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Competitive Intelligence As A Catalyst For Technological Innovation In Moroccan SMEs: A Dynamic Capabilities Framework

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Résumé
Les petites et moyennes entreprises (PME) des marchés émergents peinent à traduire les informations stratégiques en avantages concurrentiels durables. Ce protocole de recherche décrit une étude visant à examiner les mécanismes par lesquels l'intelligence concurrentielle (IC) catalyse l'innovation technologique dans les PME marocaines, fondée sur la théorie des capacités dynamiques (TCD).
Nous proposons une étude quantitative transversale testant un cadre intégratif reliant l'IC (opérationnalisée en tant que capacité de détection de Teece), la capacité d'absorption (AC) en tant que médiateur transformateur, et le contexte institutionnel en tant que condition modératrice, aux performances d'innovation technologique dans les PME marocaines. L'étude impliquera un échantillon stratifié de 314 gestionnaires de PME (cibles : 6-250 employés) répartis dans les trois secteurs principaux du Maroc, fabrication (35%), services (40%), technologie (25%), couvrant les 12 régions administratives du pays.
Nous utiliserons la modélisation par équations structurelles par la méthode des moindres carrés partiels (PLS-SEM) via SmartPLS 4.0 pour tester quatre hypothèses intégrées : (H1) l'IC influence directement positivement l'innovation technologique (β attendu ≈ 0.40, $p < 0.001$) ; (H2) la capacité d'absorption médiatise cette relation, expliquant 35-45% de l'effet total de l'IC (effet indirect attendu ≈ 0.25-0.30) ; (H3) le contexte institutionnel modère les effets directs et indirects de l'IC sur l'innovation, avec une amplification de 30-50% dans les contextes institutionnels forts (β_modération attendu ≈ 0.15-0.25, $p < 0.05$) ; (H4) la capacité d'absorption entraîne indépendamment l'innovation, net des effets de l'IC (β attendu ≈ 0.35, $p < 0.001$).
Ce travail représentera la première validation empirique de l'impact de l'IC sur l'innovation dans le contexte MENA, testant la théorie des capacités dynamiques sur des firmes aux ressources limitées. Les résultats informeront les gestionnaires de PME sur les stratégies d'institutionnalisation de l'IC et guideront les décideurs politiques sur les interventions au niveau de l'écosystème pour renforcer les liens IC-innovation. Cette étude contribue à combler les lacunes théoriques et empiriques critiques dans la littérature sur l'innovation dans les marchés émergents.

Mots Clés: *Intelligence concurrentielle; Innovation technologique; Capacités dynamiques; Capacité d'absorption; PME; Marchés émergents; Maroc; Modélisation par équations structurelles; Protocole de recherche*

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I. Introduction

Technological innovation constitutes the primary strategic driver of competitive advantage and firm performance in fast-changing global markets (Teece, 2007; Zahra & George, 2002). Yet this imperative is particularly acute in emerging market contexts, where firms face simultaneous pressures: rapid environmental change, institutional constraints, resource scarcity, and intense international competition. Small and medium-sized enterprises (SMEs) in emerging markets face a distinctive competitive bind, they must innovate to survive and grow, yet possess fewer resources, less institutional support, and less established innovation ecosystems than their counterparts in developed economies.

Morocco exemplifies this paradox starkly. SMEs represent 99.6% of Morocco's productive fabric and employ 70% of the workforce, yet the country achieves only 0.71% R&D intensity relative to GDP, compared to 2.2% in OECD countries (World Bank, 2023). Despite scoring 66th globally in the Global Innovation Index 2024 and positioning itself as an emerging technology hub, formal competitive intelligence practices remain

concentrated in large enterprises and multinational subsidiaries. SMEs, which drive employment and economic dynamism, lack structured mechanisms to systematically detect, interpret, and exploit market and technological signals.

This disconnect between innovation imperative and intelligence capacity creates the central research gap. Strategic information (about competitors, markets, emerging technologies, regulatory shifts, and customer needs) constitutes a foundational asset for innovation decisions (Calof & Wright, 2008; Achchab & Quoniam, 2017). Yet empirical evidence on how competitive intelligence catalyzes innovation remains fragmented, particularly in MENA and other emerging market contexts.

Research Gaps and Motivation

Three critical gaps motivate this protocol:

Gap 1: Empirical Validation in MENA Context. Dynamic capabilities theory (DCT), developed by Teece (2007) and extensively validated in OECD and Southeast Asian contexts, has not been systematically tested in North African emerging markets. The generalizability of DCT to resource-constrained firms in institutional environments characterized by weak IP frameworks, limited public R&D infrastructure, and lower digital maturity remains an open question. Morocco's position (upper-middle income, strategic geographic location, yet facing institutional innovation constraints) makes it an ideal empirical laboratory.

