

Enhancing Organizational Performance: Synergy of Cyber-Physical Systems, Cloud Services, and Crowdsensing

Ahmad Al-Qerem¹, Ali Mohd Ali², Ahmad Nabot¹, Issam Jebreen¹, Mohammad Alauthman³, Someah Alangari⁴, Faisal Aburub⁵, and Amjad Aldweesh⁶ ✉

ABSTRACT

In the contemporary business landscape, software has evolved into a strategic asset crucial for organizations seeking sustainable competitive advantage. The imperative of ensuring software quality becomes evident as low-quality software systems pose formidable challenges to organizational performance. This study delves into the profound impact of three key dimensions of information system quality on organizational performance—information quality (IQ), quality of service (QoS), and software quality (SQ). Anchored in the DeLone and McLean information system (IS) success model, a quantitative questionnaire was administered to 360 industry experts and academics. Rigorous data analysis, employing exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM), revealed significant positive effects of all three quality dimensions on organizational performance. Among these dimensions, software quality emerged as the most influential, showcasing substantial total effects, closely followed by information and service qualities. The study underscores the tangible value derived from strategic investments in enhancing software, information, and service quality. Elevating these facets manifests as a catalyst for improved organizational performance, empowering decision-makers with accurate and timely information while enhancing user satisfaction with the system. This research contributes significantly to the IS success literature by empirically validating the synergistic relationship between information quality, service quality, software quality, and organizational outcomes. The systematic analysis offered in this study goes beyond theoretical validation, providing actionable insights for managers. The findings guide the prioritization of quality initiatives and resource allocation, enabling organizations to maximize competitive advantage. As a future research direction, investigating moderator influences and exploring alternate quality constructs relevant to contemporary technologies, including cyber-physical systems, cloud services, and crowdsensing, holds promise for further enriching our understanding of the evolving digital landscape.

KEYWORDS

software quality; information quality; quality of service; organizational performance; cyber-physical systems; cloud service crowdsensing

This study delves into the nexus between information quality (IQ), quality of service (QoS), software quality (SQ), and organizational performance (OP). It seeks to decipher the direct positive correlations between IQ, QoS, and SQ with OP, emphasizing the immense impact of QoS and SQ on IQ and QoS.

IQ is pivotal for making decisions based on precise and reliable data. It also enhances organizations' competitive edge by enabling them to respond effectively to changes in markets and customer needs. Moreover, information accuracy leads to increased operational efficiency and reduced errors, rework, and the necessity for manual interventions, resulting in cost savings. Thus, SQ generates high-quality information that organizations rely on to increase productivity.

QoS amplifies the accessibility, reliability, and accuracy of information transmitted over networks, particularly within intricate cyber-physical and social systems that draw support from

cloud services. Concurrently, SQ is pivotal for proficient software operations, ensuring precise data processing and storage. High QoS standards ensure that data transmissions are accurate, reliable, and have minimal downtime, thereby facilitating efficient accessibility and retrieval. A superior SQ guarantees the optimization of software operations, fostering trustworthy information processes and storage. SQ significantly enhances QoS by refining performance, reliability, robustness, correctness, and security attributes. In turn, it provides heightened user experience and safeguards sensitive data.

This study contributes to the body of knowledge by achieving its aim because of the importance of SQ in organizations. SQ operation quality is mainly tailored based on the quality attributes that make up the system.

However, the absence of top-tier software tailored to firms' dynamic needs can be a formidable barrier to innovation. This study provides an exhaustive exploration of these pivotal variables

1 Computer Science Department, Faculty of Information Technology, Zarqa University, Zarqa 13110, Jordan

2 Communications and Computer Engineering Department, Faculty of Engineering, Al-Ahliyya Amman University, Amman 19328, Jordan

3 Department of Information Security, University of Petra, Amman 11196, Jordan

4 Department of Computer Science, College of Science and Humanities Dawadmi, Shaqra University, Shaqra 11911, Saudi Arabia

5 Department of Business Intelligence and Data Analytics, University of Petra, Amman 11196, Jordan

6 College of Computing and Information Technology, Shaqra University, Shaqra 11911, Saudi Arabia

Address correspondence to Amjad Aldweesh, a.aldweesh@su.edu.sa

© The author(s) 2025. The articles published in this open access journal are distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>).

to gauge their influence on OP. Our journey begins with an extensive literature review that focuses on OP to discern paramount influencers. Concurrently, we attempt to understand the intertwined variables and their overarching influence on organizational dynamics.

The expedition is structured as follows:

- (1) Review pertinent literature on OP.
- (2) Delve into the intertwined variables, shedding light on the predominant influencers.
- (3) Examine the study methodology and factors in play.
- (4) Unveil the results derived from the collected data and analytical models.
- (5) Engage in insightful discussions and draw conclusive remarks.

1 Background

1.1 Information system role in firm

Firms rely on information systems (ISs) to process information quickly and efficiently, improving their competitive edge^[1,2]. An IS is a collection of elements that work together to solve problems and achieve goals, using electronic devices such as computers and handheld devices and employing databases, analysis, and decision models^[3]. Subsystems within the system work together to process and distribute data, fulfilling organizational needs and objectives^[4,5]. The success of IS has been found to enhance organizational productivity and software development reflects the quality of information and service provided^[6-9]. Some critical roles of ISs in firms include supporting decision-making, enhancing efficiency and productivity, supporting customer service, facilitating communication and collaboration, and enabling innovation and growth.

1.2 IQ

DeLone and McLean^[10] proposed that the value of information provided to the user can be measured by IQ, a concept widely accepted in recent studies^[6,11,12]. The IQ includes relevance, accuracy, conciseness, completeness, understandability, and timeliness. These factors ensure that the information generated by the software system is error-free, easy to understand, and available at any time, making IQ critical for achieving firm goals. High-quality data can lead to better decision-making, improved operations, and a more successful organization, which is considered as a competitive advantage for firms^[7,13-15]. Thus, implementing quality assurance, testing processes, and involving end users in software development can help firms achieve the desired IQ for their consumers.

1.3 QoS

QoS is critical for service performance and includes reliability, availability, responsiveness, and service quality. Focus on software functionality, usability, and customer support for high QoS. Quality of Experience (QoE) is subjective and measures user satisfaction with an application or service. High QoE and QoS increase user satisfaction, better concentration, and revenue. Poor QoE and QoS lead to dissatisfied users, decreased revenue, and damage to an organization's reputation. QoE and QoS impact internal organizational performance and can result in slower productivity, decreased job satisfaction, and increased employee frustration. Ensuring high QoE and QoS benefits organizations by increasing revenue, customer loyalty, and employee satisfaction^[16].

1.4 SQ

SQ is a critical aspect of software development and refers to the degree to which a software system meets its intended purpose and user needs^[11,17]. SQ encompasses many factors, including functionality, reliability, usability, efficiency, and maintainability^[6,18]. Ensuring high SQ is crucial for organizations, as it enables them to deliver software systems that meet the needs of their intended audience and ultimately achieve their goals.

Various studies have highlighted the importance of information system quality. For example, a high SQ leads to improved efficiency, effectiveness, customer satisfaction, and lower costs^[19]. Additionally, SQ positively correlates with organizational performance by enhancing the decision-making and problem-solving processes. Moreover, SQ is a multifaceted construct, and its dimensions affect organizational performance differently. Among these dimensions, functionality, reliability, and usability significantly affect organizational performance^[18,20].

