International Journal of Applied Economics, Finance and Accounting
ISSN 2577-767X
Vol. 19, No. 1, pp. 196-215
2024
DOI: 10.33094/ijaefa.v19i1.1632

Healthcare service quality management: Evidence from Morocco

Manal Jeyar[1*]
Abdeslam El Moudden[2]
Omar Taouab[3]

[1,2,3]*Management Business Department, National School of Business and Management, Ibn Tofail University, Kenitra, Morocco.*
[1]*Email:* jeyarmanal1@gmail.com
[2]*Email:* elmoudden.abdesselam@uit.ac.ma
[3]*Email:* taouabomar@yahoo.fr

Keywords:
Information systems
Integrated management
Performance
Quality management
Statistical modeling.

JEL Classification:
I15; I18; H11; C38.

Received: *10 January 2024*
Revised: *29 March 2024*
Accepted: *23 April 2024*
Published: *20 June 2024*
(Corresponding Author)*

Abstract

This paper empirically evaluates the influence of implementing quality, safety, environment and information systems security practices on the organizational performance and overall quality of healthcare organizations in the Moroccan context using data from a sample of 50 healthcare entities in the Rabat-Salé-Kénitra region selected from a pool of 76 organizations. This research employs the partial least squares (PLS) method for analysis to test hypotheses regarding the nature of health service quality in Morocco across various forms. The outcomes of this study reveal a significant and positive relationship between organizational performance in Moroccan healthcare facilities and adopting practices emphasizing quality, safety, environment and information security systems. Notably, organizations incorporating these practices generally demonstrate heightened levels of performance. This study posits that the incorporation of an integrated management system can catalyse continuous improvement and enhanced performance within the Moroccan healthcare sector. These results suggest that the implementing integrated management systems could contribute to ongoing improvement and elevate organizational performance standards throughout the broader healthcare sector. However, generalizing these findings to all Moroccan healthcare facilities requires a larger sample spread across all Moroccan regions to enable a comprehensive understanding of the impact of these practices on organizational performance across the entire healthcare landscape of Morocco.

Funding: This study received no specific financial support.
Institutional Review Board Statement: The Ethical Committee of the Ibn Tofail University, Morocco has granted approval for this study (Ref. No. ETH-2024-001).
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Data Availability Statement: The corresponding author may provide study data upon reasonable request.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.

1. Introduction

Critical challenges surrounding service and work quality persist presenting variations based on the organization type such as public, semi-public or private in the Moroccan healthcare sector. These challenges carry substantial implications for citizens' health security, a concern further heightened by the ongoing COVID-19 pandemic. The pandemic has accentuated the immediate need for optimized and efficient management of logistical and human resources. The examination of establishing or restoring a specific quality management system for healthcare organizations becomes indispensable with a focus on patients rather than generic consumers given the unique clientele in healthcare. Therefore, tailored scientific research studies for each country are highly desirable. Furthermore, the dual 2RM methodology aims to enhance operational efficiency in the healthcare sector in Morocco by balancing performance considerations between risk and profitability (Jeyar, El Moudden, & Taouab, 2023).

The expansion of the national health insurance (NHI) program and the subsequent increase in social coverage foresee a surge in pressure and demand for both public and private healthcare services in the Moroccan context. This raises a crucial question regarding the ability of these services to cope with the escalating demand for access while upholding an acceptable level of quality and performance. The development of a management system is essential for ensuring the quality of healthcare services and their practical implementation. This system is designed to analyze and trace the origins of anomalies, facilitating quick and comprehensive solutions upstream and downstream. Realizing this goal necessitates a reliable information system for the real-time detection and identification of anomalies and their sources.

The Moroccan healthcare system exhibits a dynamic interplay between the public and private sectors, offering primary care and hospital services across the nation. The system faces persistent challenges including a shortage of healthcare professionals, access disparities, high fees and regional variations despite notable progress in enhancing accessibility and service quality. Structural components encompass 2,985 primary healthcare centres and 165 hospitals in the public sector, 384 private clinics and 9,603 private practices in the private sector primarily concentrated in urban areas along the northern Atlantic coast.

Human resource shortages persist with a physician density of 71 per one hundred thousand inhabitants and a density of 93 nurses and midwives per one hundred thousand inhabitants (World Health Organization, 2021).

The ongoing reforms in Morocco's healthcare sector involve the creation of 12 new regions and the introduction of generalized health insurance known as RAMED (Régimed' Assistance Médicale or Medical Assistance Scheme) in 2012. RAMED is a government-sponsored health insurance program aimed at providing access to free healthcare services in the public sector for individuals who are economically disadvantaged to expand access to free public sector healthcare for 8.5 million individuals. Efforts are also underway to extend NHI coverage to self-employed workers constitute a third of the population. However, the expansion of NHI has led to increased healthcare service demands resulting in imbalances in service quality due to resource constraints.

This necessitates an in-depth exploration of the existing healthcare model intending to develop a roadmap for achieving high-quality healthcare services. The roadmap seeks to optimize management rationally and efficiently guided by empirical analysis conducted on 50 healthcare organizations within the Rabat-Salé-Kénitra region.

A collaborative strategy is necessary to raise the quality of treatment and strengthen facility management to address obstacles to Morocco's healthcare system improvement (Zakariae & Zouhair, 2023). The implementation of integrated management systems (covering quality, safety, environment and information systems) in the Moroccan healthcare sector should be carefully customized to its specific requirements avoiding mere replication from other organizational experiences. A unified and customized approach is required because of the significant risks involved in providing healthcare services.

This work explores the factors contributing to improving quality in the Moroccan healthcare sector, emphasizing their interaction with the specific integrated management system and required information systems. We aim to delve into the nature and implementation mode of specific integrated management systems for healthcare organizations in Morocco informed by the analysis of collected data and derived needs adopting a structural equation modelling approach. The second section presents the literature review to identify the variables of our model.

The third section covers the data and methodology employed in the study. Subsequently, we present the analysis of the obtained results and engage in a thorough discussion before arriving at conclusive remarks. This systematic approach ensures a cohesive exploration of the factors influencing quality improvement in the Moroccan healthcare sector.

2. Literature Review

Two pivotal constructs are under scrutiny through an examination of factors enhancing the quality of Morocco's health sector. The ensuing challenges serve as a catalyst for comprehensive scientific research endeavours concentrating on analyzing the dynamics and relationships between these constructs. Numerous studies concentrate on the intricate interplay between practices related to quality, safety, environment and information systems security and the criteria governing the performance of health organizations.

2.1. Quality, Safety, Environment and Information System Security Practices

The practices related to quality, safety, environment and information system security in the healthcare sector encompass a comprehensive set of measures and protocols designed to ensure high standards in healthcare services. These practices address various aspects including patient care quality, safety protocols, environmental sustainability and the security of information systems within healthcare organizations. Implementation of these practices is crucial to uphold excellence and compliance in the healthcare sector.

These practices have been addressed in numerous studies highlighting the significance and intricacy of their implementation.

Quality plays a pivotal role in organizational performance and stakeholder satisfaction (Ramayah, Samat., & May-Chiun, 2011) and is integral to production and management operations (Asif, Joost de Bruijn, Douglas, & Fisscher, 2009). Beyond producing goods or services in the right quantity and time ensuring they meet required quality standards is crucial for competitiveness and profitability (Azam, Rahman, Talib, & Singh, 2012) (see Table 1).

Table 1. Some quality practices as per a literature review.

Authors	Quality practices or dimensions	Number of practices employed
Thiagaragan, Zairi, and Dale (2001)	1. Systematic analysis 2. Training and support 3. Continuous improvement 4. Planning management 5. Staff motivation: Rewards and recognition 6. Customer satisfaction	6
Thai Hoang, Igel, and Laosirihongthong (2006)	1. Leadership 2. People management 3. Process and strategy management 4. Innovation climate 5. System analysis	5
Bon and Mustafa (2013)	1. Executive leadership 2. Employee involvement 3. Employee empowerment 4. Customer focus 5. Training 6. Information analysis 7. Continuous improvement	7

Security is vital to prevent increased anomalies and malfunctions with potentially wide-reaching consequences especially in healthcare (Chiu et al., 2009; Nancy et al., 2006). Integrating security into an organization's risk and quality management is essential (Dimitrov, Panevski, & Nikolov, 2016) (see Table 2).

Table 2. Some security practices as per a literature review.

Authors	Security practices or dimensions	Number of practices employed
Vinodkumar and Bhasi (2011)	1. Executive commitment 2. Security training 3. Employee awareness 4. Security rules and procedures 5. Worker participation in security	5
Fernández-Muñiz, Montes-Peón, and Vázquez-Ordás (2012)	1. Hazard and risk identification 2. Evaluation and control measures 3. Risk management 4. Legal requirements 5. Emergency preparedness and response 6. Performance measurement and monitoring	6
Tumbaco, Alcivar, and Merchán (2016)	1. Organizational commitment 2. Planning and hazard identification 3. Leadership 4. Planning 5. Support and operations 6. Health and safety policy	6
Morgado, Silva, and Fonseca (2019)	1. Reduction of occupational accidents 2. Increase in satisfaction 3. Employee motivation 4. Reduction of accident and occupational illness costs 5. Improvement in product and service quality 6. Decrease in absenteeism 7. Increase in productivity	7

Effective internal and external organizational management enhances quality and security benefiting resource allocation particularly in healthcare. An environmental management system is a crucial tool for efficient activity and environmental aspect management (Campos, de Melo Heizen, Verdinelli, & Miguel, 2015) involving a streamlined process approach and stakeholder collaboration within healthcare organizations. Environmental management further improves the organization's image and fosters a competitive mindset (Jacqueson, 2002) (see Table 3).

