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COGNITIVE CAPITAL AND DIGITAL TRANSFORMATION: AN EMPIRICAL INVESTIGATION IN MOROCCAN SMES

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ABSTRACT

This paper on Moroccan MSMEs makes an in-depth examination of CC for its impact and enabling of the digital transformation journeys. The rapidly changing environment of technological innovation and disruption that many firms face presents a complicated and dual challenge; while there are also the increased pressures and demands that will be encountered with this digitalization, organizations cannot escape the adaptation to forces which may collaterally constrain them through pre-existing inherited structures, routines or ways in which they have been performing their operations traditionally. Consequently, the current analysis investigates whether a range of internal cognitive and organizational mechanisms (e.g. knowledge sharing, collective learning, organizational adaptability, and proactive orientations toward change) are indeed statistically linked to higher levels of digital maturity (and hence also sophistication), and consequently can be said to induce such improvement in performance.

A sound mixed-method research design was deliberately staunchly embraced to provide answers to the above research objectives. Quantitative data were carefully collected from the diverse sample of 150 Moroccan SMEs from different industries and sectors, ensuring a broad and representative dataset. In concert with this, qualitative data were collected through semi-structured in-depth interviews with managerial profiles who play a crucial role in and are accountable for leading their organizations digital transformation. These interviews yielded rich contextual and often subtle insights into the processes. Quantitative analyses were conducted in the statistical software package SPSS (version 28.0) to conduct robust statistical testing and confirmation of hypothesized relationships using these data.

The empirical results tangibly demonstrate the positive and statistically significant connection between overall intelligence of firms quantified as cognitive capital and level of digital maturity achieved by these firms. In particular, organizations are more likely to implement and realize benefits from complex digital solutions such as enterprise resource planning (ERP), customer relationship management (CRM), integration of different business applications in the cloud or on-premise if they display heavier, deeper learning-related organizational capabilities and more intensified knowledge exchange activities. These results provide strong evidence that the extent to which smaller firms in Morocco successfully undertake their digital transformation is not solely dependent on investing in those new technologies, but rather it is highly reliant on an organizational environment conducive for continuous learning, coordination and ability to change effectively.

This study is an important contribution to the literature based on objective preference linkage between cognitive capital mechanisms and digital maturity, especially establishing this link in the concentration of an emerging-economy setting. It also emphasizes the enduring role of knowledge management as a core

organizational logic, both in enabling continual transformation and ensuring firm viability and sustainability in dynamic but often unstable environmental contexts.

Keywords: *Cognitive Capital, Digital Transformation, Knowledge Management, Organizational Learning, Moroccan SMEs.*

1. INTRODUCTION

The Moroccan economy is largely composed of small and medium-sized enterprises (SMEs), which represent a dominant share of the national economic fabric and play a central role in employment generation [6]. In the context of a disruptive digital revolution, these firms are increasingly required to rethink organizational hierarchies, managerial practices, and operational tools. However, digitalization cannot be reduced to technological convergence alone; it also entails deeper transformations in human resource management, organizational design, and managerial coordination [17, 5].

Within this perspective, cognitive capital—understood as the shared individual and collective capacity to learn, adapt, and disseminate knowledge—constitutes a strategic intangible asset for both innovation and organizational change [3]. It shapes how firms develop new practices, upskill their workforce, and align strategic objectives with digital tools. This issue is particularly salient for SMEs. Compared to large firms, SMEs typically have fewer resources to formalize processes or rely on external expertise, which makes them more exposed to fragmented knowledge, weak internal coordination, and capability gaps during digital change [4].

In Morocco, digital transformation has been supported by national strategies such as Maroc Digital 2030 [9], while policy discussions also emphasize SME-specific barriers and enablers in the region [12]. Yet, digital uptake remains uneven, with certain segments especially SMEs located outside major urban areas still lagging in adoption and effective use of digital technologies [5]. These patterns suggest that infrastructure and access, while necessary, are not sufficient. Internal readiness to change supported by learning culture, leadership behaviors, and cognitive agility appears to be a decisive condition for the success and sustainability of digital initiatives [10].