1.5 OP

When contrasted and planned, OP is a reliable variable that mirrors real corporate yields, objectives, and goals. The performance idea, alongside its job in organizational adequacy, is perhaps the thorniest issue for scholastics, as with business specialists^[21]. As the resource-based view (RBV) indicates, competitive advantage begins with the idea that firm assets may be stationary and heterogeneous^[22,23]. Essentially, changeability in performance can be inferred from the interesting abilities and support that are non-substitutable, matchless, uncommon, and essential^[22,24]. In addition, a firm's competitive advantage can proceed when it actualizes a strategy that its rivals cannot effortlessly imitate^[22]. For a firm, controlling assets in supporting and creating a competitive advantage has become a focal point of marketing researchers who partner various market-based resources and abilities with a definitive company's performance^[22,25].

Nonetheless, organizational performance is influenced by the procedures and operations in the market and non-market environments^[22,26,27]. According to Ref. [28], an organization's performance in extensive business management can be defined as "the value the organization delivers to customers and other stakeholders" and "the effectiveness of the organization's management practices". The authors utilized delivery time and market consistency as key performance indicators to evaluate organizational performance.

2 Relevant Theory

The significance of theories in addressing research questions in quantitative research was highlighted in Ref. [29]. Consequently, control theory and the resource-based view theory were employed to examine the impact of the variables on linear deterministic systems. According to Ref. [30], these theoretical categories play a vital role in inventory control. Organizational reputation is dependant on the effective control of the efficient operations of any organization to ensure its managerial settings^[31]. Therefore, the utilization of the inventory control theory is identified as a promising venture in organizations^[32].

Resource-based view theory. Barney^[33] introduced the RBV theory in his publication "firm resources and sustained competitive advantage" in 1991. It has been widely cited and developed based on Wernerfelt's^[34] "resource position barriers" (1984) to explain strategies for maintaining a unique position in competitive situations. The RBV theory is based on two main

ideas: (1) within an industry, organizations can have different resources, and (2) across organizations, these resources may not be fully transferable. The RBV emphasizes the different capabilities of the organizations including process procedures, contracts, deployed technology, employees skills and knowledge, and brand names^[35]. Moreover, it helps to overcome inventory control challenges by identifying the required resources that helps improving the OP^[36]. In addition to addressing process deficiencies, the resource-based view theory also emphasizes the importance of competencies and skills in enhancing organizational performance^[37].

3 Methodology

The proposed method provides an organizational insight based on multifaceted quality assessment by the linkage of casual pathways to handle interdependencies. It allows managers to maximize business value by making more targeted and cost-effective investments. Moreover, the method advances the field by addressing the limitations of current quality performance research. In addition, it allows for a comprehensive exploration of the relationship among survey questionnaire variables to test the hypothesized model. Thus, a suitable framework for modeling complex interactions among latent and observed variables is generated. Finally, structural equation modeling (SEM) is applied to explore the direct and indirect effects of the proposed hypotheses, which allows modeling the relationship between the variables to provide a more comprehensive understanding of the underlying structure than other methods. Thus, the applied method provided different tests to ensure the findings' validity and reliability.

3.1 Instrument

The study started with conducting a comprehensive literature review to identify the related issues to ISs success, and the study hypotheses were validated based on DeLone and McLean's model^[10]. Then, the data were collected through a cross-sectional design and quantitative research method using a structured questionnaire on an interval scale. The built questionnaire consisted of five sections, the first four sections contained a set of variables namely, IQ, QoS, SQ, and OP, and each variable was measured using a set of items. The last section pertained to respondents' demographics. At first, a descriptive analysis took place to assess the items' mean (M) and standard deviation (SD) using a five-point Likert scale. The questionnaire was pre-tested to enhance its validity and improve item's clarity. Also, to test the psychometric properties of the variables, the researchers used

exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and SEM using IBM SPSS versions 22.0 and 26.0. Before conducting the EFA, CFA, and SEM, the researchers performed a descriptive analysis of the demographic attributes of the participants. Both EFA and CFA were used for scale validation purposes.

3.2 Study model

Control and RBV theories were used to develop the research model illustrated in Fig. 1, which includes four variables: IQ, QoS, SQ, and OP. The model leads to the formation of three direct hypotheses (H1, H4, and H5) and three indirect hypotheses (H2, H3, and H6), as shown in Fig. 1.

3.3 Study hypothesis

Based on the model proposed in this study, the following research hypotheses were formulated:

- H1: QoS has a direct positive impact on OP.
- H2: QoS positively affects IQ.
- H3: SQ has a positive impact on IQ.
- H4: IQ has a direct positive impact on OP.
- H5: SQ has a direct positive impact on OP.
- H6: SQ positively affects the QoS.

3.4 Sample and procedure

After questionnaire test and improvement, it was sent to 400 experts from academic and industrial backgrounds via email, Whatsapp, and Facebook groups. A total of 360 responses were collected and considered valid, resulting in a 90% response rate. This high response rate was due to the study convenient design, which took 5–10 min to complete. Of the respondents, 76.6% were male and 23.4% were female, aged 18–50 years old. The largest age group was between 31–40 years old (35.3%), followed by 50+ (24.6%), 41–50 (22.0%), and 18–30 (18.1%). Participants' positions were divided into four segments: employees, managers, consultants, and academics. Most of the collected responses were from managers (52.5%), followed by consultants (24.1%), academics (13.3%), and employees (10.1%), as shown in Table 1.

4 Result

This section represents the required details of the used analysis techniques including descriptive analysis, EFA, CFA, and SEM, to assess the structure of the observed variables. For instance, descriptive analysis represents M and SD of the questionnaire variables and their items. EFA represents the factor loadings to show the strength of the relationship between the observed and

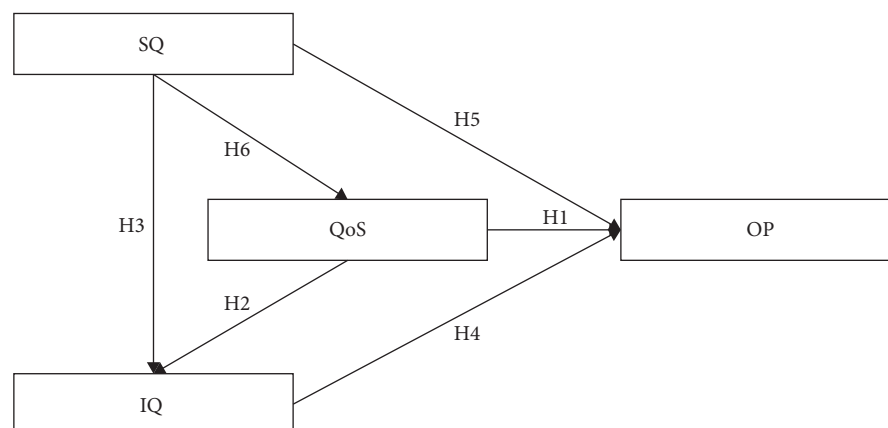


Fig. 1 Study model.

Table 1 Demographic data for respondents.

Demographic profile	Category	Frequency (<i>n</i> =360)	Percentage (%)
Gender	Male	276	76.6
	Female	84	23.4
Age	18–30	65	18.1
	31–40	127	35.3
	41–50	79	22.0
	Over 50	89	24.6
Position	Employee	36	10.1
	Manager	189	52.5
	Consultant	87	24.1
	Academic	48	13.3

latent variables. Also, CFA evaluates the validity and reliability of the proposed model through different techniques to test the latent variables. Finally, SEM estimates the relationship direction between the variables and tests the hypotheses using different techniques.

