The Impact of Knowledge Management on Performance Through Intellectual Capital in Yemen's Telecom

Fadhl Ali Mohammed Al-Rabiee[1] and Zayed Naji Nasser Shawesh[2]
[1]Centre for Business Administration (CBA), Sana'a University, Sana'a, Yemen
[2]Faculty of Commerce and Economics, Department of Business Administration, Amran University, Amran, Yemen

Fadhl3000@gmail.com (corresponding author)
Dr.shawesh9@gmail.com

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Abstract: In the contemporary knowledge-driven economy, organisations are increasingly dependent on knowledge management and intellectual capital as key drivers for enhancing organisational performance. Despite the growing academic interest in these domains, research examining their combined impact remains limited, particularly within the context of the telecommunications sector in developing economies. This study aims to address this gap by identifying the impact of knowledge management on organisational performance through intellectual capital in the Yemeni telecommunications sector. To achieve this objective, the present study employed the quantitative research methodology, incorporating descriptive and analytical approaches. SPSS was utilised for descriptive and preliminary statistical analysis, while PLS-SEM was employed to examine the effects among the variables. The questionnaire was the principal instrument used to collect the necessary data for this study. A structural model has been proposed for the study variables, illustrating the relationship between knowledge management, intellectual capital, and their subsequent impact on organisational performance. The non-proportional stratified random sampling method was employed to select the study sample individuals. The model was evaluated using data obtained from 289 individuals employed in the Yemeni telecommunications sector. The study's findings indicated that knowledge management positively impacts organisational performance (B=0.776; $p < 0.05$), suggesting that knowledge management plays a significant role in enhancing organisational performance. In addition, intellectual capital was found to have a statistically significant direct impact on organisational performance (B=0.557; $p < 0.05$), highlighting its contribution to enhancing organisational performance. Furthermore, the results revealed a significant effect of knowledge management on IC (B=0.852; $p < 0.05$), suggesting that knowledge management enhances intellectual capital, which in turn strengthens its impact on organisational performance. Moreover, the mediation analysis confirmed that intellectual capital mediated the relationship between knowledge management and organisational performance, demonstrating that knowledge management influences organisational performance both directly and indirectly through intellectual capital. The findings contribute to the development of the resource-based view (RBV) and the knowledge-based view (KBV) by demonstrating how knowledge management and intellectual capital interact and jointly influence organisational performance. Furthermore, this study contributes to the extant literature by presenting a model that connects these variables in the telecommunications sector, a field that has not been sufficiently studied in previous research. In light of the aforementioned findings, the study recommended an increased focus on organisational performance and the establishment of organisational units within the organisational structures of the Yemeni telecommunications sector concerned with knowledge management, due to its significant impact on enhancing organisational performance in the Yemeni telecommunications sector.

Keywords: Knowledge management, Intellectual capital, Organisational performance, Yemeni telecommunications sector

1. Introduction

Organisations strive for success, particularly in an era marked by rapid cognitive and technological advancements. To achieve their strategic objectives, they continuously seek to enhance performance by optimising the utilisation of both tangible and intangible resources. Organisational success is fundamentally tied to the effectiveness of their performance (Obeidat, 2016). In this context, knowledge management (KM) has emerged as a critical contemporary management concept. KM enables organisations to generate, obtain, select, organise, use, and disseminate knowledge essential for administrative activities such as decision-making, problem-solving, and strategic planning (Taher, 2018, p. 45). Consequently, many organisations have adopted KM practices, focusing on processes such as diagnosing, acquiring, generating, storing, sharing, applying, and protecting knowledge. A key resource in the knowledge economy is intellectual capital (IC), which comprises human capital, structural capital, and relational capital. IC represents a core aspect of KM, enabling organisations to leverage and invest in knowledge to enhance performance and drive development. Studies on the relationship between KM and IC highlight a shift from financial performance measures to IC management.

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Financial indicators, while useful, often focus on short-term results and lack strategic dimensions such as internal operations, learning and growth, and customer satisfaction (Babakr, 2019). Both KM and IC are vital sources of competitive advantage and organisational performance (OP) (Chowdhury, Rana, and Azim, 2019). The effective development and utilisation of IC depend on organisational members possessing the requisite knowledge and demonstrating a willingness to apply and share it (Alvino et al., 2021). Therefore, identifying ways to enhance the application of IC is imperative for impacting organisational outcomes (Weqar et al., 2020). As Grant (1996) notes, "differences in performance are due to different stocks of knowledge and different capabilities in using and developing them". In other words, resources (IC assets) and capabilities (KM practices) have the potential to create a sustainable competitive advantage and enhance organisational performance (Grant, 1996). The relationship between KM and IC has been a focal point of research, with studies consistently showing a significant positive relationship between these variables and their collective impact on enhancing organisational performance (Piri, Jasemi, and Abdi, 2013). From a theoretical perspective, scholars such as Silva and Fain (2024), Ethelmary, Udodiugwu and Nnanyelugo (2023) and Adhikari (2020), have explored the connection between KM and OP. Similarly, researchers such as Cahyono and Ardianto (2024), Muftiasa et al. (2023), Sigdel and Amponstira (2023), and Alvino et al. (2021) have investigated the link between IC and OP. Despite the widespread recognition of the importance of KM, IC, and OP in literature, few studies have jointly examined these factors, particularly in developing economies. This gap is especially pronounced in the context of Yemen, where research on the interrelationships between these factors remains scarce. The necessity of this empirical investigation is further emphasised by the limited attention given to this topic in the Yemeni context. Bridging this gap is imperative for advancing theoretical understanding and offering practical recommendations to enhance OP, particularly in the Yemeni telecommunications sector. While previous research has extensively examined the individual relationships between KM, IC, and OP (e.g., Al-Hasani, 2019; Hussini, 2019; Kharboush, 2019), fewer studies have explored their combined effects, especially in developing economies. This study builds on prior findings by integrating these three variables within a unified framework and empirically testing their interrelationships using structural equation modelling (SEM). This approach allows for a more nuanced understanding of direct and indirect effects. Moreover, by focusing on the telecommunications sector in Yemen, this study addresses a notable gap in the literature, as most existing research has been conducted in different industrial and geographical contexts. Practically, the telecommunications sector in Yemen plays a pivotal role in the national economy, serving as a primary catalyst for connectivity and business operations. However, it faces persistent challenges, including inadequate technological infrastructure, limited knowledge-sharing mechanisms, regulatory constraints, and insufficient investment in IC. The aforementioned issues have contributed to a decline in OP, as demonstrated by various reports. For example, Al-Bashiri (2021) noted a deterioration in the sector's overall performance. According to the GSM Association (GSMA), mobile phone penetration rates in Yemen decreased from 46% in 2015 (GSMA, 2015, p. 8) to 42% by the end of 2018. This figure is notably lower than both the regional average in the Middle East and North Africa (64%) and the global average (66%) for the same period (GSMA, 2019, p. 2). Academic studies have confirmed these challenges. Al-Feel (2021) found a significant decline in the overall performance of the Public Telecommunications Corporation, while Al-Soswa (2019) found that the institutional performance of mobile telecom companies in Yemen—Yemen Mobile, MTN, and Sabafon—remains below the desired level. These challenges underscore the necessity for a more profound investigation into the factors that influence OP within the Yemeni telecommunications sector. In this context, the role of KM and IC in enhancing OP becomes increasingly critical. Therefore, the objective of the present study is to address this research gap by analysing the relationship between these factors and their impact on OP in the Yemeni telecommunications sector. Specifically, the research seeks to answer the following central question: How does KM impact OP in the Yemeni telecommunications sector, and what is the mediating role of IC in this relationship?

To address this research question, the study develops a theoretical model based on the resource-based view (RBV) and the knowledge-based view (KBV). The model posits that KM exerts a direct influence on OP, with IC serving as a mediating variable in this relationship. The proposed model is empirically evaluated using survey data collected from employees working in the Yemeni telecommunications sector. Structural equation modelling (SEM) was utilised to assess and validate the hypothesised impacts among the variables. The unit of analysis for this study encompasses all organisations operating within the Yemeni telecommunications sector. The target participants include all employees based at the headquarters of these organisations in the capital city of Sana'a. The rationale for this selection lies in the relevance of the study variables to all employees, regardless of their administrative level. In the subsequent sections, we present a review of the relevant literature on KM processes, IC, and OP. This is followed by the conceptual model, which captures the relationship between KM and OP through IC. The study concludes with a discussion of the key findings and an acknowledgement of its limitations.

2. Theoretical Background

The present study utilises the theoretical underpinnings of the Resource-Based View Theory (Barney, 1991), Knowledge-Based View (KBV) Theory (Grant, 1996), and Intellectual Capital Theory (Stewart, 1997). Moreover, a review of extant literature on this subject is undertaken to ascertain the dimensions of the variables incorporated within the conceptual model, a topic that is elaborated upon in the ensuing sections.

2.1 Resource-Based View (RBV) Theory

The origins of the resource-based theory can be traced to Wernerfelt (1984), who shifted the analytical focus from products to the internal resources of organisations and introduced the term "Resource-Based View" (RBV). Subsequently, Barney (1991) then "presented and developed the basic principles of the Resource-Based View, providing a detailed definition of resources and clarifying the full set of characteristics that make a resource a potential source of competitive advantage (i.e., valuable, rare, unique, and non-substitutable)" (Barney, Ketchen and Wright, 2011, p.1301). The resource-based theory posits that internal organisational resources are more significant than external environmental factors in enhancing organisational performance and securing a sustainable competitive advantage. And that these internal resources primarily determine organisational performance. By clarifying the relationship between resource theory and the study's structural model, the Yemeni telecommunications sector (YTS) can leverage KM and IC to address persistent challenges, respond to environmental changes, and enhance OP.