Against this background, the present study examines how Moroccan SMEs mobilize cognitive capital to cope with the challenges of digital transformation. It investigates internal cognitive and organizational mechanisms that influence digital integration and empirically tests the roles of learning capacity, knowledge sharing, and innovation-oriented mindsets in explaining differences in firms' digital maturity.

Given the strategic importance of SMEs within Morocco's economic structure and the heterogeneity of digital uptake across regions and sectors, there is an urgent need to address the cognitive dimension of transformation. While previous research has often focused on technological readiness, this study positions cognitive capital as a driver of sustainable digital change. By providing empirical evidence on the relationships between knowledge sharing, learning culture, and digital maturity, the study offers actionable implications for managers and policymakers seeking to narrow the digital divide and strengthen inclusive digital transformation [12, 1].

Finally, the study contributes by producing statistically reliable evidence that can be interpreted alongside contextualized managerial insights, thereby enriching both academic understanding and practical decision-making on digital transformation in emerging-economy settings [1].

2. LITERATURE REVIEW

Globally, Small-to-Medium-sized Enterprises (SMEs) are expected to grow, and digital transformation has become a major driver of this growth and of long-term business survival. Based on the literature review [17], digital transformation involves technological, organizational, human, and economic changes. Within this broad process,

cognitive resources are pivotal to the success of digital transformation initiatives [2], [3].

A central stream of research emphasizes the influence of organizational learning on digital readiness. Several studies show that organizations with a strong learning mindset tend to integrate new digital technologies more effectively [4]. Such firms typically invest in the development of learning organizations, support knowledge circulation, and prioritize staff education—factors that contribute positively to innovation and performance [5]. In the Moroccan context, this dimension is particularly relevant, as a significant proportion of SMEs face scattered knowledge management systems and rely on informal learning behaviors [6].

The literature also indicates that cognitive capital has a direct impact on the digital maturity of SMEs. Firms characterized by strong internal cognitive dynamics appear better able to cope with technological disruption and uncertainty [7], including openness to change, problem-solving capacity, and collaborative attitudes. Complementary evidence suggests that establishing routines for knowledge sharing and strengthening employee enablement increases the likelihood of successful implementation of enterprise systems such as ERP and CRM, particularly in small businesses [8].

In addition, another research line highlights the role of leadership in developing cognitive capabilities. Dialogue-oriented, reflective, and experimental leadership has been associated with a higher degree of alignment between business strategy and digital initiatives [9]. This relationship is particularly important for SMEs, where leadership often exerts a direct influence on innovation behavior and learning practices [10].

In Morocco, several national reports address the digital divide experienced by SMEs, especially those located in rural and provincial areas. Nevertheless, recent evidence indicates that organizations nurturing cognitive capital—through workplace training, digital skills awareness campaigns, and knowledge management systems—are more capable of absorbing and responding to digital challenges [12]. Taken together, these results emphasize the importance of non-technological enablers in digital transformation and the need for both policy and managerial interventions [5]. Theoretically and practically, knowledge-based (cognitive) capital has been identified as a crucial determinant of successful digital transformation that is organic, sustainable, and inclusive. In dynamic environments, cognitive capital goes beyond facilitating technological innovation: it shapes organizational performance by strengthening the capacity to change, learn, and innovate, thereby enabling firms to remain competitive.

More broadly, digital transformation is fundamental for SME development and sustainable growth. As the literature indicates, it encompasses technological, organizational, human, and economic changes, and cognitive resources remain decisive in shaping the outcomes of digital transformation efforts [4], [17]. At the same time, recent studies stress the importance of interpreting digital transformation within its wider socio-economic context. In emerging markets, structural constraints—such as limited access to finance, heterogeneous managerial skills, and disparities in digital infrastructure—may moderate or constrain the influence of cognitive capital on digital initiative outcomes [3]. Therefore, interventions must be designed in a way that reflects the realities of firms within their local institutional and social environments. In the case of Moroccan SMEs, this study challenges homogeneous and generic models in favor of a localized approach that integrates regional differences, cultural specificities, institutional arrangements, and the policy environment [8].

In this context, the present manuscript seeks to contribute by providing empirical evidence on the nature and dimensionality of cognitive resources—specifically cooperative knowledge sharing, learning culture, and adaptability—that support digital transformation across a heterogeneous sample of Moroccan SMEs. This approach helps clarify the non-technological determinants of digital maturity and has practical implications for both practitioners and public policy aiming to narrow the digital divide. This mode of inquiry not only

addresses an important empirical gap, but also enables more nuanced recommendations to strengthen organizational cognitive readiness and digital competitiveness [7].