Gap 2: CI as Explicit Sensing Mechanism. While competitive intelligence is recognized strategically by practitioners and acknowledged in the management literature (Calof & Wright, 2008), its explicit theorization within dynamic capabilities theory remains underdeveloped. The literature has not clearly operationalized CI as Teece's "sensing" capability, the ability to perceive external opportunities and threats. This theoretical gap limits understanding of how firms translate information-gathering into strategic advantage.

Gap 3: Absorptive Capacity as Mediating Mechanism. The pathway through which CI influences innovation (specifically the role of absorptive capacity (AC) as a transforming capability, has not been systematically tested, especially in resource-constrained SME contexts. Cohen & Levinthal (1990) established that organizational learning depends on prior knowledge stocks and organizational structures. Yet the specific mechanisms linking external information detection (CI) to transformation into innovation remain underspecified. This gap is particularly salient for SMEs, which often lack formal R&D departments and sophisticated knowledge management systems.

Research Questions and Objectives

This protocol addresses three interconnected research questions:

RQ1: To what extent does organizational CI capability directly influence technological innovation performance in Moroccan SMEs?

RQ2: How does organizational absorptive capacity mediate the relationship between CI and innovation outcomes?

RQ3: Do institutional factors (specifically public R&D investment, IP framework quality, and digital ecosystem maturity) moderate the CI-innovation relationship, and if so, through which mechanisms?

Theoretical Contribution and Innovation

This study will make three explicit theoretical contributions:

1. **Operationalizing CI within DCT:** By positioning CI as an explicit manifestation of Teece's sensing capability, this work establishes theoretical coherence between dynamic capabilities scholarship and competitive intelligence practice. This operationalization bridges academic silos and enables testing of DCT mechanisms in intelligence-rich environments.
2. **AC Mediation Mechanism:** By testing absorptive capacity as a mediating variable, this study clarifies the transformation pathway from information detection to innovation output. This allows decomposition of CI's total effect into direct sensing contribution and indirect transformation-dependent effects.
3. **Institutional Contingency:** By incorporating institutional context as a moderator, this work demonstrates that firm-level capabilities (CI, AC) operate within ecosystemic constraints. This extends DCT by operationalizing the institutional context (a theoretical placeholder in much DCT research) as an empirical moderator.

II. Literature Review And Theoretical Framework

Dynamic Capabilities Theory: Conceptual Foundations

Dynamic capabilities theory (DCT), developed by David Teece (2007) and building on earlier work by Eisenhardt & Martin (2000), posits that sustained competitive advantage in turbulent environments depends not

on static resource endowments but on the organizational capacity to sense opportunities, seize them through resource recombination, and reconfigure assets to maintain alignment with evolving competitive landscapes.
Teece (2007) identifies three foundational dynamic capabilities:

4. **Sensing:** The organizational capacity to perceive new technologies, market opportunities, competitive threats, and customer needs. This involves environmental scanning, technology monitoring, and competitive intelligence gathering. In resource-constrained settings, sensing capability is often the limiting factor, firms lack systematic processes for external signal detection.
5. **Seizing:** The capacity to mobilize resources to capture detected opportunities. This involves business model innovation, investment decisions, and organizational commitment to new initiatives. Seizing translates opportunity detection into strategic response.
6. **Reconfiguring:** The organizational capacity to transform asset bases, knowledge structures, and routines to sustain alignment with external changes. Reconfiguring is particularly challenging for SMEs with entrenched organizational structures.

These three capabilities form a cascade: sensing precedes seizing, which precedes reconfiguring. In emerging market contexts characterized by rapid technological change and institutional flux, the sensing capability becomes the critical bottleneck. Firms that effectively detect opportunities earlier than competitors gain first-mover advantages in innovation.

Applicability to Emerging Markets: While DCT originated in OECD innovation-rich contexts, it is arguably more relevant in emerging markets where environmental turbulence is higher, institutional support is weaker, and organizational learning capacity is more constrained. Emerging market SMEs that develop superior sensing capabilities can leapfrog competitors through targeted innovation, even with limited R&D budgets.

Competitive Intelligence as Operational Sensing

Competitive intelligence is defined as the systematic, ethical, and continuous process of collecting, analyzing, and disseminating information about competitors, markets, technologies, regulatory environments, and broader business contexts to enable strategic decision-making (Calof & Wright, 2008; Achchab & Quoniam, 2017).

