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FROM CULTURE TO STRATEGY: UNVEILING THE MEDIATING ROLE OF INFORMATION SYSTEMS IN SAUDI HEALTHCARE

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Abstract:This study examines whether information systems (IS) mediate the relationship between organizational culture and strategy implementation (SI) in Saudi public hospitals during the national health transformation. Using a cross-sectional survey of staff in Tabuk Ministry of Health hospitals and partial least squares structural equation modeling with bootstrapped mediation, the studymodels culture types—Clan, Hierarchy, Market, and Adhocracy, alongside IS capability and effectiveness and strategy implementation. Findings show that the systems pathway is the dominant channel through which culture becomes execution. Clan and Market cultures improve implementation chiefly by strengthening IS. Adhocracy contributes both through the systems pathway and via a direct route to execution, and Hierarchy offers limited explanatory power. Measurement diagnostics and robustness checks, including alternative scoring, robust standard errors, rank-based specifications, and outlier trimming, converge on the same qualitative story. The study advances a culture–systems–execution nexus and offers actionable guidance: invest in interoperability, data quality, and user support; embed mentoring, teamwork, targets, and feedback inside digital workflows; protect pilot-and-learn initiatives linked to system monitoring; and align incentives with metrics visible in national platforms to scale implementation gains across the healthcare system.

Keywords:*Organizational culture; Strategy implementation; Health information systems; PLS-SEM; Vision 2030.*

1. Introduction

Translating strategy into consistent clinical and operational practice is uniquely difficult in healthcare because execution depends on tightly coupled processes, professional autonomy, and complex governance across multi-disciplinary teams. Implementation science reveals that outcomes depend on the organizational context, including culture, leadership, resources, and the fit between new practices and existing workflows; weak alignment often results in the familiar “design–execution” gap. In parallel, the digitalization of care adds dependency on information systems (IS),data quality, interoperability, user engagement, and governance, making IS success a pivotal conduit through which organizational conditions shape execution at the bedside. Frameworks such as the Consolidated Framework for Implementation Research (CFIR) and the DeLone–McLean IS Success model formalize these mechanisms and highlight why strategy execution is contingent on both culture and technology.

Saudi Arabia’s Vision 2030 positions health reform as a national priority through the Health Sector Transformation Program (HSTP), which restructures delivery to improve quality, access, and sustainability while accelerating digital health. The reform architecture includes the 2022 establishment of the Health Holding Company (HHC) and region-wide health

clusters**,** shifting provision toward integrated, accountable care and explicitly mandating an "advanced digital ecosystem." Flagship platforms underscore this digital pivot: TheSeha Virtual Hospital, launched under HSTP, connects facilities nationwide and is widely profiled as the world's largest virtual hospital; and the Saudi Arabia's National Platform for Health and Insurance Exchange Services (NPHIES) platform, led by the Council of Health Insurance with the National Health Information Center, standardizes and exchanges clinical/insurance data across the ecosystem. Within the broader Vision 2030 reform and the Health Sector Transformation Program, this study focuses on public hospitals in Tabuk**,** King Fahad Hospital and King Khalid Hospital, as a natural laboratory for observing strategy execution under real operational constraints. These hospitals operate withinMinistry of Health(MOH) governance, shared digital standards, and region-wide care pathways, making them ideal to examine how organizational culture interacts with IS to drive (or impede) strategy implementation (SI). The Tabuk setting also provides variation in service scope and patient flows while holding constant key policy levers (public ownership, national digital platforms), thereby sharpening identification of the culture-IS- SI pathway.

