Entrepreneurship Journal for Finance and Business (EJFB)
2026, VOL. 07, NO. special (3), 156-169, E-ISSN: 2709-4251, P-ISSN: 2708-8790

The relationship between IT capabilities and innovation capabilities by mediating role of knowledge management

Hayder A. Abdul Raheem*
Department of investment management and business economics, college of business economics, Al-Nahrain university, Baghdad, Iraq

Article information:
Received: 22–06– 2026
Revised: 26–06– 2026
Accepted: 28–06– 2026
Published: 25–07– 2026

***Corresponding author:**
Hayder A. Abdul Raheem
Hayder.adil@nahrainuniv.edu.iq

This work is licensed under a Creative Commons Attribution 4.0 International License.

Abstract:

Despite the significant role of small & medium business unit in manufacturing industry in the national economic development, especially in the developing countries, manufacturing industry has suffered from many problems such as, competition development in international markets, rapid advancement of technology and change in consumers behavior, which manufacturing unit small & medium enterprise of Iraq is unable to follow them all. This study aims to examine the role of mediation knowledge management between the IT capabilities and innovation capabilities in earlier studies, which did not involve the study of this mediating role. The technique used for collecting the data of 384 manufacturing industry (SME) in Iraq is quantitative technique with the instrument questionnaire to check the data by the using of (PLS-SEM) Model The finding results indicated that knowledge management was a positive and statistically significant mediating variable between the IT capability and the innovative capacity. Finally, there was a positive statistically significant mediation between knowledge management skills and IT capacities. The impact of mediation between knowledge management capacities and innovation capacities was also being felt. A practical contribution is suggested by the investments that needs to be done in the field of information and communication technology (ICT) that would be used as a strategic axis to promote innovation for SME in Iraq. The model accounted for much of the variance in the two constructs, namely innovation capabilities and knowledge capacities study, explaining the mechanisms that enable SMEs to innovate in Iraq, according to the Resource Based View approach (RBV).

Keywords: IT capabilities, knowledge management, innovation capabilities, SMEs, Iraq.

1. Introductions

Small and medium enterprises are very important to national economies worldwide; their development is the main driver of economic growth and employment generation. These businesses are very strategic in Iraq as part of the diversifying the Iraqi economy and withdrawing from the oil revenues. SMEs represent the bulk of the country's commercial establishments that contribute a significant portion of the non-oil GDP according to the Iraqi Ministry of planning (Iraqi Ministry of Planning, 2021) and (Mannadhan, Szymański, Zurek-Mortka, 2024). However, Iraq's manufacturing industry suffers from a variety of structural and competitive problems, notably, lack of technology adoption, lack of members in the innovation ecosystem, lack of investment in research and development and financial and environment

conditions that hinders the development of the industry (Shamkhi, M. K., Ahmed, D. A., & Hameed, 2021) and (Mishaal, 2022). Worse yet, the process of regional economic integration and globalization is further accelerating, which places the enterprises under increasing competitive pressure and compels them to increase their operation efficiency and enhance their innovation capacity. Investing in IT capability becomes a necessity, not a luxury, in this context as opportunities for process improvements, and ultimately efficiency in the use of resources is vast. This is echoed by recent international evidence: in recent years digital transformation has been identified as a key area for promoting high quality development for SMEs in developing countries (Shao et al., 2025), and digital technologies are now broadly acknowledged as being essential to being competitive in globalization and innovation facing manufacturing SMEs (Garlatti Costa et al., 2025). As with most developing economies, the transition to digitalization is far from perfect and is also creating new opportunities for SMEs to access new markets and increase operational efficiency (Telukdarie, 2024; OECD, 2025). Learning management also becomes one of the principles of innovation by offering systematic structures for production, documentation, sharing and use of knowledge to support strategic decision-making processes. Based on this assumption, the goal of the current research is to examine how knowledge management affects the IT and innovation capacities of Iraqi manufacturing small and medium-sized businesses (SMEs).

2. Theoretical Foundations and Literature Review

2.1 An Overview of (SMEs) in Iraq

According to the World Bank, SMEs are businesses that have 10 to 300 employees and annual revenues of USD 15 million or less per year. As per the Iraqi definition, establishments with 10-99 workers are considered small enterprises while those with 100-499 workers are considered medium enterprises. According to figures, the private sector in Iraq employs almost 60% of the population and generates almost 45% of non-oil gross domestic product (GDP). Despite this economic significance, these businesses are facing a great number of challenges, such as financial and banking limitations, lack of technical and human resources, and paperwork and regulatory difficulties which may be provided by the Iraqi Ministry of Planning, 2021.

