Llusar, J. C. (2022). Sustainability and Quality management: has EFQM fostered a sustainability orientation that delivers to stakeholders?. *International Journal of Operations &Production Management, 42*(2), 155-184. https://doi.org/10.1108/IJOPM-10-2021-0634

Messmann, L., Köhler, S., Antimisaris, K., Fieber, R., Thorenz, A., & Tuma, A. (2024). Indicator-based environmental and social sustainability assessment of hospitals. *Journal of Cleaner Production, 462*, 142721. https://doi.org/10.1016/j.jclepro.2024.142721

Mitsiou, E., & Zafiropoulos, K. (2024). Systematic literature review on the application of the EFQM model as a framework in quantitative research in the context of the Greek public sector. In Vrontis, D., Weber, Y., & Tsoukatos, E. (Eds.), *Global Business Transformation in a Turbulent Era* (pp. 591-605). EuroMed Press, Greece.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3 ed.). New York: McGraw-Hill.

Otieno, A. (2025). The Impact of dynamic capabilities on the performance of quality management systems in manufacturing companies in Kenya. *The University Journal, 7*(1), 152-164. https://doi.org/10.59952/tuj.v7i1.380

Purba, J. T., & Setiawan, S. (2021). A systematic literature review of Malcolm Baldrige national quality award (MBNQA). *Journal of Technology Management for Growing Economies, 12*(1), 1-12. https://doi.org/10.15415/jtmge.2021.121001

Sabella, A., Kashou, R., & Omran, O. (2014). Quality management practices and their relationship to organizational performance. *Journal of Operations & Production Management, 34*(12), 1487-1505. https://doi.org/10.1108/IJOPM-04-2013-0210

Saha, T., Belal, & Jackson. (2022). Examining the role of Tqm and industry 4.0 on sustainability performance: an empirical study on Bangladesh's ready-made garment sector. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.4079777

Sahamira, N. Z., & Zakaria, R. (2014). Green assessment criteria for public hospital building development in Malaysia. *Procedia Environmental Sciences, 20*, 106-115. https://doi.org/10.1016/j.proenv.2014.03.015

Santerre, R. E., & Neun, S. P. (2012). *Health economics: theory, insights, and industry studies* (5th ed.). Mason, OH: South-Western Cengage Learning.

Schoten, S. M., de Blok, C., Spreeuwenberg, P., Groenewegen, P. P., & Wagner, C. (2015). The EFQM Model as a framework for TQM in healthcare. *International Journal of Operations, 35*(6), 901-922. https://doi.org/10.1108/IJOPM-03-2015-0139

SDS Egypt. (2023). *Sustainable health strategy: health pillar- Egypt 2030.* Retrieved from http://sdsegypt2030.com/?lang=en

Sekaran and Bougie. (2016). *Research Methods for business* (7 ed.). West sussex, UK: John Wiley & sons.

Shergold, K., & Reed, D. M. (1996). Striving for excellence: how self-assessment using the Business Excellence Model can result in step improvements in all areas of business activities. *TQM Magazine, 8*(6), 48-52. https://doi.org/10.1108/09544789610152937

Singh, S. K., Del Giudice, M., Chiappetta Jabbour, C. J., Latan, H., & Sohal, A. S. (2022). Stakeholder pressure, green innovation, and performance in small and medium-sized enterprises: the role of green dynamic capabilities. *Business Strategy and the Environment, 31*(1), 500-514. https://doi.org/10.1002/bse.2906

SSE. (2015). *Model guidance on reporting ESG.* Retrieved from https://sseinitiative.org/sites/sseinitiative/files/documents/sse-model-guidance-on-reporting-esg.pdf

Subaşı, B., Öztürk, G. K., & Bolaç, S. (2022). Total Quality Management and the Impact of Innovation on the Performance of Hospitals: example of Private Hospitals in Ankara. *Lokman Hekim Journal, 12*(3), 645-657. https://doi.org/10.31020/mutftd.1097160

Teece, D. (2007). Explicating dynamic capabilities:the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal, 28*(13), 1319-1350. https://doi.org/10.1002/smj.640

UNFCC. (2015). *The Paris Agreement.* Retrieved from https://unfccc.int/process-and-meetings/the-paris-agreement

Wassan, A. N., Memon, M. S., Mari, S. I., & Kalwar, M. A. R. (2022). Impact of total quality management (TQM) practices on sustainability and organisational performance. *Journal of Applied Research in Technology & Engineering, 3*(2), 93-102. https://doi.org/10.4995/jarte.2022.17408

WHO. (2023). *Ambient air pollution attributable death rate (per 100 000 population), WHO World Health Data Hub.* Retrieved from https://data.who.int/indicators/i/CCCEBB2/217795A

WHO. (2023). *Global health observatory.* Retrieved from https://www.who.int/data/gho/data/themes/sustainable-development-goals

WHO. (2025). *WHO Data.* Retrieved from https://data.who.int/countries/818

Wong, K. Y., Chong, C. W., Chew, B. C., Tay, M. L., & Mohamed, N. M. (2018). KEY performance indicator for measuring sustainability in healthcare industry in Malaysia. *Journal of Fundamental and Applied Sciences, 10*(1), 646-657.

World Bank. (2023). *World Bank Open Data.* Retrieved from https://data.worldbank.org/indicator

Yousaf, Z. (2021). Go for green: green innovation through green dynamic capabilities:accessing the mediating role of green practices and green value co-creation. *Environmental Science and Pollution Research, 28*(39), 54863-54875. https://doi.org/10.1007/s11356-021-14343-1

Zahra, S. A., Sapienza, H. J., & Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: a review, model and research agenda. *Journal of Management Studies, 43*(4), 917-955. https://doi.org/10.1111/j.1467-6486.2006.00616.x

Zaid, A. A., Othman, M., Qubbaj, I. S., & Asaad, A. M. (2024). Does total quality management mediate the relationship between Industry 4.0 and business sustainability in private hospitals?. *International Journal of Quality & Reliability Management, 41*(3), 905-932. https://doi.org/10.1108/IJQRM-03-2024-0084