2.2 Knowledge-Based View (KBV) Theory

This theory was mainly developed by researcher William Grant in 1996, in his famous paper "Toward a Knowledge-Based Theory of the Firm", in which he explained that knowledge is the basic resource that can give organisations a sustainable competitive advantage. This theory posits that effective KM fosters a sustainable competitive advantage and enhances organisational performance (Grant, 1996). Moreover, in the knowledge-based theory of the firm, knowledge is regarded as a firm's most valuable strategic asset. This theory explains the characteristics of knowledge: that it is the most strategic resource in the organisation, that the production activities and processes in the organisation include the application of knowledge, and that individuals in the organisation form the basis for creating, retaining, and sharing knowledge (Irawan, Bastian and Hanifah, 2019). The knowledge-based theory establishes knowledge as the foundation for all organisational activities. This knowledge necessitates the implementation of KM, which facilitates the transformation of both individual and collective knowledge into IC to enhance OP in the YTS .The conceptualisation of KM in this study is based on an extensive review of previous research. A matrix analysis was conducted to identify the most frequently examined KM dimensions across previous studies, ensuring a comprehensive and empirically supported framework. The analysis revealed that core KM processes in the literature include knowledge diagnosis, acquisition, generation, storage, sharing, and application. However, this study also incorporates knowledge protection, a dimension that, while less frequently examined in previous research, is particularly critical in the telecommunications sector. Given the sector's dependence on intellectual assets and data security, knowledge protection is vital for safeguarding proprietary information and sustaining competitive advantage. The integration of these dimensions ensures a comprehensive assessment of KM and its impact on OP in this study.

2.3 Intellectual Capital Theory

Intellectual capital theory emerged in response to the growing recognition of the importance of information and knowledge (Williams, 2001). Research based on IC theory has shown a relationship between IC and OP. Stewart (1997, 75) stated that IC consists of three dimensions: human capital, structural capital, and relational capital. This theory holds that the tangible assets (land, buildings, equipment, and money) of today's leading companies around the world have less value than intangible assets. The conceptualisation of IC in this study is based on an extensive review of previous research. A matrix analysis was conducted to identify the most frequently examined IC dimensions across previous studies, ensuring a comprehensive and empirically supported framework. The analysis revealed that the core components of IC in the literature include human capital, structural capital, and relational capital, as they provide a comprehensive framework for understanding and managing IC within organisations. These are the exact dimensions highlighted by Stewart (1997).

2.4 Knowledge Management

Sultana (2023) defined KM as a structured, institutionally defined process for acquiring, organising, keeping, deploying, exchanging, and reinvigorating both explicit and implicit staff knowledge. Wagh (2023) defined it as

the process of capturing, developing, sharing, retaining, and effectively utilising organisational knowledge. Furthermore, KM includes a variety of processes. “These processes can be defined as the activities associated with the creation, capture, storage, organisation, dissemination, and application of knowledge that enhance organisational competitiveness” (Obeidat, 2016).

2.5 Intellectual Capital

Intellectual capital refers to the intangible assets of an organisation, such as knowledge, skills, and expertise possessed by its employees (Halim, 2024). Roos and Röös (1997) defined it as a set of intangible assets–comprising competencies, resources, and capabilities–that enhance organisational performance and create value for the firm. Despite the differences in the definition of IC, scholars largely concur on a framework comprising three key components: human capital, structural capital, and relational capital (Alhamoudi, 2023; Muhammad and Salma, 2021; Wang et al., 2016). It should be mentioned that John K. Galbraith is credited with coining this phrase, which first appeared in 1969. "Researchers frequently use the term "intellectual capital" to refer to intangible assets" (Alzenknh, 2023).

2.6 Organisational Performance

Organisational performance can be broadly defined as the extent to which an organisation achieves its objectives (Mobolade and Ibojo, 2024). This "can be measured using various key performance indicators (KPIs) such as profitability, productivity, innovation, customer satisfaction, and market share" (Chidiadi, 2024). Obtaining and sustaining excellent performance is the objective of all organisations, including those whose ultimate objective is not always to generate profit (Mukaro, Deka and Rukani, 2023). Historically, the assessment of OP was predominantly confined to financial metrics, such as revenue, profit, net operating income, return on assets (ROA), return on equity (ROE), and return on sales (ROS), along with other indicators primarily linked to revenue and profitability (Mobolade and Ibojo, 2024). It is worth noting that most institutions assess their performance primarily through traditional financial reports, which do not adequately capture the true dynamics of competitive variables within the business environment, which led to the need to use non-financial indicators alongside financial ones when assessing performance, including aspects such as clients’ satisfaction, internal operations efficiency, and learning and growth, has become essential. This is precisely what the Balanced Scorecard achieves, as it serves as a measurement tool that enables organisations to translate their vision and strategy into actionable objectives while offering a clear and comprehensive view of organisational performance (Mehralian, Nazari and Ghasemzadeh, 2018). The Balanced Scorecard (BSC) framework has been widely adopted as a strategic management tool. Since it was proposed in the 1990s, it has been utilised as a tool for measuring and managing four key dimensions of organisational performance: Financial, Customers, Internal Business Processes, and Learning and Growth (Sadic, de Sousa and Crispim, 2020) .Based on the Balanced Scorecard framework developed by Kaplan and Norton (1992), this study adopts four key dimensions to measure OP: customer, internal processes, learning and growth, and financial performance. These dimensions were selected for their ability to provide a comprehensive and balanced view of OP, encompassing both financial and non-financial aspects, and ensuring that performance is measured from multiple perspectives that reflect the organisation’s strategic objectives. In addition, these dimensions have been widely used in previous studies, which enhances their credibility and ability to deliver accurate and reliable results.

2.7 Theoretical and Methodological Classification

To provide a more rigorous theoretical foundation, the reviewed studies were grouped and synthesised according to their methodological approaches and theoretical frameworks. From a theoretical perspective, several studies drew upon the resource-based view (RBV) and knowledge-based view (KBV) to explain how intangible resources such as KM and IC contribute to sustained OP (e.g., Alvino et al., 2021; Gold et al., 2001; Babakr, 2019). Other studies adopted capability-based frameworks, focusing on KM as a dynamic organisational capability that facilitates innovation and performance (e.g., Hussinki et al., 2017; Adhikari, 2020). Methodologically, previous research varies in its approach to testing these relationships. Some studies utilised traditional regression analysis to examine direct effects between variables (e.g., Setyawan, 2021; Kharboush, 2019), while others adopted structural equation modelling (SEM) to explore both direct and indirect paths–particularly those involving mediating roles such as that of IC (e.g., Babakr, 2019; Al-Gburi & Mohsin, 2025). These nuanced theoretical debates and methodological differences underscore the need for a unified model that captures the multidimensional interplay between KM, IC, and OP.

2.8 Conceptualising the Role of Intellectual Capital in the KM–OP Relationship

Previous research has conceptualised IC in diverse roles within the KM and OP nexus. While some studies have positioned IC as a mediator that channels the effects of KM towards improved performance outcomes (e.g., Babakr, 2019), other studies have treated IC as an independent variable, directly impacting OP (e.g., Kharboush, 2019; Dhiban, 2020). In addition, there is emerging literature suggesting that IC can function as a moderating variable, influencing the strength or direction of the KM–OP relationship, particularly under specific contextual conditions such as industry type or organisational maturity. This conceptual diversity reflects the evolving understanding of IC's strategic role in organisational success. In this study, IC is modelled as a mediator, consistent with the assumptions of the resource-based view (RBV) and knowledge-based view (KBV), which emphasise the transformation of knowledge resources into performance outcomes through intangible assets as IC.

3. Hypotheses Development

The present study proposes four main hypotheses, each of which is further subdivided into sub-hypotheses. These four hypotheses were formulated on the extant literature on this topic, thereby providing a foundation for examining and testing the relationships among the study's variables. The following sections elaborate on each hypothesis with reference to relevant previous studies.

3.1 First Hypothesis: Impact of KM on Organisational Performance

Effective KM plays a pivotal role in enhancing decision-making processes and enhancing organisational performance (Silva and Fain, 2024; Adhikari, 2020). By aligning KM practices with organisational objectives and strategies, organisations can ensure that knowledge is effectively managed to create value. This involves identifying the sources and nature of knowledge, fostering a culture conducive to continuous learning, knowledge sharing, and creation, and ensuring that knowledge is delivered to the right individuals at the right time. In addition, KM facilitates the generation of new and relevant knowledge, which enhances organisational performance in line with strategic objectives while addressing potential threats and opportunities (Ethelmary, Udodiugwu, and Nnanyelugo, 2023). Furthermore, KM enables organisations to coordinate and optimise their knowledge resources, leveraging collective expertise to drive innovation and enhance decision-making processes. This, in turn, "enhances organisational performance and provides a competitive advantage" (Rehman et al., 2021; Bailey et al., 2018, p. 280). However, measuring the effectiveness of KM and its contribution to organisational performance remains a significant challenge for many organisations (Tubigi and Alshawi, 2015). "In addition to potentially impacting people, products, and processes, KM may also affect the overall performance of the organisation, either directly or indirectly." (Becerra-Fernandez, Sabherwal, and Kumi, 2024, p. 82). Recent studies highlight KM's vital role in enhancing organisational performance, particularly within knowledge-intensive sectors such as telecommunications. For example, Al-Adwan (2019) found that KM systems–including knowledge acquisition, storage, sharing, and application–significantly impacted the performance of Jordanian telecommunications companies. Similarly, Al-Hasani (2019) emphasised the importance of KM processes, such as knowledge generation, acquisition, storage, transfer, and application, in enhancing OP from the perspective of employees in Jordan's telecommunications sector. The positive impact of KM extends beyond the telecommunications sector, as demonstrated by recent studies across various industries. Megha and Sushan (2024) explored the effects of KM practices–such as knowledge creation, transfer, storage, and application–on operational efficiency, financial performance, and employee satisfaction. Their findings revealed that organisations with structured KM strategies consistently outperformed those without, demonstrating improvements in productivity and collaboration. Similarly, Yang and Nuruly (2024) demonstrated that KM enhances decision-making, innovation, and workforce capabilities in educational institutions, highlighting its broad applicability. In the manufacturing context, Onikoyi et al. (2024) found that KM technologies, training, strategic approaches, and knowledge application significantly enhanced workforce effectiveness and productivity in Nigerian firms. Building on these findings, this study hypothesises that KM positively influences OP within the telecommunications sector. However, not all studies have reached consistent conclusions. For example, Setyawan (2021) investigated the impact of KM on OP in the Indonesian coal mining sector and found no significant direct effect. This discrepancy may be attributed to industry-specific characteristics, as KM tends to play a more central role in knowledge-intensive sectors like telecommunications, where innovation and IC are critical competitive assets. In contrast, asset-intensive industries such as mining may not rely as heavily on KM for performance improvement. In addition, Setyawan's study utilised regression analysis instead of SEM, which may have limited its ability to capture the complex, interconnected relationships