Table 3. Some environmental practices as per a literature review.

Authors	Environmental practices or dimensions	Number of practices employed
Olivier and Jean-Marie (1998)	1. Commitment and policy 2. Planning 3. Implementation and operation 4. Control and corrective measures 5. System review and «continuous improvement»	5
de Vries, Bayramoglu, and Van Der Wiele (2012)	1. Strong internal motivation 2. Executive leadership engagement 3. Communication with stakeholder groups 4. Stakeholder involvement 5. Clearly defined environmental management 6. Training and education programs	6
Boiral and Henri (2012)	1. Employee mobilization 2. Employee awareness and participation in the environment 3. Resources 4. Managerial values and support	4
Halila and Tell (2013)	1. Employee and manager initiatives 2. Communication forum 3. Resources 4. Learning network 5. Mutual engagement and trust	5

Information system security is paramount for an organization's efficient functioning encompassing human, technical and organizational resources (Abouelmehdi, Beni-Hessane, & Khaloufi, 2018; Monideepa & Steven, 2007; Varun, Myun, & James, 1996). Studies explore the impact of information system competencies on process innovation within a U.S. healthcare firm addressing challenges related to block chain implementation in healthcare systems for security and effectiveness (Swapnil Shrivastava, Srikanth, & Dileep, 2020; Tariq, Qamar, Asim, & Khan, 2020) underscores the critical importance of integrating telemedicine services for healthcare providers in the Indian context (see Table 4).

Table 4. Some information system security practices as per a literature review.

Authors	Information system's security practices or dimensions	Number of practices employed
Dhillon (1997)	1. Security policy 2. Security evaluation 3. Security design considerations 4. Implementation of information system security	4
Barlette (2008)	1. Intrinsic motivation 2. Awareness 3. Leadership involvement 4. Employee involvement 5. Device identification	5
Gikas (2010)	1. System risk identification 2. Security policies 3. Security control identification 4. Network security reference 5. Incident prevention and handling 6. Information system risk management 7. Information security training requirements 8. Risk management	8

Authors	Information system's security practices or dimensions	Number of practices employed
Gillies (2011)	1. Security policy 2. Information security organization 3. Asset management 4. Human resource security 5. Physical and environmental security 6. Communication and operations management 7. Information system acquisition, development, and maintenance 8. Information security incident management 9. Business continuity management	9

For instance, Hohan, Olaru, and Keppler (2015) advocate an approach that integrates information security management into an integrated management system enhancing efficiency in Romanian public administration entities while adhering to management standards. This underscores the importance of integrating risk management and continuous improvement processes for effective implementation as organizations contend with diverse requirements.

Subsequently, Moumen and El Aoufir (2017) explore empirical studies on the adoption of quality, safety, and environmental management systems in various countries including Spain, Italy, China, India and Australia. It assesses the performance of Moroccan companies across sectors identifies improvement priorities and evaluates strengths and weaknesses shedding light on firms' perceptions of the benefits and challenges of integrating these management systems.

Similarly, Kizilelma, Tutuncu, and Aydin (2023) investigate the interconnections among information security, patient safety climate and quality management in a healthcare system revealing a strong and positive relationship between quality and information security management and safety climate suggesting potential improvements in patient safety through enhancements in quality and information security measures. Thus, Benyettou and Megnounif (2022) introduce a theoretical model for an Integrated Management System (IMS), merging quality, safety, health, environment and food safety systems into a unified framework fostering implementation across various sectors particularly in the food industry. Purwanto (2020) investigates the impact of an IMS on the business performance of Indonesian packaging industries highlighting the significant positive influence of a Food Safety Management System (FSMS). Quality Management Systems (QMS), Safety Management Systems (SMS) and Environment Management Systems (EMS) show positive effects but they are not statistically significant in this context.

2.2. Healthcare Organizational Performance Criteria

Healthcare organizational performance criteria encompass standards for evaluating effectiveness, efficiency and quality in healthcare institutions. According to the study conducted by Bremer et al. (2021) hospitals implementing the Malcolm Baldrige Health Care Criteria for Performance Excellence (HCPE) exhibited superior performance on patient experience measures when compared to non-HCPE hospitals. This suggests that HCPE serves as an effective model for aligning organizational design, strategy, systems and human capital to foster long-term effectiveness within a high-performance culture.

Additionally, monitoring, planning, organizing, leadership, resource management, communication and patient orientation are the seven main themes that Abbas et al. (2019) highlighted while exploring the responsibilities of hospital managers in their qualitative phenomenological study. This study underscores the importance of evaluating and addressing managers' performance as a critical factor in improving overall hospital function and achieving optimal efficiency in healthcare delivery.

Otay, Sezi, and Cengiz (2017) present the criteria used for assessing healthcare performance (see Table 5). These criteria serve as the foundational elements for evaluating various aspects of healthcare delivery which are identified as follows:

Table 5. Healthcare organizational performance criteria.

Inputs	Outputs
Patient care and other expenditures	Annual revenues
Number of beds	Number of outpatient visits
Number of physicians	Overall patient satisfaction
Number of nurses	Number of admissions to inpatient service
Number of other staff range of services	Organizational agility and responsiveness
Technology level	Conformance to quality procedures
Service combination	Bed usage rate

Source: Otay et al. (2017).

We organised a focus group with experts based on this study to classify these criteria. The resulting list is as follows:

- Optimization of human and material resources (OHMR).
- Quality of services provided and patient satisfaction (SPPS).
- Organizational agility and responsiveness (OAR).

We consolidate all the elements from the selected constructs identified in the literature review in the following Table 6.

Table 6. List of elements in the constructs of the proposed conceptual model.

Elements in the constructs	Code	Titled
Construct 1: Quality, safety, environment and information system security practices	(LDE)	Leadership's engagement
	(PPM)	Process planning and management
	(TC)	Training and communication
	(DMIS)	Development and maintenance of information systems
	(RM)	Risk management
	(CI)	Continuous improvement
Construct 2: Healthcare organizational performance criteria	(OHMR)	Optimization of human and material resources
	(SPPS)	Quality of services provided and patient satisfaction
	(OAR)	Organizational agility and responsiveness

Restoring effective service quality management in the Moroccan healthcare sector requires strong performance and mastery of implemented interfaces and dashboards. The study aims to validate theoretically constructed hypotheses operationally relying on survey results from healthcare organizations in the central region of Rabat-Salé-Kénitra, Morocco. Key hypotheses are presented in Table 7.

Table 7. Derived hypotheses.

Hypothesis no	Causal links	Formulated derived hypotheses
H1	LDE ------------>PPM	LDE has a positive impact on PPM.
H2	LDE ------------>TC	LDE has a positive impact on the TC.
H3	LDE ------------> DMIS	LDE has a positive impact on DMIS.
H4	PPM ------------> RM	PPM has a positive impact on RM.
H5	PPM ------------>CI	PPM has a positive impact on CI.
H6	TC --------------> RM	TC has a positive impact on RM.
H7	TC --------------> CI	TC has a positive impact on CI.
H8	DMIS ----------> RM	DMIS has a positive impact on RM.
H9	DMIS-----------> CI	DMIS has a positive impact on CI.
H10	RM -------------> OHMR	RM has a positive impact on OHMR.
H11	RM -------------> SPPS	RM has a positive impact on SPPS.
H12	RM -------------> OAR	RM has a positive impact on OAR.
H13	CI ---------------> OHMR	CI has a positive impact on OHMR.
H14	CI ---------------> SPPS	CI has a positive impact on SPPS.
H15	CI ---------------> OAR	CI has a positive impact on OAR.

The exploration also aims to verify if quality, safety, environment and information security system practices positively impact the organizational performance of healthcare institutions. The overarching hypothesis is deconstructed into several sub-hypotheses identifying 15 derived sub-hypotheses (see Table 7).

Finally, the research explores the impact of the leadership's level of commitment on process approach planning, training and communication systems as well as the development and maintenance of the information system in Moroccan healthcare services. These practices, in turn, positively impact effective risk management and the implementation of the continuous improvement approach contributing to the total quality of service in Moroccan healthcare service organizations.

This study aims to explore the real-existing nature of the relationship between the implementation of quality practices and the performance of health services in Morocco using a database of 50 health organizations chosen from the central region of Morocco: Rabat-Salé-Kenitra.

3. Research Methodology

This study examines complex structural equation models with multiple interdependent variables focusing on regression, principal component analysis (PCA) and PLS regression to estimate relationships among latent variables using the partial least squares structural equation modeling (PLS-SEM) method (Hair, Ringle, & Sarstedt, 2011). PLS-SEM proves advantageous for handling small sample sizes coping with violations of the normality assumption and accommodating non-linear models. The method's iterative nature and the use of the bootstrap technique for result reliability assessment are highlighted by Henseler, Christian, and Rudolf (2009). PLS-SEM flexibility allows for analyzing intricate models involving latent and observed variables without requiring a normal distribution. The book "Handbook of Partial Least Squares", concepts, methods, and applications edited by Chin, Esposito Vinzi, Henseler, and Wang (2010) offers comprehensive coverage, including the maximization of explained variance in PLS-SEM. This study collected data using questionnaires and employed regression estimation.

According to Tahir, Kristian Hovde, and Lars Snipen (2012) PLSR regression (PLSR) is a statistical method where various variable selection methods for PLSR are presented and classified into three categories: filter methods, wrapper methods and embedded methods. PLSR is used for regression modelling especially when dealing with datasets containing a large number of variables. It aims to identify and select relevant variables while addressing the risk of overfitting and the conclusion emphasizes the importance of proper validation in the variable selection process. PLSR integrates variable selection into the modelling process offering a structural approach to enhance interpretability and model performance.