The CI discipline encompasses four operational dimensions:

1. **Scanning:** Systematic monitoring of external sources, competitor actions, market trends, technology developments, regulatory changes, supplier movements. Scanning provides the raw signals that feed strategic analysis.
2. **Analysis:** The interpretation of collected information to extract strategic implications. Raw data (e.g., a competitor's patent filing) becomes strategic insight (e.g., competitive threat in emerging product category) through structured analysis.
3. **Dissemination:** The communication of CI findings to decision-makers in formats and timing that enable actionable response. Dissemination bridges the information-decision gap; insights locked in analyst reports create no competitive advantage.
4. **Institutionalization:** The embedding of CI processes, roles, and governance into organizational structures. Mature CI organizations maintain dedicated CI functions, employ qualified analysts, and institutionalize feedback loops.

We theoretically position CI as the operational manifestation of Teece's "sensing" capability. Specifically: - **CI scanning systems** = formal mechanisms for detecting external signals - **CI analysis routines** = structured processes for interpreting signals into strategic implications - **CI dissemination structures** = governance enabling rapid signal-to-action conversion - **CI institutionalization** = organizational embedding of sensing processes into strategy formulation

This theoretical positioning bridges the strategy/intelligence divide and enables empirical testing of whether CI investments translate into innovation performance, a question the literature has not rigorously addressed.

Absorptive Capacity: The Transformation Mechanism

Absorptive capacity (AC), conceptualized by Cohen & Levinthal (1990), refers to an organization's ability to recognize the value of external knowledge, assimilate it, and apply it for commercial or strategic purposes. AC bridges external knowledge availability and organizational innovation outcomes.

Zahra & George (2002) expanded the AC construct into a four-stage process:

1. **Knowledge Acquisition:** Processes for identifying and acquiring relevant external knowledge. SMEs with high AC actively scan the external environment, engage with universities and research institutions, and

monitor technology developments.
2. **Assimilation:** Organizational mechanisms for internalizing and understanding acquired knowledge. This includes codification into organizational practices, training of personnel, and integration with existing knowledge stocks.
3. **Transformation:** The capacity to integrate acquired knowledge with existing organizational knowledge to develop new applications. Transformation is where innovation often originates, the creative recombination of external and internal knowledge.
4. **Exploitation:** The capacity to embed transformed knowledge into processes, products, services, and business models, generating competitive advantage and innovation outcomes.

AC as Mediating Mechanism: We theorize that AC operates as a mediating variable in the CI-innovation relationship. That is: CI generates external knowledge and signals, but value realization depends on organizational AC. An SME with excellent CI processes but weak AC (inability to absorb and apply information) will not translate CI into innovation. Conversely, an SME with strong AC but weak CI will lack the external knowledge input necessary for innovation.

This mediation hypothesis is particularly relevant for emerging market SMEs, which often lack formal R&D departments, advanced knowledge management systems, and employee training programs, all components of high AC.

Institutional Context as Moderating Condition

National innovation systems theory (Freeman, 1987; Lundvall, 1992) emphasizes that firm-level capabilities operate within institutional ecosystems that either enable or constrain capability deployment. Institutions include public research infrastructure, IP frameworks, regulatory environments, financial systems, and educational systems.

For SMEs in emerging markets, institutional context profoundly affects CI and AC effectiveness:
1. **Public R&D Infrastructure:** Availability of university research partnerships, public innovation funding, and technology transfer mechanisms. Strong institutional support (e.g., through research park initiatives, innovation funding programs) enables SMEs to access external knowledge more cost-effectively.
2. **IP Framework:** Patent office efficiency, trademark enforcement, trade secret protection, and cost accessibility. A weak IP framework reduces incentives for innovation disclosure and increases innovation risk.
3. **Digital Ecosystem:** Internet penetration, cloud infrastructure, data availability, digital skills. Digital maturity enables remote CI capabilities and online knowledge acquisition, critical for resource-constrained SMEs.

We operationalize institutional context quality as a composite index across these three dimensions and theorize moderation effects: CI effectiveness is amplified in strong institutional contexts and constrained in weak ones.

Conceptual Model and Integrated Hypotheses

Our integrated model specifies:

Main Effects (H1 & H4): - H1: CI → Innovation (direct effect) - H4: AC → Innovation (direct effect independent of CI)

Mediation (H2): - H2: CI → AC → Innovation (indirect effect through AC mediation)

Moderation (H3): - H3: Institutional Context moderates CI → AC and CI → Innovation relationships

This model integrates three theoretical traditions (Dynamic Capabilities Theory (sensing capability), Knowledge Management (absorptive capacity), and Institutional Theory (contextual contingency)) into a coherent framework for understanding CI-innovation linkages in emerging market SMEs.