between KM and OP. SEM, as applied in this study, allows for a more comprehensive examination of both direct and indirect effects, particularly through mediating variables such as IC. Given these inconsistencies, further research is needed to explore the interconnected role of KM and IC in shaping OP. This study aims to address this gap by examining the hypothesis that KM positively influences OP, particularly within the telecommunications sector, while considering the mediating role of IC. By doing so, it seeks to provide a deeper understanding of how KM can be leveraged to drive performance and competitive advantage in knowledge-intensive industries.

H1: KM has a significant impact on OP.

3.2 Second Hypothesis: Impact of Knowledge Management on Intellectual Capital

KM plays a vital role in enhancing IC, which is widely recognised as a critical intangible asset for organisations (Simalango, Isnurhadi, and Andriana, 2023). KM and IC are closely interrelated concepts (Kianto et al., 2014; Hussinki et al., 2017; Mehralian, Nazari, and Ghasemzadeh, 2018), with each reinforcing the other (Simalango, Isnurhadi, and Andriana, 2023; Jordão and Novas, 2017). This mutual reinforcement contributes significantly to value creation within firms (Abeysekera, 2021). The academic discourse on knowledge in organisations primarily revolves around two key areas: IC and KM. While the IC literature focuses on identifying and categorising the intangible resources available to firms, the KM literature explores the mechanisms through which these resources can be effectively controlled and managed (Kianto et al., 2014). From a static perspective, IC represents a stock of knowledge predominantly shaped by cognitive activities within the organisation and serves as a foundation for value creation (Vaz, Selig, and Viegas, 2019; Mehralian, Nazari, and Ghasemzadeh, 2018). "To facilitate the creation and management of intellectual capital, organisations should work to establish knowledge management systems" (Kioko and Muriuki, 2024). The effective and continuous application of KM enables organisations to maximise their IC, generate value, and achieve a competitive edge in the market. Recent studies highlight the critical role of KM in fostering IC development. For example, Hussini (2019) study within Algeria's telecommunications sector (Biskra region) demonstrated that KM significantly enhances IC within this sector. These findings highlight the importance of KM as a strategic tool for enhancing IC and driving organisational success. Therefore, the authors develop the second hypothesis of this study as follows:

H2: KM has a significant impact on IC.

3.3 Third Hypothesis: Impact of Intellectual Capital on Organisational Performance

"The Resource-Based View underscores the importance of effectively leveraging a company's strategic resources, particularly intangible assets like IC, to secure competitive advantage and superior performance" (Cahyono and Ardianto, 2024). According to resource-based theory, intangible assets are the primary drivers of organisational performance (Forte et al., 2017). "These intangible assets—such as employee experience, intellectual property, patents, trademarks, brand name, and human resources—have a significant impact on a company's overall worth" (Achmad, 2022). Efficient utilisation of intellectual capital can enhance non-financial performance metrics, such as customer and employee satisfaction, internal business processes, effective operational management, and the expansion of social and financial networks (Sigdel and Amponstira, 2023). Furthermore, an organisation's success in today's rapidly changing and unpredictable global business environment depends heavily on its ability to create and utilise IC effectively (Irawan, Bastian, and Hanifah, 2019). IC management focuses on recognising the IC's potential to create new opportunities and add value to organisations, thereby positively influencing organisational performance (Todericiu, 2021; Lee and Wong, 2019). As highlighted by Alvino et al. (2021), IC not only ensures current OP, but also aligns with long-term strategic objectives, positioning it as a central pillar of sustained success. Recent studies demonstrate the significant impact of IC on OP, particularly within the telecommunications sector. For example, Kharboush (2019) conducted a study on Algeria Telecom (Biskra branch) and found a statistically significant effect of IC on OP. Similarly, Dhiban (2020) investigated the role of IC in enhancing performance at Yemen Mobile, revealing that even with limited availability of IC components, its impact on OP–measured through the Balanced Scorecard–remained positive. More recent research has further reinforced this relationship. Al-Gburi and Mohsin (2025) examined the role of IC in sustainable performance among Iraqi telecommunications firms and demonstrated that various components of IC–including human, structural, and relational capital–significantly contribute to corporate performance and long-term sustainability. Their findings are consistent with earlier research highlighting the critical role of IC efficiency in enhancing OP. Therefore, the authors develop the third hypothesis of this study as follows:

H3: IC has a significant impact on OP.

3.4 Fourth Hypothesis: The Mediating Role of Intellectual Capital in the Relationship Between Knowledge Management and Organisational Performance

To the authors' knowledge, only one study—Babakr (2019)—has integrated KM, IC, and OP within a single research framework. Examining the mediating role of IC in the relationship between KM and OP at the Sudanese PetroEnergy Oil and Gas Company. The results revealed a direct effect of KM on OP and an indirect effect through IC, highlighting a positive relationship between KM and IC that ultimately enhanced OP. These findings underscore the critical role of IC as a mediator in the relationship between KM and OP, a dimension this study aims to further investigate within the context of the Yemeni telecommunications sector. Therefore, the authors develop the fourth hypothesis of this study as follows:

H4: IC mediates the impact of KM on OP.

After grounding the hypotheses in established theoretical foundations (as discussed above), we present the proposed structural model in Figure 1.

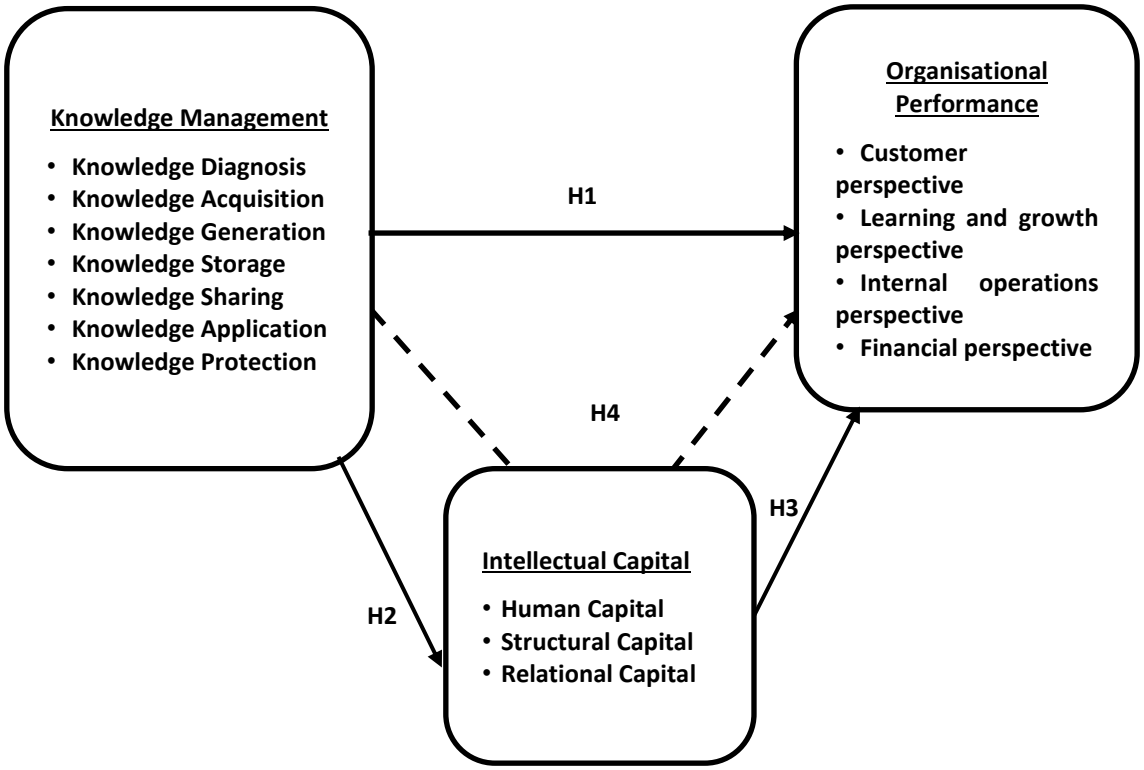

Figure 1: Proposed structural model. Source: Authors own work

This conceptual model illustrates the hypothesised relationships among the study's three core constructs: KM, IC, and OP, as articulated in hypotheses H1 to H4. Specifically, the model posits that:

H1: KM has a significant impact on OP.

H2: KM has a significant impact on IC.

H3: IC has a significant impact on OP.