José, Jorge, and Jacinto (2014) conducted a study exploring the relationships between Principal Component Analysis (PCA) and PLSR. The PLSR is a numerical technique for constructing linear models that capture the primary relationships among process variables. PLSR reduces challenges associated with ill-conditioned datasets particularly beneficial for managing high-dimensional multivariate systems with collinear variables. It can be considered a specific case within broader regression approaches, including ordinary least squares and principal component regression.

We thoroughly explored various regional healthcare organizations to empirically verify our study's hypotheses. This process enabled us to select a representative sample. We followed up with in-person meetings to administer the final questionnaire. This approach facilitated discussions on quality management themes within Moroccan healthcare institutions.

We meticulously selected a sample of 50 healthcare organizations to ensure a meaningful representation and enhance the efficacy and accuracy of our tests from an initial pool of 57 clinics and 19 public hospitals. We used SPSS (Statistical Package for the Social Sciences) version 26 to carry out principal component and factor analyses. In this case, SPSS was used specifically for these purposes. These statistical techniques were instrumental in condensing questionnaire data and evaluating the research model and sub-hypotheses as shown in Figure 1.

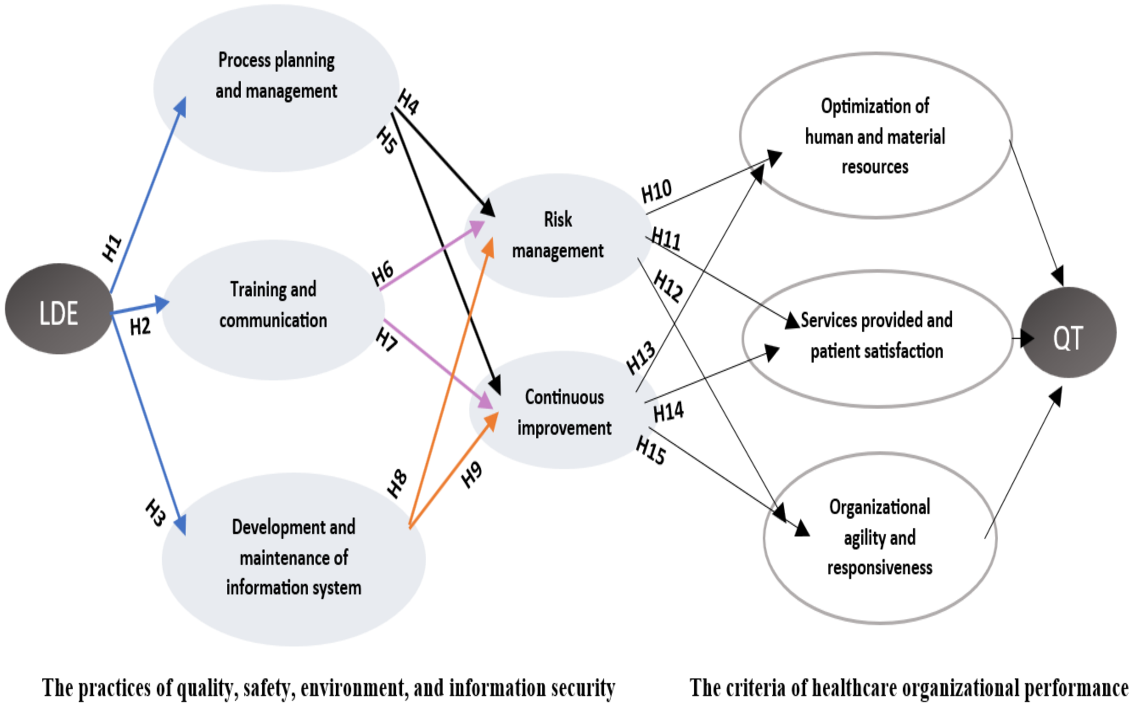

Figure 1. Interactional diagram of practices and criteria in the service quality management model of an organization.

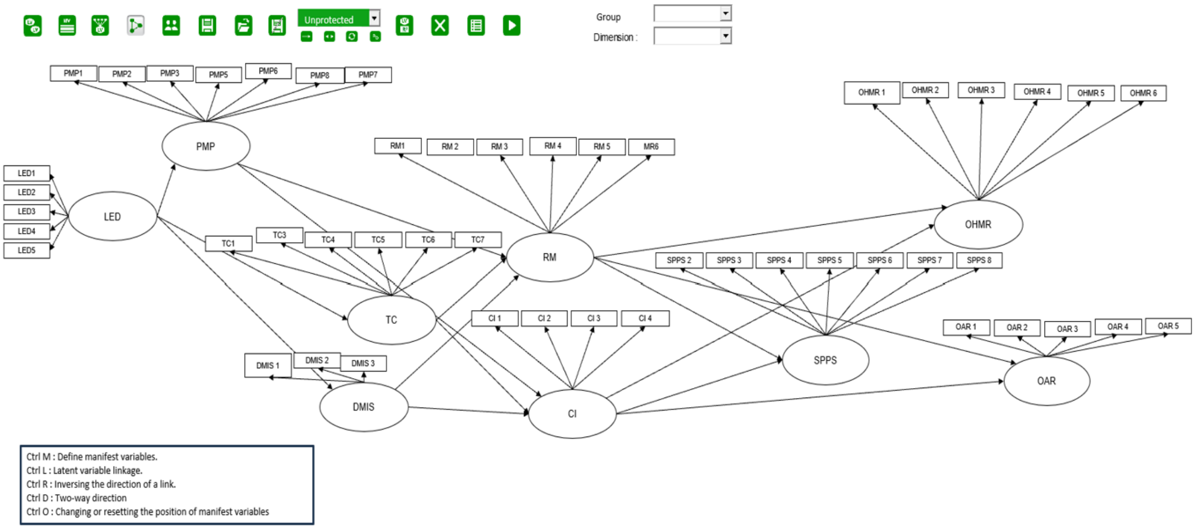

Figure 2. Path diagram using XL.

Table 8 illustrates the dimension reduction process allowing to proceed with the evaluation of measurement reliability and the unidimensionality of the blocks after item reduction. The results confirm the suitability of our variable measurement model supported by a Kaiser-Meyer-Olkin adequacy index exceeding 0.7 and a significant Bartlett's sphericity test ($p < 0.001$).

Table 8. KMO index and Bartlett's test.

Measurement of Kaiser-Meyer-Olkin sampling adequacy		0.868
Test of sphericity: Bartlett's test	Approximate chi-square	240.603
	Degrees of freedom	28
	The significance of Bartlett	0.000

We verified this dimension reduction condition to evaluate measurement reliability and construct one-dimensionality following item reduction. We initially conducted a descriptive analysis of the sample's characteristics before assessing measurement, reliability and model validity using the PLS approach to structural equations. This involved examining the location of healthcare organizations, respondents' job positions, the type of organization certification, the implementation of quality safety and environmental approaches and the reasons for pursuing certification. This analysis aims to ensure the consistency and reliability of the description of quality practices within Moroccan healthcare organizations. According to the approach of Douglas and Judge Jr (2001) the geographical distribution of these organizations and the hierarchical distribution of practitioners involved in these practices.

Our study's sample comprises 74% of healthcare establishments and structures located in Rabat followed by 24% in the city of Kenitra and 2% in the city of Salé. This distribution aligns perfectly with the organizations' geographical distribution in proportion to each city's population size. The data from this sample will be reliable for a comprehensive vision that can be generalized.

The sample encompasses responses from 54% of interviewed physicians, 24% of administrative staff, 12% of nurses and 10% of managers. This distribution adequately reflects the degree of involvement of healthcare practitioners in the quality management process.

Most organizations select the certification of their quality practices, notably ISO certifications. In our survey, we sought to explore the behavior of healthcare organizations in Morocco represented in our sample regarding their access to ISO certification.

4. Results

We can affirm the suitability of our variable measurement model as indicated by the Kaiser-Meyer-Olkin adequacy index which stands at 0.868 surpassing the threshold of 0.7 based on the information provided in Table 8 and employing the principal component analysis method. Subsequently, we conducted partial statistical tests to assess various components of the model focusing on the reliability and one-dimensionality of test of the constructs.

It is essential to establish the reliability of measurements signifying the precision of the conducted measurements to ensure the robustness of our empirical study. In our study, we ascertain the reliability of latent variable measurements by calculating each variable's Cronbach's alpha and Dillon Goldstein's Rho indices.

Additionally, only **22%** of the surveyed healthcare structures hold ISO 9001 certification with the majority yet to attain this certification within our sample. This reveals a relatively low rate of ISO certification among the surveyed healthcare organizations suggesting a need for increased motivation and immersion in the quality measurement of services and their environment (see Tables 9, 10 and 11).

Table 9. ISO 9001 certification.

Valid	Counts	Percentage
Yes	11	22 %
No	39	78 %
Total	50	100 %

Table 10. ISO 45001 certification.

Valid	Counts	Percentage
No	50	100 %

Table 11. ISO 14001 certification.

Valid	Counts	Percentage
No	50	100 %

Furthermore, the motivations driving organizations to pursue quality practice certification become apparent through the data. Among the surveyed establishments, **82%** aspire to achieve quality, safety or environmental certifications. Within this group, the intention to obtain ISO certification is justified as it is demanded by **48%** of patients and **20%** of suppliers. Additionally, **58%** of these establishments view certification as essential for enhancing performance with **20%** considering it a fundamental commitment (see Tables 12, 13, 14 and 15). These findings underscore the growing trend among healthcare organizations in Morocco to adopt quality service measurement tools and frameworks driven by heightened competition in the privatized healthcare sector and evolving patient-client expectations.

Table 12. Certification required by patients.