4.1 Descriptive analysis

The descriptive results of the questionnaire in Table 2 show good scores for the following variables: SQ, QoS, OP, and IQ have $M = 4.28$, $SD = 0.92$; $M = 4.24$, $SD = 1.07$; $M = 4.49$; $SD = 1.11$; and $M = 4.39$, $SD = 0.65$, respectively. The scores indicated that most participants agreed that all constructs impacted organizational performance.

4.2 EFA

As a first step in using EFA, principal axis factoring with orthogonal rotation on 19 items was applied to investigate

whether there is a correlation between the items, which indicates no correlation between the factors^[38].

Table 3 shows the results of the rotated factor matrix for all items; one item with factor loadings <0.60 was removed from the matrix. The remaining items were kept for further analysis with no cross-loading of >75% between the items. Eigenvalues were selected to extract the factors. The Kaiser-Meyer-Olkin (KMO) value was acceptable at > 0.60, with 0.830 for SQ, 0.821 for QoS, 0.841 for OP, and 0.864 for IQ, respectively. In addition, the total variance explained was 68% for all variables.

4.3 CFA

CFA is a statistical method that evaluates the validity of a theoretical model by assessing how well it fits the observed data. CFA is commonly used in social science research to test and validate measurement models such as questionnaires or scales. The researcher starts by proposing a model that outlines the

Table 2 Descriptive analysis results.

Variable	Item	<i>M</i> for items	<i>M</i> for variable	<i>SD</i> for variable
IQ	IQ1: The provided information is complete, valuable, and understandable.	4.41	4.39	0.65
	IQ2: The provided information is timely and meets your needs.	4.36		
	IQ3: The provided information is up-to-date and accurate.	4.39		
	IQ4: The provided information helps firms' managers make the right decisions.	4.40		
QoS	QoS1: The provided services are affected by the collected data.	4.22	4.24	1.07
	QoS2: The response time of the provided services is reduced.	4.36		
	QoS3: The provided services to the customers and employees are of high quality.	4.19		
	QoS4: The provided services are up-to-date.	4.21		
	QoS5: The cost of the provided services is reduced.	4.22		
SQ	SQ1: The used information system meets firm needs, which helped in improving the quality of the provided services.	4.43	4.28	0.92
	SQ2: The information system is easy to use, flexible, responsive, and efficient to enable firms to achieve a competitive advantage.	4.19		
	SQ3: The information system helps the firm achieve its goal by providing up-to-date information.	4.21		
	SQ4: The used information system helps firm managers in enhancing organizational planning.	4.29		
OP	OP1: Does inventory management improve customer satisfaction, which increases organizational performance?	4.47	4.49	1.11
	OP2: Respect employees' qualities and contributions increased company success.	4.49		
	OP3: Social responsibility of business satisfied customers' and employee's expectations which increased organizational performance.	4.48		
	OP4: My firm uses a reward system for innovative employees, which increases organizational performance.	4.51		
	OP5: My firm offers managerial and technical programs for employees.	4.50		

Table 3 Rotated factor matrix results.

Item	Result of the rotated factor matrix			
	IQ	QoS	SQ	OP
IQ3	0.860	–	–	–
IQ2	0.852	–	–	–
IQ1	0.774	–	–	–
IQ4	0.756	–	–	–
IQ5	0.451<0.60	–	–	–
QoS1	–	0.948	–	–
QoS5	–	0.934	–	–
QoS4	–	0.932	–	–
QoS2	–	0.794	–	–
QoS3	–	0.784	–	–
SQ1	–	–	0.911	–
SQ2	–	–	0.907	–
SQ4	–	–	0.828	–
SQ3	–	–	0.808	–
OP1	–	–	–	0.880
OP4	–	–	–	0.859
OP3	–	–	–	0.825
OP2	–	–	–	0.788
OP5	–	–	–	0.786

relationships between variables and tests the model's fit to the data using statistical techniques, such as the maximum likelihood estimation. CFA determines how well the observed data support the proposed model and assesses its validity and reliability, as well as its unidimensionality, convergent validity, discriminant validity, and normality test. A CFA was used to validate the latent variables and their items.

4.3.1 Validity and reliability test

The study evaluated variable validity using fitness indices, such as parsimonious, incremental, and absolute fit, and assessed reliability using Cronbach's alpha (α) to measure consistency. The goodness-of-fit (GoF) indices were reported, including χ^2/df for parsimonious fit, and normed fit index (NFI), Tucker-Lewis index (TLI), comparative fit index (CFI), adjusted goodness-of-fit index (AGFI), and root mean square error of approximation (RMSEA) for incremental and absolute fit. An alpha value of 0.7 or greater indicates excellent reliability^[39]. The validity and reliability of the data are shown in Table 4.

The psychometric properties of the model's four latent variables were evaluated for validity and reliability as shown in Table 4. The indicators used for testing included parsimonious fit (χ^2/df), which should range from 1–3; incremental fit measures

NFI > 0.9, TLI > 0.9, and CFI > 0.9; AGFI > 0.8; and absolute fit (RMSEA) test < 0.05^[40]. Cronbach's alpha ranged from 0.733 to 0.941, indicating excellent reliability. Overall, the results showed that the model had good psychometric properties.

4.3.2 Unidimensionality

Unidimensionality is used to measure the adequacy of the items that comprise a variable. In the analysis of moment structures (AMOS) output, the factor loadings for all variables ranged from 0.783–0.877 without any redundant items. The maximum likelihood estimation (MLE) results in Fig. 2 indicate that SQ5 was deleted because its factor loading was less than 0.6. The model was then re-run to ensure its unidimensionality.

4.3.3 Convergent validity

Convergent validity is often assessed using the NFI approach to evaluate the consistency of different construct measures. A strong convergent validity of constructs is indicated by NFI values of 0.90 or higher, as outlined in Table 5. Additionally, a factor loading of 0.7 or higher is generally considered acceptable to ensure that an item effectively captures a significant portion of the variance in that variable. The convergent validity test evaluates the relationship between items and latent variables. Furthermore,

Table 4 Goodness of fit indices (GoF).

Variable	Number of items	Parsimonious fit (χ^2/df)	Incremental fit				Absolute fit (RMSEA)	Cronbach's alpha (α)
			NFI	TLI	CFI	AGFI		
SQ	4							0.823
QoS	5	1.321	0.920	0.933	0.961	0.892	0.031	0.941
OP	5							0.751
IQ	4							0.733