H4: IC mediates the impact of KM on OP.

In the visual representation of the model, solid arrows indicate direct effects (H1–H3), while the dashed arrow indicates the mediating effect of IC (H4).

4. Research Method

This study adopted a quantitative research methodology, selected for its suitability in empirically examining the relationships between KM, IC, and OP. This approach enables statistical validation of hypotheses, ensuring generalisability and replicability (Creswell, 2018). This study employs both descriptive and analytical methods, enabling a theoretical understanding of the phenomenon through secondary data while also enabling an

empirical examination via fieldwork and unbiased data collection and analysis (Al-Ariqi, 2020). Unlike qualitative methods, which offer in-depth exploration through subjective insights, the quantitative approach enables a structured and objective assessment of variables, rendering it particularly appropriate given the nature and objectives of this study. Although a mixed-methods approach was considered, the primary objective of this research is to test an established conceptual model rather than generate new theoretical insights. Therefore, a survey-based quantitative method was considered the most suitable approach for this study. We used a questionnaire to collect data for this study to obtain information on KM, IC, and OP. Several statistical methods were employed, consistent with the nature of this study. The collected data were coded and analysed using the Statistical Package for the Social Sciences (SPSS, **v**ersion 28) and Partial Least Squares (Smart PLS). The collected data were screened for missing values and data entry errors. Subsequently, the data were rigorously analysed using scientific methods, and the results were interpreted to address the study's objectives and used to test its hypotheses.

4.1 Sample and Data Collection

The study population comprised five Yemeni telecommunications organisations operating in Yemen: Public Telecommunications Corporation (PTC), Yemen Mobile Company, TeleYemen Company, SabaFon Mobile Company, and YOU Mobile Company. The job titles that were the focus of the study included the following: Chief Executive Officer, Deputy Chief Executive Officer, Director General of Administration, Deputy Director General of Administration, Department Managers, Deputy Department Managers, Section Heads, Supervisors, and Specialists. The population consisted of 4,171 employees at the organisations' headquarters in Sana'a. Due to the variation in the number of individuals across different layers of the study population, a non-proportional stratified random sampling method was utilised to select the sample members. Following Thompson's (2012) sampling methodology, a representative sample size of 352 participants was determined to be statistically appropriate for this study. Data were collected by distributing 352 questionnaires to participants in the YTS. We received 289 valid responses, yielding a response rate of 82%. The majority of the respondents were male (75%). Participants held various positions, with 62% occupying supervisory roles and 38% serving in specialist positions.

4.2 Measures

The survey instrument was composed of several questions related to the KM processes, IC, and OP. Specifically, 35 items addressing the seven KM processes (knowledge diagnosis, acquisition, generating, storage, sharing, application, and protection); 15 items addressing the dimensions of IC (human capital, structural capital, and relational capital); and 20 items addressing the dimensions of OP (customer perspective, learning and growth perspective, internal operations perspective, and financial perspective). Each item was rated on a seven-point Likert-type scale, ranging from strongly disagree (1) to strongly agree (7). To ensure the face validity of the study instrument, it was initially presented to 8 academics specialising in relevant disciplines. They assessed the questionnaire in terms of structure, clarity, and relevance, as well as its alignment with the study's research questions, objectives, and hypotheses. Based on their feedback, modifications were made, including rearranging, adding, deleting, merging, and separating certain items. The final version of the questionnaire is presented in Appendix A.

4.3 Common Method Variance

Initial steps in the study's design prioritised procedural rigour, firstly through careful attention to the scale items to avoid ambiguous and vague terms in the questionnaire and by keeping the questions simple. Next, participants' anonymity was ensured by stating that clearly at the beginning of the questionnaire. During the data collection process, sufficient time was also provided to complete and return the survey, thus minimising assessment apprehension, all of which have the potential to cause method bias in the data (Podsakoff et al., 2003). As an ex-post measure, we evaluate the extent of common method variance. Harman's single-factor test was conducted. This involved performing a principal component factor analysis that included all items. (Podsakoff and Organ, 1986). The first factor accounted for 48.01% of the variance, which is below the 50% threshold commonly cited as indicative of potential common method variance issues.

5. Results

5.1 Statistical Analysis

The analysis of the study data was conducted using SPSS version 28 and the Hayes and Preacher Process Macro version 4. The study employed a range of statistical tests to examine the relationships among KM, IC, and OP. Partial Least Squares Structural Equation Modelling (PLS-SEM) was utilised to analyse the hypothesised

relationships, as it is well-suited for research involving latent constructs and exploratory models. PLS-SEM offers advantages over traditional regression analysis by enabling the simultaneous estimation of both measurement and structural models. Furthermore, compared to covariance-based SEM (CB-SEM), PLS-SEM is more appropriate for studies with complex models and relatively small sample sizes (Hair et al., 2021). Given the study's emphasis on theory development and prediction, rather than strict theory confirmation, PLS-SEM was the most appropriate analytical approach.

5.2 Descriptive Statistics of the Study Variables

Table 1 presents the descriptive statistics for the main study variables: KM, IC, and OP, including their mean, standard deviation, and Relative Importance Index (RII).

Table 1: Descriptive statistics results related to the study variables

	Mean	SD	RII
Knowledge Management (KM)	4.711	1.039	67.3%
Intellectual Capital (IC)	4.828	0.981	69.0%
Organisational Performance (OP)	5.050	0.927	72.1%

As shown in Table 1, the significance of KM was apparent in its aggregate mean of 4.711 (SD = 1.039) and a Relative Importance Index (RII) of 67.3%, thereby underscoring its perceived importance. A comparable level of significance was observed in IC, which attained an aggregate mean of 4.828 (SD = 0.981) and an RII of 69.0%. OP demonstrates an even higher level of perceived importance, with an aggregate mean of 5.050 (SD = 0.927) and an RII of 72.1%, thus highlighting the strong emphasis placed on OP across the study sample.

5.3 Correlational Analysis

The correlational analysis revealed significant relationships among KM, IC, and OP. The Pearson correlation coefficient between KM and IC is 0.866, indicating a strong positive correlation, which is statistically significant at the 0.01 level. Similarly, KM demonstrated a significant positive correlation with OP (r = 0.787), suggesting that improvements in KM are associated with enhanced OP. Furthermore, IC demonstrates a robust positive correlation with OP (r = 0.889), which is also significant at the 0.01 level. Table 2 presents the correlational analysis. Table 3 shows the Heterotrait-Monotrait (HTMT) ratio of correlations.

Table 2: Correlational analysis

	KM	IC	OP
KM	1		
IC	.866**	1	
OP	.787**	.889**	1

Table 3: Heterotrait-Monotrait (HTMT) Ratio of Correlations

	Customer perspective	Learning and growth perspective	Internal operations perspective	Financial perspective	Knowledge Diagnosis	Knowledge Acquisition	Knowledge Generation	Knowledge Storing	Knowledge Sharing	Knowledge Application	Knowledge Protection	Human Capital	Structural Capital	Relational Capital
Customer perspective														
Learning and growth Perspective	0.745													
Internal operations perspective	0.841	0.801												
Financial perspective	0.836	0.797	0.869											
Knowledge Diagnosis	0.584	0.478	0.669	0.581										
Knowledge Acquisition	0.828	0.808	0.855	0.815	0.863									
Knowledge Generating	0.638	0.665	0.711	0.712	0.839	0.853								
Knowledge Storage	0.566	0.582	0.669	0.596	0.758	0.794	0.863							
Knowledge Sharing	0.714	0.637	0.769	0.672	0.786	0.811	0.866	0.833						
Knowledge Application	0.690	0.657	0.803	0.720	0.835	0.883	0.870	0.859	0.898					
Knowledge Protection	0.616	0.498	0.689	0.605	0.766	0.737	0.729	0.788	0.748	0.778				
Human Capital	0.821	0.625	0.800	0.761	0.733	0.849	0.833	0.697	0.851	0.850	0.742			
Structural Capital	0.780	0.753	0.897	0.785	0.706	0.851	0.723	0.720	0.811	0.802	0.718	0.800		
Relational Capital	0.914	0.719	0.847	0.849	0.710	0.793	0.790	0.682	0.775	0.748	0.687	0.846	0.836	

5.4 Measurement Model Assessment (External Model)

Hair et al.(2021) stated that the assessment of results in PLS-SEM follows a two-step approach: first, assessing the measurement model, and then assessing the structural model. The assessment procedures differ depending on whether the constructs are specified as reflective or formative. According to Hair et al.(2019), the measurement model indicators can be divided into two main levels: the first degree is related to the relationship between items and dimensions, and the second degree is concerned with the relationship between dimensions and main variables. The first-order standard model is an important tool in mathematical logic to represent relationships between elements in an organised manner. In PLS-SEM, items may be removed from the measurement model when they fail to demonstrate sufficient discriminant validity or exhibit cross-loadings. This purification process enhances model parsimony and analytical efficiency. Table 4 shows the items excluded from the first-order measurement model, and Figure 2 shows the final structure of the measurement model after these modifications.