2.2 IT Capabilities

IT capabilities can be described as the ability to ensure the successful usage, development, and deployment of technology to accomplish certain targeted objectives and improve competitive performance within an organization (Bharadwaj 2000). These include three parts: IT Infrastructure, IT human capabilities and IT deployment capabilities. IT capabilities can be viewed as a strategically valuable resource according to the Resource Based View (Barney, 1991), because they are unique to a specific organization, hard to emulate, and are part and parcel of the social network of group activity within an organization's routines and processes. If IT resources are scarce, cannot be substituted readily by other resources, and can be used for a significant time, then they meet the VRIN criteria and can provide a long-term competitive advantage. In this theoretical perspective, IT infrastructure jacks up a stake while IT human competencies and digital organizational capabilities play a less tangible part, in which the social complexity makes them the most difficult ones to duplicate by the competitors. Studies have shown that developing nations including Iraq, have SMEs that lack proper investments in digital systems, thus impacting their competitiveness in the regional and international markets. Several studies have shown positive linkages between ICT use adoption and subsequent operational performance and innovation capabilities (Tippins & Sohi, 2003; Ravichandran & Lertwongsastien, 2005). It is supported by more recent evidence too: Wu et al. (2024) identified that the IT capability positively influences firm performance indirectly, and Marchiori et al. (2022) showed a mediated relationship between human factors, IT capability, innovativeness, and organizational performance.

2.3 Knowledge Management

The definition of knowledge management is the process of acquiring, documenting, sharing and using all the organizational knowledge to improve institutional efficiency (Davenport & Prusak, 1998). The processes involve four fundamental components: knowledge building, transformation, implementation and preservation. More recently these have been considered a multidimensional capability that covers the means of knowledge development, knowledge capture, knowledge sharing and knowledge use (Tamirat & Amentie, 2023; AL-Khatib et al., 2024). In the Resource-Based View, the knowledge management can best be described as a dynamic organizational capability, which can be continuously reconfigured in response to change in the environment and satisfy the "dynamic capability" requirement put forward by Teece et al. (1997). This dynamic quality is the answer to the "why" of the mediation role of knowledge management in IT capabilities to innovation, as it is also the organizational mechanism that transforms technological inputs into innovative outputs. The political and security disruptions in Iraq create a very particular challenge for knowledge management, as they have impacted both the education and training system in the country and the development and build-up of knowledge capital. However, the awareness of the importance of knowledge management is rising among Iraqi companies, particularly based on the governmental orientation towards establishing a diversified world of knowledge.

2.5 The Link between Knowledge Management, Innovation, and IT Capabilities

A positive and bi-directional connection between IT capabilities and knowledge management has been well documented in academic literature. Many studies have shown that successful introduction of advanced forms of information technologies supports the processes of creation, sharing and utilization of knowledge in the organization (Gold et al., 2001; Zack et al., 2009). Studies have shown that such knowledge management, consequently, increases innovation capabilities within an organization by speeding up the organizational learning process and the creation of innovative ideas (Nonaka & Takeuchi, 1995). Recent research continues this argument, as knowledge management capability can partially mediate the relationship between open innovation and innovation performance (Che et al., 2024), and knowledge factors' integration is a significant influence on innovation capability and business performance in the emerging economy among SMEs (Nguyen et al., 2025In this sense, the current research indicates that knowledge management plays a crucial role in mediating the process by which Iraqi SMEs transform their IT skills into innovative capabilities. The Resource Based View, which describes an organization's competitive advantage as the outcome of the efficient utilization of the organization's special resources and competences, serves as the foundation for the following hypothesis.

2.6 Research Gap

Despite the abundance of study on IT skills, there are several gaps in the literature concerning knowledge management and innovation capabilities. Of particular interest, two studies of models closely related to the one under investigation are seen by Al Teneiji, Ahamat, Murad, Raheem, (2022); Migdadi, Mahmoud Mohammad. (2022), but they used a different sample frame and a different perspective of knowledge management, which is narrower and less captures the four-dimensional structure of knowledge management that was used in the current study. Their work also predates the speeded-up uptake of digital adoption by SMEs in Iraq following the outbreak of pandemic (Khan et al., 2021) and will not capture the structural changes that have occurred due to Iraq's Vision 2030 initiative, nor due to the Organization for Economic Cooperation and Development (OECD) digitalization agenda for SMEs (2025). Further, it was not tested for common method bias, nor were Variance Accounted For (VAF) indices reported, nor was there any built-in checks of the robustness of the results in the case of Variance Accounted For (VAF), which are now standard requirements for PLS-SEM studies (Hair et al., 2017). The

present study, then, was characterized by a difference and an extension of previous research in three aspects. First, it uses an updated, wider measurement model based on the latest literature (years 2022-2025) which will provide a finer-grained evaluation of the respective contributions of constructs. Second, it offers a stringent test of partial versus full mediation performed by calculating VAF and bootstrapping confidence intervals, that enable gaining more precise insight into the mechanism connecting the IT capabilities to the innovation. Third, it incorporates full collinearity VIF procedure explicitly to deal with common method bias, thus enhancing the internal validity of the results. All these attributes make the present study significant theoretical and empirically with respect to previous studies, from the perspective of the manufacturing SMEs context in Iraq.

3. Conceptual Framework and Hypotheses

Having considered the above-mentioned literature, the following hypotheses are put forward:

H2: Knowledge management is at a positive level and statistically significant of IT capabilities among manufacturing SMEs in Iraq.

H2 knowledge management exerts a positive and statistically significant influence on innovation capabilities among manufacturing SMEs in Iraq.

H3: Innovation capacities of manufacturing SMEs in Iraq are positively and statistically significant influenced by the IT capacities.

H4: The association between IT capabilities and innovation capacity among Iraqi manufacturing SMEs is mediated by knowledge management.