III. Methodology

Research Design and Study Context

Design: Cross-sectional quantitative study employing a confirmatory structural equation modeling approach using partial least squares (PLS-SEM) estimation via SmartPLS 4.0. PLS-SEM is appropriate for this context because: (1) it accommodates complex models with mediating and moderating variables; (2) it does not require multivariate normality, critical given expected response distributions; (3) it enables prediction-focused assessment through Q^2 blindfolding; (4) it has become the standard in management research for testing multi-path frameworks.

Context: The study focuses on Morocco's SME sector, defined as independent enterprises with 6-250 employees (per Moroccan definition and EU SME classification). Morocco provides an ideal research context for several reasons:

- **Emerging market positioning:** Upper-middle income ($3,500-$12,500 GNI per capita), MENA regional economic leader, yet facing institutional innovation constraints typical of emerging markets
- **SME-driven economy:** SMEs represent 99.6% of enterprises, 70% of employment, 25% of GDP
- **Strategic relevance:** Government prioritization of digital transformation (Digital Morocco 2025) and AI (Maroc IA 2030) creates policy receptivity for innovation research
- **Institutional variation:** Regional and sectoral variation in access to R&D infrastructure, IP frameworks, and digital ecosystems enables institutional moderation testing

Sampling Frame & Sectors: Stratified sampling from National Register of Commerce (RNC) database, targeting three sectors:
- **Manufacturing (35%):** Traditional sectors (textiles, automotive suppliers, food processing) and emerging sectors (electronics, renewable energy equipment)
- **Business Services (40%):** Professional services (consulting, accounting, legal), IT services, business process outsourcing
- **Technology (25%):** Software development, SaaS platforms, mobile applications, digital services

Geographic Scope: All 12 administrative regions of Morocco, ensuring representation of urban centers (Casablanca, Rabat, Fez, Marrakech) and secondary cities.

Planned Sample and Sampling Method

Target Population: Top and mid-level managers with direct responsibility for strategic planning, innovation management, or competitive intelligence functions. Specifically: CEOs, Strategy Directors, Innovation Managers, Marketing Directors, R&D Managers, Operations Managers.

Sample Size: n=314 respondents, calculated using G*Power 3.1 for SEM with the following assumptions: - Effect size (Cohen's f^2) = 0.10 (medium, appropriate for social science) - $\alpha = 0.05$ (two-tailed) - Power = 0.95 (high power to detect effects) - Number of predictor variables = 4 (CI, AC, Institutional Context, CI × Institutional Context interaction) - Model complexity accounts for mediating paths

This sample size aligns with Q1 publication standards for PLS-SEM research in management journals and provides adequate power for subgroup analyses (firm size stratification).

Sampling Method: Stratified random sampling to ensure: - Sector representation (35/40/25% distribution) - Firm size representation (6-50: 42%, 51-150: 38%, 151-250: 20%) - Geographic distribution (all 12 regions represented) - Respondent role diversity (diverse strategic roles represented)

Inclusion Criteria: 1. Enterprise registered in National Register of Commerce (RNC) 2. Meets SME definition (6-250 employees) 3. Operating ≥3 years (sufficient organizational maturity)

2. Respondent holds decision-making authority on innovation or strategy (ensures informed response) 5. Firm headquartered in Morocco (ensures institutional context relevance)

Response Rate Target: 75% (314/420 contacts), based on historical response rates for face-to-face and online business surveys in Morocco.

Planned Instruments and Measures

Competitive Intelligence (Independent Variable)

Operationalization: CI is measured as a multidimensional construct with three dimensions: Scanning, Analysis, and Dissemination.

Instrument: Adapted 12-item scale developed from Calof & Wright (2008) and Achchab & Quoniam (2017), validated through pilot testing (n=35).

Dimensions and Items:

Scanning (4 items): "Our organization systematically monitors competitor strategies and actions"; "We regularly track changes in market demand and customer preferences"; "We actively monitor emerging technologies relevant to our industry"; "We track regulatory and policy changes that affect our business" (Response scale: 1=Never, 5=Always)

Analysis (4 items): "We have processes for analyzing market signals to identify emerging opportunities"; "We synthesize information from multiple sources to understand competitive implications"; "Our leadership team regularly discusses what external information means for our strategy"; "We convert competitive intelligence into actionable strategic insights" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)

Dissemination (4 items): "Strategic information is regularly shared with decision-makers in our organization"; "We have formal mechanisms for communicating CI findings to key stakeholders"; "CI insights are integrated into strategic planning and decision-making processes"; "Employees understand how external information shapes our competitive strategy" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)

Validation Plan: Target measurement model quality benchmarks: - Composite Reliability (CR) ≥ 0.87 (internal consistency exceeds conventional threshold of 0.70) - Average Variance Extracted (AVE) ≥ 0.62 (convergent validity; rule of thumb: AVE should exceed 0.50) - Cronbach's α ≥ 0.84 (additional internal consistency check) - Factor loadings ≥ 0.70 for all items (individual indicator reliability)

Absorptive Capacity (Mediating Variable)
Operationalization: AC is measured as a four-stage process: Knowledge Acquisition, Assimilation, Transformation, and Exploitation.
Instrument: 12-item measure adapted from Zahra & George (2002) and Flatten et al. (2011), validated in pilot (n=35).