Table 4: Items deleted from the first-order measurement model

Item No.	Dimension	Variable	Reason
1, 3	Human Capital	Intellectual Capital	There is an overlap, resulting in a lack of clear differentiation
2, 4	Relational Capital	Intellectual Capital	There is an overlap, resulting in a lack of clear differentiation
1, 3	Customer Perspective	Organisational Performance	There is an overlap, resulting in a lack of clear differentiation

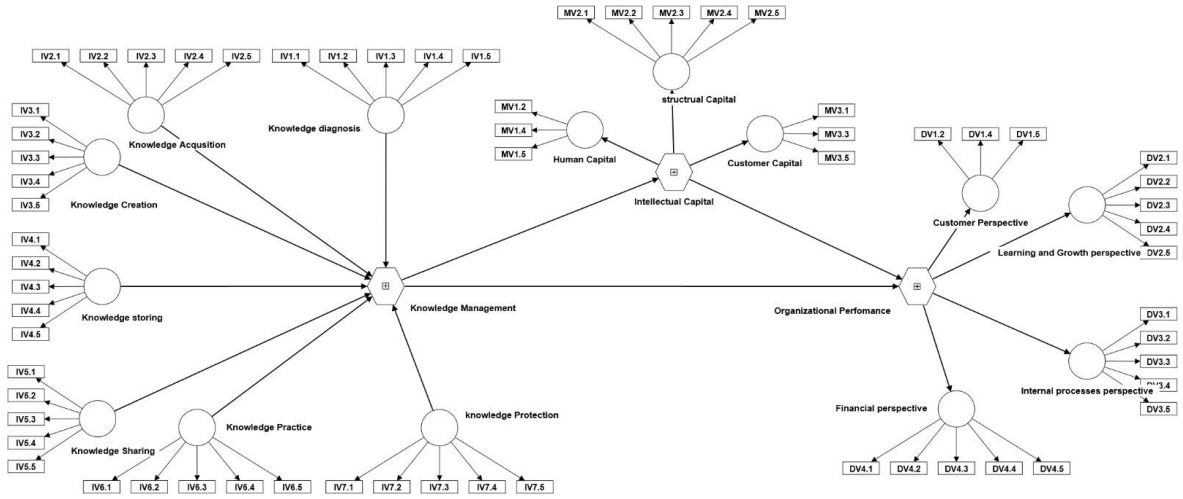

Figure 2: Measurement model

5.4.1 First-Order measurement model assessment

First-Order Measurement Model Assessment: Dependent Variable Dimensions:

Table 5 shows the convergent validity results for the dimensions of organisational performance, including loadings, Cronbach's alpha, composite reliability, and AVE.

Table 5: Convergence validity indicators for the dimensions of the dependent variable (organisational performance)

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Customer Dimension	DV1.2	0.859	0.847	0.848	0.766
	DV1.4	0.881			
	DV1.5	0.885			

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Learning & Growth Dimension	DV2.1	0.828	0.834	0.870	0.601
	DV2.2	0.610			
	DV2.3	0.859			
	DV2.4	0.733			
	DV2.5	0.819			
Internal Processes Dimension	DV3.1	0.770	0.897	0.902	0.708
	DV3.2	0.876			
	DV3.3	0.880			
	DV3.4	0.826			
	DV3.5	0.852			
Financial Dimension	DV4.1	0.828	0.833	0.849	0.607
	DV4.2	0.874			
	DV4.3	0.817			
	DV4.4	0.740			
	DV4.5	0.606			

As shown in Table 5, the first-order measurement model for organisational performance demonstrates strong psychometric properties that meet the required reliability and validity standards. External saturation analysis confirmed high indicator reliability, with most outer loadings exceeding the 0.708 threshold, except for two indicators, which remained within acceptable limits due to sufficient AVE values. Internal consistency analysis (Cronbach's alpha) showed that all dimensions exceeded 0.700, confirming the scale's reliability. Composite reliability (CR) results also exceeded the required threshold, ensuring internal consistency. Convergent validity analysis confirmed that all dimensions met the AVE criterion (≥0.5), demonstrating adequate explained variance. Despite minor deviations, the model remains statistically robust for measuring organisational performance.

Second: First-Order Measurement Model Assessment: Independent Variable Dimensions:

Table 6 shows the convergent validity results for the dimensions of knowledge management, including loadings, Cronbach's alpha, composite reliability, and AVE.

Table 6: Convergent Validity Indicators for the Dimensions of the Independent Variable (knowledge management)

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Knowledge Diagnosis	IV1.1	0.783	0.880	0.885	0.677
	IV1.2	0.819			
	IV1.3	0.770			
	IV1.4	0.842			
	IV1.5	0.895			
Knowledge Acquisition	IV2.1	0.788	0.829	0.836	0.595
	IV2.2	0.812			
	IV2.3	0.807			
	IV2.4	0.673			
	IV2.5	0.768			
Knowledge Generation	IV3.1	0.829	0.921	0.921	0.760
	IV3.2	0.889			

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
	IV3.3	0.848			
	IV3.4	0.907			
	IV3.5	0.884			
Knowledge Storage	IV4.1	0.878	0.947	0.949	0.826
	IV4.2	0.924			
	IV4.3	0.910			
	IV4.4	0.902			
	IV4.5	0.929			
Knowledge Sharing	IV5.1	0.819	0.890	0.892	0.695
	IV5.2	0.848			
	IV5.3	0.853			
	IV5.4	0.799			
	IV5.5	0.848			
Knowledge Applying	IV6.1	0.885	0.905	0.913	0.728
	IV6.2	0.728			
	IV6.3	0.877			
	IV6.4	0.903			
	IV6.5	0.860			
Knowledge protection	IV7.1	0.736	0.860	0.867	0.645
	IV7.2	0.719			
	IV7.3	0.867			
	IV7.4	0.884			
	IV7.5	0.795			

As shown in Table 6, the first-order measurement model for knowledge management demonstrates strong psychometric properties. Most outer loadings exceeded 0.708, with the highest in knowledge storage (0.878–0.929) and knowledge generation (0.829–0.907), while one acquisition indicator (0.673) remained acceptable due to sufficient AVE. Cronbach's alpha (0.829–0.947) and composite reliability (0.836–0.949) exceeded 0.700, ensuring internal consistency. Convergent validity (AVE) values ranged from 0.595 to 0.826, confirming adequate variance explanation. Overall, the model demonstrates high reliability and validity, particularly in knowledge storage and generation. However, periodic review of lower-performing indicators, especially in knowledge acquisition, is recommended.

Third: First-Order Measurement Model Assessment: Mediating variable Dimensions:

Table 7 shows the convergent validity results for the dimensions of intellectual capital, including loadings, Cronbach's alpha, composite reliability, and AVE.

Table 7: Convergence validity indicators for the dimensions of the mediating variable (intellectual capital)

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Human Capital	MV1.2	0.832	0.738	0.759	0.654
	MV1.4	0.854			
	MV1.5	0.736			
Structural Capital	MV2.1	0.756	0.885	0.891	0.687

Dimension	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
	MV2.2	0.848			
	MV2.3	0.860			
	MV2.4	0.878			
	MV2.5	0.798			
Relational Capital	MV3.1	0.888	0.800	0.808	0.715
	MV3.3	0.849			
	MV3.5	0.798			

As shown in Table 7, the first-order measurement model for intellectual capital demonstrates strong psychometric properties. Most outer loadings exceeded 0.708, with the highest in relational (0.888) and structural capital (0.878), while one human capital indicator (0.736) remained acceptable. Internal consistency was high, with Cronbach's alpha values ranging from 0.738 to 0.885 and composite reliability (CR) values from 0.759 to 0.891, all above the 0.700 threshold. Convergent validity (AVE) exceeded 0.500 across all dimensions, confirming adequate variance explanation. Overall, the model meets reliability and validity standards, with structural and relational capital performing best, making it a reliable tool for assessing IC.

Table 8 presents the discriminant validity assessment using the single ratio criterion and the Heterotrait-Monotrait (HTMT) ratio.

Table 8: Heterotrait-Monotrait (HTMT) Ratio of Correlations

	Customer Dimension	Learning & Growth Dimension	internal processes Dimension	Financial Dimension	Knowledge Diagnosis	knowledge acquisition	Knowledge generation	Knowledge Storing	Knowledge sharing	Knowledge Applying	knowledge protection	Human Capital	Structural capital	Relational capital
Customer Dimension														
Learning & Growth Dimension	0.745													
Internal processes Dimension	0.841	0.801												
Financial Dimension	0.836	0.797	0.869											
Knowledge Diagnosis	0.584	0.478	0.669	0.581										
knowledge acquisition	0.828	0.808	0.855	0.815	0.863									
Knowledge generation	0.638	0.665	0.711	0.712	0.839	0.853								
Knowledge Storing	0.566	0.582	0.669	0.596	0.758	0.794	0.863							
Knowledge sharing	0.714	0.637	0.769	0.672	0.786	0.811	0.866	0.833						
Knowledge Applying	0.690	0.657	0.803	0.720	0.835	0.883	0.870	0.859	0.898					
knowledge protection	0.616	0.498	0.689	0.605	0.766	0.737	0.729	0.788	0.748	0.778				
Human Capital	0.821	0.625	0.800	0.761	0.733	0.849	0.833	0.697	0.851	0.850	0.742			
Structural capital	0.780	0.753	0.897	0.785	0.706	0.851	0.723	0.720	0.811	0.802	0.718	0.800		
Relational capital	0.914	0.719	0.847	0.849	0.710	0.793	0.790	0.682	0.775	0.748	0.687	0.846	0.836	

As shown in Table 8, the results indicate that most variable relationships fall within the acceptable threshold (<0.900), confirming a good level of discriminant validity. However, one instance exceeded this threshold, requiring further review of indicators MV3 and DV1 to enhance differentiation. While high HTMT values may be theoretically justified for interrelated variables, clear documentation remains essential. Furthermore, additional analyses and validation across different contexts are recommended to ensure the robustness of these findings.

5.4.2 Second-Order Measurement Model Assessment

First: Dependent variable and mediating variable (reflective)

Table 9 presents the results of reliability, convergent validity, and discriminant validity tests for the second-order dimensions of the dependent and mediating variables.