The fourth hypothesis (H4) must have an explanation ability rather than description only. Although the constructs are related, it is explained how and why IT capabilities are related to innovative outcomes in H4: it suggests that whether the purported mechanism is knowledge management or not is tested, as it is assumed that the only bridging mechanism between technological investments and innovative outcomes is knowledge management. There are three reasons why it is important. From a theoretical perspective, it brings the study into the perspective of a process, going beyond the only input–output relation with technology to consider the “black box” between technology and innovation: such addition would be in line with the application of a resource-based view as presented by the other authors. Methodologically, the examination of the direct effect (H3) and the indirect effect (H4) provide insight into the full or partial mediation of the effect of IT, which helps to understand what portion of the effect of IT is mediated by KM. On the ground, if H4 is true, it means that while managers and policy makers value investing in IT, it alone is not enough, and that the payoffs of IT depend on the creation of processes for generating and using knowledge that technology generates. That is, H4 is the lever to maximize the value of IT investments and derive long-term innovation strength. The conceptual framework presented in the study is shown in figure 1 below which indicates that IT capabilities, as the independent variable, is mediated by knowledge management and ultimately leads to innovation as the dependent variable.

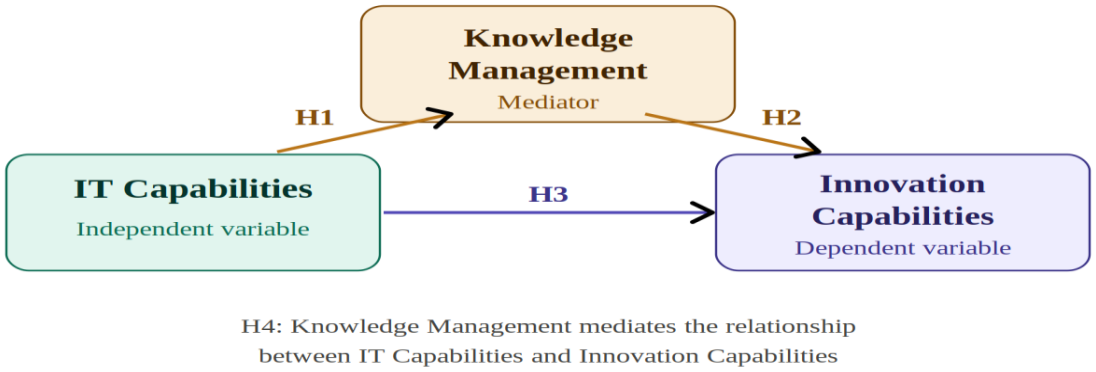


Figure 1: Study Conceptual Model

4. Methodology

4.1 Study Design, Population, and Sample

The study used the quantitative approach, which was suitable for testing the hypotheses and measuring relations between the variables and followed the modelling of the field survey method. The study population consists of manufacturing SMEs listed in the official data obtained in the year 2024 from the Federation of Iraqi Industries (FII) and the Iraqi Federation of Chambers of Commerce (IFCC) that are 2847 firms. The z value (384 firms) used for the appropriate sample size determined was from the Krejcie and Morgan (1970) formula. The design used was stratified random sampling to ensure balanced representation among the different governorates and among the industrial sectors such as food and beverage, textile and apparel, construction and building materials, plastic and metal products, printing and publishing and others. The questionnaire was circulated to the managers of the companies and to the IT officers from January 2025 to March 2025. A total of 384 questionnaires were sent out and 371 were returned giving a response rate of 96.6%. 15 questionnaires were discarded after data screening: 9 questionnaires were incomplete (for more than 10% of the respondents), 4 questionnaires yielded responses patterns signifying careless responding, and 2 questionnaires were excluded because of extreme outlier values on more than one construct. This gave 356 valid questionnaires (92.7% of all those sent out) that could be analysed.

4.2 Measurement Instrument

The questionnaire developed consisted of three main constructs: IT Capabilities, Knowledge Management, Innovation Capabilities. Its content was drawn from reliable valid instruments used in the previous research which were suitable for the Iraqi context as each item was measured by a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The IT capabilities built included 15 items across three subdimensions technological infrastructure (5 items), IT human competencies (5 items), and digital organizational capabilities (5 items) (Bharadwaj, 2000; Tippins & Sohi, 2003). The knowledge management construct consists of 16 knowledge generation (4 items), knowledge storage (4 items), knowledge sharing (4 items) and knowledge application (4 items) items (Gold et al., 2001; Tamirat & Amentie, 2023). A total of 12 items were built in these dimensions of innovation capabilities (product, process and organizational innovation) (Donate & Guadamillas, 2011; Nguyen et al., 2025).