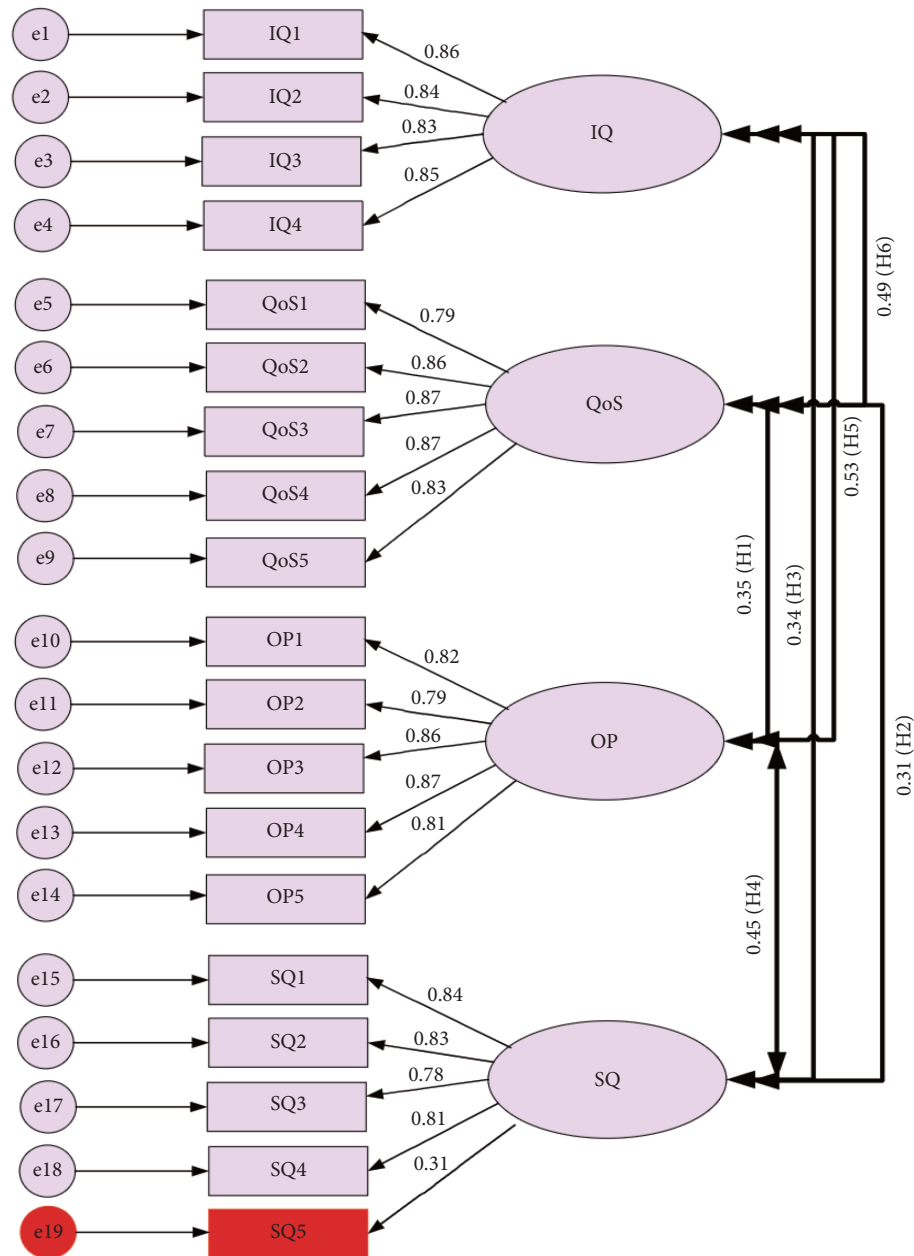


Fig. 2 The first SEM model.

factor loading indicates the variance that a variable explains on a particular item. In SEM, a factor loading of 0.7 or higher is widely accepted to indicate that the item effectively captures a significant portion of the variance in that variable.

4.3.4 Discriminant validity

To assess discriminant validity, the researchers evaluate the ability of the latent variables and their items to differentiate from other variables and their items. It can be achieved by comparing each variable's square root of the AVE with its squared correlation. Table 6 displays the comparison results, with the correlation values being lower than the AVE values. This outcome indicates no multicollinearity, and the model has achieved discriminant validity^[41].

4.3.5 Normality test

Skewness and kurtosis tests were performed to check the normal data distribution for all model items, which should fall between

−1.0 and +1.0. Additionally, Mahalanobis distance was examined to identify any remaining cases from the centroid^[38].

4.4 SEM

SEM is a multivariate analysis technique used to test theoretical models that describe the relationships between latent and observed variables. It combines factor analysis, regression analysis, and causal modeling. The modeler specifies a theoretical model defining the relationships between variables and evaluates the individual paths and coefficients in the model. SEM tests complex theoretical models, assesses the model's overall fit to the data, and tests direct and indirect hypotheses^[39].

4.4.1 Direct hypotheses test

Direct hypotheses H1, H4, and H5, which relate to the direct effect of variables on organizational performance, were evaluated using SEM, and the results are presented in Table 7. The significance of the direct relationship between QoS and OP, IQ and OP, and SQ

Table 5 Cronbach's alpha (α), standardized loadings (Std β), CR, and average variance extracted (AVE).

Variable	Item	Cronbach's alpha ($\alpha > 0.7$)	Std β (> 0.7)	CR (> 0.7)	AVE (> 0.5)
IQ	IQ1	0.733	0.843	0.876	0.781
	IQ2		0.833		
	IQ3		0.783		
	IQ4		0.814		
QoS	QoS1	0.941	0.797	0.921	0.852
	QoS2		0.864		
	QoS3		0.874		
	QoS4		0.877		
	QoS5		0.834		
SQ	SQ1	0.823	0.863	0.918	0.841
	SQ2		0.842		
	SQ3		0.833		
	SQ4		0.853		
OP	OP1	0.751	0.821	0.824	0.710
	OP2		0.791		
	OP3		0.865		
	OP4		0.876		
	OP5		0.812		

Note: CR: critical ratios; AVE for the second-order model = averaging the squared multiple correlations for the first-order indicators.

Table 6 Discriminant validity results.

Variable	AVE	IQ	QoS	SQ	OP
IQ	0.781	0.609	–	–	–
QoS	0.852	0.661	0.725	–	–
SQ	0.710	0.773	0.754	0.501	–
OP	0.841	0.712	0.719	0.810	0.707

Table 7 Direct hypotheses path.

Hypothesis	Path	Std β	SE	CR	Result
H1	QoS $\rightarrow$ OP	0.351***	0.112	3.452	Supported
H4	IQ $\rightarrow$ OP	0.456***	0.123	3.921	Supported
H5	SQ $\rightarrow$ OP	0.532***	0.120	4.342	Supported

Nots: SE: standard error; ***, $p < 0.001$.

and OP was indicated by the standardized loadings (Std β).

4.4.2 Indirect hypothesis test

Hypotheses H2, H3, and H6 propose that certain variables have a moderating effect on organizational performance through other variables, and they were tested using SEM. The results for these three hypotheses are presented in Table 8.

4.4.3 Coefficient of determinants

The model's predictive power (R^2) indicates the influence of the

exogenous variable on the endogenous variable. QoS can predict 67% of OP, IQ can predict 62% of OP, and SQ can predict 64% of OP. These R^2 values are strong, indicating a robust model fit^[12,42].

4.4.4 Effect size (f^2)

The study used effect size f^2 to evaluate the influence of the latent independent variables on the dependent variables. The results indicated a strong impact of IQ, QoS, and SQ on OP, as their effect size exceeded 0.35. Cohen's (2013) criteria for effect size classification were used, where f^2 values of ≥ 0.02 , ≥ 0.15 , and ≥ 0.35

Table 8 Indirect hypotheses path.

Hypothesis	Relationship	Std β	SE	CR	Result
H2	QoS $\rightarrow$ IQ	0.310***	0.143	3.043	Supported
H3	SQ $\rightarrow$ IQ	0.342***	0.161	3.530	Supported
H6	SQ $\rightarrow$ QoS	0.496***	0.134	3.325	Supported

Note: ***, $p < 0.001$.

represent small, medium, and large effect sizes, respectively^[41].

