



Leveraging intellectual capital for quality management excellence through knowledge management in the banking sector

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ABSTRACT

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This study examines the mediating role of knowledge management (KM) in the relationship between intellectual capital (IC) and total quality management (TQM) in commercial banks in Sana'a, Yemen. A quantitative cross-sectional research design was adopted, and data were collected through a structured questionnaire from 328 employees and managers representing different departments of commercial banks. The data were analyzed using SPSS and SmartPLS 4 to test the hypothesized relationships and mediation effect. The findings reveal that intellectual capital has significant positive relationships with both knowledge management and total quality management, while knowledge management is also positively associated with total quality management. Furthermore, knowledge management partially mediates the relationship between intellectual capital and total quality management ($\beta = 0.345$, $p < 0.001$), indicating that effective knowledge management practices enhance the contribution of intellectual capital to quality management. These findings suggest that commercial banks can derive greater value from their intellectual capital by developing mechanisms for creating, sharing, and applying organizational knowledge. Practically, bank managers should strengthen knowledge-oriented policies, employee knowledge development, knowledge-sharing mechanisms, and organizational systems that facilitate the effective utilization of intellectual assets. Such practices can support TQM implementation, enhance service quality, and strengthen organizational sustainability and competitive advantage in a rapidly changing, knowledge-based banking environment.

Contribution/Originality: This study contributes to theory by integrating three complementary lenses to explain the mechanism through which intangible resources drive service quality. Practically, it offers guidance for bank managers and policymakers on leveraging intellectual and knowledge assets to foster continuous improvement, innovation, and customer satisfaction in resource-constrained environments.

1. INTRODUCTION

In today's knowledge-driven economy, competitiveness is not determined solely by physical assets but also by an organization's ability to provide high-quality services (Dima, Begu, Vasilescu, & Maassen, 2018). Total Quality Management (TQM) represents a strategic organizational approach designed to embed continuous quality improvement across all operational processes, with the ultimate goals of enhancing service effectiveness, customer satisfaction, and overall organizational performance (Fadhel & Alqurs, 2025). TQM is widely recognized as a holistic and systematic management philosophy that transcends traditional quality inspection, requiring active engagement from all organizational levels to achieve excellence and competitive differentiation (Deming, 2000; Oakland, 2014).

In diverse organizational settings, robust TQM practices have been linked to improvements in innovation, operational agility, and customer responsiveness, indicating their central role in sustainable performance outcomes (Dedunu, Weerasinghe, & Wickramasinghe, 2025; Nonaka & Takeuchi, 1995). However, the effectiveness of TQM is not solely a function of formal procedures and tools; it also depends critically on the organization's underlying intangible assets and capabilities (Silva, Gomes, Lages, & Pereira, 2014).

Foremost among these influential intangible assets is intellectual capital (IC), which acts as a foundational driver of TQM effectiveness and organizational outcomes (Suparwadi, Musadieq, Riza, & Hutahayan, 2024). IC is broadly defined as the sum of knowledge-based resources within an organization, including human capital (skills and expertise), structural capital (systems and processes), and relational capital (networks and customer relationships) (Bontis, 2001; Edvinsson & Malone, 1997). IC significantly influences organizational outcomes by enabling innovation, enhancing decision-making, and fostering adaptive capabilities, essential for quality improvement initiatives to succeed in complex environments (Huynh, Van Nguyen, Do, Dinh, & Vo, 2024; Sayed & Nefzi, 2024; Yunita, Sasmoko, Bandur, & Alamsjah, 2023). Prior studies across multiple sectors demonstrate that stronger intellectual capital correlates positively with improved quality management practices, suggesting that IC functions as a key strategic input for fostering quality-oriented outcomes (Abdualdaem, 2021; Kański, Chadam, & Kłosowski, 2022). Yet, this relationship is not direct, particularly in settings where knowledge flows are weak and organizational learning mechanisms are underdeveloped (Caddy, 2007).

This indirect relationship suggests the need to facilitate the process. Precisely, this gap is bridged by Knowledge Management (KM), which emerges as a critical mediating mechanism that connects intellectual capital to the effective implementation of TQM. Knowledge management encompasses the systematic processes by which organizations generate, store, share, and apply knowledge, thereby turning individual expertise into organizational capability (Yazdani, Bayazidi, & Mafi, 2020). Empirical scholars have argued that KM facilitates the transformation of IC into usable knowledge that informs decision-making, supports continuous improvement, and embeds quality practices into organizational routines (Usman, Zaveri, & Hamza, 2021). This perspective posits that without robust KM processes, the latent value of intellectual capital may remain underutilized, weakening its potential impact on TQM outcomes. Academic work highlights the role of KM processes as enablers that channel intangible assets into performance gains and quality improvements, often serving as necessary mediators in organizational models linking knowledge assets to strategic outcomes.

However, within the Yemeni banking sector, the integrative linkage among IC, KM, and TQM remains largely underexplored. This is justified by the fact that Yemeni banks operate in a context marked by institutional challenges, informal knowledge practices, and evolving quality frameworks, creating a unique setting in which to examine how knowledge management can mediate the impact of intellectual capital on quality management outcomes.

This study, therefore, seeks to address this notable gap by empirically investigating how KM functions as a bridge through which intellectual capital influences TQM practices in Yemeni banks, offering novel insights into how intangible resources can be strategically mobilized to improve quality within a developing and transitional context.

Accordingly, this study aims to:

1. Examine the direct effect of Intellectual Capital on Total Quality Management.
2. Assess the relationship between Intellectual Capital and Knowledge Management.
3. Investigate the effect of Knowledge Management on Total Quality Management.
4. Test the mediating role of Knowledge Management in the relationship between Intellectual Capital and Total Quality Management.