4.3 Instrument Validity and Reliability

The questionnaire was first subjected to them to confirm its face and content validity by having it examined by a panel of seven academic and university experts/specialists and after making the required corrections based on their comments. A pilot study by using a sample of 30 firms, Cronbach's alpha reliability return was in a range of 0.78-0.91, which is larger than the commonly accepted minimum scale reliability of 0.70 (Hair et al., 2010). Furthermore, the findings of confirmatory factor analysis showed

that it had accepted construct validity, all the average variance extracted, also known as the values of AVE, for the variables have exceeded the limit of 0.50. As the data was gathered from one source at one time, CMB was considered by following the complete collinearity-VIF procedure suggested by Kock (2015). The common method variance does not have a significant threat to the validity of the results for the findings because all inner VIF values were less than 3.3, with maximum VIF value of 2.87. This test is favored over Harman's single factor test as this test can be used in PLS-SEM settings and allows for a stricter analysis of possible amount of bias. Specifically, the validity and reliability results for the three variables are as follows: For IT Capabilities, Cronbach's alpha = 0.863, Composite Reliability (CR) = 0.901, and AVE = 0.597, confirming strong internal consistency and convergent validity. For Knowledge Management, Cronbach's alpha = 0.897, CR = 0.923, and AVE = 0.641, indicating excellent reliability across all four sub-dimensions (knowledge generation, storage, sharing, and application). For Innovation Capabilities, Cronbach's alpha = 0.812, CR = 0.841, and AVE = 0.512, exceeding the minimum threshold of 0.50 for AVE and 0.70 for reliability. Discriminant validity was confirmed for all three constructs using both the Fornell-Larcker criterion and the HTMT ratio, with all HTMT values below the 0.85 threshold (Henseler et al., 2015).

4.4 Methods of Statistical Analysis

Partial least squares structural equation modeling (PLS-SEM) served as the principal statistical tool for data analysis, using Smart-PLS 3.0 software. This model offers advantages in handling non-normally distributed data and complex multivariate models, making it the most suitable for the nature of this study. The analysis was conducted in two successive stages following the methodology adopted by Hair et al. (2017): first, the assessment of the measurement model, and second, the assessment of the structural model.

5. Results

5.1 Sample Characteristics

Of the 384 questionnaires sent, 356 were returned, yielding a 92.7% response rate. No demographic data is missing from all the participants in this study as is shown in Table 1. 25.6% of the respondents in the sample were females and 74.4% were males. 18.5% of respondents were between the ages of 25 and 34, 39.3% were between the ages of 35 and 44, 31.7% were between the ages of 45 and 54, and 10.5% were 55 or older. Regarding education, 12.6% had a diploma or less, 52.8% had a bachelor's degree, 28.9% had a master's degree, and 5.7% had a PhD. This ranged from 0 to 30 years: 32.6% had five to ten years exposure, 36.8% from eleven to twenty years, 16.3% more than 20 years and 14.3% less than five years. The small businesses (10-49 employees) comprised 61.2% of the study while the medium size businesses (50-299 employees) grasped 38.8% of the sample companies. The respondents' geographic distribution is as follows: Basra (18.3%), Baghdad (38.5%), Mosul (12.6%), Erbil (10.4%), and other governorates (20.2%). Food and beverage Industry ranked No. 1, representing 32.6% of all sectors, while the Construction and building materials sector occupied No. 2 with 24.2%, the Textiles and clothing segment ranked at No. 3 for 19.4%, the plastics and metals production sector ranked No. 4 at 15.7%, and the Printing and publishing sector took the No. 5 position with 8.1%.

Table 1: Respondents' Demographic Characteristics (n = 356)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	265	74.4%
	Female	91	25.6%

Age Group	25 to 34 years	66	18.5%
	35 to 44 years	140	39.3%
	45 to 54 years	113	31.7%
	From 55 years and more	37	10.5%
Education	A diploma or less	45	12.6%
	Undergraduate degree	188	52.8%
	A master's degree	103	28.9%
	Doctorate	20	5.7%
Work Experience	Five years or less	51	14.3%
	5 to 10 years	116	32.6%
	11 to 20 years	131	36.8%
	20 years or more	58	16.3%
Firm Size	Small (10–49 employees)	218	61.2%
	Medium (50–299 employees)	138	38.8%
Geographic Region	Baghdad	137	38.5%
	Basra	65	18.3%
	Mosul	45	12.6%
	Erbil	37	10.4%
	Other governorates	72	20.2%
Industrial Sector	Food & Beverage	116	32.6%
	Construction & Building Materials	86	24.2%
	Textiles & Apparel	69	19.4%
	Plastics & Metals	56	15.7%
	Printing & Publishing	29	8.1%

5.2 Assessment of the Measurement Framework

The validity and reliability of the measurement model supported at satisfactory level. The factor loadings were also all greater than 0.70, indicating convergent validity. Cronbach's alpha and the composite reliability values (0.812–0.897, 0.841–0.923 respectively) were all above the recommended level and the AVE values (0.512–0.641) far exceeded the 0.50 mark. The notions of the Fornell-Larcker criterion (0.681–0.724), which is lower than the threshold 0.85, and the HTMT ratio also supported the discriminant validity. Overall, the fitness of the model was satisfactory, with a SRMR = 0.062.