5 Discussion

The study's second SEM model, depicted in Fig. 3, was utilized to confirm the research hypotheses. It was found that all data adhered to the proposed model, which consisted of four variables, thereby fulfilling the study's previously stated objectives as follows:

Objective 1: The three direct hypotheses (H1, H4, and H5) were tested, and the analysis found a statistically significant positive effect of SQ, IQ, and QoS on OP. The analysis revealed that all variables in these hypotheses have a statistically significant positive impact on organizational performance. As software, information, and service quality improve, decision-makers receive more accurate and timely information, leading to better decision-making and positively impacting organizational performance. Additionally, the overall user satisfaction with technology and services provided within the organization increases user satisfaction, affecting their productivity and engagement with their work. These findings are consistent with the results of Ref. [6].

Objective 2: The findings of hypothesis H2 indicated a

significant positive effect of quality of service on information quality, which is in line with the results of Ref. [43]. Information quality affects service quality, considered a prerequisite for business success, leading to higher profitability, customer loyalty, higher returns, increased efficiency, and lower costs^[44,45]. Finally, a significant positive impact of QoS on IQ is likely due to its ability to improve the service's overall quality, reliability, consistency, accuracy, usability, and security, all of which can lead to better information quality.

Objective 3: The findings of hypothesis H3 show a significant positive effect of software quality on information quality because the capabilities of a software system are integrated into the organizational process and provide unique capabilities to the firm, resulting in high-quality information. Moreover, SQ includes factors such as functionality and usability, and a higher SQ means that the software product is more functional and usable. In addition, the overall consistency and accuracy of the information provided by the software product led to better information quality. These results align with derivatives^[7,46].

Objective 4: The findings of hypothesis H6 indicate a

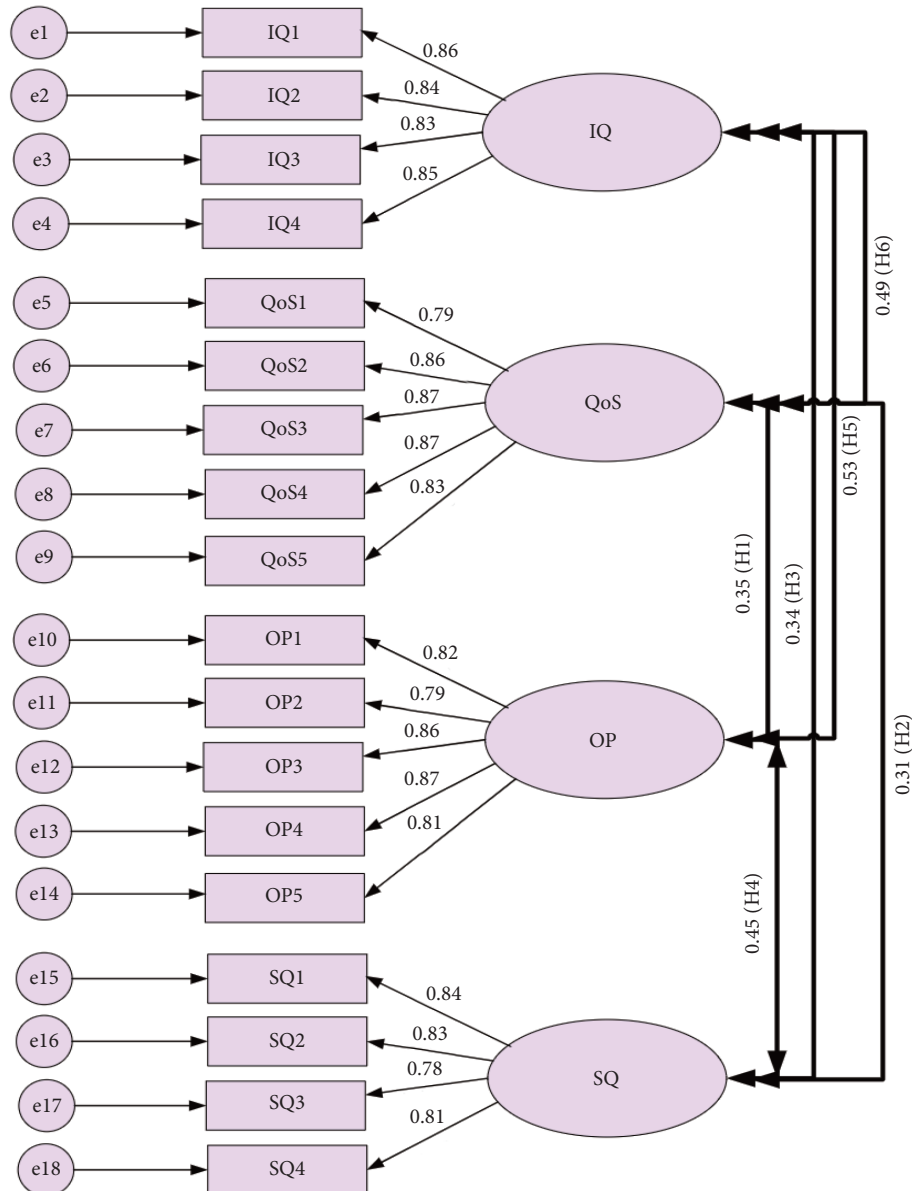


Fig. 3 The second SEM model.

significant positive effect of system quality on the quality of service that the firm provides to other firms or customers. As mentioned in this study, software quality is essential for firms' competitive advantage and how well the provided services are delivered. Additionally, the consistency and accuracy of the services provided by the system can provide users with more reliable and accurate services, leading to better QoS. Finally, the unique capabilities of a software system, such as IT support services, help fulfill end-users and different firm departments' needs, increasing service quality. The findings of this hypothesis are consistent with the results of Ref. [43].

6 Study Contribution and Implication

6.1 Theoretical contribution

The SEM integration and validation of a second-order model succeeded in this study. It added to the control theory and RBV theory literature and the body of tested models. The study expanded the existing knowledge base by evaluating the effect of SQ, IQ, and QoS on OP.

6.2 Organizational contribution

The integration and validation processes of the second model through SEM in this study was successful. It contributed to control theory, RBV theory, and the literature on tested models. Furthermore, the study provided a theoretical contribution through its assessment of the impact of SQ, IQ, and QoS on organizational performance. This study also enriched the existing database of knowledge.

6.3 Cyber-physical systems contribution

The integration of cyber-physical systems (CPS) marks a pivotal advancement in organizational frameworks, notably through the deployment of Internet of Things (IoT) devices. This incorporation fundamentally transforms how organizations collect and analyze data, ushering in an era of real-time capabilities that revolutionize decision-making processes. IoT devices, characterized by interconnected physical devices and sensors, act as data collection nodes distributed throughout the organizational infrastructure. This distributed network facilitates the instantaneous capture of information from various sources, contributing to the first dimension of the CPS framework.

This real-time capability engenders a significant boost in IQ within the organizational landscape. Decision-makers can now access data that are not only accurate but also timely, providing a robust foundation for strategic planning and operational decision-making. The immediacy of information flow allows organizations to respond swiftly to changing conditions, identify emerging trends, and make informed decisions in a proactive manner. The enhanced IQ resulting from real-time data collection aligns seamlessly with the dynamic and fast-paced nature of contemporary business environments, offering a competitive edge to organizations navigating complex operational landscapes.

6.4 Cloud services contribution

Cloud services stand as a cornerstone in the synergy of technological dimensions within organizational frameworks, particularly in the context of CPS. The pivotal role of cloud services is characterized by its provision of scalable and accessible computing resources, fundamentally altering the landscape of data storage, processing, and overall organizational operations. In this dimension, the cloud acts as a dynamic reservoir, catering to the

evolving needs of CPS-generated data and contributing significantly to the QoS.