Hypotheses

Based on the literature review and the research gap identified, the following hypotheses are proposed:

H1: There is a positive and significant relationship between the Knowledge Sharing Index (KSI) of Moroccan SMEs and their Digital Maturity Index (DMI). Prior research suggests that effective knowledge-sharing systems are significant predictors of the adoption and integration of digital tools, particularly in resource-constrained firms [7], [8].

H2: The Learning Culture Score (LCS) has a positive and significant influence on the Digital Maturity Index (DMI) of Moroccan SMEs. Existing evidence indicates that promoting a learning culture—through continuous training, openness to new practices, and flexibility—supports digital readiness and performance [4], [5], [9].

H3: There is a significant interaction effect of knowledge sharing and learning culture on Moroccan SMEs' digital maturity. This complementarity is consistent with cognitive capital theory emphasizing the joint role of information flows and organizational learning in sustainable digital transformation and broader socio-economic development [2], [3], [12].

Integrating these insights, the literature provides consistent arguments that cognitive capital is a key determinant of sustainable digital transformation in resource-constrained settings such as Moroccan SMEs. Its impact is not limited to technology diffusion; it also contributes to stronger innovation capacity, improved strategic alignment, and enhanced organizational resilience. However, the limited availability of empirical evidence in this area reinforces the need to address this gap. Accordingly, the present research contributes by empirically testing how specific dimensions of cognitive capital—namely knowledge sharing and learning culture—shape digital maturity, thereby providing a structured foundation for the hypotheses advanced above.

3. MATERIALS AND METHODS

To meet the research objectives, a methodological framework was developed to ensure coherence between the measured variables and the contextual elements underpinning the relationship between cognitive capital and digital transformation in Moroccan SMEs. This section presents the research design, the sampling strategy used to obtain a representative sample, the data collection procedures, and the analytical techniques applied. Combining quantitative rigor with qualitative depth provides an appropriate basis for examining how organizational learning, knowledge sharing, and adaptability relate to digital maturity.

3.1. Research Design

The study followed a three-stage design. First, a review of the relevant literature was conducted to develop a conceptual framework and specify the constructs and hypotheses. Second, fieldwork was carried out through an online survey designed to capture learning-oriented practices, knowledge-sharing mechanisms, and digital maturity, complemented by semi-structured interviews to provide contextual insights. Third, the collected data were analyzed using descriptive and inferential statistics in SPSS to examine correlations and test the proposed hypotheses (Figure 1).

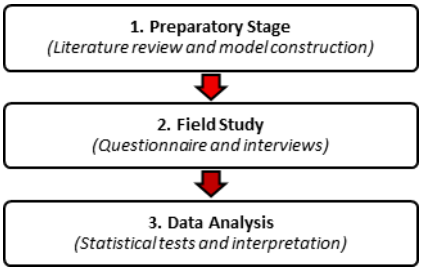

Figure 1. Research design

3.2. Sampling

The target population consisted of Moroccan SMEs operating across the national territory. A stratified sampling strategy was used to ensure representation in terms of firm size, sector of activity, and geographical coverage. In total, 150 SMEs were recruited from Casablanca–Settat,

Rabat–Sale–Kenitra, Marrakech–Safi, and Tangier–Tétouan–Al Hoceïma. Selection criteria included firm size (10–250 employees), legal form, and active involvement in digitalization projects or digital training initiatives.

Survey responses were provided by general managers, HR directors, and digital project coordinators, as these roles typically combine visibility over organizational practices with responsibility for digital initiatives.

3.3. Methods

This study adopted a mixed-method approach to examine the relationship between cognitive capital and digital maturity in Moroccan SMEs. The methodological choice reflects the need to combine (i) quantitative measurement and hypothesis testing with (ii) qualitative insights that help interpret how learning- and knowledge-related routines operate in practice. This design is suitable for investigating organizational constructs that are partly intangible, yet observable through structured indicators and managerial accounts.