Valid	Effective	Percentage
Yes	24	48 %
No	26	52 %
Total	50	100 %

Table 13. Certification required by suppliers.

Valid	Counts	Percentage
Yes	10	20 %
No	40	80 %
Total	50	100 %

Table 14. Certification required for performance improvement.

Valid	Effective	Percentage
Yes	29	58 %
No	21	42 %
Total	50	100 %

Table 15. Certification required by the will of the establishment.

Valid	Counts	Percentage
Yes	10	20 %
No	40	80 %
Total	50	100 %

Two equations are tested using the PLS approach through the XL-STAT software yielding structural equations for the conceptual model as follows:
Figures 3, 4, 5 and 6 show hypothesis testing.

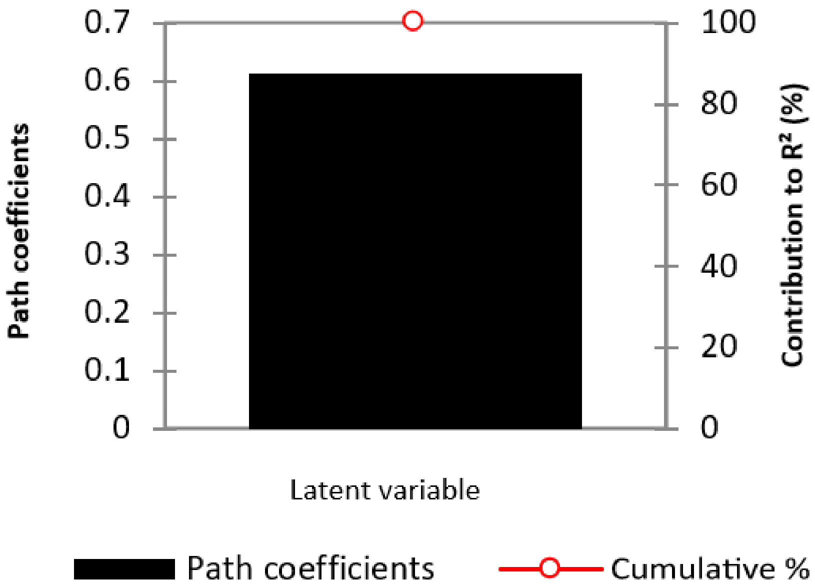

Figure 3. Impact and contribution of the LDE variable for PPM.

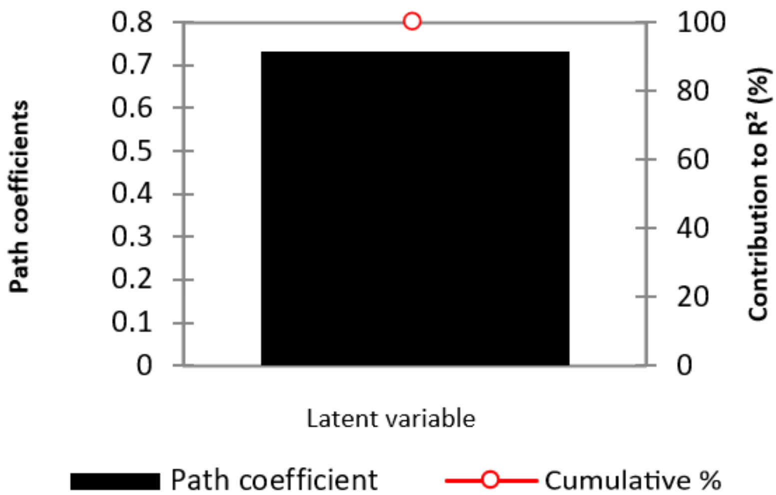

Figure 4. Impact and contribution of the LDE variable for TC.

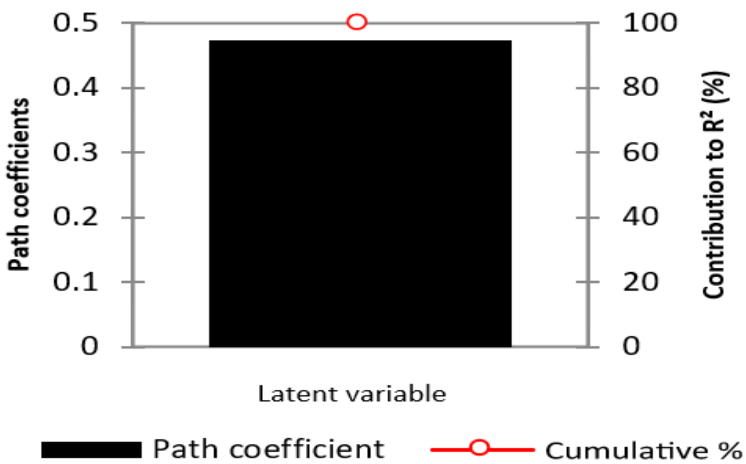

Figure 5. Impact and contribution of the LDE variable for DMIS.

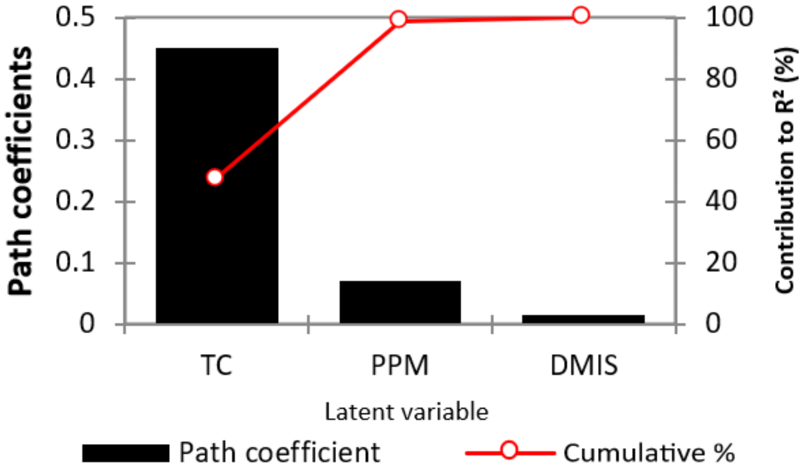

Figure 6. Impact and contribution of TC, PPM and DMIS variables for RM.

Figure 3 shows the impact of leadership engagement (LDE) on process planning and management (PPM) given the equation PPM=0,6173×LDE. For training and communication (TC), Figure 4 presents the equation TC=0,7314×LDE. The equation DMIS=0,4733×LDE refers to the leadership's engagement (LDE) in the development and maintenance of IS (DMIS) as shown in Figure 5.

Figure 6 shows how the variables PPM, TC and DMIS contribute to the dependent variable risk management (RM) resulting in the following equation: RM is equal to 0,2476×PPM+0,2830×TC+0,2909×DMIS. Finally, for the dependent variable continuous improvement (CI), the effect size index (f^2) is examined to validate the structural coefficients. This index quantifies the level of explained variance when the explanatory latent variable is included in the model compared to when it is excluded. It is calculated as follows:

$$f^2 = \frac{R^2\text{incl} - R^2\text{excl}}{1 - R^2\text{incl}}$$

We systematically evaluate and confirm the proposed hypotheses, contributing to a comprehensive understanding of the complex relationships in the model by applying this approach.

According to Cohen (1988) the interpretations of effect sizes are linked to the following reference values:

Effect Size: 0.02: small, 0.15: medium and 0.35: large.

The causal relationships between the different latent variables forming the model are measured using the correlation coefficient (R), the path coefficient (β) and Cohen's f^2 coefficient. The results from Table 25 reveal the outcomes of 15 derived hypotheses within our proposed model.

It is evident that the exogenous variable leadership and management engagement significantly and positively impacts PPM, TC and DMIS for the relationships in the quality safety environment and information systems security practices. Moreover, RM is positively influenced by TC and DMIS although with weaker effects from PMM.

Training and communication exhibit a strong influence on continuous improvement while continuous improvement is statistically significantly impacted with a large positive effect by the variables training and communication and a medium effect by the variables PMM and DMIS.

In the relationships between quality, safety, environment, information systems security practices and healthcare organizational performance criteria, risk management demonstrates a positive effect on organizational agility and responsiveness but a weak effect on services rendered, patient satisfaction and optimization of human and material resources.

Additionally, continuous improvement has a substantial positive influence on optimization of human and material resources and weak effects on services rendered, patient satisfaction and organizational agility and responsiveness. Four hypotheses were found to be invalid. Therefore, the PLS evaluation of our conceptual model is presented in Figure 7.