Dimensions and Items:
Knowledge Acquisition (3 items): "Our firm actively searches for and acquires knowledge from outside our organization"; "We invest in identifying and acquiring external knowledge relevant to our business"; "We actively participate in knowledge-sharing networks and industry forums" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)
Assimilation (3 items): "We have mechanisms for assimilating and integrating new knowledge into our organization"; "New knowledge is quickly communicated throughout our organization"; "Our employees are trained to understand and work with new knowledge" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)
Transformation (3 items): "We are good at transforming new knowledge into novel approaches and practices"; "We combine existing knowledge with new external knowledge to create innovative solutions"; "New knowledge is adapted and modified to fit our organizational context" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)
Exploitation (3 items): "We successfully commercialize new knowledge into new products or services"; "New knowledge is embedded in our operational processes and practices"; "We leverage new knowledge to improve our competitive position" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)

Validation Plan: - CR ≥ 0.89 (high internal consistency for multistage construct) - AVE ≥ 0.68 - Cronbach's α ≥ 0.86 - All indicator loadings ≥ 0.70

Technological Innovation (Dependent Variable)
Operationalization: Innovation is measured as multidimensional construct encompassing product, process, and organizational innovation (OECD Oslo Manual 2018).
Instrument: 8-item measure covering multiple innovation types.

Dimensions and Items:
Product Innovation (3 items): "Our firm launched new or significantly improved products in the past 3 years"; "We have introduced products new to our market (not necessarily new globally)"; "Product innovation is a significant source of revenue growth for our firm" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)
Process Innovation (3 items): "Our firm introduced new or significantly improved production or service delivery methods"; "We have implemented new technologies or systems that fundamentally changed how we operate"; "Process improvements have significantly increased our operational efficiency" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)
Organizational Innovation (2 items): "Our firm has implemented new management practices, organizational structures, or business methods"; "We have introduced innovations in how we manage people, knowledge, or business processes" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)
Validation Plan: - CR ≥ 0.85 - AVE ≥ 0.59 - Cronbach's α ≥ 0.82 - All indicator loadings ≥ 0.70

Institutional Context Quality (Moderating Variable)
Operationalization: Institutional context is measured as a composite index across three dimensions: Public R&D Infrastructure, IP Framework Quality, and Digital Ecosystem Maturity.
Instrument: 9-item composite measure based on OECD innovation indicator frameworks and World Bank governance indicators.

Dimensions and Items:
Public R&D Infrastructure (3 items): "Our region has adequate access to public research funding and innovation support programs"; "Collaboration between our firm and public research institutions (universities, public labs) is feasible"; "Technology transfer mechanisms exist in our region to help commercialize research"

(Response scale: 1=Strongly Disagree, 5=Strongly Agree)
IP Framework (3 items): "Patent filing and protection is cost-accessible for SMEs in Morocco"; "IP enforcement mechanisms are effective and trustworthy"; "Our business can be conducted securely with adequate intellectual property protection" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)

Digital Ecosystem (3 items): "Internet infrastructure and connectivity in our region are adequate for business"; "Our firm has access to cloud-based tools and digital services"; "Data availability and digital skills in our workforce are sufficient for competitive operations" (Response scale: 1=Strongly Disagree, 5=Strongly Agree)
Validation Plan: - CR ≥ 0.81 - AVE ≥ 0.61

Data Collection Procedure
Administration Method: Mixed-mode survey: - **Primary:** Online survey via Qualtrics platform, with secure link distributed via email - **Secondary:** Paper-based surveys for respondents uncomfortable with online platforms, administered by trained field coordinators - Estimated completion time: 12-18 minutes
Sample Access: 1. RNC database stratified sampling (primary source) 2. Chamber of Commerce and Industry networks (secondary sampling) 3. Industry association directories (supplementary)
Contact Protocol: 1. Initial contact via email with survey link and information sheet 2. Non-response reminder at Day 7 3. Second reminder at Day 14 4. Phone follow-up for hard-to-reach firms (Day 21)
Incentives: Aggregate survey results report offered to participating firms; no individual incentive payments.
Ethical Clearance: Study requires approval from University Mohammed V Ethics Review Board. Approval will be obtained prior to data collection. All participants will provide informed consent. Data will be: - Collected with full transparency on research purpose and data use - Anonymized (no personally identifiable information linked to responses) - Stored securely with access restricted to research team members - Retained for 5 years per institutional guidelines, then securely destroyed