3.3.1. Quantitative component

Quantitative data were collected using a structured questionnaire based on a five-point Likert scale, covering the main research variables related to cognitive capital (including organizational learning and knowledge-related practices) and digital maturity. The survey instrument was designed to capture variations in practices and perceptions among SME decision-makers in a standardized manner.

A pilot test was conducted with 15 SMEs to assess clarity and coherence of the questionnaire items. Internal consistency was evaluated using Cronbach's alpha, which yielded $\alpha = 0.83$, indicating strong reliability of the measurement scales. Quantitative analyses were performed using SPSS (version 28). The statistical procedure included descriptive statistics, followed by Pearson correlation to assess bivariate associations, and multiple linear regression to test the proposed relationships and estimate the explanatory contribution of cognitive-capital dimensions to digital maturity.

3.3.2. Qualitative component and triangulation

To strengthen interpretation, survey findings were triangulated with qualitative evidence obtained through five semi-structured interviews with managers involved in digital transformation initiatives. The interview protocol focused on organizational learning routines, knowledge circulation practices, and perceived readiness for digital change. This qualitative material was used to contextualize the quantitative results and to ensure that statistical patterns were consistent with the operational realities described by practitioners.

Overall, the combination of reliable measurement (as indicated by Cronbach's alpha) and contextual depth from interviews provided a robust basis for testing the hypotheses and interpreting the empirical findings reported in the next section. section.

3.4. Instruments

Τομ To establish a solid empirical basis and to test systematically the effect of cognitive capital on digital transformation, this study employed a set of measurement and analysis instruments selected to ensure both measurement validity and sample representativeness. The instrument choice responds to a central requirement of empirical research: organizational constructs such as knowledge sharing, learning climate, and digital maturity are often difficult to observe directly, and therefore must be measured with sufficient precision while remaining comparable across heterogeneous firms.

3.4.1. Survey instrument and measurement structure

Data were collected primarily through a structured questionnaire designed to operationalize the main dimensions of interest using standardized items. The questionnaire was organized into four sections:

- Firm profile (basic characteristics and organizational context)

- Cognitive capital measures (learning-related practices and knowledge dynamics)
- Digital transformation initiatives (implemented technologies and practices, including the adoption of new digital solutions during the pandemic period)
- Perceived outcomes (perceived effects associated with digital transformation)

To facilitate participation and reduce barriers for firms located in less urban or more remote areas, an online version of the questionnaire was distributed via Google Forms. This approach increased geographical coverage and strengthened the diversity of the participating SMEs.

3.4.2. Composite indicators and operationalization

Beyond item-level measurement, the study relied on composite indicators to capture key dependent variables in a consistent way across firms. These composite measures provided the basis for operationalizing and validating the following indices used in subsequent analyses:

- Knowledge Sharing Index (KSI)
- Learning Culture Score (LCS)
- Digital Maturity Index (DMI)

These indicators were constructed to translate organizational realities into interpretable scores and to support comparability across SMEs with different sizes, sectors, and regional contexts. The use of composite indicators also reduces the dependence on single items and supports more robust statistical testing.

3.4.3. Data processing, analysis, and reporting tools

Quantitative data processing and hypothesis testing were performed using SPSS, while Excel was used for data management and graphical representation. Systematic visualization procedures were applied to enhance transparency and facilitate reproducible interpretation of the results. Together, these tools supported both descriptive reporting and inferential analysis aimed at identifying relationships between cognitive-capital dimensions and digital transformation outcomes.

Overall, the instrument package—structured questionnaire, composite indicators, and statistical software—was selected for its operational feasibility in field conditions and its capacity to produce reliable, comparable measurements suitable for rigorous empirical analysis. Three synthetic indicators were constructed to measure these factors:

Table 1. Operational Definitions of Composite Indicators

Indicator	Operational definition
KSI (Knowledge Sharing Index)	Measures the intensity of formal and informal knowledge flows within the firm. Captures practices such as routine meetings, collaborative platforms/tools, and mentoring, which support coordination and collective problem-solving.
LCS (Learning Culture Score)	Assesses the extent to which the organization sustains a continuous learning culture. Reflects support for training, skills development, and routines that encourage knowledge improvement, creativity, and innovation.
DMI (Digital Maturity Index)	Captures both the breadth and depth of digitalization in the firm. Based on the adoption and effective use of ERP, CRM, and cloud solutions, and the degree of their integration into processes and activities.