Table 9: Test of Reliability, Convergent Validity, and Discriminant Validity for Second-Order Dimensions

Variable	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
Organisational performance	Customer Dimension	0.875	0.909	0.912	0.786

Variable	Indicator	External Saturation (> 0.708)	Cronbach's Alpha (≥ 0.7)	Composite Reliability (> 0.7)	Average Variance Explained (AVE) (> 0.5)
	Learning & Growth Dimension	0.868			
	Internal Processes Dimension	0.914			
	Financial Dimension	0.889			
Intellectual Capital	Human Capital	0.870	0.864	0.865	0.786
	Structural Capital	0.898			
	Relational Capital	0.891			

As shown in Table 9, discriminant validity between the mediating and dependent variables is confirmed, as the Heterotrait-Monotrait (HTMT) ratio value was below 0.900, which is considered the threshold for conceptual closeness between the variables.

Based on these results, it can be concluded that the second-order structural model demonstrates high reliability and validity, rendering it suitable for hypothesis testing and subsequent statistical analyses.

Second: Convergent Validity of the Independent Variable (Formative Variable)

Table 10 presents the assessment of the second-order formative model for the independent variable, Knowledge Management (KM), based on outer weights and variance inflation factors (VIF).

Table 10: Assessment of the Second-Order Structural Model for the Independent Variable (Formative)

Variable	Indicator	Outer Weight	Variance Inflation Factor
Knowledge Management	Knowledge Diagnosis	-0.175	3.124
	Knowledge Acquisition	0.521	3.132
	Knowledge Generation	0.212	4.415
	Knowledge Storage	-0.161	4.072
	Knowledge Sharing	0.304	3.655
	Knowledge Applying	0.219	4.658
	Knowledge Protection	0.169	2.416

As shown in Table 10, outer weights varied across KM dimensions, with Knowledge Acquisition being the highest (0.521), while two indicators —Knowledge Diagnosis and Storage—exhibited negative values. Nevertheless, all indicators were retained due to the formative nature of the construct. VIF values ranged from 2.416 to 4.658, remaining below the threshold of 5, thus indicating no multicollinearity issues. Overall, the construct demonstrates acceptable convergent validity, with all indicators contributing theoretically to its formation.

5.5 Structural Model Assessment (Inner Model): Examining the Relationship among the Key Variables of the Study

The structural model, also known as the inner model, plays a pivotal role in quantitative research by elucidating relationships among key variables. Its assessment relies on several statistical metrics to ensure robustness. Path significance is first assessed to confirm that hypothesised relationships are statistically meaningful, thereby validating the model. Subsequently, the coefficient of determination (R^2) is examined to determine the model's explanatory power, with values exceeding 0.10 indicating that it accounts for at least 10% of the variance in the dependent variable. The effect size (f^2) was then analysed to quantify the influence of independent variables, with values above 0.02 indicating a substantive impact. Finally, predictive relevance (Q^2) was assessed to gauge the model's ability to predict new data, with values greater than zero signifying positive predictive capability. Together, these indicators ensure the model's reliability in both explaining and forecasting outcomes.

Structural Model Measurement Indicators

First: Coefficient of determination value (R^2)

Shmueli and Koppius (2011) stated that the coefficient of determination is a measure of the explanatory power of the model within the sample. The coefficient of determination represents the proportion of variance explained by the independent variable in the dependent variable. According to Hair et al. (2019), the values are compared against the following: (0.25 - weak), (0.50 - moderate), and (0.75 - strong), with the acceptable value being 0.10.

Table 11 presents the coefficient of determination (R^2) values for assessing the explanatory power of the structural model in relation to the dependent, mediating, and independent variables.

Table 11: Measuring the coefficient of determination (R^2)

Type of variable	Variable	Coefficient of determination value (R^2)
Dependent variable	Organisational performance	0.779
The mediating variable	Intellectual Capital	0.737
Independent variable: Knowledge management		

As shown in Table 11, the independent variable (KM) and mediator (IC) collectively explain 77.9% of the variance in the dependent variable (OP), highlighting the model's effectiveness. In addition, KM alone accounts for 73.7% of the variance in IC, highlighting its significant role in shaping and enhancing IC. These results demonstrate the model's robustness in explaining the relationships among the variables.

Second: Effect size (f^2)

The effect size (f2) is an important indicator for assessing the contribution of each independent variable in explaining the variance in the dependent variable. According to commonly accepted standards for assessing effect size, values of 0.35, 0.15, and 0.02 are classified as indicators of large, medium, and small effect sizes, respectively.

Table 12 presents the effect size (f^2) values, which assess the individual contribution of both the independent and mediating variables in explaining the variance in the dependent variable.

Table 12: Measuring the effect size coefficient (f^2)

Type of variable	Variable	f^2
The independent variable	Knowledge Management	0.153
The mediating variable	Intellectual Capital	0.368
A. Dependent Variable: Organisational Performance		

As shown in Table 12, the results of the effect size (f^2) analysis indicate that the mediator variable (IC) exerts a substantial effect on OP (f^2 = 0.368), exceeding the high-effect threshold of 0.35. This underscores its pivotal role in enhancing performance. The independent variable (KM) demonstrates a medium effect (f^2 = 0.153), thereby confirming its relative importance. These findings highlight that IC has a more substantial impact on OP compared to the direct influence of KM, emphasising its critical mediating role. This suggests organisations should prioritise developing IC to strengthen the link between KM and OP.

Third: Predictive and Explanatory Accuracy of the Model Within and Beyond the Study Sample (Q^2)

The explanatory and predictive accuracy of the study model was assessed using Geisser's (1974) and Stone's (1974) blindfolding procedure, which systematically omits parts of the data matrix to compare out-of-sample (deleted) and in-sample (remaining) values. (Q^2) measures prediction accuracy, with values >0 indicating validity: 0–0.25 (weak), 0.25–0.50 (moderate), and >0.50 (strong). Smaller differences between deleted and remaining values confirm higher predictive accuracy.

Table 13 presents the (Q^2) values assessing the model's predictive accuracy for the dependent and mediating variables.

Table 13: Predictive Relevance of the Model (Q^2)

Type of variable	Variable	Q^2 (=1-SSE/SSO)
Dependent variable	Organisational Performance	0.602
The mediating variable	Intellectual Capital	0.570
Independent variable: Knowledge management		

As shown in Table 13, the results corroborate the model's robust predictive capacity for both the dependent and mediator variables. OP recorded a high Q^2 value (0.602), exceeding the 0.35 threshold, indicating strong predictive accuracy. Similarly, Intellectual Capital achieved a Q^2 of 0.570, reinforcing the model's reliability in forecasting both variables. These results validate the theoretical model's predictive power, supporting its applicability in similar contexts.

5.6 Hypotheses Testing

To test the hypotheses of the study, the Hayes and Preacher Process was utilised to examine the mediation role of IC in the relationship between KM and OP (Preacher and Hayes, 2004). Table 14 shows the direct, indirect, and total effects of all significant effects in the structural model

Table 14: Direct, indirect, and total effects of all significant effects in the structural model

Hypotheses	Effect Type	Path		B	SE	T	p	Result
H1: KM has a significant impact on OP	Total Effect	Path c	KM -> OP	0.776	0.057	13.715	0.000	Supported
H2: KM has a significant impact on IC		Path a	KM -> IC	0.852	0.048	17.763	0.000	Supported
H3: IC has a significant impact on OP		path b	IC -> OP	0.736	0.077	9.572	0.000	Supported
H4: IC mediates the impact of KM on OP	Indirect Effect	Path a*b	KM -> IC -> OP	0.627	0.069	9.061	0.000	Supported
	Direct Effect	Path c'	KM -> OP	0.149	0.087	1.720	0.043	Supported

The results confirm a statistically significant relationship between KM and OP, with IC as a mediator.

- Hypothesis 1: KM has a significant positive impact on OP (B = 0.776, SE = 0.057, T = 13.715, $p < 0.001$), confirming a strong effect.
- Hypothesis 2: KM has a significant positive impact on IC (B = 0.852, T = 17.763, $p < 0.001$), highlighting its role in the development of IC.
- Hypothesis 3: IC has a significant positive impact on OP (B = 0.736, T = 9.572, $p < 0.001$), highlighting its role as a key driver of OP.
- Hypothesis 4: IC mediates the KM‑OP relationship, as evidenced by a significant indirect effect (B = 0.627, T = 9.061, $p < 0.001$). The direct effect of KM on OP diminishes when IC is included (B = 0.149, T = 1.720, p = 0.043), confirming partial mediation.

These findings validate the model, demonstrating that KM enhances OP both directly and indirectly through IC.