Table 2: Results of the Measurement Model Assessment

Construct	Cronbach's α	CR	AVE	√AVE	HTMT (IT)	HTMT (KM)	HTMT (IC)
IT Capabilities (IT)	0.863	0.901	0.597	0.773	—	0.724	0.681
Knowledge Management (KM)	0.897	0.923	0.641	0.800	0.724	—	0.713
Innovation Capabilities (IC)	0.812	0.841	0.512	0.715	0.681	0.713	—
Threshold (min)	≥ 0.70	≥ 0.70	≥ 0.50	—	< 0.85	< 0.85	< 0.85

5.3 Structural Model Evaluation and Hypothesis Testing

The pathways were subjected to structural analysis by Bootstrapping with 5000 subsamples for checking the significance of the paths. The following table shows the main findings of the hypothesis testing:

Table 3: Results Testing of the Hypothesis

Hypothesis	Path	Path Coeff. (β)	t-value	p-value	Decision
H1	IT → KM	0.612	11.24	0.000	Accepted
H2	KM → IC	0.538	9.87	0.000	Accepted
H3	IT → IC (direct)	0.284	4.53	0.000	Accepted
H4	IT → KM → IC (mediation)	0.329	8.16	0.000	Accepted

The analysis in this study was conducted using SmartPLS 3.0 software for PLS-SEM, as PLS-SEM is more suitable for the non-normal data distribution and the complex model structure adopted in this study (Hair et al., 2017). The complete output tables generated by SmartPLS, including path coefficients, bootstrapping results, and model fit indices, are included in Appendix A at the end of this research for reference and verification purposes. For Knowledge Management, IT capabilities were found with positive and significant impact ($\beta = 0.612$, $t = 11.24$, $p < 0.001$) as shown in the results of Table 4 supporting the first hypothesis. Knowledge Management has also a positive and significant impact on Innovation Capabilities ($\beta = 0.538$, $t = 9.87$, $p < 0.001$) supporting the second hypothesis. The findings of the direct-effect test indicate that the third hypothesis is supported since IT capabilities have a positive direct effect on innovation capabilities ($\beta = 0.284$, $t = 4.53$ and $p < 0.001$). For the fourth hypothesis about the mediating effect of knowledge management, it was fully statistically supported, as indicated by the indirect effect of ($\beta = 0.329$, $t = 8.16$, $p < 0.001$), and the 95% bias-corrected bootstrapped Confidence interval for the indirect effect (CI = [0.261, 0.401] CI does not contain zero), thus indicating the mediation. The overall impact of IT capabilities on innovation capabilities is 0.613 (0.284 + 0.329). The Variance Accounted For (VAF = indirect effect / total effect = 0.329 / 0.613) of the relationship amounts to 53.7% which is within the range accepted index of partial mediation (Hair et al., 2017). Specifically, the

direct effect and the indirect effect are both positive and statistically significant, meaning it is complementary partial mediation: Knowledge Management has an independent direct influence on Innovation, and Knowledge Management partially mediates the influence of IT capabilities on Innovation. Theoretically, this finding is significant because it indicates that the role of knowledge management as a pathway affecting innovation will have a more significant influence than will a direct impact on innovation from sources that do not involve knowledge management.

5.4 Model Fit Indices

Goodness-of-fit indices of the model were acceptable. The coefficient of determination (R^2) value obtained was 0.374 for KM and 0.521 for Innovation capabilities, representing 37 and 52.1% variance-based explanations respectively of the model. Stone–Geisser's predictive relevance (Q^2) based on an omission distance of 7 values obtained were 0.248 for knowledge management and 0.371 for innovation capabilities both values were greater than 0 that is it has adequate predictive relevance for both endogenous constructs (Hair et al., 2017). The effect size (f^2) values were as follows: IT → KM: $f^2 = 0.326$ (large effect); KM → IC: $f^2 = 0.219$ (medium-to-large effect); IT → IC (direct): $f^2 = 0.071$ (small effect). The results confirm that knowledge management has a significant impact on the business value of IT capabilities for innovation, which goes far beyond the direct path. Inner model VIF values were between 1.342 and 2.087, which did not exceed the limit of 5.0, and thus no multicollinearity problems were observed in the structural model. The goodness of the model fit is reinforced in the SRMR where average values are in a welcome range of values below 0.08, and the value for this part of the model is 0.062.

Table 5: Structural Model Fit Indices

Index	IT Capabilities	Knowledge Management	Innovation Capabilities
R^2 (Explained Variance)	—	0.374	0.521
Q^2 (Predictive Relevance)	—	0.248	0.371
f^2 (Effect Size)	—	IT→KM: 0.326 (Large)	KM→IC: 0.219 (Medium-Large); IT→IC: 0.071 (Small)
Inner VIF (max)	—	1.342	2.087
SRMR (Model Fit)	0.062 (overall)		Threshold: < 0.08
CMB – Full VIF (max)	2.87		Threshold: < 3.3

Figure 2 illustrates the tested structural model with every endogenous and exogenous construct and its sub-dimensions (measurement paths), the standardized path coefficients (β) for the hypothesized structural relationships, the explained variance (R^2) of the endogenous constructs, and the significance levels.