Scalability and accessibility lie at the heart of the cloud's transformative impact. Organizations leveraging CPS often face fluctuating demands for computational resources, driven by the dynamic nature of data generated by interconnected physical devices. Cloud services offer a scalable infrastructure, allowing organizations to dynamically adjust their computing resources based on demand. This scalability not only optimizes resource utilization, but also ensures that the organizational infrastructure can seamlessly accommodate the evolving requirements of CPS applications.

Beyond mere scalability, cloud services contribute profoundly to the QoS within organizational operations. The reliability and responsiveness of services are critical factors in the efficient functioning of CPS applications. The cloud infrastructure, with its distributed architecture and redundancy mechanisms, ensures high levels of reliability, minimizing the risk of service disruptions. Moreover, the responsiveness of services is enhanced through the cloud's ability to allocate resources dynamically, responding in real-time to the demands placed on the system.

Cloud services, therefore, act as an enabler for organizations to seamlessly integrate and scale their CPS applications. The cloud's adaptability allows for the efficient deployment of CPS-generated data across the organizational landscape, facilitating a more efficient and resilient operational environment. By leveraging cloud services, organizations can transcend traditional limitations, fostering an ecosystem where the interplay between CPS and cloud infrastructure contributes to heightened operational efficiency, responsiveness, and overall service quality. This symbiotic relationship positions cloud services as a linchpin in the technological evolution reshaping modern organizational landscapes.

6.5 Crowdsensing contribution

Crowdsensing emerges as a transformative dimension in the integration of emerging technologies within organizational frameworks, specifically in conjunction with CPS. This dimension signifies a paradigm shift by bringing human intelligence into the loop, emphasizing the collective wisdom of diverse crowds as a valuable resource. Organizations leveraging crowdsensing initiatives stand to gain substantial benefits in terms of improving the quality of data collected by CPS and enhancing the effectiveness of decision-making processes.

The core concept of crowdsensing revolves around tapping into the distributed knowledge and experiences of a diverse group of individuals. In the context of CPS, this entails incorporating human insights alongside the data generated by interconnected physical devices. By doing so, organizations not only enrich the data collected by CPS but also gain a more holistic understanding of the contextual nuances that might escape automated data collection. The diverse perspectives of the crowd contribute to a more comprehensive and nuanced dataset, enhancing the overall IQ available to decision-makers.

Crowdsensing initiatives, when supported by advanced technologies, empower organizations to go beyond mere data collection. They become instrumental in validating analytical models, gathering real-world insights, and adapting to dynamic conditions. The collective intelligence harnessed through crowdsensing contributes significantly to overall SQ within organizational operations. Human-in-the-loop approaches aid in refining analytical models, identifying patterns that automated systems might overlook, and validating the accuracy of algorithms

deployed in CPS applications.

Moreover, the adaptability of crowdsensing to dynamic conditions further bolsters operational excellence. Organizations can utilize real-time insights from the crowd to make informed adjustments to their CPS applications, ensuring responsiveness to changing circumstances. This adaptability not only contributes to the efficiency of CPS-generated data but also elevates the overall operational resilience of the organization.

In essence, crowdsensing emerges as a potent force in the realm of organizational dynamics, seamlessly integrating with CPS and other technologies to enhance data quality, decision-making processes, and overall operational excellence. The collaborative intelligence of the crowd becomes a valuable asset in navigating the complexities of the modern business landscape, adding a human-centric dimension to the technological evolution reshaping organizational paradigms.

Enhancing organizational performance through the integration of CPS, cloud services, and crowdsensing holds transformative implications for the efficiency, agility, and overall effectiveness of contemporary enterprises. The synergy among these technologies is not merely a sum of their parts but rather a catalyst for profound organizational advancements.

Firstly, the incorporation of cyber-physical systems, such as IoT devices, into organizational frameworks facilitates real-time data collection and analysis. This real-time capability translates into enhanced IQ, enabling decision-makers to access accurate and timely data for strategic planning and operational decision-making. The interconnectedness of physical devices, sensors, and cloud-based analytics in CPS optimizes organizational processes, providing a robust foundation for data-driven decision support.

Moreover, cloud services play a pivotal role in this enhancement by offering scalable and accessible computing resources. The cloud infrastructure not only supports the storage and processing needs of CPS-generated data but also contributes to the QoS by ensuring the reliability and responsiveness of organizational services. Cloud services act as an enabler, allowing organizations to seamlessly integrate and scale their CPS applications, ultimately contributing to a more efficient and resilient operational environment.

Crowdsensing further extends the impact, bringing human intelligence into the loop. By tapping into the collective wisdom of a diverse crowd, organizations can improve the quality of data collected by CPS and enhance the effectiveness of decision-making processes. Crowdsensing initiatives, supported by advanced technologies, empower organizations to validate analytical models, gather real-world insights, and adapt to dynamic conditions, thereby contributing to overall SQ and operational excellence.

6.6 Practical implications of the study

The ripple effect of these enhancements is not confined to organizational boundaries; it extends to the lives of individuals within the crowd. As organizations leverage CPS, cloud services, and crowdsensing to optimize their operations, the products and services offered to the public are imbued with higher quality, efficiency, and responsiveness. This, in turn, enhances the everyday experiences of individuals who interact with these services, fostering a positive feedback loop between organizational performance improvements and the overall well-being of the crowd. Whether through improved healthcare services, streamlined transportation systems, or more responsive public utilities, the integration of these technologies contributes to a smarter, more connected, and more user-centric environment,

ultimately enhancing the quality of life for individuals within the broader community. In essence, the organizational performance gains realized through the symbiosis of CPS, cloud services, and crowdsensing have far-reaching implications that extend beyond the corporate realm, positively shaping the lived experiences of the crowd.

The study's findings carry significant practical implications for organizations aiming to navigate the transformative landscape of emerging technologies. Firstly, decision-makers can strategically allocate resources based on a nuanced understanding of the direct and indirect impacts of CPS, cloud services (cloud), and crowdsourcing on OP. This insight guides organizations in making informed investments that align with their overarching strategic objectives.

To enhance decision-making processes, organizations can practically implement the integration of CPS. This involves real-time data utilization, ensuring a dynamic and responsive approach to decision-making. By optimizing this technological integration, organizations can achieve greater agility and accuracy in their strategic choices.

QoS optimization emerges as a practical avenue for organizations leveraging cloud services. Through regular assessments and adjustments, organizations can ensure that their cloud infrastructure provides reliable, efficient, and accessible services. This practical step directly influences customer satisfaction and operational efficiency.

Crowdsourcing, identified as a positive influence on organizational performance, presents a practical avenue for fostering innovation. Organizations can implement platforms and initiatives that encourage crowdsourced intelligence, creating a culture of collaboration and idea-sharing. This approach taps into the diverse perspectives of employees and external contributors, driving innovation and problem-solving.

Recognizing the impact of SQ on organizational outcomes, practical measures include the development of employee training programs. These initiatives aim to enhance technological literacy and skills, ensuring that the workforce is proficient in utilizing emerging technologies to their full potential.

Continuous monitoring and adaptation form a practical strategy for organizations to stay abreast of technological advancements. Implementing dedicated teams or technology monitoring tools enables organizations to proactively adjust their strategies in response to changing technological landscapes.