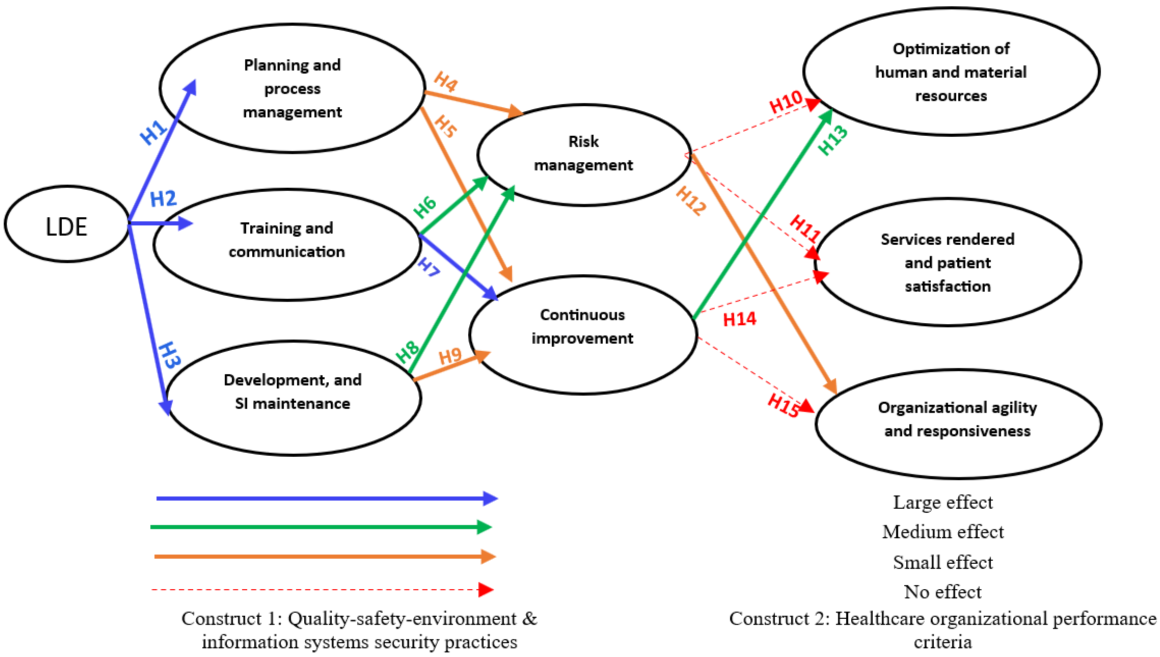

Figure 7. Evaluation of the conceptual model using the PLS approach for structural equations.

5. Discussion

Many studies have examined the impact of quality management practices on healthcare organizational performance criteria in the area of healthcare quality. According to Zakariae and Zouhair (2023) hospital accreditation is a significant initiative aimed at ensuring the excellence of care and efficiency in the management of health establishments. Similarly, Chahouati (2020) affirms that quality management represents revolutionary platform for hospital management, remedying the shortcomings of traditional models guaranteeing effective management and sustainable improvement in the services of public hospitals. However, Oumlil (2022) highlights persistent shortcomings in the health sector in Morocco despite government initiatives aimed at improving management and quality of care. This observation is particularly relevant in the context of information technology integration in a provincial hospital as highlighted by the study.

The structure of the practices of quality, security, environment and information system security consists of 6 latent variables of which one is exogenous and five are endogenous. The values of Cronbach's alpha and Dillon Goldstein's Rho for the variables of this construct are summarized in Tables 16 and 17 which presents Cronbach's alpha values and Dillon Goldstein's Rho values for the dimensions within the healthcare organizational performance criteria. All variables within the overall performance of the territorial community exhibit excellent reliability with α > 0.7 and Dillon-Goldstein's Rho > 0.8 demonstrating strong reliability as per the criteria set by Nunnally and Berstein (1994) and Kate and Christopher (2004).

Table 16. Reliability analysis of quality, safety, environment and information system security practices.

Latent variables	Number of items		Cronbach's alpha		Rhô de D. G	
	Before purification	After purification	Before purification	After purification	Before purification	After purification
LDE	5	5	0.841	0.841	0.888	0.888
PPM	8	7	0.910	0.919	0.926	0.935
TC	7	6	0.809	0.882	0.835	0.910
DMIS	5	3	0.917	0.873	0.968	0.922
RM	6	6	0.910	0.910	0.930	0.930
CI	4	4	0.890	0.890	0.924	0.924

Table 17. Reliability analysis of healthcare organizational performance criteria.

Latent variables	Number of items		Cronbach's alpha		Rhô de D. G	
	Before purification	After purification	Before purification	After purification	Before purification	After purification
OHMR	7	6	0.819	0.821	0.868	0.871
SPPS	8	7	0.881	0.892	0.904	0.916
OAR	5	5	0.889	0.889	0.918	0.918

The next step involves testing the one-dimensionality of the blocks surrounding their latent variables. The reliability of the variables in our model has been confirmed (Fornell & Larcker, 1981). These latent variables are expressed through variables that manifest themselves in the form of blocks. We compared the largest eigenvalue of each block of latent variables to the other eigenvalues within the same block to ensure the one-dimensionality of these blocks. Our criterion requires this primary eigenvalue to account for at least **50%** of the sum of all eigenvalues within its block. This assessment ensures that the manifest variables effectively reflect their corresponding latent variables.

Table 18 confirms block one-dimensionality allowing us to ensure our causal model's internal and external validity. After validating measurement reliability, we used the PLS approach for structural equation modelling with XLSTAT (2017) (see Figure 2). In our study, we employed the reflective scheme to link manifest variables to latent variables assessing how latent variables influence manifest variables while acknowledging the inherent subjectivity involved. We tested convergent and discriminant validity to evaluate our model's external validity. Convergent validity assessed through factor loadings and average variance extracted (AVE) indicates that items within the same latent variable share more variance with that latent variable than with specific measurement errors demonstrating strong convergent validity (see Table 19). AVE values exceeding 0.7 reinforce good convergent validity (see Table 20) consistent with Fornell and Larcker (1981) and Nunnally & Berstein (1994).

Divergent validity is established when items measuring the same phenomenon exhibit low correlations with items measuring other concepts meaning that items of a single concept contribute less strongly to other concepts. This verification is performed according to the guidelines of Chin et al. (2010). We compare the square root of the Average Variance Extracted (AVE) of each dimension (latent variable) with the correlations between different dimensions (pairwise). Divergent validity is confirmed when the square root of the AVE exceeds the correlations between the different dimensions in the model.

Table 18. Eigen values of the latent variables in our model.

Latent variables	LDE	PPM	TC	DMIS	RM	CI	OHMR	SPPS	OAR
Dimensions	5	8	6	3	6	4	6	7	5
Own values	3.069	4.727	3.778	2.396	4.156	3.013	3.205	4.290	3.471
	0.823	0.703	0.748	0.422	0.845	0.485	0.949	0.829	0.509
	0.527	0.538	0.493	0.180	0.385	0.275	0.721	0.787	0.421
	0.304	0.373	0.403	-	0.332	0.225	0.551	0.430	0.324
	0.276	0.249	0.321	-	0.147	-	0.430	0.328	0.273
	-	0.230	0.253	-	0.130	-	0.141	0.194	-
	-	0.177	-	-	-	-	-	0.139	-

Table 19. Factorial contributions.

Latent variables	LDE	PPM	TC	DMIS	RM	CI	OHMR	SPPS	OAR
LDE1	0.729	0.294	0.455	0.329	0.298	0.378	0.234	0.257	0.280
LDE2	0.688	0.176	0.400	0.250	0.257	0.312	0.106	0.170	0.277
LDE3	0.791	0.630	0.587	0.461	0.568	0.401	0.235	0.573	0.601
LDE4	0.883	0.681	0.717	0.385	0.630	0.642	0.531	0.509	0.502
LDE5	0.784	0.381	0.591	0.366	0.350	0.409	0.465	0.504	0.526
PPM1	0.476	0.819	0.477	0.171	0.465	0.381	0.240	0.341	0.319
PPM2	0.487	0.805	0.557	0.110	0.486	0.531	0.353	0.263	0.192
PPM3	0.528	0.791	0.553	0.251	0.377	0.465	0.296	0.270	0.277
PPM5	0.512	0.745	0.446	0.282	0.577	0.374	0.269	0.428	0.373
PPM6	0.427	0.869	0.477	0.335	0.552	0.567	0.360	0.252	0.327
PPM7	0.538	0.858	0.493	0.269	0.538	0.579	0.382	0.310	0.355
PPM8	0.560	0.855	0.488	0.427	0.598	0.521	0.276	0.269	0.322
TC1	0.596	0.622	0.784	0.277	0.536	0.748	0.564	0.408	0.450
TC3	0.598	0.438	0.781	0.390	0.605	0.773	0.631	0.438	0.523
TC4	0.558	0.293	0.787	0.441	0.543	0.535	0.504	0.687	0.514
TC5	0.520	0.504	0.815	0.335	0.523	0.596	0.597	0.522	0.489
TC6	0.633	0.526	0.827	0.429	0.507	0.593	0.516	0.501	0.478
TC7	0.566	0.491	0.761	0.580	0.583	0.533	0.482	0.484	0.493
DMIS2	0.332	0.273	0.424	0.866	0.460	0.516	0.340	0.349	0.500
DMIS3	0.447	0.282	0.470	0.943	0.601	0.513	0.387	0.474	0.601
DMIS4	0.480	0.315	0.475	0.869	0.566	0.428	0.282	0.328	0.494
RM1	0.414	0.363	0.515	0.465	0.701	0.706	0.448	0.282	0.359
RM2	0.519	0.634	0.568	0.425	0.804	0.657	0.480	0.469	0.332