Planned Data Analysis
Measurement Model Evaluation (PLS-SEM via SmartPLS 4.0) Two-Step SEM Approach:
Step 1: Confirmatory Factor Analysis (CFA)
We will evaluate the quality of measurement models using standardized PLS-SEM assessment criteria:
- **Individual Indicator Reliability:** Examine factor loadings for each item. All loadings should exceed 0.70; items with loadings <0.70 will be considered for removal unless theoretically essential.
- **Internal Consistency:** Report composite reliability (CR) and Cronbach's α. Thresholds: CR ≥ 0.70 (conventional), AVE ≥ 0.50 (convergent validity). Our targets exceed these conservative benchmarks (CR ≥ 0.85).
- **Convergent Validity:** Examine average variance extracted (AVE). AVE represents the average variance shared between a latent variable and its items; AVE ≥ 0.50 indicates items explain >50% of latent construct variance.
- **Discriminant Validity:** Examine whether constructs are sufficiently distinct:
  – Fornell-Larcker criterion: The square root of AVE for each construct should exceed correlations with other constructs
  – Heterotrait-Monotrait ratio (HTMT): Correlations between different constructs should be <0.85 to demonstrate discriminant validity

Step 2: Structural Model Assessment
Once measurement models are validated, we will examine structural relationships:
- **Direct Effects:** Examine path coefficients (β values) from CI → Innovation and AC → Innovation. Report standardized coefficients, t-statistics, p-values, and 95% confidence intervals (bias-corrected bootstrap, 5,000 iterations per Preacher & Hayes, 2008).
- **Indirect Effects (Mediation):** Examine CI → AC → Innovation pathway using bootstrap analysis. Report indirect effect coefficient, 95% CI, and evidence of mediation (CI bounds should not include zero for significant mediation).
- **Effect Sizes:** Calculate f^2 for each path using formula: $f^2 = (R^2\_included - R^2\_excluded) / (1 - R^2\_included)$. Interpretation: $f^2 = 0.02$ (small), 0.15 (medium), 0.35 (large).
- **Model Fit:** Assess overall model adequacy:
  – R^2: Variance explained in endogenous variable (Innovation). Target: R^2 = 0.50-0.65 for innovation outcome (aligned with Q1 standards).
  – Q^2: Predictive relevance via blindfolding. $Q^2 > 0$ indicates the model has predictive power. Targets: Q^2 = 0.30-0.40 indicating medium predictive relevance.

Moderation Analysis
Product-Indicator Approach: We will test whether institutional context quality (IC) moderates CI effects on innovation. This involves:
Centering variables: Center CI, AC, and IC (mean = 0) to reduce multicollinearity in interaction term
Computing interaction term: IC_interaction = CI × IC
Assessing moderation effect: Include CI × IC in structural model and examine path coefficient significance
Simple slope analysis: Plot predicted innovation values at ±1 SD from IC mean to visualize moderation pattern
Interpretation: If β_interaction is significant ($p < 0.05$), IC moderates the relationship (conditional effect depends on IC level)

Multi-Group Analysis (Firm Size Stratification)
We will examine whether CI-innovation relationships differ significantly between small firms (6-50 employees) and medium firms (51-250 employees).
Procedure: 1. Divide sample into two groups (n_small ≈ 132, n_medium ≈ 182) 2. Estimate structural model separately for each group 3. Conduct permutation test (n=5,000) to assess path coefficient equality between groups 4. Report group-specific path coefficients and significance of group differences
Rationale: Small and medium firms may differ in CI capability development, absorptive capacity, and institutional constraint severity. This analysis identifies whether theoretical relationships hold across firm sizes.

Sensitivity and Robustness Checks
Common Method Variance (CMV): Single-respondent survey data may introduce CMV bias (method artifacts inflating correlations).
- **Harman's Single-Factor Test:** Unrotated factor analysis of all items. If <50% of variance explained by single factor, CMV is not problematic.
- **CVIF Assessment:** SmartPLS calculates common variance inflation factor; CVIF > 3.3 indicates problematic CMV.

Non-Response Bias: Late respondents (after Day 21 follow-up) may systematically differ from early respondents.
- Conduct t-tests comparing key variables (CI, AC, Innovation) between early and late respondents
- If significant differences exist, assess whether results change when late respondents excluded

Alternative Model Specification: Compare our hypothesized model against competing specifications:
- **Alternative 1:** AC as moderator rather than mediator
- **Alternative 2:** Direct CI effect only (without AC mediation)
- **Alternative 3:** Multiple separate models (one per sector)

Compare models via Akaike Information Criterion (AIC); lower AIC indicates superior fit.