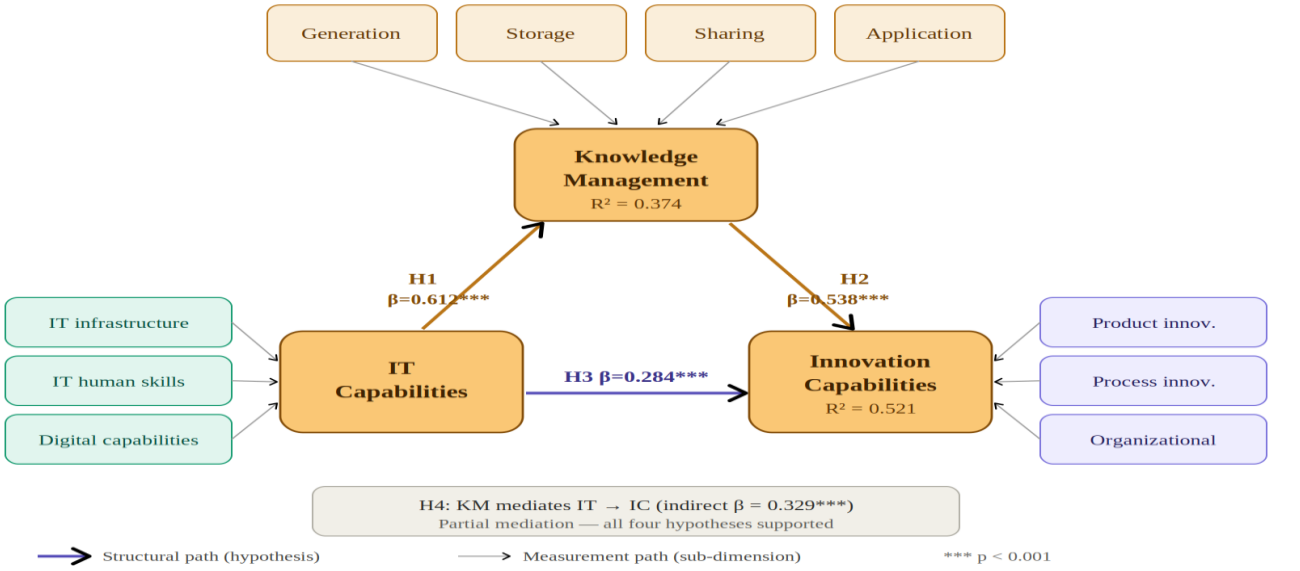


Figure 2: Tested Structural Model with Sub-dimensions, Path Coefficients, and Hypotheses

6. Discussion

The results obtained in this research work are considered according to each of the following hypotheses, and according to the theoretical review as follows, taking into consideration the issues of convergence, divergence and the context in the Iraqi context. The strong positive effect of IT capabilities on knowledge management is in line with the findings of Tanriverdi (2005) and Zack et al. (2009) that investment in IT assets positively contributes to their organizational capability on knowledge generation, storage and sharing. In addition, it is consistent with the results of Wu et al., (2024) that indicated IT capability influences KM as one of the intermediaries in the performance chain.

The path coefficient found in the Iraqi context (0.612) is particularly high: it is higher than a similar figure seen in more digitalized economies as reported in the studies, indicating that in less developed economies with formalized knowledge-sharing infrastructures that are typically found in the Iraq context, IT systems play a proportionately larger role as the primary means to promote knowledge sharing activities. This is in line with Resource Based View theory, which states that the value of IT resources is significantly greater, particularly when alternatives are limited in the organization. The positive and significant relationship of KM with innovative capability is consistent with the study of Donate and Guadamillas (2011) which revealed that firms with effective KM systems have significantly higher innovative performance. Likewise, Nguyen et al. (2025) showed that integrated knowledge factors positively influence SME's e-commerce innovation in emerging economies, while Che et al. (2024) asserted that knowledge management capability is the mediator between open innovation and innovation performance. It has further significance in the context of Iraq.

The problem is that the manufacturing SMEs (M-SMEs) in Iraq lack formal R&D departments and depend largely on elements of tacit and experiential knowledge and information gained by experience over time. These companies can make the most of their informal competitive assets by investing in knowledge management systems that formalize their capture and sharing of tacit knowledge. Policymakers will find this an important lesson as it implies that they could achieve innovation dividends with lower levels of R&D spending by intervening with measures focused on the knowledge management formalization. H3 & H4 (Mediation, VAF = 53.7%): This provides theory to the existing

literature on complementary partial mediation. Unlike Al Iraqi et al. (2022) who only identified a mediating role for KM in an Iraqi sample, the present study explores the relationship between direct and indirect mediation of IT → IC by visually quantifying the mediating role through VAF analysis and demonstrating the meaningful of the direct path (β = 0.284) even though the mediating path (β = 0.329) is there.

Unlike Zia et al. (2024), who found near-complete mediation of knowledge management in a Pakistani sample, it may be that in more nascent IT scenarios like Iraq, IT or information capabilities can directly influence innovation via operational efficiencies and/or by providing access to external information sources outside of formal KM systems. The Gold et al. (2001) framework is still the most appropriate theoretical underpinning in these respects – the ability to innovate is based on appropriate technology use in producing and using knowledge, and the residual direct effect implies that the capacity for innovation is also a function of technology-empowering properties that are not exclusively dependent on knowledge management processes. This is an important discovery in the context of Iraq, as it does in other contexts. Iraqi business environment is characterized by a high degree of uncertainty, a weak formal knowledge economy and dispersion of human competencies, making the creation of a formal knowledge management system a twofold challenge, and a strategic gain. Therefore, companies having managed to establish KM and incorporate it into their technological structure will have a competitive edge in the competitive Iraqi market for the time being.