Source: Authors owns elaboration.

The analysis therefore considers not only whether digital technologies are present, but also the extent to which they effectively improve operational performance, decision-making quality, and interactions with customers. To ensure meaningful comparisons across firms of different sizes, sectors, and regions, each index was normalized on a 0–100 scale. This normalization improves interpretability and facilitates the detection of statistical regularities, correlations, and trends within the sample, thereby strengthening confidence in the empirical results.

Overall, the methodological framework provides a sound basis for examining the links

between cognitive capital and digital transformation. The use of stratified sampling further ensured diversity in terms of firm size, sectoral activity, and geographical distribution. Questionnaire data were complemented by interviews in order to refine interpretation and to enrich understanding of the observed relationships.

Finally, the construction of standardized composite measures—KSI, LCS, and DMI—enabled consistent comparisons across cases and supported more robust statistical testing. Together, these methodological choices provide a reliable foundation for the analyses presented in the following section.

4. RESULTS AND DISCUSSION

The empirical results are provided in this section using This section reports the empirical results based on data collected from 150 Moroccan SMEs. The findings are presented in three steps: descriptive statistics, correlation analysis, and regression-based evidence on the association between cognitive capital and digital maturity.

4.1 Descriptive statistics

Descriptive results indicate a moderate level of knowledge exchange across the sampled firms (KSI mean = 68.4; SD = 12.1). This suggests that information circulates within SMEs, but that knowledge-sharing practices remain only partially structured and could be strengthened through more coordinated and systematic mechanisms.

The Learning Culture Score also remains at an intermediate level (LCS mean = 61.7; SD = 13.5), reflecting the presence of learning-related routines (e.g., some training and innovation-support practices) that have not yet been fully institutionalized.

With respect to technology usage, the Digital Maturity Index reveals an early stage of digital integration (DMI mean = 57.2; SD = 14.6). While many SMEs report initial adoption of tools such as ERP, CRM, and cloud solutions, these technologies do not yet appear to be deeply embedded in operational processes. Taken together, the descriptive evidence suggests that cognitive capital exists within the sample, but its capacity to accelerate digital transformation remains underexploited.

Table 2. Descriptive statistics for KSI, LCS, and DMI (0–100 scale) among surveyed SMEs

Indicator	Mean (0–100)	Standard deviation	Interpretation
Knowledge Sharing Index (KSI)	8.4	2.1	Moderate knowledge exchange
Learning Culture Score (LCS)	1.7	3.5	Developing learning practices
Digital Maturity Index (DMI)	7.2	4.6	Early stage of digital integration

Source: Authors' calculations based on survey data (SPSS v.28 output).

4.2 Correlation analysis

Pearson correlations were computed to examine the strength and direction of relationships between the cognitive-capital indicators and digital maturity. The results show positive and statistically significant associations among the three measures. Knowledge sharing is strongly correlated with digital maturity ($r = 0.64$, $p < 0.01$), and learning culture is also positively correlated with digital maturity ($r = 0.58$, $p < 0.01$). In addition, knowledge sharing and learning culture are significantly related ($r = 0.51$, $p < 0.01$), suggesting that these two dimensions may reinforce one another within SMEs.

Table 3. Pearson correlation matrix between KSI, LCS, and DMI

Variables	KSI	LCS	DMI
KSI		.51**	.64**
LCS	.51**		.58**
DMI	.64**	.58**	

Note: p < 0.01 (two-tailed). Source: Authors' calculations based on survey data (SPSS v.28 output).

The findings show that all three variables are positively and significantly correlated at the 0.01 level. The Knowledge Sharing Index (KSI) is strongly associated with the Digital Maturity Index (DMI) ($r = 0.64$, $p < 0.01$), indicating that SMEs with more effective knowledge sharing tend to exhibit higher levels of digital maturity.

The Learning Culture Score (LCS) is also positively correlated with digital maturity ($r = 0.58$, $p < 0.01$), suggesting that a stronger learning culture supports digital integration. In addition, KSI is positively related to LCS ($r = 0.51$, $p < 0.01$), which reflects the complementarity between these two dimensions of cognitive capital: firms that facilitate knowledge exchange are also more likely to sustain continuous learning practices.