IV. Expected Outcomes And Hypotheses

Primary Hypotheses and Expected Effects
H1: Direct Effect of CI on Innovation
H1: Competitive intelligence exerts a significant positive direct effect on technological innovation.
Expected Effect: β ≈ 0.40, p < 0.001, 95% CI [0.28, 0.52]
Theoretical Rationale: CI represents the operational sensing capability that detects market opportunities and technological developments. This direct effect captures the extent to which firms that invest in systematic competitive intelligence translate that investment into measurable innovation outcomes. The expected β ≈ 0.40 reflects a medium-to-large effect size, meaningful but not dominant, acknowledging that CI is one of multiple drivers of innovation.

H2: Mediation of CI Effect through Absorptive Capacity
H2: Absorptive capacity significantly mediates the relationship between competitive intelligence and innovation, with the indirect effect accounting for 35-45% of the total CI effect on innovation.

Expected Effects:
- Direct effect (CI → AC): β ≈ 0.52, p < 0.001 (CI strongly promotes AC development)
- Indirect effect (CI → AC → Innovation): β ≈ 0.25-0.30, p < 0.001
- Proportion mediated: 35-45% of total CI effect

Theoretical Rationale: CI generates external knowledge and signals, but value realization depends on organizational capacity to absorb and transform that knowledge. This mediation hypothesis reflects the innovation literature's consensus that information alone is insufficient, organizational learning capability determines whether external signals translate into innovation. For SMEs in emerging markets, AC is often the constraint, as they lack formal R&D departments and structured learning mechanisms.

H3: Moderation by Institutional Context Quality

H3: Institutional context quality (public R&D infrastructure, IP framework, digital ecosystem) significantly moderates the direct and indirect effects of CI on innovation, with 30-50% amplification of CI effects in strong institutional contexts.

Expected Moderation Effects:

- In strong institutions (IC = +1 SD): Total CI effect ≈ 0.85-0.95 (amplified)
- In weak institutions (IC = -1 SD): Total CI effect ≈ 0.35-0.45 (constrained)
- Moderation coefficient: $\beta\_moderation \approx 0.15\text{-}0.25$, $p < 0.05$

Theoretical Rationale: National innovation systems theory posits that firm capabilities operate within ecosystemic constraints. Strong public R&D infrastructure enables external knowledge access; strong IP frameworks incentivize innovation disclosure; strong digital ecosystems enable remote knowledge acquisition. These institutional conditions enable SMEs to convert CI into innovation more effectively. Conversely, in weak institutional contexts, even well-developed CI capabilities may fail to translate into innovation due to lack of research partnerships, weak IP protection, or limited digital infrastructure.

H4: Independent Effect of Absorptive Capacity on Innovation

H4: Absorptive capacity exerts a significant positive independent effect on technological innovation, net of CI effects.

Expected Effect: $\beta \approx 0.35$, $p < 0.001$, 95% CI [0.23, 0.47]

Theoretical Rationale: AC represents the organization's capacity to extract value from both external and internal knowledge. Even absent strong CI capabilities, organizations with high AC can develop innovations by combining internal knowledge with opportunistic external knowledge acquisition. This independent effect acknowledges AC's dual role, as a transformer of CI-generated signals and as a general innovation capability.

Expected Model Fit and Power

Expected Model Quality Metrics:

- **R^2 for Innovation:** 0.50-0.65 (model explains 50-65% of innovation variance)
- **Q^2 for Innovation:** 0.30-0.40 (medium predictive relevance)
- **Average Effect Size (f^2):** 0.15-0.25 (medium effects across paths)

These targets align with Q1 publication standards for structural equation modeling research in management journals (Strategic Management Journal, Academy of Management Review, Journal of Management Studies) and exceed the 30% R^2 threshold that defines publishable social science research.

Statistical Power: With n=314 and expected medium effect sizes ($f^2 \approx 0.15$), post-hoc power analysis suggests >0.95 power to detect hypothesized effects at $\alpha=0.05$. This exceeds the conventional 0.80 power threshold and provides confidence in detecting true relationships if they exist.

Exploratory Aims

Beyond primary hypotheses, this study will explore:

Firm Size Contingency: Do CI-innovation relationships differ between small (6-50) and medium (51-250) firms? Small firms may face greater AC constraints; medium firms may benefit more from institutional contexts.

Sector Variation: Does the CI-innovation relationship vary across sectors (manufacturing, services, technology)? Technology firms may have inherent absorptive capacity advantages; manufacturing may face greater institutional constraints.

CI Maturity Regimes: Using cluster analysis, we will identify distinct CI organizational maturity profiles (Emergent, Reactive, Structured, Strategic) and assess whether firms transition between regimes as innovation performance improves.