7. Conclusions and Recommendations

7.1 Conclusions

The paper provides a solid academic and entrepreneurial contribution to the field of exploring innovation dynamics in manufacturing SMEs in Iraq. It has proven empirically that: (a) IT positively influences KM; (b) KM positively influences the Innovation capabilities; and (c) IT indirectly influences Innovation capabilities via mediation by KM. In support of the hypothesized model based on the Resource-Based View (RBV), these results reiterate the importance and relevance of the relationship between the IT capabilities and the Knowledge Management as a strategic resource, which can deliver innovative performance, and is rare and difficult to imitate.

7.2 Recommendations

Based on these results, the following recommendations are made:

First, at the firm level: Iraqi SMEs need to incorporate the development of capability in IT as one of the priorities in their strategic plans and at the same time make sure of developing formal knowledge management systems that incorporate digital technology tools. The indirect IT → KM → IC path ($f^2 = 0.219$) is significantly stronger than the direct path of IT investment directly to IC ($f^2 = 0.071$); therefore, when considering how to leverage IT projects for formalization efforts, companies should focus more on the deliberate formalization of KM activities and resources. Strategic IT audit results should be used to help inform budget setting; not clear percentage targets set in isolation. Second at the governmental level: The Ministry of Industry and Minerals and the National Investment Commission are proposed to create support programs aimed at the modernization of the technological infrastructure of the SME sector such as facilitating access to finance, setting up sector-specific training programmers and providing tax incentives to invest in technology and innovation. Thirdly, at the research level: Longitudinal designs should be supplemented by future studies to further examine the researched relations over time; other mediating and moderating factors worthy of examination should also be tested, including organizational learning, transformational leadership, and social capital.

8. Limitations of the Study

When interpreting and generalizing the results, several limitations should be considered: (a) the study was restricted to the manufacturing

sector and excluded other economic sectors; (b) compared to longitudinal designs, the cross-sectional design limits the ability to establish causal relationships; (c) self-reported responses may be subject to subjective perception bias; and (d) data collection revealed a significant concentration in major provinces, which may underrepresent firms in less urbanized provinces. Therefore, care should be used when extrapolating the findings outside of this setting.

Data Availability:

The data used to support the results of this study has been included in the article.

Conflict of Interest:

The authors declare that they have no conflicts of interest.

Funding Sources:

No financial support was received.

Acknowledgments:

None.

References:

1. Al Teneiji, T. M., Ahamat, A., Murad, M. A., & Raheem, H. A. A. (2022). The Mediating Role of Knowledge Management in the Relationship between IT Capabilities and Innovation Capabilities. *Specialusis Ugdymas*, *1*(43), 43. https://doi.org/10.15823/su.2022.43.212.
2. AL-Khatib, A. W., Al-Fawaeer, M. A., & Alajlouni, M. I. (2024). Knowledge management systems and the digital transformation of SMEs: an integrative perspective. Journal of Knowledge Management, 28(4), 1021–1044. https://doi.org/10.1108/JKM-04-2023-0382.
3. Barney, J. B. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99–120. https://doi.org/10.1177/014920639101700108.
4. Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: an empirical investigation. MIS Quarterly, 24(1), 169–196. https://doi.org/10.2307/3250983.
5. Che, T., Wu, Z., & Zhang, Y. (2024). The mediating role of knowledge management capability in the relationship between open innovation and innovation performance. Journal of Infrastructure, Policy and Development, 8(5), 3887. https://doi.org/10.24294/jipd.v8i5.3887.
6. Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly, 35(1), 128–152. https://doi.org/10.2307/2393553.
7. Costa, A. C. F., Capelo Neto, F., Espuny, M., da Rocha, A. B. T., & Oliveira, O. J. de. (2024). Digitalization of customer service in small and medium-sized enterprises: drivers for the development and improvement. International Journal of Entrepreneurial Behavior & Research, 30(2/3), 305–341.
8. Davenport, T. H., & Prusak, L. (1998). Working knowledge: How organizations manage what they know. Harvard Business Press.
9. Dinh, V. H., Nguyen, T. H., Han, V. T., Phan, N. T. P., & Duong, T. T. T. (2025). Digital capabilities and sustainable competitive advantages: the case of emerging market manufacturing SMEs. SAGE Open, 15(1).
10. Donate, M. J., & Guadamillas, F. (2011). Organizational factors to support knowledge management and innovation. Journal of Knowledge Management, 15(6), 890–914. https://doi.org/10.1108/13673271111179271.
11. Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39–50. https://doi.org/10.1177/002224378101800104.
12. García-Pérez, A., Pérez-Calero, L., & Villanueva-Flores, M. (2025). Innovation, green management and SME performance: evidence from Latin American

manufacturing firms. Journal of Economics, Finance and Administrative Science.

13. Garlatti Costa, A., Bertoni, V., & Bordin, L. (2025). How digital technologies enhance competitiveness in manufacturing SMEs. Journal of Innovation and Entrepreneurship, 14, 76. https://doi.org/10.1186/s13731-025-00457-8.

14. Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. Journal of Management Information Systems, 18(1), 185–214. https://doi.org/10.1080/07421222.2001.11045669.

15. Hair, J. F., Ringle, C. M., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM) (2nd ed.). SAGE Publications.

16. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8.