1.1. Theoretical Lenses

This study is underpinned by three complementary theoretical perspectives: the Resource-Based View (RBV), the Knowledge-Based View (KBV), and Organizational Learning Theory (OLT), which together explain how

intellectual capital, knowledge management, and total quality management interact to enhance performance in banking institutions. According to Barney (1991), competitive advantage stems from valuable, rare, inimitable, and non-substitutable (VRIN) resources. Intellectual capital, comprising human, structural, and customer capital, acts as a strategic resource that, when effectively utilized, can lead to the improvement of organizational performance. However, these resources must be managed and integrated through knowledge processes to generate superior quality outcomes (Indriyani et al., 2025).

Building on RBV, Grant (1996) and Nonaka and Takeuchi (1995) emphasized knowledge as the most critical strategic asset. Therefore, knowledge management processes, namely, creation, storage, sharing, and application, are well suited to enabling the transformation of intellectual capital into operational excellence, thereby supporting TQM principles such as customer focus and continuous improvement.

Organizational Learning Theory (OLT), developed by Argyris and Schön (1978), highlights learning as a continuous process that drives adaptation and innovation. Therefore, by institutionalizing learning and knowledge-sharing mechanisms, banks strengthen intellectual capital and foster a culture that supports TQM practices and service quality (Aribi, Kociatkiewicz, & Micheaux, 2025). Together, these perspectives explain that intellectual capital provides the foundation (RBV), knowledge management acts as the leveraging mechanism (KBV), and organizational learning ensures continuous improvement (OLT). This integrated lens supports the study's proposition that intellectual capital enhances total quality management through knowledge management, leading to sustained competitive advantage in the banking sector.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Prior research in developed economies consistently shows that Intellectual Capital (IC) is positively correlated with a number of organizational variables, including innovation, service quality, and competitive advantage. This results from firms having mature infrastructural and institutional settings, along with corporate cultures that support the ongoing development and exchange of knowledge among employees. In this environment, the effective use of Knowledge Management (KM) allows an organization to create a competitive advantage by converting its intellectual assets into superior performance outcomes. Total Quality Management (TQM) practices typically complement these efforts by establishing systematic processes for ensuring quality through leadership, training, recognition, and the use of technology (Nkambule, Wang, Ting, & Lu, 2022).

In contrast, studies in developing or resource-constrained countries have yielded a variety of results, with many indicating that, while intellectual capital helps increase service quality, factors such as limited technological infrastructure, mediocre knowledge management practices, and limited organizational capacity lessen its effect. The role of knowledge management as a mediator of the relationship between intellectual capital and total quality management has also yet to be established, providing an uncertain basis for how intellectual assets translate into quality products in less stable environments like Yemen. Such gaps create an academic need for empirical investigation of the relationships between these variables in developing-country settings.

2.1. Intellectual Capital and Total Quality Management

Intellectual Capital (IC) represents the collective knowledge, skills, experiences, systems, and relationships that enable organizations to create and sustain value (Bontis, 2001). To operationalize this broad concept, scholars divided it into three sub-constructs: human, structural, and customer (relational) capital (Al-Husseini, 2023; Cabrita & Bontis, 2008; Edvinsson & Malone, 1997). Specifically, human capital is reflected in employees' proficiencies, creativity, and problem-solving abilities that drive organizational performance (Bai, 2024); structural capital refers to institutionalized systems, databases, culture, and processes that support knowledge retention and operational consistency (Beltramino, García-Perez-de-Lema, & Valdez-Juárez, 2020); and customer capital captures the strength

and quality of relationships with clients and stakeholders, contributing to trust, loyalty, and market insight (Chahal & Bakshi, 2016; Khan, Salamzadeh, Iqbal, & Yang, 2022).

In contrast, Total Quality Management (TQM) is defined as “a philosophy centered on continuous improvement of services, enhancement of customer satisfaction, and active employee engagement (Afzal, Hanif, & Rafique, 2022; Deming, 2000; Oakland, 2014). Its effective implementation is not a simple process but requires significant foundations of tangible and intangible resources that reinforce learning, innovation, and process excellence (Alkoliby et al., 2025; Yeung & Chan, 1999).

Theoretical and empirical evidence suggests that IC is one of these critical foundations and resources. Theoretically, the Resource-Based View (RBV) posits IC as a valuable, rare resource that can boost organizational competitiveness (Awwad, 2025; Barney, 1991). It provides the intellectual infrastructure that enables quality-driven cultures to flourish. Applied to quality management, IC provides essential intellectual infrastructure, including skilled human resources, supportive systems, and customer insights, which enable a quality culture to flourish. Empirically, findings from prior studies, such as (Al-Tit et al., 2022; Mehralian, Farzaneh, Yousefi, & Haloub, 2024), confirm that organizations with strong intellectual capital show superior quality outcomes due to improved communication, innovation, and problem-solving capabilities (Al-Tit et al., 2022; Mehralian et al., 2024).

However, research indicates that the degree to which IC affects TQM varies by context (Kianto, Sáenz, & Aramburu, 2017; Nhon, Thong, & Trung, 2020). Therefore, while evidence supports the role of IC as one of the dominant influences on quality management, its greatest impact is likely to be realized in stable settings. In limited-resource and fragile contexts such as Yemen, this link may therefore have a different level of influence. Accordingly, this study proposes:

H₁: IC has a significant positive effect on TQM.

2.2. Intellectual Capital and Knowledge Management

The relationship between Intellectual Capital and Knowledge Management (KM) is the cornerstone of contemporary strategic management. This interdependence is based on the Knowledge-Based View (KBV), which establishes that knowledge is the most strategically paramount resource of the firm (Grant, 1996; Nonaka & Takeuchi, 1995). Within this framework, IC is not merely an asset but represents the main foundation upon which knowledge is generated, stored, shared, and applied (Li, Song, Wang, & Li, 2019).