While prior work associates organizational culture with performance and documents rapid digital health adoption, empirical studies rarely test whether IS mediate the relationship between culture and SI in hospital settings, and this is particularly under-examined amid Saudi Arabia's large-scale transformation. Existing frameworks (e.g., CFIR; DeLone–McLean) imply such mediation, yet most evaluations emphasize direct effects or adoption endpoints rather than the indirect, technology-enabled pathway from culture to execution. Against the backdrop of Vision 2030 and cluster reorganization, this omission is consequential: without quantifying the culture-IS-implementation mechanism, leaders risk over-investing in isolated cultural initiatives or technology deployments that fail to translate into execution gains. This study addresses that gap by modeling and testing IS as a formal mediator in Saudi hospitals. By concentrating on two MOH hospitals in Tabuk, the study offers context-rich evidence on mediated effects that is directly actionable for regional leaders, while still informative for analogous public providers across the Kingdom. This delimitation enhances internal validity (shared policy and IS environment) and supports external learning to similar public hospital clusters.

This paper pursues three objectives: (i) estimate the direct effect of organizational culture on SI; (ii) test the mediating role of IS capability, integration, and use in transmitting culture's effects to execution; and (iii) explore contextual differences across public organizations relevant to Saudi reforms. The study contributes theoretically by integrating culture, IS, and execution into a single mediated model grounded in implementation science and IS success literature; empirically by offering what, to our knowledge, is the first mediated-path evidence situated within Vision 2030's HSTP and cluster reforms; and practically by identifying which IS capabilities most effectively convert cultural strengths into execution results, actionable for MOH/HHC executives and policy stewards. The paperis structured as follows: Section 2 synthesizes theory on organizational culture, SI, and healthcare IS to motivate a mediated model. While the conceptual framework and testable hypotheses are specified.Section 3details the Saudi setting, measures, sampling, and analysis. Section 4 reports measurement, structural, and mediation results with robustness checks. Section 5 interprets findings for theory, management, and policy, and Section 6 concludes with limitations and avenues for future research.

2. Literature Review

Theoretical Background

Culture comprises the shared assumptions that guide how work gets done. In Schein's view, it acts as a control and sense-making system, while CVF/OCAI and Denison translate it into measurable patterns (clan/adhocracy/market/hierarchy; involvement, consistency, adaptability, mission). Accordingly, culture is a higher-order antecedent to implementation.

Executiondistinct from formulationturns intent into routines, decision rights, and feedback. Classic work highlights obstacles (role ambiguity, weak governance, misaligned incentives), and tools like the Balanced Scorecard convert strategy into maps and key performance indicators (KPIs).

IS are not mere automation; they embody capability. RBV explains performance via IT infrastructure, skills, and intangibles; DeLone–McLean links quality → use/satisfaction → net benefits; strategic alignment ties business and IT domains. Together, IS functions as both capability and execution mechanism.

Dynamic capabilities theory adds that organizations adapt by sensing, seizing, and reconfiguring. Culture shapes these microfoundations; IS extends them through data/analytics, decision support, and modular processes—so their interplay is pivotal during transformation.

Implementation science specifies determinants of change: inner setting (including culture), people, and processes. Culture drives readiness and engagement; IS quality and use turn that readiness into routinized practice and feedback—making IS a theoretically grounded mediator.

Mechanistically, collaborative, learning-oriented cultures foster flexible IT (connectivity, compatibility, modularity) and user competence, raising information/system/service quality and purposeful use. This improves coordination, compliance, and KPI attainment; alignment provides the design rule linking clinical strategy to IS portfolios.

In Tabuk MOH hospitals, King Fahad and King Khalidpolicies, accreditation, and shared digital standards hold external conditions relatively constant, sharpening the focus on internal drivers. The culture-IS-execution pathway is therefore especially observable and testable in this setting.

2.1. Organizational culture in healthcare

Organizational culture (OC) provides the deep, shared assumptions that guide "how things get done," shaping coordination, learning, and control in hospitals where professional logics and safety norms dominate daily practice (Schein, 2010). Two widely used lenses operationalize culture for empirical work: the Competing Values Framework (CVF) and its OCAI instrument, which profile Clan, Adhocracy, Market, and Hierarchy emphases (Cameron & Quinn, 2011), and the Denison model, which links Involvement, Consistency, Adaptability, and Mission traits to performance (Denison & Mishra, 1995). Evidence from healthcare shows that cultures that balance discipline with learning, e.g., safety-oriented consistency combined with adaptive problem-solving, are associated with higher quality and improvement capacity, reinforcing the centrality of culture to execution in clinical settings (Mannion & Davies, 2018; Nimat et al., 2025).