Cross-functional collaboration emerges as a practical approach for enhancing SQ and fostering innovation. Organizations can encourage interdisciplinary teams, knowledge-sharing platforms, and recognize innovative contributions. This collaborative culture fuels creativity and supports the development of high-quality software.

Strategic resource allocation becomes a practical imperative, with organizations aligning budgets and human resources with initiatives that promise the most significant positive outcomes. This strategic approach ensures that investments are directed toward areas with the highest potential for impact on organizational performance.

For organizations focusing on cloud services, a practical implication involves adopting customer-centric service delivery. Emphasizing QoS and tailoring services to meet customer needs enhances satisfaction and loyalty, contributing to positive overall organizational performance.

Lastly, practical implications extend to the adoption of CPS for operational efficiency. Organizations can practically integrate IoT devices, automate physical processes, and utilize data-driven

insights to optimize workflows, thereby achieving tangible operational improvements.

In summary, the practical implications derived from this study provide a comprehensive roadmap for organizations seeking to strategically harness the potential of emerging technologies. By translating research findings into actionable initiatives, organizations can foster innovation, enhance operational efficiency, and position themselves for sustained success in the digital era.

7 Conclusion

The study contributed to the existing knowledge by successfully incorporating and validating SEM with the tested model and literature. Additionally, it sheds light on the relationship between the proposed variables and their impact on organizational performance, emphasizing the significance of software quality in management. The study also highlighted the importance of identifying critical software quality attributes for organizations to improve their performance and the direct and indirect effects of overall software quality on organizational performance. Given organizations' heavy reliance on information systems and the potential losses associated with poor IT quality, management prioritizes IT quality improvement. A 2007 Chief Information Officer (CIO) survey revealed that IT quality improvement is a top priority among IT executives. Since IT quality encompasses multiple dimensions, it is essential to identify the key aspects that matter most to organizations to ensure the optimal allocation of limited resources.

Consequently, it is recommended that managers identify their firms' software system requirements and provide ongoing training to staff to enhance their skills and service quality. Furthermore, software and firm managers must recognize the criticality of information quality and services in driving organizational performance. Information quality can be improved by aligning IT strategy with business strategy and utilizing data mining and warehousing techniques. System quality is critical in determining the relationship between information quality and organizational impact. It is recommended that IS managers prioritize using up-to-date technology and well-designed systems to enhance system quality. Furthermore, investing in software quality improvement methods can lead to cost savings. Finally, organizations are advised to implement IT service management programs to optimize IT services and improve service quality, which can substantially impact business benefits.

The IS managers should strive to enhance capabilities, including IT infrastructure, human IT resources, and their relationships with the business units, to raise the standards of system quality, information quality, and service quality. According to the resource-based view, improving IS capabilities in the core IS functional areas, such as planning, system development, IS support, and IS operations, as well as developing IS applications that reinforce the core competencies of the business, will result in improved IS quality and better organizational performance. The IS managers should aim to create valuable, rare, inimitable, and non-substitutable IS capabilities to grant the firm a competitive advantage. These IS capabilities in system development will be unique to the organization, integrating seamlessly with organizational processes, thereby leading to higher information quality. The custom-made and mature IT support services, tailored to the end user's skill level and meet each business unit's specific needs, will enhance the service quality. Better IS capabilities will improve system quality and reduce disruptions to

business operations, leading to increased benefits for the business.

8 Limitation and Future Work

In response to this study's limitations, the reported results may have been biased to some variables of the quality-based that affect organizational performance. Therefore, many other variables not used in this study could affect organizational performance. In addition, the number of respondents who participated in this study might not be enough, which could affect the reliability and validity of the result.

The current study sheds light on a crucial IS quality aspect and its impact on organizational performance. However, it only offers a starting point for future research to delve deeper into the topic. Conducting a longitudinal study that traces the relationship between the quality of IS and its impact on the organization over an extended period would provide significant benefits for a comprehensive understanding of IS quality. Additionally, this research could be replicated in different IS contexts, such as web-based information systems or outsourcing, to provide further insights. Software system quality is essential for firms' competitive advantage and performance due to the continuous need for them. Therefore, assessing the relationship between software quality and organizational performance over time is recommended. Also, future research should be conducted to re-validate IS success models by comparing their different quality attributes with firms' needs. Finally, further research is required to scrutinize the impact of other variables on organizational performance.

Acknowledgment

This work was supported by the Deanship of Scientific Research at Shaqra University.

Dates

Received: 7 September 2023; Revised: 6 December 2023; Accepted: 14 December 2023

References

- [1] R. V. Ferreira and A. P. M. S. Cherobim, Impacto dos investimentos em TI no desempenho organizacional de empresas de panificação de minas gerais: Estudo multicaso, *BASE Rev. De Adm. E Contabilidade Da Unisinos*, vol. 9, no. 2, pp. 147–161, 2012.
- [2] M. M. Moughari and T. U. Daim, Developing a model of technological innovation for export development in developing countries, *Technol. Soc.*, vol. 75, p. 102338, 2023.
- [3] J. A. O'Brien and G. Marakas, *Management Information Systems*. New York, NY, USA: McGraw-Hill, 2011.
- [4] E. Turban, L. Volonino, G. R. Wood, and J. C. Sipior, *Information Technology for Management: Advancing Sustainable, Profitable Business Growth*. Hoboken, NJ, USA: Wiley, 2013.
- [5] J. Issam and A. Q. Ahmad, Empirical study of analysts' practices in packaged software implementation at small software enterprises, *Int. Arab J. Inf. Technol.*, vol. 14, no. 4, pp. 543–551, 2017.
- [6] N. Gorla, T. M. Somers, and B. Wong, Organizational impact of system quality, information quality, and service quality, *J. Strateg. Inf. Syst.*, vol. 19, no. 3, pp. 207–228, 2010.
- [7] M. Al-Okaily, R. Alghazzawi, A. F. Alkhawaldi, and A. Al-Okaily, The effect of digital accounting systems on the decision-making quality in the banking industry sector: A mediated-moderated model, *Glob. Knowl. Mem. Commun.*, vol. 72, nos. 8&9, pp. 882–901, 2023.
- [8] Q. Fu, A. A. Abdul Rahman, H. Jiang, J. Abbas, and U. Comite, Sustainable supply chain and business performance: The impact of strategy, network design, information systems, and organizational