Each component of IC contributes uniquely and plays an important role in advancing KM processes. Human capital contributes to KM by facilitating knowledge creation and transfer through expertise and learning (Linda, Thabrani, & Firman, 2020). Structural capital provides the essential infrastructure for storing knowledge, such as systems and databases (Boikanyo, 2025). Meanwhile, customer capital serves as a vital channel through which knowledge is acquired through connections to market insights and stakeholder interactions (Cristache, Croitoru, & Florea, 2025; Qiao & Wang, 2021).

This theoretical link is supported empirically. Prior research has validated this link, establishing that higher levels of IC lead to enhanced KM implementation (Chatterjee, Chaudhuri, Mariani, & Wamba, 2023). Similarly, Suparwadi et al. (2024) and Inkien (2015) found that IC determines firms' capacity to generate, share, and apply knowledge in pursuit of innovation and operational improvement. This dynamic is exemplified in the banking industry, where service delivery depends heavily on employees' tacit knowledge and customer relationships. To sum up, IC provides the cognitive and relational basis for effective KM systems (Boikanyo, 2025).

The critical importance of this link is greatly magnified in the context of developing economies. In environments that suffer from resource constraints and limited technological infrastructure, organizations cannot rely primarily on physical assets alone. Therefore, their intellectual assets are considered critical strategic sources for making effective use of IC and KM for survival and growth. Accordingly, given the theoretical foundation and consistent empirical evidence, the following hypothesis is proposed:

H₂: IC has a significant positive effect on KM.

2.3. Knowledge Management and Total Quality Management

Knowledge Management (KM) refers to the systematic processes of creating, storing, sharing, and applying knowledge to improve organizational performance (Alavi & Leidner, 2001; Cristache et al., 2025; Gold, Malhotra, & Segars, 2001). Significantly, the objectives of KM mechanisms are inherently aligned with the core philosophy of TQM. Both KM and TQM emphasize a culture of continuous learning, teamwork, and customer focus (Lehyani, Zouari, Ghorbel, & Tollenaere, 2024). In addition, the synergy between KM and TQM lies in their shared commitment to continuous improvement and knowledge-based decision-making (Bukari, Kheni, Boateng, Owusu-Ansah, & Gyenfie, 2023).

This synergy is operationalized through KM processes that lead to TQM practices. By creating and disseminating knowledge, employees are empowered to identify performance gaps and develop innovative measures (Obeng, Arhinful, Mensah, & Owusu-Sarfo, 2024). Concurrently, knowledge storage and retrieval systems ensure that lessons learned are institutionalized to prevent the recurrence of errors. Finally, knowledge application enables organizations to refine processes and services based on accumulated experience (Jerez-Gómez, Céspedes-Lorente, & Valle-Cabrera, 2005; Kucharska & Bedford, 2023).

The relationship between KM and TQM is supported at both the theoretical and empirical levels. The theoretical foundation for this rationale is provided by Organizational Learning Theory (OLT), which posits that continuous learning is the foundational driver of advancing quality principles toward excellence (Argyris & Schön, 1978). KM provides the structural framework that supports continuous improvement. Empirical studies confirm that KM practices enhance TQM implementation by facilitating organizational learning and innovation (Hashem & Jaradat, 2020; Lehyani et al., 2024).

In the service-oriented and competitive banking sector, KM ensures that insights derived from customers, operations, and employees are translated into quality improvements and consistent service delivery. In light of clear theoretical underpinnings and consistent empirical evidence, it is hypothesized that:

H₃: KM has a significant positive effect on TQM.

2.4. The Mediating Role of Knowledge Management

Intellectual Capital constitutes a driver of organizational knowledge, yet its value remains latent unless effectively enhanced and leveraged (Abeysekera, 2021). As highlighted by the KBV, achieving competitiveness depends not only on possessing knowledge but also on integrating, sharing, and applying it (Abdalla, Renukappa, Suresh, Das, & Veenith, 2026; Grant, 1996). Accordingly, KM acts as a transformational mechanism that mediates the relationship between IC and TQM, translating intangible resources into operational and quality outcomes (Chotivanich & Phorncharoen, 2023; Hesniati, Margaretha, & Kristaung, 2019; Illendula & El-Gayar, 2025; Kianto et al., 2017; Saeidi, Saeidi, & Saeidi, 2024).

The mediating mechanism of TQM between IC and organizational performance has been well established in the prior literature. Scholars consistently find that KM processes contribute to transforming intellectual property into effective organizational outcomes (Inkinen, 2015), and Kianto et al. (2017) found that KM mediates the link between IC and performance by enhancing the value of intellectual property.

Additionally, this mechanism is more evident in the banking sector. According to Chaudhary, Mehrotra, Alsabban, Quintino, and Papa (2025), KM facilitates the conversion of IC into systemic improvements in service quality, which largely relies on knowledge, expertise, and information sharing. Consequently, without an effective KM system in place, an organization's extensive IC will not be fully realized and may result in disjointed quality initiatives and knowledge losses.

This dynamic is particularly essential in contexts characterized by limited resources, unstable environments, and emerging markets. In a context like Yemen, where organizations often face constraints in resources and technology, the mediating role of KM is especially critical because it enables firms to leverage intellectual assets for sustained enhancement of quality management.

In light of the above reasoning, which posits KM as a connecting bridge between IC and TQM by translating intellectual resources into quality improvement, the final hypothesis is proposed as follows:

H₄: KM mediates the relationship between IC and TQM.