To assess the predictive contribution of these factors, a multiple linear regression model was estimated with KSI and LCS as predictors of DMI. The model results are reported in Table 3.

Table 3. Multiple regression model summary for the prediction of Digital Maturity Index (DMI) by Knowledge Sharing Index (KSI) and Learning Culture Score (LCS).

Model	Adjusted R^2	F-value	Sig. (p-value)	Interpretation
KSI & LCS → DMI	0.283	29.83	< 0.001	Model is statistically significant

Source: Authors' calculations based on survey data (SPSS v.28 output).

The regression model using KSI and LCS as predictors of DMI is statistically significant ($F = 29.83$, $p < 0.001$) and explains a meaningful share of variation in digital maturity (Adjusted $R^2 = 0.283$). This indicates that approximately 28.3% of the differences in digital maturity across the surveyed SMEs are accounted for by differences in knowledge sharing and learning culture. Although other determinants are likely to contribute as well, the results provide strong empirical support that these cognitive-capital dimensions are significant predictors of digital transformation progress.

Table 4. Regression coefficients for Knowledge Sharing Index (KSI) and Learning Culture Score (LCS) predicting Digital Maturity Index (DMI).

Predictor	Beta (β)	t-value	Significance (p)
Knowledge Sharing Index (KSI)	0.37	4.76	< 0.01
Learning Culture Score (LCS)	0.31	3.88	< 0.01

Source: Authors' calculations based on survey data (SPSS v.28 output).

Both predictors display positive and statistically significant standardized coefficients. The effect of knowledge sharing on digital maturity is slightly stronger ($\beta = 0.37$; $t = 4.76$; $p < 0.01$) than the effect of learning culture ($\beta = 0.31$; $t = 3.88$; $p < 0.01$). This pattern indicates that both dimensions contribute meaningfully to digital maturity, while suggesting that the capacity to circulate and mobilize knowledge through structured knowledge-management practices may represent a more immediate mechanism supporting digital integration.

Descriptive results (Table 2) show that Moroccan SMEs exhibit moderate knowledge-sharing levels (KSI mean = 68.4; SD = 12.1), which implies scope to strengthen both formal and informal information flows and to institutionalize knowledge circulation more systematically. The learning culture score (LCS mean = 61.7; SD = 13.5) suggests that continuous learning practices are present, but not yet fully embedded, indicating a need for more structured training routines and innovation-oriented initiatives. The digital maturity distribution (DMI mean = 57.2; SD = 14.6) places most SMEs at an early-to-intermediate stage of digital integration: basic tools are in place, yet digital solutions are not fully integrated into core activities and processes.

Correlation results (Table 3) confirm significant positive relationships among the three variables at the 0.01 level. Knowledge sharing shows the strongest association with digital maturity ($r = 0.64$; $p < 0.01$), while learning culture also exhibits a substantial relationship with digital maturity ($r = 0.58$; $p < 0.01$). The correlation between knowledge sharing and learning culture ($r = 0.51$; $p < 0.01$) is consistent with the complementarity of these cognitive-capital

dimensions, as firms that support knowledge exchange also tend to sustain stronger learning-oriented practices.

Regression results (Table 3) indicate that knowledge sharing and learning culture, taken together, explain a meaningful share of variance in digital maturity (Adjusted $R^2 = 0.283$; $F = 29.83$; $p < 0.001$). This finding highlights the substantive though not exclusive role of cognitive capital in shaping digitalization outcomes among Moroccan SMEs.

Coefficient estimates (Table 4) show that both predictors are positive and statistically significant. Knowledge sharing displays a slightly stronger effect on digital maturity ($\beta = 0.37$; $t = 4.76$; $p < 0.01$) than learning culture ($\beta = 0.31$; $t = 3.88$; $p < 0.01$). This pattern suggests that, while both dimensions are important, the capacity to diffuse, mobilize, and apply knowledge internally may represent a more immediate mechanism through which SMEs achieve effective digital integration.