Latent variables	LDE	PPM	TC	DMIS	RM	CI	OHMR	SPPS	OAR
RM3	0.634	0.559	0.706	0.388	0.815	0.716	0.531	0.423	0.393
RM4	0.441	0.538	0.527	0.573	0.884	0.543	0.516	0.625	0.603
RM5	0.496	0.555	0.652	0.598	0.913	0.668	0.686	0.602	0.601
RM6	0.418	0.468	0.508	0.577	0.859	0.519	0.619	0.573	0.591
CI1	0.563	0.644	0.760	0.441	0.808	0.873	0.697	0.540	0.502
CI2	0.453	0.512	0.713	0.376	0.616	0.887	0.559	0.475	0.411
CI3	0.403	0.385	0.635	0.489	0.602	0.846	0.676	0.306	0.318
CI4	0.545	0.500	0.661	0.579	0.555	0.861	0.571	0.381	0.457
OHMR1	0.267	0.235	0.474	0.352	0.496	0.609	0.671	0.247	0.378
OHMR2	0.313	0.390	0.541	0.273	0.466	0.577	0.695	0.438	0.403
OHMR4	0.353	0.080	0.491	0.407	0.419	0.443	0.608	0.308	0.490
OHMR5	0.313	0.205	0.484	0.179	0.411	0.491	0.788	0.535	0.346
OHMR6	0.306	0.293	0.467	0.156	0.499	0.473	0.825	0.516	0.265
OHMR7	0.364	0.403	0.577	0.298	0.582	0.544	0.766	0.530	0.370
SPPS2	0.446	0.295	0.456	0.411	0.443	0.366	0.389	0.854	0.601
SPPS3	0.511	0.372	0.525	0.340	0.495	0.333	0.384	0.830	0.577
SPPS4	0.526	0.276	0.638	0.371	0.452	0.443	0.532	0.734	0.665
SPPS5	0.262	0.185	0.381	0.287	0.386	0.305	0.479	0.654	0.366
SPPS6	0.295	0.158	0.434	0.349	0.501	0.419	0.487	0.798	0.505
SPPS7	0.502	0.336	0.511	0.312	0.522	0.389	0.484	0.848	0.593
SPPS8	0.504	0.389	0.519	0.295	0.517	0.462	0.489	0.738	0.606
OAR1	0.515	0.306	0.488	0.623	0.451	0.397	0.361	0.495	0.823
OAR2	0.404	0.217	0.504	0.482	0.578	0.451	0.445	0.586	0.792
OAR3	0.479	0.311	0.547	0.481	0.410	0.437	0.388	0.557	0.831
OAR4	0.501	0.314	0.501	0.457	0.391	0.325	0.412	0.699	0.852
OAR5	0.571	0.418	0.533	0.450	0.573	0.422	0.498	0.656	0.860

Table 20. Measurement model quality index.

Latent variables	Type	Average variance extracted (AVE)	Rho de D.G.
LDE	Exogenous	0.605	0.888
PPM	Endogenous	0.675	0.935
TC	Endogenous	0.629	0.910
DMIS	Endogenous	0.798	0.922
RM	Endogenous	0.692	0.930
CI	Endogenous	0.752	0.924
OHMR	Endogenous	0.532	0.871
SPPS	Endogenous	0.605	0.916
OAR	Endogenous	0.675	0.918

The data in Table 21 confirms the discriminant validity of the external model as the square root of AVE for each latent variable surpasses the correlations between them. This underscores the overall validity of our measurement model combined with the established convergent and divergent validity. Additionally, the coefficient of determination R^2 values exceeding 0.1 as indicated in Table 22 demonstrate the significant structural causality between exogenous and endogenous variables in our model. According to Falk and Nancy (1992) and Croutsche (2002) the structural model holds vital significance. Lastly, the Goodness of Fit Index (GoF) considers the effectiveness of both the structural and measurement models (Michel & Vincenzo, 2005). This index is calculated as GoF= ($\sqrt{\overline{H}2 \times \overline{R}2}$). In our case, GoF= (√(0,662x0,521)) = 0,587 which supports the effectiveness of both the structural and measurement models with the usual values of 0.1, 0.25 and 0.36 indicating a moderate fit with our model (see Table 23).

Table 21. Discriminant validity.

Latent variables	LDE	PPM	TC	DMIS	RM	CI	OHMR	SPPS	(AVE)
LDE	0.778*								0.605
PPM	0.377	0.821*							0.675
TC	0.536	0.368	0.793*						0.629
DMIS	0.224	0.105	0.261	0.893*					0.798
RM	0.339	0.393	0.482	0.373	0.832*				0.692
CI	0.328	0.358	0.644	0.294	0.566	0.867*			0.752

Latent variables	LDE	PPM	TC	DMIS	RM	CI	OHMR	SPPS	(AVE)
OHMR	0.191	0.144	0.484	0.142	0.440	0.523	0.729*		0.532
SPPS	0.314	0.136	0.403	0.187	0.370	0.249	0.351	0.782*	0.605
OAR	0.351	0.141	0.384	0.357	0.345	0.244	0.260	0.518	0.832 *

Note: * Square root of AVE.

Table 22. R^2 and adjusted R^2 results.

Latent variables	Type	R^2	Adjusted R^2
LDE	Exogenous	0.377	0.377
PPM	Endogenous	0.329	0.329
TC	Endogenous	0.224	0.224
DMIS	Endogenous	0.682	0.662
RM	Endogenous	0.689	0.668
CI	Endogenous	0.614	0.598
OHMR	Endogenous	0.639	0.624
SPPS	Endogenous	0.430	0.406
Average		0.521	

Table 23. Goodness of fit.

Fit assessment metrics	GoF	GoF (bootstrap)	Standard error	Critical ratio (CR)
Absolute	0.587	0.603	0.047	0.587
Relative	0.856	0.804	0.049	0.856
External model	0.988	0.976	0.044	0.988
Internal model	0.866	0.824	0.026	0.866

The survey results validate the measurement and structural models enabling us to test the hypotheses formulated in this paper (see Table 7) concerning the causal relationships in our proposed model. We begin by examining our overarching hypothesis which addresses the impact of implementing an IMS combined with information systems security on healthcare organizational performance in the Rabat-Kenitra-Sale region. Concurrently, we test 15 derived hypotheses corresponding to specific causal relationships presented in Table 24 . Our analysis using the PLS approach to structural equations confirms 11 of the 15 derived hypotheses illustrating the intricate interactions among various variables within Moroccan healthcare organizations' internal and external environments.

Table 24. Hypothesis testing.

	Derived hypothesis no	Independent variable (cause)	Dependent variable (effect)	Student's T	P-value	Effect size f^2	Validity of hypotheses
1*	H1	LDE	PPM	53.89	0.000	0.605	Valid
	H2	LDE	TC	74.47	0.000	11.55	Valid
	H3	LDE	DMIS	37.22	0.000	0.288	Valid
	H4	PPM	RM	21.81	0.034	0.105	Valid
	H5	PPM	CI	197.36	0.045	0.097	Valid
	H6	TC	RM	23.34	0.024	0.121	Valid
	H7	TC	CI	52.92	0.000	0.622	Valid
	H8	DMIS	RM	28.24	0.007	0.177	Valid
	H9	DMIS	CI	19.67	0.049	0.089	Valid
2*	H10	RM	OHMR	0.341	0.734	0.002	Invalid
	H11	RM	SPPS	0.949	0.347	0.019	Invalid
	H12	RM	OAR	19.70	0.048	0.023	Valid
	H13	CI	OHMR	30.11	0.004	0.197	Valid
	H14	CI	SPPS	-0.339	0.735	0.002	Invalid
	H15	CI	OAR	0.101	0.919	0.000	Invalid

Note: 1* Quality, safety, environment, and information system security practices.
2* Healthcare organizational performance criteria.

The hypotheses in quality, safety, environment and information systems security practices demonstrate that all 9 global hypotheses proposed are valid. In the case of hypotheses connecting variables from the quality-safety-environment and information systems security practices to variables in the healthcare organizational performance criteria, 2 out of the 6 derived global hypotheses linking the two constructs are supported. Our model comprises one exogenous variable and 8 endogenous variables; each endogenous variable is expressed by one or more variables plus an error term (see Table 25).

Table 25. Effect sizes between different causal links.

	Derivation hypothesis no	Independent variable (cause)	Dependent variable (effect)	Correlation coefficient (R)	Structural coefficient (β)	Effect size f2	Effect
1*	H1	LDE	PPM	0.614	0.614	0.605	Large effect
	H2	LDE	TC	0.732	0.732	1.155	Large effect
	H3	LDE	DMIS	0.473	0.473	0.288	Large effect
	H4	PPM	RM	0.627	0.247	0.105	Small effect
	H5	PPM	CI	0.598	0.190	0.087	Small effect
	H6	TC	RM	0.694	0.283	0.121	Medium effect
	H7	TC	CI	0.802	0.619	0.622	Strong effect
	H8	DMIS	RM	0.611	0.290	0.177	Medium effect
	H9	DMIS	CI	0.542	0.187	0.099	Small effect
2*	H10	RM	OHMR	0.705	0.055	0.002	No effect
	H11	RM	SPPS	0.609	0.167	0.019	No effect
	H12	RM	OAR	0.587	0.243	0.023	Small effect
	H13	CI	OHMR	0.663	0.430	0.197	Medium effect
	H14	CI	SPPS	0.499	-0.052	0.0025	No effect
	H15	CI	OAR	0.494	0.017	0.0002	No effect

Note: 1* Quality, safety, environment, and information system security practices.
2* Healthcare organizational performance criteria.

Nonetheless, our research distinguishes itself from these previous approaches in several significant ways. Firstly, we have adopted an integrated and holistic approach by amalgamating quality, safety, environmental, and information security practices into a unified model named quality-safety-environment and information systems security practices. As a result, we provide a more comprehensive perspective on how these practices interact to influence organizational performance. Furthermore, our model encompasses a broader range of healthcare organizational performance criteria, extending beyond patient satisfaction to operational efficiency, healthcare quality, environmental sustainability and information security management by exploring the nature of the real or potential interactions of the different factors resulting from quality management as input and the other factors resulting from the level of performance and satisfaction as output.

This innovative approach has been validated by our findings as summarized in Table 26 which lists the direct effects among the six latent variables within the quality-safety-environment and information systems security practices and their interactions with the latent variables within the healthcare organizational performance criteria. These results confirm our overarching research hypothesis which posits that quality-safety-environment and information systems security practices within healthcare establishments positively impact the healthcare organizational performance criteria of these entities. Furthermore, this underscores the significance of the sustainability of various quality practices within an organization regardless of the nature of its activities influencing its organizational and managerial performance.

Table 26. Assessment of direct effects between variables.