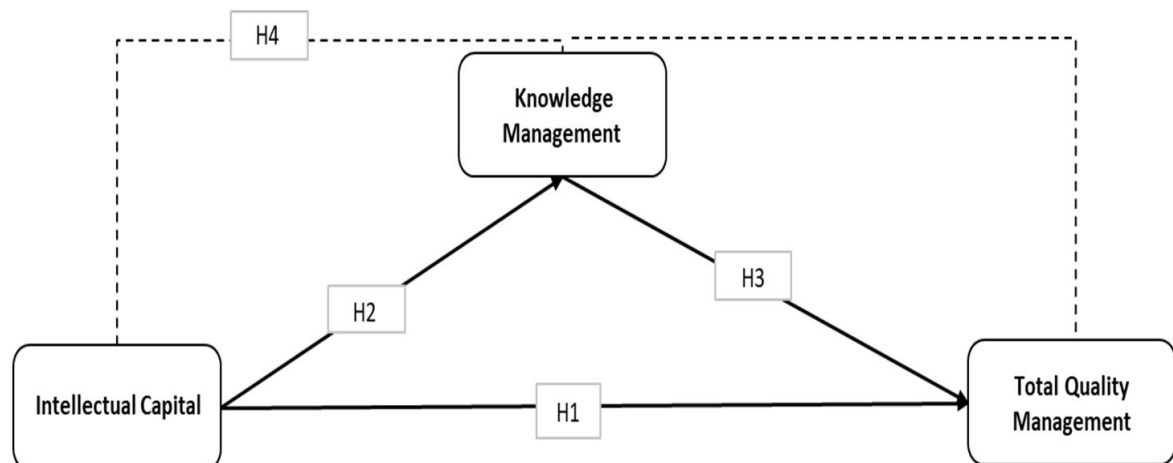


Figure 1. Conceptual model.

2.5. Conceptual Model of the Study

As shown in Figure 1, with reference to the theoretical and empirical components explained earlier, this research offers an integrated conceptual framework that connects three distinct and significant constructs: Intellectual Capital (IC), Knowledge Management (KM), and Total Quality Management (TQM). The proposed structure is built upon the Resource-Based View (RBV), the Knowledge-Based View (KBV), and Organizational Learning Theory (OLT). It proposes that IC acts as the Strategic Base (RBV) of an organization, while KM serves as the Leveraging Mechanism (KBV), and continuous learning provides the means to ensure the improvement and attainment of Quality Excellence (OLT). KM will mediate the relationship between IC and TQM by demonstrating how Intellectual Capital is converted into Superior Service Quality and Performance in the Yemeni Banking Industry.

3. METHODOLOGY

3.1. Research Design

A quantitative, cross-sectional empirical study was designed to highlight the mediating effect of knowledge management on the relationship between intellectual capital and total quality management in commercial banks operating in Sana'a, Yemen's capital city. The quantitative approach enabled the objective quantification of constructs and testing of statistical relationships between them through structural equation modeling.

3.2. Population and Sampling

Commercial banks located in Sana'a, Yemen, were selected as the research target population because of their large concentration of financial operations and employees compared with other banking institutions. The target respondents for the study comprised individuals focused on knowledge-based management, as well as those working in other areas related to commercial bank operations, including operations, finance, customer service, and information technology. These positions directly relate to decision-making and, consequently, affect the overall quality of banking services.

Through a combination of stratified random sampling and proportional stratification, questionnaires were sent to a total of 400 individuals at various banks throughout the United States. Of the 400 questionnaires sent, 360 were returned, yielding an overall response rate of 90%, which is considered very high for research studies in organizations. After completing data-screening and validation procedures, 328 valid questionnaires were identified for analysis. The remaining 32 questionnaires were excluded from further analysis because the respondents' answers were either incomplete or contradictory.

3.3. Research Instrument

The instrument for measuring the study constructs was based on established measurement scales adapted from prior studies. It consisted of four main sections corresponding to the study variables, as shown in Table 1.

Table 1. Measurement of construct sources.

Construct	Dimensions / Processes	Key Measurement Sources
Intellectual Capital (IC) Formatively measured	- Human Capital - Structural Capital - Customer Capital	Asare, Laryea, Onumah, and Asamoah (2021); Ali, Hussin, Haddad, Al-Araj, and Abed (2021); Bontis (2001); Cabrita and Bontis (2008); Chahal and Bakshi (2016) and Marr and Moustaghfir (2005)
Knowledge Management (KM)	- Knowledge Creation - Knowledge Storage - Knowledge Sharing - Knowledge Application	Gold et al. (2001); Mahboub and Ghanem (2024); Jerez-Gómez et al. (2005) and Ştefan, Popa, Olariu, Popa, and Popa (2024)
Total Quality Management (TQM)	- Customer Focus - Continuous Improvement - Top Management Commitment - Employee Engagement	Hariyani, Hariyani, Mishra, and Sharma (2024); Lepistö, Saunila, and Ukko (2024); Oakland (2014) and Saraph, Benson, and Schroeder (1989)

All metrics in this study were rated on a 7-point Likert-type scale, where '1' represents 'Strong Disagreement' and '7' represents 'Strong Agreement'. Before actual data collection, the study was pretested with 20 banking professionals to assess the clarity of the instruments, their appropriateness for the sample population, and the reliability of the measures used in the study. The second-order construct of IC was measured formatively, whereas KM and TQM were measured reflectively.

3.4. Data Collection Procedure

Quantitative data were gathered via self-reported online forms and paper questionnaires over 8 weeks, allowing respondents anonymity and/or confidentiality when completing the forms to facilitate honest responses from participants. Participants were free to choose whether or not to take part in the survey and were informed that their responses would be used only for academic purposes. All ethical issues were addressed according to the policy established by the institution for research.