6. Discussion

A summary of direct, indirect, and total effects of all significant effects in the structural model is presented in Table 14. The results indicate that KM exerts the strongest effect on OP, supporting acceptance of the first hypothesis (H1). The findings of this study are consistent with organisational theories, particularly the Knowledge-Based View (Grant, 1996), and are congruent with previous empirical studies, such as Abu-Hatab (2021), which found a statistically significant effect of KM processes on the OP of agricultural and development civil society organisations in the Gaza Strip, and with the findings of Al-Adwan (2019), which found a statistically significant positive effect of KM processes on OP in Jordanian telecommunications companies. These findings are further supported by recent studies conducted in developing economies (Onikoyi et al., 2024) and more recent research (Megha and Sushan, 2024; Yang and Nuruly, 2024), particularly in knowledge-intensive sectors

such as telecommunications and education. However, these findings contradict those of Setyawan (2021), who reported no significant direct effect in the Indonesian coal mining sector. This discrepancy may stem from sector-specific characteristics, particularly in knowledge-intensive industries where reliance on IC and knowledge-sharing mechanisms is more pronounced. These differences underscore the need for further empirical validation across diverse economic and industrial contexts to better understand the varying impacts of KM on OP. The findings of this study highlight the urgent need for organisations to implement KM to ensure the ongoing success of their OP. Furthermore, the findings of this study reaffirm the positive impact of KM on OP. Regarding the second hypothesis (H2), the results confirm that KM significantly impacts IC, consistent with those of previous studies, such as Fani and Saduq (2020) in the context of Sonelgaz Electricity and Gas Distribution Company in Adrar, Algeria, and Hussini (2019) within the telecommunications sector in Biskra, Algeria. Regarding the third hypothesis (H3), the results confirm that IC impacts OP, aligning with those of previous studies, such as Kharboush (2019), which concluded that there is an effect of IC on OP in the Algerian telecommunications corporation. Similarly, Dhiban (2020) investigated the role of IC in enhancing performance at Yemen Mobile, revealing that despite the limited availability of IC components, its impact on OP—as measured by the Balanced Scorecard—nevertheless remained positive. Similarly, Al-Gburi and Mohsin (2025) examined the role of IC in sustainable performance among Iraqi telecommunications companies and demonstrated that various components of IC significantly contribute to corporate performance and long-term sustainability. Regarding the fourth hypothesis (H4), which focuses on the mediating role of IC, it is clear that IC mediates the relationship between KM and OP according to the results of the testing of H4. In other words, the implementation of KM can be made more efficient when organisations possess the IC necessary to support OP. These findings are consistent with those reported by Babakr's study (2019), which concluded that there is an indirect effect of KM on OP with the presence of IC. Hence, the results of this study not only confirm the relationships among the three constructs, as suggested by previous research, but also highlight the mediating role of IC, making a significant contribution to the literature. In addition, the consistency of these findings with studies in various economic and industrial contexts reinforces the broader applicability of the theoretical framework. However, the observed discrepancies underline the importance of sectoral dynamics, pointing to the need for further research to determine whether these findings hold across different industries and geographical settings.

Practical Implications

The findings of this study offer valuable insights for practitioners within the telecommunications sector and beyond. To enhance OP through KM and IC, organisations should:

- Establish KM Units—Create dedicated units to acquire, store, and share knowledge, ensuring continuity despite employee turnover.
- Invest in IC Development—Strengthen human (training, knowledge platforms), structural (IT infrastructure), and relational capital (partnerships, customer management).
- Leverage Technology—Utilise AI, digital platforms, and cloud-based KM systems to enhance decision-making and innovation.
- Foster a Knowledge-Sharing Culture—Incentivise collaboration through rewards, performance assessments, and internal knowledge communities.

Implementing these strategies can optimise knowledge resources, enhance IC, and drive OP.

Policy Implications:

At the policy level, governments and regulatory bodies should:

- Provide Funding and Incentives: Support KM and IC initiatives within the telecommunications sector through grants, tax incentives, or subsidies.
- Develop National Policies: Create policies that promote knowledge sharing, innovation, and the adoption of advanced technologies.
- Facilitate Industry Collaboration: Establish industry-wide knowledge networks to encourage collaboration among telecom companies and other stakeholders.

Limitations and Future Research

Limitations

Despite its contributions, this study has several limitations. First, it focuses exclusively on the Yemeni telecommunications sector, which may limit the generalisability of the findings to other industries or regions.

Second, the study adopts a cross-sectional research design, capturing data at a single point in time, which does not account for dynamic changes over time. Third, the reliance on self-reported survey data may introduce response biases, including social desirability bias and common method variance. Fourth, while the focus on second-order constructs ensures model parsimony and theoretical coherence, it limits the ability to explore the individual dimensions of KM and IC in greater depth. This approach precludes a nuanced understanding of how specific dimensions influence OP.

Future Research

To address these limitations, future studies could expand the investigation to different industries, such as manufacturing or financial services, to assess whether the proposed model holds across varying knowledge-intensive environments. In addition, employing a longitudinal research design would provide deeper insights into how KM and IC evolve over time and influence OP. Finally, integrating objective performance indicators alongside self-reported data or adopting multi-source data collection methods could enhance the robustness and validity of findings.

Future Research Directions

Beyond addressing the study's limitations, several promising research avenues emerge. Comparative studies between developing and developed economies could shed light on contextual factors influencing the KM–IC–OP relationship. Moreover, case studies and expert interviews could elucidate the underlying mechanisms of these relationships. Future research could also explore the role of emerging technologies—such as artificial intelligence and big data analytics—in strengthening KM and IC practices. In addition, future studies could investigate the individual dimensions of KM and IC, particularly within the context of Yemen's unique cultural and industry-specific dynamics, to provide a more granular understanding of their impact on OP.

7. Conclusion

This study presented empirical evidence on the effect of KM on OP, which was mediated by IC. Building on the study's results, it was found that KM and IC exert both direct and indirect effects on OP, as well as its various dimensions measured by the BSC. The results demonstrate that KM processes result in improved OP. The results also indicate that human, structural, and relational capital dimensions in IC enhance OP. In addition, IC also mediates the relationship between KM and OP. Based on the research results, the implication of this research was that the top management in the Yemeni telecommunications sector should establish organisational units in the organisational structures of the YTS that are concerned with KM, due to its significant impact on enhancing OP in the sector.

This study presented empirical evidence that KM, mediated by IC, positively impacts OP. The findings show that KM and IC directly and indirectly enhance OP across various dimensions measured by the BSC. Specifically, KM processes enhance performance, while IC further strengthens this effect. In addition, IC serves as a mediator in the relationship between KM and OP.

The study recommends that Yemeni telecommunications companies establish dedicated KM units to leverage these benefits and improve sector-wide performance.

Broader Implications:

The findings of this study extend beyond the Yemeni telecommunications sector, offering valuable insights for other developing economies and global industries facing similar challenges, such as resource constraints and the need for innovation. For example, the proposed framework could be applied in sectors like healthcare, education, and manufacturing, where KM and IC play a critical role in driving performance. By adopting similar strategies, organisations in these sectors can enhance their efficiency and competitiveness. This global relevance underscores the study's contribution to both academic research and practical applications across diverse contexts.

7.1.1 Abbreviations

Abbreviations	Meaning
B	A coefficient
H1	Main Hypothesis No. 1
H2	Main Hypothesis No. 2

H3	Main Hypothesis No. 3
H4	Main Hypothesis No. 4
IC	Intellectual Capital
KBV	Knowledge-Based View
KM	Knowledge Management
OP	Organisational Performance
p	P-value
PLS	Partial Least Squares
RBV	Resource-Based View
SE	Standard Error
SPSS	Statistical Package for the Social Sciences
T	T- value
YTS	Yemeni Telecommunications Sector

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Authors' Contributions

FR addressed the research gaps, performed the literature review, designed the study methodology, collected the data, and wrote and revised the manuscript accordingly. ZS made substantial contributions to this research, including project leadership and critical revisions to the final manuscript.

All authors have read and approved the manuscript.

AI Statement: The authors declare that this work is original content prepared by them and no technology (e.g. AI) was used to generate all or part of its content.

Ethics declarations: Ethics Approval and Consent to Participate. Although this study did not require formal ethical clearance, all procedures adhered to ethical guidelines, including informed consent and compliance with the 1964 Helsinki Declaration and its later amendments. The research involved anonymous surveys with no sensitive data.

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Appendix A: Questionnaire

Section One: Demographic and Job Information

Please mark (√) in the box that best represents your response.

1. Gender:

☐ Male

☐ Female

2. Age:

☐ 30 years or less

☐ 31 to 39 years

☐ 40 to 49 years

☐ 50 years and above

3. Educational Qualification:

☐ High school or less

☐ Diploma after high school

☐ Bachelor's degree

☐ Master's degree

☐ Doctorate (Ph.D.)

4. Job title:

☐ Specialist

☐ Supervisor

☐ Section Head

☐ Deputy Department Manager

☐ Department Manager

☐ Deputy Director General of Administration

☐ Director General of Administration

☐ Deputy Chief Executive Officer

☐ Chief Executive Officer

5. Nature of Work:

☐ Technical

☐ Administrative

6. Years of service in the telecommunications sector:

☐ Less than 6 years

☐ From 6 to less than 10 years

☐ From 10 to less than 15 years

☐ 15 years and above

7. Organisation you work for:

☐ PTC

☐ Yemen Mobile

☐ Sabafon

☐ Yemen Oman United Telecommunication Company (YOU)

☐ Y

☐ Telyemen

Section Two / Measurement of Variables:

Note: All items were measured using a seven-point Likert scale, ranging from 1 = Strongly Disagree to 7 = Strongly Agree.

Please indicate your level of agreement with the following statements by marking (✓) in the box provided for your response.

Knowledge Management:

It refers to the organised management of knowledge assets within an organisation aimed at creating added value that contributes to fulfilling strategic needs and enhancing organisational performance. It includes all initiatives, processes, and systems involved in diagnosing, acquiring, generating, storing, sharing, applying, and protecting knowledge.