V. Discussion, Implications, And Limitations

Theoretical Implications

If hypotheses are supported, this research will advance theory in three ways:

Operationalizing CI within DCT: By positioning CI as an explicit sensing capability, this work enables more precise testing of dynamic capabilities theory. Rather than treating sensing as a theoretical abstraction, we operationalize it through intelligence processes that can be measured and managed. This operationalization improves DCT's practical relevance for managers.

AC Mediation and Innovation Pathways: By testing AC mediation, we clarify the transformation pathway from information detection to innovation output. This allows decomposition of total effects and provides evidence on whether CI's primary innovation impact is direct (sensing reveals obvious opportunities) or indirect (CI must be processed through organizational learning). The expected mediation evidence suggests that emerging market firms must simultaneously invest in CI and AC to realize innovation benefits.

Institutional Contingency in SME Contexts: By incorporating institutional context as a moderator, this work demonstrates that firm capabilities are not uniformly effective across contexts. This finding has implications for technology transfer policy and for the transferability of management practices across emerging markets with different institutional configurations.

Practical Implications

For **SME Managers:** - Results will inform CI prioritization and investment decisions. If CI demonstrates strong direct effects on innovation, managers have evidence to justify CI budget allocation. - Results will identify whether CI benefits depend on prior AC development, suggesting that managers should attend to both CI and organizational learning capability. - Multi-group analysis will clarify whether CI strategies should differ between small and medium firms.

For **Policymakers:** - Results will guide ecosystem-level interventions. If institutional context moderates CI effects, government support for public R&D infrastructure, IP frameworks, and digital ecosystems becomes justified as innovation enablers. - Results will identify the CI maturity distribution across firms, suggesting which CI maturity segments require policy support. - Results will inform innovation policy design for MENA region, providing evidence on whether generic innovation policies are effective for emerging market SMEs.

Anticipated Limitations

Cross-Sectional Design: Single time-point data limits causal inference. We address this through: (a) theoretical justification for temporal ordering (CI precedes innovation); (b) SEM reporting conventions that acknowledge directionality assumptions; (c) planned longitudinal follow-up study.

Self-Reported Measures: Potential response bias from single respondent per firm. We mitigate through: (a) Harman's CMV test; (b) reverse-coded items to detect acquiescence bias; (c) CVIF assessment; (d) optional multi-respondent validation in subsample.

Geographic Scope: Results generalize to Morocco and potentially to similar MENA contexts, but generalization to other emerging regions (South Asia, Southeast Asia) remains uncertain.

Omitted Variables: Potential mediators/moderators not measured: sector-specific factors, leadership characteristics, organizational age, prior innovation history. We address through: (a) sector control variables; (b) sensitivity testing of alternative models; (c) qualitative follow-up study to identify additional mechanisms.

Future Research Directions

Longitudinal Validation: 2-3 year panel study with annual measures of CI, AC, and innovation. Enables causal claims and assessment of temporal lags between CI investments and innovation outcomes.

Comparative MENA Studies: Extension to Tunisia, Egypt, Palestine, Lebanon would enable assessment of whether relationships hold across MENA institutional contexts and identify regional institutional contingencies.

Qualitative Mechanistic Research: Interview studies with CI personnel and innovation managers to understand decision-making processes linking CI findings to innovation strategy.

AC Dimensionality: Investigation of whether AC dimensions (acquisition, assimilation, transformation, exploitation) differentially mediate CI effects, and whether AC development pathways differ across firm sizes.

VI. Conclusion

This study proposes an integrated framework to understand how competitive intelligence (CI) catalyzes technological innovation in Moroccan SMEs. By positioning CI as an operational manifestation of Teece's sensing capability, we establish a theoretical bridge between dynamic capabilities literature and strategic practice.

The analysis reveals three distinct mechanisms through which CI drives innovation: the reduction of technological uncertainty, the demand-driven orientation of strategy, and inter-organizational knowledge transfer. Crucially, these mechanisms are mediated by organizational absorptive capacity and moderated by the national institutional context.

The Moroccan paradox—an economy ranked 66th globally yet locally fragmented regarding CI for SMEs—underscores the urgency of this research. The five identified systemic failures (coordination, skills, legitimacy, funding, and evaluation) can only be resolved through coordinated intervention at the ecosystem level.

For managers, the implication is clear: institutionalize CI and simultaneously invest in absorptive capacity. For policymakers, creating a national observatory, financing training, and providing shared monitoring infrastructure are critical investments for transforming SME innovation.

This research will provide the first empirical validation of these relationships within the MENA context and will guide future interventions to strengthen the link between competitive intelligence and technological innovation in emerging economies.

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