17. Iraqi Ministry of Planning. (2021). Annual Report on Small and Medium Enterprises in Iraq. Baghdad: Directorate of Economic Statistics.

18. Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. International Journal of e-Collaboration, 11(4), 1–10. https://doi.org/10.4018/ijec.2015100101.

19. Mishaal, M. F., & Haw, H. F. (2022). Barriers in adopting technological innovation, organizational capacity, and business environment into Iraq SMEs: A preliminary study. *Research Progress in Mechanical and Manufacturing Engineering*, 3(1), 1032–1040.

20. Mannadhan, P., Szymański, J. R., Zurek-Mortka, M., & Sathiyanarayanan, M. (2024). A Novel Framework for the Iraqi Manufacturing Industry Towards the Adoption of Industry 4.0. *Sustainability*, *16*(20), 9045. https://doi.org/10.3390/su16209045.

21. Migdadi, Mahmoud Mohammad. (2022). Knowledge management processes, innovation capability and organizational performance. International journal of productivity and performance management, *71*(1), 182-210. https://doi.org/10.1108/IJPPM-04-2020-0154.

22. Marchiori, D. M., Rodrigues, R. G., Popadiuk, S., & Mainardes, E. W. (2022). The relationship between human capital, information technology capability, innovativeness and organizational performance: an integrated approach. Technological Forecasting and Social Change, 177, 121526. https://doi.org/10.1016/j.techfore.2022.121526. https://doi.org/10.1016/j.techfore.2022.121526.

23. Nasir, M., Alamsjah, F., et al. (2024). Systematic literature review: the role of innovation and competitive advantage of micro, small and medium enterprises as mediation variables. International Journal of Business and Management.

24. Nguyen, T. H., Tran, V. D., & Le, M. H. (2025). The role of knowledge management and knowledge capabilities in driving innovation and business performance in e-commerce SMEs. Electronic Journal of Knowledge Management, 23(2), 110–129. https://doi.org/10.34190/ejkm.23.2.3312.

25. Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. Oxford University Press.

26. OECD. (2025). SME digitalisation for competitiveness: 2025 OECD D4SME survey. OECD Publishing, Paris.

27. Ravichandran, T., & Lertwongsatien, C. (2005). Effect of information systems resources and capabilities on firm performance: A resource-based perspective. Journal of Management Information Systems, 21(4), 237–276. https://doi.org/10.1080/07421222.2005.11045820.

28. Shamkhi, M. K., Ahmed, D. A., & Hameed,

O. (2021). The effectiveness of the manufacturing industry in Iraq. *ScienceDirect*. https://doi.org/10.1016/j.matpr.2021.09.087

29. Shao, Q., Jiang, C., Liou, J., Su, P., Yuan, Y., & Dan, Z. (2025). Exploring the influencing factors of digital transformation: empirical results from SMEs in China. Managerial and Decision Economics, 46, 2364–2380. https://doi.org/10.1002/mde.4399.

30. Singh, R., & Shethia, K. (2023). Effect of knowledge management practices on organizational and financial performance: a study on MSMEs in India. Russian Law Journal, 11(5), 2797–2810.

31. Sustainability. (2024). Navigating digital challenges for SMEs: a two-tier approach to risks mitigation and sustainability. Sustainability, 16(14), 5857. https://doi.org/10.3390/su16145857.

32. Telukdarie, A., Dube, T., Munsamy, M., Murulane, K., & Mongwe, R. (2024). Navigating digital challenges for SMEs: a two-tier approach to risks mitigation and sustainability. *Sustainability*, *16*(14), 5857.

33. Tamirat, A., & Amentie, C. (2023). Knowledge management capability dimensions and innovation: evidence from manufacturing firms in a developing economy. International Journal of Knowledge Management Studies, 14(3), 245–268. https://doi.org/10.1504/IJKMS.2023.131563.

34. Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multibusiness firms. MIS Quarterly, 29(2), 311–334. https://doi.org/10.2307/25148681.

35. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. Strategic Management Journal, 18(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266.

36. Tippins, M. J., & Sohi, R. S. (2003). IT competency and firm performance: is organizational learning a missing link? Strategic Management Journal, 24(8), 745–761. https://doi.org/10.1002/smj.337.

37. Wu, J., Li, X., & Surangkana, S. (2024). Mediation effect of knowledge management on the impact of IT capability on firm performance: exploring the moderating role of organizational culture. Frontiers in Psychology, 15, https://doi.org/10.3389/fpsyg.2024.1344330.

38. Zack, M., McKeen, J., & Singh, S. (2009). Knowledge management and organizational performance: an exploratory analysis. Journal of Knowledge Management, 13(6), 392–409. https://doi.org/10.1108/13673270910997088.

39. Zia, U., Zhang, J., & Alam, S. (2024). Role of tacit knowledge management process and innovation capability for stimulating organizational performance: empirical analysis, PLS-SEM approach. Kybernetes, 53(11), 4976–5000. https://doi.org/10.1108/K-09-2022-1291.

40. Zia, U., Zhang, J., & Alam, S. (2024). Role of tacit knowledge management process and innovation capability for stimulating organizational performance: empirical analysis, PLS-SEM approach. Kybernetes, 53(11), 4976–5000.