3.5. Data Analysis Technique

The data analysis for this research was undertaken using Partial Least Squares Structural Equation Modeling (PLS-SEM) through the SmartPLS software program. PLS-SEM was selected because it is most suitable when the model is complex, includes mediation (variables that have a direct effect on other variables), uses a sample size considered small to moderate, and involves data that do not meet the requirements for a normal distribution (as described by Hair, Hult, Ringle, and Sarstedt (2021)).

Missing and outlier data were checked before analysis. There were only a few cases of missing data; therefore, it was decided that these cases would be deleted listwise. Outliers were assessed using z-scores and boxplots and appeared to represent logical responses rather than errors; thus, they were retained in the data set for this study.

There were two types of analysis performed in this research. The first was the measurement model assessment. The purpose of conducting the measurement model assessment was to determine whether the constructs used the quantitative measures of interest were valid and reliable, and whether the measurement model for each construct was adequately validated through tests of reliability, validity, and non-bias. Reliability was assessed through both composite reliability and Cronbach's alpha (Hair, Risher, Sarstedt, & Ringle, 2019). Validity was assessed through the AVE, and non-bias was assessed through the Heterotrait-Monotrait Ratio (HTMT) (Henseler, Ringle, & Sarstedt, 2015).

The second stage consisted of evaluating the structural model based on the hypothesized relationships between the variables. The significance of the relationships was determined using 5,000 bootstrap samples for the path coefficients, t-values, and p-values through bootstrapping. The second stage evaluated additional features of the structural model, including the R^2 , f^2 , and Q^2 effect sizes (based on the explanatory power of the model, the predictive ability of the model, and the predictive relevance of the model). Together, these evaluations provided for the evaluation of both the measurement aspect(s) and the structural aspect(s) of the research model.

3.6. Common Method Variance (CMV)

Before assessing the structural model, a test was conducted, as recommended by Podsakoff, MacKenzie, Lee, and Podsakoff (2003), to assess whether common method variance (CMV) might be present in the collected data. In particular, Harman's single-factor method was used to evaluate whether CMV existed. The analysis indicated that a single factor accounted for only 30.91 percent of the total variance in the dataset; therefore, the presence of CMV may not be viewed as a major concern in this research (Tehseen, Ramayah, & Sajilan, 2017).

3.7. Justification for Methodological Choice

The use of PLS-SEM provides both explanatory and predictive insights into how intellectual capital directly and indirectly influences total quality management through knowledge management. This approach is particularly appropriate for exploratory research in developing economies such as Yemen, where empirical evidence on knowledge-based resources in the banking sector remains limited.

Table 2. Reliability, internal consistency and convergent validity.

HOC	LOC	Indicator	Loading	Cronbach's Alpha	CR	AVE
IC	Human Capital	IV1.1	0.725	0.786	0.799	0.545
		IV1.2	0.791			
		IV1.3	0.816			
		IV1.4	0.762			
		IV1.5	0.573			
	Structural Capital	IV2.1	0.813	0.866	0.868	0.651
		IV2.2	0.795			
		IV2.3	0.772			
		IV2.4	0.850			
		IV2.5	0.802			
	Customer Capital	IV3.1	0.816	0.869	0.871	0.656
		IV3.2	0.823			
		IV3.3	0.782			
		IV3.4	0.833			
		IV3.5	0.796			
KM	Knowledge Generation	MV1.1	0.815	0.879	0.880	0.674
		MV1.2	0.826			
		MV1.3	0.844			
		MV1.4	0.828			
		MV1.5	0.791			
	Knowledge Storage	MV2.1	0.825	0.906	0.907	0.728
		MV2.2	0.862			
		MV2.3	0.870			
		MV2.4	0.848			

HOC	LOC	Indicator	Loading	Cronbach's Alpha	CR	AVE
	Knowledge Sharing	MV2.5	0.860			
		MV3.1	0.703	0.863	0.863	0.649
		MV3.2	0.825			
		MV3.3	0.836			
		MV3.4	0.844			
		MV3.5	0.809			
	Knowledge Application	MV4.1	0.812	0.898	0.899	0.711
		MV4.2	0.864			
		MV4.3	0.851			
		MV4.4	0.850			
		MV4.5	0.838			
TQM	Customer Focus	DV1.1	0.827	0.888	0.888	0.690
		DV1.2	0.790			
		DV1.3	0.856			
		DV1.4	0.846			
		DV1.5	0.833			
	Continuous Improvement	DV2.1	0.810	0.884	0.886	0.684
		DV2.2	0.865			
		DV2.3	0.835			
		DV2.4	0.841			
		DV2.5	0.783			
	Top Management Commitment	DV3.1	0.792	0.895	0.897	0.704
		DV3.2	0.845			
		DV3.3	0.877			
		DV3.4	0.849			
		DV3.5	0.830			
	Employee Involvement	DV4.1	0.816	0.906	0.908	0.727
		DV4.2	0.872			
		DV4.3	0.886			
		DV4.4	0.877			
		DV4.5	0.809			

4. RESULTS

4.1. Measurement Model Assessment

As shown in Table 2, reliability and validity assessments were conducted on the measurement model. The measurements indicate that all indicator items had factor loading values greater than 0.70, with the exception of IV1.5, which had a loading of 0.573 and was retained due to its theoretical importance. The range of Cronbach's alpha for the measurements was between 0.786 and 0.906, while the range of composite reliability was between 0.799 and 0.908. Both values suggest strong internal consistency of the measurements. The Average Variance Extracted (AVE) results were between 0.545 and 0.728, indicating sufficient convergent validity for all measurements.

Table 3. Discriminant validity using HTMT.