Latent variables	LDE	PPM	TC	DMIS	RM	CI	OHMR	SPPS	OAR
LDE									
PPM	0.614								
TC	0.732	0.000							
DMIS	0.473	0.000	0.000						
RM	0.000	0.247	0.283	0.290					
CI	0.000	0.190	0.619	0.187	0.000				
OHMR	0.000	0.000	0.000	0.000	0.055	0.430			
SPPS	0.000	0.000	0.000	0.000	0.167	-0.052	0.000		
OAR	0.000	0.000	0.000	0.000	0.243	0.017	0.000	0.000	-

All nine hypotheses tested were valid for quality, safety, environment and information systems security practices. Moreover, our analysis revealed that the exogenous variables leadership and executive engagement demonstrated valid indirect links and exhibited strong effects on various variables within the same construct. Notably, it significantly impacted risk management and continuous improvement as outlined in Figure 7.

Furthermore, the distinctive aspect of our research is the strong positive effects that these exogenous variables, leadership and executive engagement also showed on several other important variables.

These included optimization of human and material resources, services rendered, patient satisfaction and even the organizational agility and responsiveness variables within the organizational performance criteria of the healthcare establishments involved in our empirical investigation. It is noteworthy that this level of confirmation indicating the far-reaching impact of leadership and executive engagement hasn't been previously derived using a specific model that facilitates the measurement of such an impact as seen in earlier studies (Morgado et al., 2019; Trunfio et al., 2022).

This explains why the majority of health organizations surveyed are aware of the importance of mastering the three interfaces in the first row (see Figure 7). It follows the same way the rest of the second and third-row interfaces with different levels of degree of influence with the exception of two interactions appearing between risk management and continuous improvement with optimization of human and material resources, organizational agility and responsiveness on the one hand, and services rendered and patient satisfaction on the other hand, because patient satisfaction is a complex measure influenced by multiple variables such as quality of care, communication, accessibility and other elements.

This reinforces the unique contributions of our research in uncovering these significant relationships and their implications for healthcare service quality and organizational performance.

According to Table 27, the invalidity of hypotheses regarding the variable risk management about the variables optimization of human and material resources ($t_{Student}$ = 0,3413, p= 0,7344, β =0,0552, f^2 = 0,0025) and services rendered and patient satisfaction ($t_{Student}$ =0,9493, p=0,3475, β =0,1674, f^2 =0,0196) and continuous improvement about the variables services rendered and patient satisfaction ($t_{Student}$ = -0,3398 p= 0,7356, β = -0,0529, f^2 = 0,0025) and organizational agility and responsiveness ($t_{Student}$ =0,1013, p= 0,9198, β =0,0176, f^2 = 0,0002) within the healthcare organizational performance criteria of healthcare establishments which means that there is still an effort to be made to remedy the situation.

Table 27. Assessment of indirect effects between variables.

Latent variables	LDE	PPM	TC	DMIS	RM	CI	OHMR	SPPS	OAR
LDE									
PPM	0.000								
TC	0.000	0.000							
DMIS	0.000	0.000	0.000						
RM	0.624	0.000	0.000	0.000					
CI	0.627	0.000	0.000	0.000	0.000				
OHMR	0.542	0.122	0.452	0.102	0.000	0.000			
SPPS	0.475	0.077	0.302	0.048	0.000	0.000	0.000		
OAR	0.440	0.095	0.277	0.081	0.000	0.000	0.000	0.000	-

Future research perspectives come to the forefront concerning healthcare service quality and organizational performance based on the research findings presented in this study. This is especially evident in the potential implementation of mapping using an algorithmic process approach to effectively and efficiently manage diverse interactions between interfaces. Further research could also explore the role of readiness for change in enabling the effective implementation of IMS (Britel & Cherkaoui, 2022) as well as the determining factors to improve healthcare governance (Jeyar et al., 2023).

6. Conclusion

In this comprehensive study, we embarked on a meticulous exploration of the intricate interplay among quality, safety, environment, information systems security practices and management within Morocco's healthcare sector. Our primary objective has been to make a substantial contribution to the ongoing enhancement of health services in the country by elucidating the dynamic relationships among these pivotal factors and their ramifications on organizational performance.

Our study employed a comprehensive framework incorporating quality-safety-environment practices, information systems security and management criteria focussed on 50 healthcare organizations in the Rabat-Salé-Kénitra region. Utilizing the PLS structural equations method, our analysis confirmed the validation of 11 out of 15 derived hypotheses shedding light on the nuanced connections between these variables.

Our findings provided robust support for all nine global hypotheses linking quality, safety, environment and information systems security practices. This underscores the foundational importance of these elements within Morocco's healthcare system. However, the hypotheses linking these variables to organizational health performance criteria depicted a more nuanced scenario with only 2 out of 6 derived global hypotheses verified.
Our research shows the essential requirement to enhance Morocco's healthcare service quality considering the COVID-19 pandemic's challenges. The insights gleaned into the dynamics of quality, safety, environment, and information security practices offer a strategic roadmap for improving the organizational performance of

healthcare establishments. This study advocates for the implementation of comprehensive quality management within the IMS of healthcare services in Morocco ensuring sustained improvement and heightened performance.

The role of leadership emerges as a key factor influencing the performance of various constructs related to quality, security, environment and information security systems in healthcare organizations across Morocco. A notable gap exists in awareness regarding the crucial interaction between risk management, continuous improvement of services rendered and patient satisfaction. This observation may be attributed to the gradual progression of the Moroccan health system and the unique dynamics of patient behaviour.

This research suggests avenues for future exploration. Subsequent studies could delve deeper into the mechanisms and contextual factors influencing the relationships between quality practices and organizational performance criteria in healthcare. This could involve a more granular examination of the impact of leadership, risk management and continuous improvement on healthcare services and patient satisfaction. Such research endeavors can further refine our understanding and inform targeted interventions for the continual enhancement of healthcare service quality in Morocco.

This study has certain limitations despite the valuable insights gained. The identified gap in awareness regarding the interaction between risk management and continuous improvement with services rendered and patient satisfaction signals a need for more in-depth exploration. Additionally, the gradual progress of the Moroccan health system may impact the generalizability of our findings. It is essential to acknowledge these limitations to ensure a nuanced interpretation of the study's outcomes.

In a nutshell, our research stands as a foundational pillar for strategic interventions emphasizing an integrated approach to quality management within routine operations and during extraordinary events. Policymakers and healthcare practitioners should be guided by the implications, limitations and future research suggestions outlined to ensure sustained improvement in healthcare services in Morocco.

References

Abbas, P., Anahita, A., Saeid, S., Faezeh, Z., Mehrdad, J., Hafez, A., & Mohammad, K. (2019). Performance evaluation criteria for hospitals' managers: A qualitative study. *Evidence Based Health Policy, Management & Economics*, 52-65. https://doi.org/10.18502/jebhpme.v3i1.582

Abouelmehdi, K., Beni-Hessane, A., & Khaloufi, H. (2018). Big healthcare data: Preserving security and privacy. *Journal of Big Data*, *5*(1), 1-18. https://doi.org/10.1186/s40537-017-0110-7

Asif, M., Joost de Bruijn, E., Douglas, A., & Fisscher, O. A. (2009). Why quality management programs fail: A strategic and operations management perspective. *International Journal of Quality & Reliability Management*, *26*(8), 778-794. https://doi.org/10.1108/02656710910984165

Azam, M., Rahman, Z., Talib, F., & Singh, K. (2012). A critical study of quality parameters in health care establishment: Developing an integrated quality model. *International Journal of Health Care Quality Assurance*, *25*(5), 387-402. https://doi.org/10.1108/09526861211235892.

Barlette, Y. (2008). A study of behaviors related to the security of information systems in SMEs. *Systèmes D'information et Management*, *13*(4), 7-30. https://doi.org/10.3917/sim.084.0007

Benyettou, S., & Megnounif, A. (2022). Integrated quality, environment, food safety, and security management systems using a systemic approach. Part 1: Theoretical development. *Les Cahiers du Mecas*, *18*(1), 17-32.

Boiral, O., & Henri, J.-F. (2012). Modelling the impact of ISO 14001 on environmental performance: A comparative approach. *Journal of Environmental Management*, *99*, 84-97. https://doi.org/10.1016/j.jenvman.2012.01.007

Bon, A. T., & Mustafa, E. M. (2013). Impact of total quality management on innovation in service organizations: Literature review and new conceptual framework. *Procedia Engineering*, *53*, 516-529. https://doi.org/10.1016/j.proeng.2013.02.067

Bremer, D., Klockmann, I., Jaß, L., Härter, M., von dem Knesebeck, O., & Lüdecke, D. (2021). Which criteria characterize a health literate health care organization?–a scoping review on organizational health literacy. *BMC Health Services Research*, *21*, 1-14. https://doi.org/10.1186/s12913-021-06604-z

Britel, Z., & Cherkaoui, A. (2022). Development of a readiness for change maturity model: An energy management system implementation case study. *Production Engineering Archives*, *28*(1), 93-109. https://doi.org/10.30657/pea.2022.28.11

Campos, L. M., de Melo Heizen, D. A., Verdinelli, M. A., & Miguel, P. A. C. (2015). Environmental performance indicators: A study on ISO 14001 certified companies. *Journal of Cleaner Production*, *99*, 286-296. https://doi.org/10.1016/j.jclepro.2015.03.019

Chahouati, W. (2020). Public hospitals: Towards a new hospital governance inspired by quality management. *Revue du Contrôle de la Comptabilité et de l'Audit*, *4*(2), 321-347.