- structure, *Sustainability*, vol. 14, no. 3, p. 1080, 2022.
- [9] M. Alauthman, A. Al-Qerem, S. Alangari, A. M. Ali, A. Nabo, A. Aldweesh, I. Jebreen, A. Almomani, and B. B. Gupta, Machine learning for accurate software development cost estimation in economically and technically limited environments, *Int. J. Softw. Sci. Comput. Intell.*, vol. 15, no. 1, pp. 1–24, 2023.
 - [10] W. H. DeLone and E. R. McLean, Information systems success: The quest for the dependent variable, *Inf. Syst. Res.*, vol. 3, no. 1, pp. 60–95, 1992.
 - [11] Y. H. Al-Mamary, A. Shamsuddin, and N. Aziati, The pilot test study of relationship between management information system success factors and organization performance at sabafon company in Yemen, *Int. J. U E Serv. Sci. Technol.*, vol. 8, no. 2, pp. 337–346, 2015.
 - [12] S. I. Ali Al Randi, R. C. Jalagat, and A. Bashayreh, Influence of social media usage and work performance on organizational performance: The case of A broadband company in Oman, *Turk Turizm Arastirmalari Dergisi*, vol. 4, no. 4, pp. 419–435, 2022.
 - [13] J. Zhang, Y. Shu, and H. Yu, Fairness in design: A framework for facilitating ethical artificial intelligence designs, *International Journal of Crowd Science*, vol. 7, no. 1, pp. 32–39, 2023.
 - [14] L. Dagiliene and K. Štutienė, Corporate sustainability accounting information systems: A contingency-based approach, *Sustain. Account. Manag. Policy J.*, vol. 10, no. 2, pp. 260–289, 2019.
 - [15] P. Q. Huy and V. K. Phuc, Does strategic corporate social responsibility drive better organizational performance through integration with a public sector scorecard? Empirical evidence in a developing country, *Processes*, vol. 8, no. 5, p. 596, 2020.
 - [16] L. Burkon, Quality of service attributes for software as a service, *J. Syst. Integr.*, vol. 4, no. 3, pp. 38–47, 2013.
 - [17] J. Agarwal, M. Kumar, M. Sharma, D. Verma, and R. Sharma, Application of intelligent adaptive neuro fuzzy method for reusability of component based software system, *Int. Arab J. Inf. Technol.*, vol. 20, no. 5, pp. 773–781, 2023.
 - [18] V. Yadav, R. Singh, and V. Yadav, Estimation model for enhanced predictive object point metric in OO software size estimation using deep learning, *Int. Arab J. Inf. Technol.*, vol. 20, no. 3, pp. 293–302, 2023.
 - [19] A. C. Gillies, *Software Quality: Theory and Management*. London, UK: Chapman & Hall, Ltd., 2011.
 - [20] K. Naik and P. Tripathy, *Software Testing and Quality Assurance: Theory and Practice*. New York, NY, USA: John Wiley & Sons, 2011.
 - [21] T. Ravichandran, and C. Lertwongsatien, Effect of information systems resources and capabilities on firm performance: A resource-based perspective, *J. Manag. Inf. Syst.*, vol. 21, no. 4, pp. 237–276, 2005.
 - [22] G. Ray, L. Xue, and J. B. Barney, Impact of information technology capital on firm scope and performance: The role of asset characteristics, *Acad. Manag. J.*, vol. 56, no. 4, pp. 1125–1147, 2013.
 - [23] R. H. Ananda and E. S. Astuti, Analysis of the relationship of information technology capability to innovation and organizational performance (meta-analysis), *Profit: Jurnal Administrasi Bisnis*, vol. 17, no. 1, pp. 55–68, 2023.
 - [24] S. Chatterjee, R. Chaudhuri, D. Vrontis, and G. Giovando, Digital workplace and organization performance: Moderating role of digital leadership capability, *J. Innov. Knowl.*, vol. 8, no. 1, p. 100334, 2023.
 - [25] S. N. Ramaswami, R. K. Srivastava, and M. Bhargava, Market-based capabilities and financial performance of firms: Insights into marketing's contribution to firm value, *J. Acad. Mark. Sci.*, vol. 37, no. 2, pp. 97–116, 2008.
 - [26] M. S. Kim and B. Thapa, Relationship of ethical leadership, corporate social responsibility and organizational performance, *Sustainability*, vol. 10, no. 2, p. 447, 2018.
 - [27] A. Nabot, V. Garaj, and W. Balachandran, Consumer attitudes toward online shopping, *Int. J. Soc. Ecol. Sustain. Dev.*, vol. 5, no. 3, pp. 13–24, 2014.
 - [28] Z. Awang, *SEM Made Simple: A Gentle Approach to Learning Structural Equation Modeling*. Bangi, Malaysia: MPWS Rich Publication, 2015.
 - [29] J. W. Creswell, *Qualitative, Quantitative, and Mixed Methods Approaches*. Thousand Oaks, CA, USA: Sage, 2003.
 - [30] A. R. Hashmi, N. A. Amirah, and Y. Yusof, Organizational performance with disruptive factors and inventory control as a mediator in public healthcare of Punjab, Pakistan, *Management Science Letters*, vol. 11, no. 1, pp. 77–86, 2021.
 - [31] M. M. Kokar, K. Baclawski, and Y. A. Eracar, Control theory-based foundations of self-controlling software, *IEEE Intell. Syst. Appl.*, vol. 14, no. 3, pp. 37–45, 1999.
 - [32] M. Nakhaeinejad, H. Khademi Zare, M. Habibi, and M. R. Khodoomi, Improvement of multi-item order systems and inventory management models using optimal control theory, *Trans. Inst. Meas. Contr.*, vol. 45, no. 1, pp. 104–119, 2023.
 - [33] J. Barney, Firm resources and sustained competitive advantage, *J. Manag.*, vol. 17, no. 1, pp. 99–120, 1991.
 - [34] B. Wernerfelt, A resource-based view of the firm, *Strateg. Manag. J.*, vol. 5, no. 2, pp. 171–180, 1984.
 - [35] J. Liu, B. Liang, and W. Ji, An anomaly detection approach based on hybrid differential evolution and K-means clustering in crowd intelligence, *International Journal of Crowd Science*, vol. 5, no. 2, pp. 129–142, 2021.
 - [36] R. J. Arend, and M. Lévesque, Is the resource-based view a practical organizational theory? *Organ. Sci.*, vol. 21, no. 4, pp. 913–930, 2010.
 - [37] T. Connor, The resource-based view of strategy and its value to practising managers, *Strateg. Change*, vol. 11, no. 6, pp. 307–316, 2002.
 - [38] S. W. O'Leary-Kelly and R. J. Vokurka, The empirical assessment of construct validity, *J. Oper. Manag.*, vol. 16, no. 4, pp. 387–405, 1998.
 - [39] R. B. Kline, Response to Leslie Hayduk's review of principles and practice of structural equation modeling, 4th edition, *Can. Stud. Popul.*, vol. 45, nos. 3&4, pp. 188, 2018.
 - [40] W. Black and B. J. Babin, Multivariate data analysis: Its approach, evolution, and impact, in *The Great Facilitator*, B. J. Babin and M. Sarstedt, eds. Cham, Switzerland: Springer, 2019, pp. 121–130.
 - [41] J. Cohen, *Statistical Power Analysis for the Behavioral Sciences*. New York, NY, USA: Routledge, 2013.
 - [42] X. Li, T. Zhang, X. Sun, and Y. Ma, Product map analysis from a crowd of small- and medium-sized e-commerce sites: A bottom-up approach, *International Journal of Crowd Science*, vol. 7, no. 3, pp. 131–136, 2023.
 - [43] G. Gable, D. Sedera, and T. Chan, Re-conceptualizing information system success: The IS-impact measurement model, *J. Assoc. Inf. Syst.*, vol. 9, no. 7, pp. 377–408, 2008.
 - [44] H. H. Weng, J. S. Chen, and P. C. Chen, Effects of green innovation on environmental and corporate performance: A stakeholder perspective, *Sustainability*, vol. 7, no. 5, pp. 4997–5026, 2015.
 - [45] Y. Choi and Y. Yu, The influence of perceived corporate sustainability practices on employees and organizational performance, *Sustainability*, vol. 6, no. 1, pp. 348–364, 2014.
 - [46] I. Jebreen, R. Wellington, and S. G. MacDonell, Packaged software implementation requirements engineering by small software enterprises, in *Proc. 20th Asia-Pacific Software Engineering Conf. (APSEC)*, Bangkok, Thailand, 2013, pp. 50–57.