Dimensions	DV1.	DV2.	DV3.	DV4.	IV1.	IV2.	IV3.	MV1.	MV2.	MV3.	MV4.
DV1.											
DV2.	0.793										
DV3.	0.698	0.802									
DV4.	0.594	0.681	0.688								
IV1.	0.660	0.676	0.567	0.591							
IV2.	0.629	0.646	0.579	0.726	0.735						
IV3.	0.773	0.780	0.668	0.536	0.537	0.581					
MV1.	0.649	0.701	0.712	0.779	0.528	0.668	0.579				
MV2.	0.581	0.646	0.625	0.570	0.501	0.477	0.486	0.666			
MV3.	0.681	0.727	0.742	0.751	0.618	0.654	0.608	0.797	0.794		
MV4.	0.632	0.678	0.662	0.746	0.560	0.682	0.610	0.796	0.695	0.797	

4.2. Discriminant validity (HTMT)

To assess whether different constructs are conceptually distinct from one another, discriminant validity was analyzed using the Heterotrait–Monotrait (HTMT) ratio, as recommended by Henseler et al. (2015). The results showed that all HTMT ratios (see Table 3) were below 0.85, thereby establishing adequate discriminant validity and indicating that TQM, IC, and KM represent distinct, though related, theoretical constructs. Thus, the measurement model provides adequate discriminant validity for the study and can be used to reliably interpret the structural relationships among the various constructs in later analyses.

Table 4. Structural model assessment (R^2 , f^2 , Q^2) and Model fit (SRMR, NFI).

Path	R^2	f^2	Q^2	SRMR	NFI
Total quality management (TQM)	0.785	-	0.563	0.04	0.956
Knowledge management (KM)	0.501	0.551	0.371		
Intellectual capital (IC)	-	0.516	-		

4.3. Structural Model Assessment

Table 4 presents the structural model was evaluated using R^2 , f^2 , and Q^2 to determine its explanatory power, effect size, and predictive relevance (Hair et al., 2019). The R^2 value for TQM was 0.785, indicating that IC and KM explain 78.5% of the variance in TQM, reflecting substantial explanatory power. In addition, the R^2 for KM was 0.501, suggesting that IC accounts for 50.1% of its variance, reflecting moderate explanatory power. Regarding effect size (f^2), IC effect size was 0.516, and KM was 0.551, showing large effects on TQM, with KM having a higher effect size than IC. Finally, the Q^2 values for TQM (0.563) and KM (0.371) were both above zero, demonstrating that the model has high predictive relevance for the endogenous constructs. The SRMR value was below 0.080, and the NFI was greater than 0.900, indicating good model fit.

4.4. Hypotheses Testing PLS SEM (Bootstrapping)

The hypothesized relationships among Intellectual Capital (IC), Knowledge Management (KM), and Total Quality Management (TQM) were tested using bootstrapping in PLS-SEM with 5,000 resamples. Table 5 and Figure 2 present the results of the path analysis, including standardized path coefficients (β), standard errors (SE), t-values, and p-values.

Table 5. Bootstrapping Results for Hypothesis Testing.

Path	Beta	SE	t	p	95% CI	
					Low	High
Intellectual Capital → Total Quality Management	0.816	0.022	37.462	0.000	0.772	0.859
Intellectual Capital → Knowledge Management	0.708	0.032	21.913	0.000	0.645	0.770
Knowledge Management → Total Quality Management	0.487	0.047	10.439	0.000	0.394	0.579
Intellectual Capital → Knowledge Management → Total Quality Management (Indirect Effect)	0.345	0.038	9.186	0.001	0.270	0.419

4.5. Direct Effects

The results of the study showed that IC is a strong predictor of TQM ($\beta = 0.816$, $t = 37.462$, $p < 0.001$, 95% CI $[0.772, 0.859]$), which in turn supports H1, indicating that banks possessing a greater level of Intellectual Capital are more likely to perform better in TQM implementation.

Moreover, the findings confirmed a positive and significant relationship between Intellectual Capital and Knowledge Management ($\beta = 0.708$, $t = 21.913$, $p < 0.001$, 95% CI $[0.645, 0.770]$), supporting H2. This indicates that Intellectual Capital is an important precursor to Knowledge Management in the banking industry.

In addition, Knowledge Management has a significant positive effect on Total Quality Management ($\beta = 0.487$, $t = 10.439$, $p < 0.001$, 95% CI $[0.394, 0.579]$); thus, this result supports hypothesis H3. Banks that are more proficient at engaging in KM activities, which include sharing best practices and creating an environment for learning, will have enhanced capabilities to successfully manage quality and maintain consistent delivery of service.