Taken together, these results provide robust empirical support for the argument that cognitive capital is not merely a facilitating condition, but a central organizational driver of digital transformation in Moroccan SMEs. Firms that invest in structured knowledge-sharing infrastructures and reinforce continuous learning practices appear better positioned to adopt digital systems, sustain their use, and extract value from them even under resource constraints.

The hypothesis tests are consistent with these conclusions. The positive association between KSI and DMI supports H1, and the positive association between LCS and DMI supports H2. Furthermore, the multiple regression results show that KSI and LCS jointly account for 28.3% of the variance in DMI, supporting H3 and underscoring the complementary role of these two cognitive-capital dimensions in the digital transformation process.

5. CONCLUSION AND IMPLICATIONS

The This study examined the role of cognitive capital in shaping digital transformation among Moroccan SMEs in a context where competitive pressure increasingly requires firms to extract value from digital tools. Using a mixed-method design, the analysis provided empirical support for the proposition that intangible organizational drivers—particularly knowledge sharing, learning culture, and adaptability—are systematically associated with higher levels of digital maturity and more effective integration of ICT solutions.

Main findings

The results show a positive and statistically significant relationship between cognitive-capital dimensions and digital maturity. SMEs that sustain routines of knowledge exchange and continuous learning appear more capable of adopting and operationalizing digital systems such as ERP, CRM, and cloud-based solutions. Regression evidence further indicates that knowledge sharing and learning culture are significant predictors of digital maturity, even in resource-constrained settings. Taken together, the findings suggest that cognitive capital functions not only as a supportive condition but as a strategic organizational driver of digital transformation.

Interview evidence reinforces this interpretation by highlighting the importance of managerial practices that enable learning and coordination—especially leadership behaviors that promote employee involvement, trust-based communication, and organizational agility. At the same time, the study points to uneven levels of cognitive readiness across firms, consistent with observed disparities in digital uptake between urban/semi-urban SMEs and those located in more peripheral areas. These differences imply that national digital strategies cannot rely on infrastructure expansion alone; they must also address the organizational conditions that determine whether technologies become embedded in routines and decision processes.

Theoretical contribution

The study contributes to research at the intersection of cognitive learning perspectives and information systems in emerging economies by providing empirical evidence from a heterogeneous sample of Moroccan SMEs. By translating cognitive-capital mechanisms into comparable measures and combining them with qualitative interpretation, the study advances understanding of non-technological determinants of digital maturity and clarifies how organizational learning and

knowledge circulation jointly support digital integration.

Managerial implications

For SME leaders, the results imply that digital transformation should be treated as an organizational capability-building process rather than a purely technical upgrade. Priority actions include: (i) structuring internal knowledge-sharing channels (formal and informal), (ii) institutionalizing continuous learning routines and skills development, and (iii) reinforcing leadership practices that encourage participation, experimentation, and cross-functional coordination. These practices increase the likelihood that digital tools will be adopted, sustained, and translated into operational improvements.

Policy implications

For policymakers, the findings suggest that effective support for SME digitalization requires interventions beyond access and infrastructure. Policy measures that can strengthen cognitive readiness include:

- Public co-funded programs for digital skills, soft skills, and agile mindsets targeting both employees and SME leaders;
- Financial incentives (grants, tax support, matching funds) to promote investment in internal knowledge-management systems and structured training;
- Strengthened SME university partnerships through applied research, participatory learning projects, and knowledge-transfer initiatives;
- Integration of cognitive-capital indicators into national digital strategies to assess and improve organizational readiness;
- Creation of regional digital innovation hubs/clusters that facilitate peer learning and diffusion of best practices;
- Leadership-development initiatives focused on strategic thinking, learning governance, and innovation management.

Limitations and future research

The study remains subject to typical limitations of cross-sectional survey designs and SME heterogeneity. Future research would benefit from longitudinal approaches to capture how investments in cognitive capital evolve over time and how they affect performance trajectories. Additional work could also test sector-specific mechanisms and compare regional contexts more explicitly, particularly to explain persistent rural–urban gaps in digital maturity.

Concluding statement

Overall, the evidence indicates that the digitalization of Moroccan SMEs is not driven by financial investment and technology acquisition alone. It depends fundamentally on human and organizational resources—especially the capacity to share knowledge, learn continuously, and adapt routines—through which digital technologies become effective tools for competitiveness, resilience, and sustainable growth.

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