Chin, W. W., Esposito Vinzi, V., Henseler, J., & Wang, H. (2010). How to write up and report PLS analyses. *Handbook of Partial Least Squares*, 655–690. https://doi.org/10.1007/978-3-540-32827-8_29

Chiu, Y.-W., Weng, Y.-H., Su, Y.-Y., Huang, C.-Y., Chang, Y.-C., & Kuo, K. N. (2009). The nature of international health security. *Asia Pacific Journal of Clinical Nutrition*, *18*(4), 679-683.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). New York: Routledge. https://doi.org/10.4324/9780203771587.

Croutsche, J.-J. (2002). Study of causal relationships: Use of structural equation models (Methodological approach). *La Revue des Sciences de Gestion: Direction et Gestion*, *198*, 81. https://doi.org/10.1051/larsg:2002037 de Vries, H. J., Bayramoglu, D. K., & Van Der Wiele, T. (2012). Business and environmental impact of ISO 14001. *International Journal of Quality & Reliability Management, 29*(4), 425-435.

Dhillon, G. (1997). *Managing information system security.* Basingstoke: Red Globe Press.Macmillan. https://doi.org/10.1007/978-1-349-14454-9_2.

Dimitrov, D., Panevski, V., & Nikolov, G. (2016). Example of security management system of the organization–components and concepts. *Science Business Society, 1*(4), 37-40.

Douglas, T. J., & Judge Jr, W. Q. (2001). Total quality management implementation and competitive advantage: The role of structural control and exploration. *Academy of Management Journal, 44*(1), 158-169. https://doi.org/10.5465/3069343

Falk, R. F., & Nancy, B. M. (1992). *A primer for soft modeling.* Akron, Ohio: The University of Akron Press.

Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2012). Occupational risk management under the OHSAS 18001 standard: Analysis of perceptions and attitudes of certified firms. *Journal of Cleaner Production, 24*, 36-47. https://doi.org/10.1016/j.jclepro.2011.11.008

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50. https://doi.org/10.1177/002224378101800104

Gikas, C. (2010). A general comparison of fisma, hipaa, iso 27000 and pci-dss standards. *Information Security Journal: A Global Perspective, 19*(3), 132-141. https://doi.org/10.1080/19393551003657019

Gillies, A. (2011). Improving the quality of information security management systems with ISO27000. *The TQM Journal, 23*(4), 367-376. https://doi.org/10.1108/17542731111139455

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-152. https://doi.org/10.2753/MTP1069-6679190202

Halila, F., & Tell, J. (2013). Creating synergies between SMEs and universities for ISO 14001 certification. *Journal of Cleaner Production, 48*, 85-92. https://doi.org/10.1016/j.jclepro.2012.11.014

Henseler, J. r. R., Christian, M. S., & Rudolf, R. (2009). The use of partial least squares path modeling in international marketing. *New Challenges to International Marketing, 20*, 277-319. https://doi.org/10.1108/S1474-7979(2009)0000020014

Hohan, A. I., Olaru, M., & Keppler, T. (2015). Integration of risk management practices in the framework of an integrated management system environment-health and safety-information security. *Quality-Access to Success, 16*(S1), 289-295.

Jacqueson, L. (2002). *Integration of the environment in business: Proposal of a tool for managing the process of creating environmental knowledge.* Doctoral Dissertation, Arts et Métiers ParisTech.

Jeyar, M., El Moudden, A., & Taouab, O. (2023). Dual 2RM risk minimization-richness maximization approach for an oriented continuous improvement healthcare performance and governance. *International Journal of Strategic Management and Economic Studies, 2*(6), 2262–2276. https://doi.org/10.5281/zenodo.10433628

José, L. G., Jorge, R. V., & Jacinto, L. M. (2014). Relationships between PCA and PLS-regression. *Chemometrics and Intelligent Laboratory Systems, 130*, 182-191. https://doi.org/10.1016/j.chemolab.2013.11.008

Kate, M. L., & Christopher, A. L. (2004). *An introduction to psychological tests and scales* (2nd ed.). Hove, UK: Psychology Press. doi:https://doi.org/10.4324/9781315782980.

Kizilelma, T. T., Tutuncu, O., & Aydin, I. (2023). the relationship between quality and information security management, and safety climate in healthcare. *International Journal for Quality Research, 17*(3), 1-18.

Michel, T., & Vincenzo, E. V. (2005). PLS regression, PLS path modeling and generalized procrustean analysis: A combined approach for multiblock analysis. *Journal of Chemometrics, 19*(3), 145-153. https://doi.org/10.1002/cem.917

Monideepa, T., & Steven, R. G. (2007). Understanding the influence of information systems competencies on process innovation: A resource-based view. *The Journal of Strategic Information Systems, 16*(4), 353-392. https://doi.org/10.1016/j.jsis.2007.09.001

Morgado, L., Silva, F., & Fonseca, L. (2019). Mapping occupational health and safety management systems in Portugal: Outlook for ISO 45001: 2018 adoption. *Procedia Manufacturing, 38*, 755-764. https://doi.org/10.1016/j.promfg.2020.01.103

Moumen, M., & El Aoufir, H. (2017). Quality, safety and environment management systems (QSE): Analysis of empirical studies on integrated management systems (IMS). *Journal of Decision Systems, 26*(3), 207-228. https://doi.org/10.1080/12460125.2017.1305648

Nancy, L., Nicolas, D., David, Z., Joel, C.-G., John, C., & Betty, B. (2006). Engineering resilience into safety-critical systems. In Hollnagel, E.woods, D.D, Leveson, N (Eds)Resilience Engineering: Concepts and Precepts. In (pp. 95-124). London: CRC Press. https://doi.org/10.1201/9781315605685.

Nunnally, J. C., & Berstein, I. H. (1994). Psychometric theory. In (pp. 752). New York: McGraw-Hill. https://doi.org/10.1177/014662169501900308.

Olivier, B., & Jean-Marie, S. (1998). Environmental management: Should industry adopt ISO 14001? *Business Horizons, 41*(1), 57–64.

Otay, İ. B. Ö., Sezi, Ç. O., & Cengiz, K. (2017). Multi-expert performance evaluation of healthcare institutions using an integrated intuitionistic fuzzy AHP&DEA methodology. *Elsevier, 133*, 90-106. https://doi.org/10.1016/j.knosys.2017.06.028

Oumlil, R. (2022). Adoption of e-health by health organizations in developing countries: The case of Morocco. *Aenoob, 2*(3), 584–599. https://doi.org/10.5281/zenodo.6944415

Purwanto, A. (2020). Does quality, safety, environment and food safety management systemInfluence business performance? Answersfrom Indonesian packaging industries. *International Journal of Control and Automation, 13*(1), 22-35. https://doi.org/10.4324/9781003042846-13

Ramayah, T., Samat., N., & May-Chiun, L. (2011). Market orientation, service quality and organizational performance in service organizations in Malaysia. *Asia-Pacific Journal of Business Administration*, *3*(1), 8-27. https://doi.org/10.1108/17574321111116379

Swapnil Shrivastava, T., Srikanth, K., & Dileep, V. (2020). e-Governance for healthcare service delivery in India: Challenges and opportunities in security and privacy. *Proceedings of the 13th International Conference on Theory and Practice of Electronic Governance* 180–183. https://doi.org/10.1145/3428502.3428527

Tahir, M., KristianHovde, L., & LarsSnipen, S. (2012). A review of variable selection methods in partial least squares regression. *Chemometrics and Intelligent Laboratory Systems*, *118*, 62-69. https://doi.org/10.1016/j.chemolab.2012.07.010

Tariq, N., Qamar, A., Asim, M., & Khan, F. A. (2020). Blockchain and smart healthcare security: A survey. *Procedia Computer Science*, *175*, 615-620. https://doi.org/10.1016/j.procs.2020.07.089

Thai Hoang, D., Igel, B., & Laosirihongthong, T. (2006). The impact of total quality management on innovation: Findings from a developing country. *International Journal of Quality & Reliability Management*, *23*(9), 1092-1117. https://doi.org/10.1108/02656710610704230

Thiagaragan, T., Zairi, M., & Dale, B. (2001). A proposed model of TQM implementation based on an empirical study of Malaysian industry. *International Journal of Quality & Reliability Management*, *18*(3), 289-306. https://doi.org/10.1108/02656710110383539

Trunfio, T. A., Scala, A., Giglio, C., Rossi, G., Borrelli, A., Romano, M., & Improta, G. (2022). Multiple regression model to analyze the total LOS for patients undergoing laparoscopic appendectomy. *BMC Medical Informatics and Decision Making*, *22*, 141. https://doi.org/10.1186/s12911-022-01884-9

Tumbaco, S. L. C., Alcivar, B. J. L., & Merchán, S. M. R. (2016). Occupational health and safety system transition from OHSAS 18001: 2007 to the new ISO 45001. *Revista Publicando*, *3*(9), 638-648.

Varun, G., Myun, J. C., & James, T. C. T. (1996). The effect of service quality and partnership on the outsourcing of information systems functions. *Journal of Management Information Systems* 89-116. https://doi.org/10.1080/07421222.1996.11518102

Vinodkumar, M., & Bhasi, M. (2011). A study on the impact of management system certification on safety management. *Safety Science*, *49*(3), 498-507. https://doi.org/10.1016/j.ssci.2010.11.009

World Health Organization, W. (2021). *Healthcare system profile of Morocco: 2021 situation report. World Health Organization (WHO)*. Retrieved from www.who.int

XLSTAT. (2017). *XLSTAT: Statistical and data analysis solution (Version 2017) [Software]*: Addinsoft.

Zakariae, L., & Zouhair, E. (2023). The contribution of hospital accreditation project to healthcare governance in Morocco: The mediating effect of public management through quality. *African Scientific Journal*, *3*(20), 513- 540. https://doi.org/10.5281/zenodo.10048192