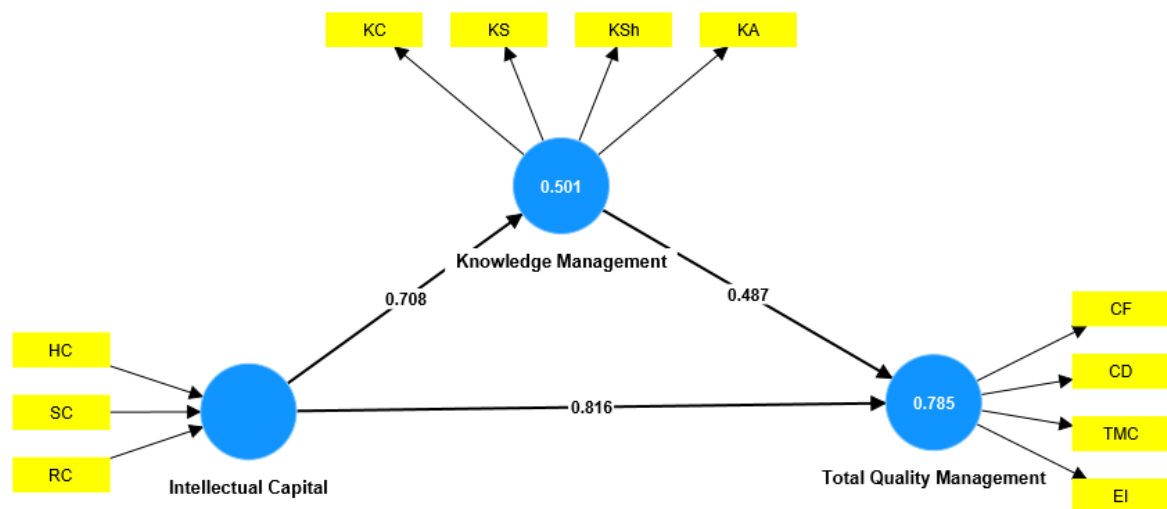


Figure 2. Direct effects (H1, H2, H3).

4.6. Indirect Effect (Mediation Analysis)

As shown in Figure 3, the study found that Knowledge Management serves as a mediator between Intellectual Capital and Total Quality Management through an indirect pathway (IC $\rightarrow$ KM $\rightarrow$ TQM). The findings indicate a positive and significant indirect effect ($\beta = 0.345$, $t = 9.186$, $p = 0.000$, 95% CI $[0.271, 0.419]$) of KM on the relationship between IC and TQM, supporting Hypothesis H4.

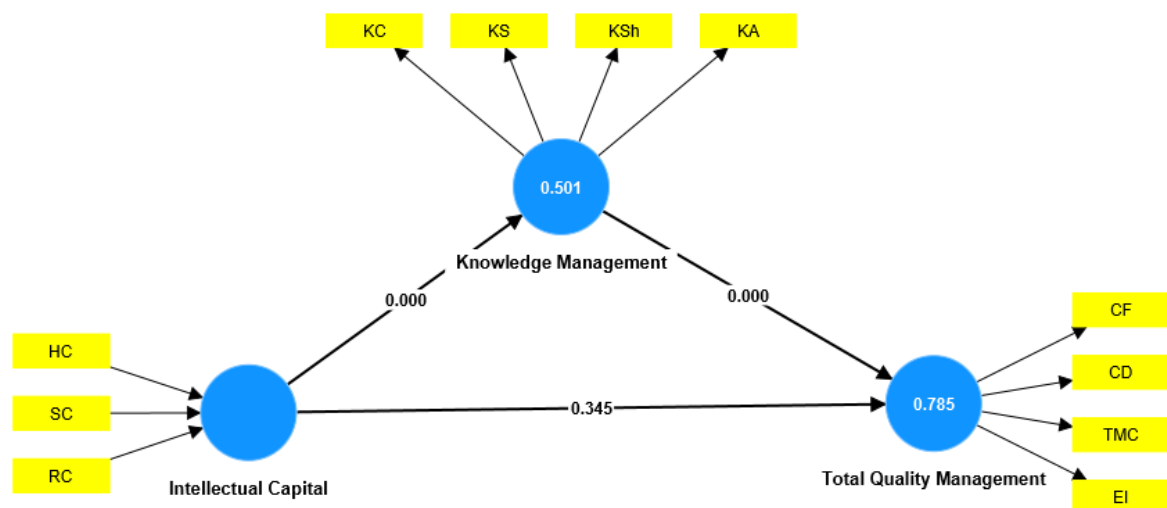


Figure 3. Indirect effect (Mediation) H4.

5. DISCUSSION

This study investigated the relationship between Intellectual Capital (IC) and Total Quality Management (TQM), both directly and indirectly through Knowledge Management (KM), in commercial banks in Sana'a, Yemen. The results provide an empirical examination of an integrated model grounded in the Resource-Based View (RBV), Knowledge-Based View (KBV), and Organizational Learning Theory (OLT).

5.1. Intellectual Capital and Total Quality Management

The analysis confirmed a strong and significant relationship between IC and TQM, indicating that banks rich in IC are better positioned to institutionalize quality management practices. From the RBV perspective (Barney, 1991), these forms of capital constitute strategic assets that are valuable, rare, and difficult to imitate, thereby fostering sustained quality advantage. The finding aligns with prior research (Abdualdaem, 2021; Calingo, 2024; Zhengmeng, Malik, Hussain, & Hussain, 2024), which demonstrates that employees' competencies, supportive organizational structures, and enduring customer relationships collectively enhance service quality and continuous improvement.

Although Yemen is an emerging economy, the extent to which the quality management system (QMS) depends heavily on intellectual assets and relationships might significantly escalate the interaction effect. The QMS in Yemen is not supported by technology; instead, the tacit and relational knowledge of employees and customers contributes to its success. Therefore, investment in IC becomes the basis of the QMS when resources are limited, while human and relational capital remain significant for the development of the QMS.

5.2. Intellectual Capital and Knowledge Management

The study findings also pointed to a significant positive correlation between IC and KM, indicating that intellectual assets are the bedrock on which knowledge processes are established. This finding supports the KBV (Grant, 1996), which acknowledges that knowledge is the most vital organizational resource. The finding is in line with the theoretical framework and studies by Abeysekera (2021); Cabrita and Bontis (2008); Cabrilo, Dahms, and Tsai (2024); Hesniati et al. (2019); Inkinen (2015); and Suparwadi et al. (2024), confirming that organizations can only maximize intellectual capital when it is handled well and widely shared. The link is particularly significant for banks operating within Yemen. Banks in an unstable situation, with limited access to the digital world, would realize that turning their intellectual capital into well-organized knowledge management forms (KM) is essentially a survival tool. Besides, the results show that the intellectual capital of banks not only puts them in a position to generate knowledge but also provides the groundwork for continuous learning and the development of new services.