No	Item Statement	Item Source
Dimension One: Knowledge Diagnosis Identify the topics of knowledge and experience that the organisation currently possesses and the topics of critical knowledge that it wants in the future, as well as determining where that knowledge is located, whether it is in the heads of employees, in systems, or procedures, and how important it is to the organisation.		
1	Employees in the organisation can easily identify the knowledge needed to perform the job.	Adopted from Awtayef (2019)
2	The organisation utilises employee performance assessment reports to evaluate the cognitive abilities of its employees.	Adapted from Ahmed (2018)
3	The person with the knowledge required by the organisation can be easily identified.	Adopted from Awtayef (2019)
4	The organisation assesses its knowledge base in comparison to that of competing organisations.	Adopted from Hussini (2019)
5	The organisation regularly identifies the knowledge it requires to maintain its competitive edge.	Adopted from Hussini (2019)
Dimension Two: Knowledge Acquisition The process by which an organisation can obtain knowledge from its original sources, whether internal or external.		
1	The organisation actively seeks to acquire new knowledge from the various entities it interacts with, such as suppliers, competitors, partners, customers, and others.	Adopted from Al-Shalabi (2018)
2	The organisation encourages its employees to continually learn to gain new knowledge.	Adopted from Ahmed (2018)
3	The organisation provides technological means that help employees acquire knowledge.	Adopted from

No	Item Statement	Item Source
		Al-Shaer (2021)
4	Employees in the organisation are required to attend training courses, workshops, or scientific conferences to gain new knowledge.	Adapted from Abdelkader (2014)
5	The organisation is keen to attract and recruit individuals with distinguished competencies and benefit from their knowledge.	Adopted from Sharifa (2019)
Dimension Three: Knowledge Generation The process of meeting with specialists and using modern methods and techniques, such as brainstorming technology, to generate new knowledge that is used in the organisation.		
1	The organisation is constantly interested in knowledge generation.	Adopted from Ben Maatouk (2019)
2	The organisation uses dialogues or brainstorming sessions to enable employees to generate new knowledge.	Adopted from Abu Hila (2019)
3	The organisation rewards employees for their contributions to generating new knowledge.	Adopted from Awtayef (2019)
4	The organisation establishes specialised teams for knowledge generation.	Adopted from Barhama (2017)
5	The organisation supports areas of research and development initiatives to generate knowledge.	Adopted from Shaabna and Boujaâtat (2020)
Dimension Four: Knowledge Storage The process of retaining, maintaining, and organising knowledge to facilitate its search, access, and retrieval within the organisational memory of the organisation.		
1	The organisation utilises electronic systems to store its available knowledge.	Adopted from Sokar (2021)
2	The knowledge within the organisation is classified in a way that facilitates its retrieval and use.	Adopted from Al-Hasani (2019)
3	The organisation encourages employees to preserve and document their knowledge.	Adopted from Abu Hila (2019)
4	The organisation prioritises documenting lessons learned from past experiences.	Adapted from Cumari (2018)
5	The organisation is keen to continuously update its stored knowledge.	Adapted from Al-Mustafa (2021)
Dimension Five: Knowledge Sharing The processes and activities undertaken by the organisation to facilitate the sharing of knowledge among employees and ensure its availability to all who need it.		
1	An atmosphere of trust and mutual cooperation prevails among employees within the organisation.	Adopted from Al-Ammar (2017)
2	The culture of the organisation supports the sharing of information and knowledge.	Adapted from Hussini (2019)
3	Employees who possess valuable knowledge are keen to share their knowledge with others.	Authors Developed
4	The organisation releases periodic publications to facilitate the dissemination of knowledge among its employees.	Adapted from Al-Ammar (2017)
5	The organisation adopts knowledge sharing as a criterion in employee performance assessments.	Authors Developed
Dimension Six: Knowledge Application The process of effectively and timely utilising knowledge, leveraging its presence within the organisation, and employing it to address the challenges faced by the organisation.		
1	The organisation encourages the application of new knowledge to enhance its performance.	Adapted from Haffadh (2018)

No	Item Statement	Item Source
2	Employees are fully aware of the knowledge and expertise they possess.	Authors Developed
3	The organisation leverages the outcomes of employee training programmes by translating them into practical applications.	Adopted from Ajjan (2017)
4	The organisation is keen to overcome the difficulties that hinder employees from effectively applying their knowledge.	Adopted from Al-Shaer (2021)
5	Employees who effectively apply their knowledge to benefit the organisation are recognised and motivated.	Adapted from Al-Ali (2013)
Dimension Seven: Knowledge Protection The process by which knowledge is preserved within the organisation through the implementation of appropriate technological tools, policies, and procedures.		
1	Employees are well-informed and sufficiently aware of the importance of knowledge protection.	Adopted from Mtawali (2018)
2	The organisation maintains secure databases to store all information about its internal operations.	Adopted from Abdelkader (2014)
3	The management of the organisation implements security systems to protect knowledge against potential risks.	Adopted from Al-Mustafa (2021)
4	The organisation adopts both legal and technological measures to ensure the protection of its knowledge resources.	Adopted from Hussini (2019)
5	The organisation communicates with suppliers and customers continuously to remind them of the importance of protecting the organisation's knowledge and information.	Adopted from Al-Ali (2013)

Intellectual Capital

It refers to the group of intangible assets, including human capital, structural capital, and relational capital, owned by the organisation that earns it the ability to perform its functions, enhance its organisational performance, and increase its competitiveness.

No	Item Statement	Item Source
Dimension One: Human Capital The capabilities and competencies possessed by the employees of the organisation, which they utilise and invest in their work.		
1	The organisation is keen to identify skills gaps among its employees.	Adopted from Haffadh (2018)
2	The organisation encourages its employees to provide creative opinions and ideas that help in business development.	Adopted from Shaabna and Boujaâtat (2020)
3	The organisation values and retains experienced individuals, implementing strategies to prevent them from transitioning to other organisations.	Adopted from Al-Shaer (2021)
4	Employees have sufficient knowledge of the services offered by the organisation.	Adopted from Hussini (2019)
5	The employees of the organisation have the ability to effectively adapt to work-related pressures.	Adopted from Al-Aloufi (2019)
Dimension Two: Structural Capital It includes all systems, laws, regulations, policies, procedures, organisational structures, and internal processes owned by the organisation, as well as the programmes and databases.		
1	The organisation's information systems enhance the efficiency and speed of task completion as needed.	Adopted from Al-Aloufi (2019)
2	The organisation is keen to continuously develop and update its information systems and databases.	Adopted from Abdelhadi (2017)

No	Item Statement	Item Source
3	The administrative processes within the organisation are sufficiently flexible to effectively achieve its objectives.	Adopted from Abdelhadi (2017)
4	The organisation is keen to continuously develop administrative processes to reduce errors in the work.	Adopted from Ben Haizia (2017)
5	The organisation continuously adapts and evolves its organisational structure in line with the changes in the competitive environment.	Adopted from Al-Aloufi (2019)
Dimension Three: Relational Capital It refers to the relationships maintained by the organisation with its customers, suppliers, partners, and even competing organisations.		
1	The organisation offers its permanent customers additional advantages to distinguish them from other customers.	Adopted from Hussini (2019)
2	The organisation grants its permanent customers additional advantages to distinguish them from other customers.	Adopted from Shaabna and Boujaâtat (2020)
3	The organisation periodically analyses the services offered by its competitors.	Adopted from Hussini (2019)
4	The organisation carefully considers the economic conditions of the community when delivering its services to beneficiaries.	Adopted from Abdelhadi (2017)
5	The organisation is keen to build distinguished relationships with external stakeholders closely related to its work.	Adopted from Hussini (2019)
Organisational Performance It refers to the integrated system of outcomes achieved by the Yemeni telecommunications sector, measured across the dimensions of the Balanced Scorecard: customer perspective, internal processes perspective, learning and growth perspective, and financial perspective. It is assessed within the context of its interaction with both internal and external environments.		
No	Item Statement	Item Source
Dimension One: Customer Perspective Through this dimension, the organisation focuses on meeting customer needs by enhancing service quality, reducing service delivery time, increasing customer satisfaction, and thus increasing market share.		
1	Information flows seamlessly between the organisation and its customers, ensuring effective communication.	Adapted from Kharboush (2019)
2	The organisation is keen to achieve customer satisfaction to retain them.	Adopted from Kharboush (2019)
3	The organisation implements an effective assessment and follow-up system to monitor and improve the services delivered to customers.	
4	The organisation prioritises the continuous improvement of service quality to meet customer expectations.	
5	The organisation seeks to minimise the rate of customer complaints.	Adapted from Al-Aloufi (2019)
Dimension Two: Learning and Growth Perspective Through this dimension, the organisation focuses on enhancing employee capabilities, developing their skills, and providing the necessary infrastructure to support their growth.		
1	The organisation encourages its employees to continually enhance their skills and abilities.	Adopted from Al-Maamari (2018)
2	The organisation offers grants to its employees to complete their postgraduate studies.	Authors Developed
3	The organisation offers a variety of training programmes designed to help employees enhance their performance levels.	Adopted from Al-Maamari (2018)
4	The organisation dedicates an annual budget for the training of its employees.	Adopted from Kharboush (2019)

No	Item Statement	Item Source
5	The organisation has an organisational climate that encourages new and creative practices.	Adopted from Ahmed (2019)
Dimension Three: Internal Processes Perspective Through this dimension, the organisation focuses on all critical internal activities and processes that are essential for meeting customer needs and achieving organisational objectives.		
1	The organisation utilises appropriate technology and equipment.	Adopted from Kharboush (2019)
2	The organisation is keen to utilise a variety of methods and approaches to efficiently complete tasks.	Adapted from Sharifa (2019)
3	Coordination among the various administrative units is aligned with the vision, mission, and objectives of the organisation.	Adopted from Barhama (2017)
4	The organisation is keen to deliver its services with high quality.	Adapted from Sharifa (2019)
5	The key processes within the organisation are clear.	Adopted from Abdelhadi (2017)
Dimension Four: Financial Perspective Through this dimension, the organisation focuses on managing the financial aspects of its organisational performance.		
1	The organisation establishes its financial objectives in advance to ensure clear targets are set.	Adopted from Sharifa (2019)
2	The organisation effectively utilises its available financial resources to enhance and develop its performance.	Adopted from Kharboush (2019)
3	Financial reports are regularly and consistently prepared to achieve effective financial performance.	
4	The organisation prioritises introducing new services to increase revenue.	
5	The organisation strives to minimise costs as much as possible without compromising quality.	