5.3. Knowledge Management and Total Quality Management

The study findings revealed that KM is a critical driver of TQM in the context of private banks in Yemen. This positive association reinforces the argument that knowledge processes are the main enablers of quality improvement. KM supports TQM by ensuring that lessons learned, best practices, and customer insights are not only captured but also applied throughout the organization to improve products and services. This outcome supports the argument made in the cited papers (Adamson, 2005; Akdere, 2009; Hashem & Jaradat, 2020; Lehyani et al., 2024; Marchiori & Mendes, 2020; Obeidat, Hashem, Alansari, Tarhini, & Al-Salti, 2016), which state that organizations with strong KM systems have better quality performance and customer satisfaction.

This finding clearly indicates that organizations that implement KM as part of their routine operations, using OLT as a perspective, create an environment that not only corrects mistakes but also redefines processes, minimizing the likelihood of those errors recurring. Thus, for banks in Yemen, the proper implementation of KM can be a source of greater resilience and flexibility when they are exposed to external pressures or demands, while also making use of TQM's central features of continual improvement and customer focus.

5.4. The Mediating Role of Knowledge Management

The mediation analysis showed that KM is a significant mediator between IC and TQM, providing strong support for the model. In other words, the finding indicates that intellectual assets do not lead directly to quality performance but mainly do so through their conversion into usable knowledge. KM is considered a technology-based process that translates intellectual capital into standard processes, which aligns with the KBV's focus on knowledge integration and application as the main sources of sustainable advantage (Grant, 1996; Wiig, 1997).

The mediating mechanism has important consequences for developing economies, as they do not have sufficient resources for material investment. Therefore, organizational learning must substitute for material investment. Moreover, the findings show that banks possessing valuable IC will not achieve high-quality results unless they have effective KM infrastructure. Therefore, it appears that KM is the means through which IC is converted into measurable quality improvements and enhanced performance, thus supporting the strategic and organizational perspective on KM in financial institutions in Yemen.

6. CONCLUSION

This study offers an integrative understanding of how Intellectual Capital (IC), Knowledge Management (KM), and Total Quality Management (TQM) interact to strengthen organizational performance, particularly within resource-constrained environments. Theoretically, the study advances scholarship by unifying the Resource-Based View (RBV), Knowledge-Based View (KBV), and Organizational Learning Theory (OLT) into a comprehensive model. This theoretical synthesis demonstrates that the development, consolidation, and effective mobilization of intellectual resources, supported by knowledge management processes and learning capabilities, constitute foundational drivers of quality excellence. By empirically establishing the mediating role of KM between IC and TQM, the study contributes to ongoing debates about how intangible assets translate into operational improvements, particularly in developing-country contexts.

From a practical perspective, the findings underscore the strategic importance of investing in and strengthening the infrastructure that supports IC and KM within banking institutions. Enhancing human capital through continuous training, professional development, and knowledge-sharing opportunities; reinforcing structural capital through digital repositories, standardized procedures, and communication systems; and cultivating customer capital through long-term relationships and systematic feedback mechanisms collectively form a robust foundation for quality improvement. Establishing clear KM policies that encourage the creation, dissemination, and application of knowledge across organizational levels is particularly relevant in resource-constrained settings, where optimizing existing intellectual assets can generate meaningful improvements in innovation, service quality, and overall performance. Contextually, the study provides timely and relevant insights for developing nations such as Yemen, where economic instability, technological limitations, and shortages of skilled personnel challenge organizational growth. The findings suggest that strengthening intangible and knowledge-based resources enhances resilience and competitiveness, enabling organizations to maintain quality outcomes despite environmental volatility. By cultivating a learning-oriented and knowledge-driven culture, Yemeni banks can build sustainable capabilities that transcend immediate resource constraints. Beyond Yemen, the study expands global conversations about how IC and KM jointly underpin quality management in knowledge-intensive industries, particularly within fragile or emerging economies.

However, the authors acknowledge that these contributions are subject to several limitations. First, the cross-sectional design allows only correlations to be identified and does not provide an opportunity to observe changes over time in IC, KM, and TQM. Second, the research focuses solely on commercial banks in Sana'a; therefore, the results may not apply to other sectors or regions. Third, the use of self-reported survey data may introduce common-method and social-desirability biases. Fourth, although KM was the only mediator considered in the model, other organizational capabilities, such as leadership style, innovation capability, and organizational culture, may affect or influence the IC–TQM relationship. Lastly, external factors, including economic instability, inadequate technological infrastructure, and limited human capital, may restrict the applicability of the findings to environments that differ from the study context. These limitations open several avenues for future research. Longitudinal and panel studies could provide deeper insights into how IC, KM, and TQM evolve. Expanding the model to other sectors or Arab contexts would enhance external validity. Incorporating alternative theoretical frameworks, such as Dynamic Capabilities or Systems Theory, may reveal how organizations reconfigure their intellectual resources amid environmental change. Examining moderating factors, including leadership commitment, digital transformation,

learning orientation, and innovation climate, would offer a more nuanced understanding of contextual contingencies. Future research may also benefit from mixed-methods, comparative, or cross-national designs to explore how knowledge-based resources are cultivated and deployed across diverse institutional and cultural settings.

Overall, this research extends the theory, offers practical guidance to resource-constrained organizations, draws attention to the local realities of the Third World, and establishes a basis for further academic research on using intellectual and knowledge-based resources as a strategy for achieving quality excellence.

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Informed Consent Statement: Informed verbal consent was obtained from all participants, and all data were anonymized to protect participant confidentiality.

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

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