2.2. Strategy implementation

SI translates intent into coordinated routines, decision rights, and feedback, yet it commonly falters due to weak accountability, cross-functional misalignment, and inadequate measurement (Hrebiniak, 2006). A canonical remedy is the Balanced Scorecard, which cascades strategy maps and multi-perspective KPIs to align operations and learning with strategic goals (Kaplan & Norton, 1996). In hospitals, implementation science clarifies the

micro-mechanisms, inner-setting factors (culture, leadership, readiness), and process activities (engagement, reflection), that enable uptake (Damschroder et al., 2009). Integrative strategy frameworks similarly stress that timing, structure, and power dynamics interact with content and context, making execution a socio-technical process rather than a purely administrative one (Okumus, 2003).

2.3. IS in hospitals

IS is both capabilities and success systems. From a resource-based view, IT capabilityspanning infrastructure, human skills, and IT-enabled intangiblesexplains performance differentials when such capabilities are valuable, rare, and hard to imitate (Bharadwaj, 2000). The DeLone-McLean model details the success pathwayinformation/system/service quality use & satisfaction net benefitslinking sociotechnical design to outcomes (DeLone & McLean, 2003). Strategic alignment theory shows that performance materializes when business and IS strategies and infrastructures are mutually reinforcing (Henderson & Venkatraman, 1993). In healthcare, reviews find thatElectronic Health Record/Health Information Technology(EHR/HIT) effects on quality and safety are strongest where systems are interoperable and wellintegrated into workflows, underscoring capability, integration, and alignment as the actionable levers (Buntin et al., 2011).

2.4. Culture and Strategy Implementation

A large body of evidence connects culture directly to execution and performance. Meta-analytic work on the CVF shows systematic links between cultural profiles and effectiveness criteria (Hartnell et al., 2011; Nimat et al., 2025). In hospitals, stronger safety and teamwork climates are associated with fewer adverse events and better outcomes, indicating a direct culture-implementation channel (Singer et al., 2009; Mardon et al., 2010). Interventions that deliberately cultivate safety culture also show improvements in implementation processes and results, reinforcing culture's first-order role in making strategy actionable (Weaver et al., 2013).

2.5. Culture andIS

Culture also shapes whether and how complex IS takes root. Implementation effectiveness rises where climates emphasize learning, cooperation, and implementation valuesconditions that support user engagement, training absorption, and routinization (Klein & Sorra, 1996). IS research converging: cross-study reviews show that cultural assumptions and values systematically influence technology adoption, use, and outcomes (Leidner & Kayworth, 2006). In healthcare, organizational reviews find that sociotechnical fit, often a cultural product,drives whether digital projects succeed (Cresswell & Sheikh, 2013), while classic innovation syntheses highlight that receptive contexts accelerate health IT spread (Greenhalgh et al., 2004).

2.6. ISand Strategy implementation

Well-designed and well-used IS converts plans into practice through process integration, coordination, auditability, and timely feedback, the very mechanisms by which execution occurs. Alignment studies show that business-IT fit improves execution capacity and strategic agility (Tallon & Pinsonneault, 2011), while IT value research explains how infrastructure and complementary practices translate into performance (Melville, Kraemer, & Gurbaxani, 2004). In hospitals, systematic reviews link EHR/HIT, especially with interoperability and substantive use, to gains in quality and safety, clarifying IS's direct contribution to implementation outcomes (Jones, Rudin, Perry, & Shekelle, 2014; Kruse et al., 2016).

2.7. How doesculture transmit's effects to strategy implementation

Integrating these streams yields a testable mediation. CFIR positions culture within the inner setting that shapes readiness and implementation processes (Damschroder et al., 2009). DeLone–McLean specifies how IS quality and use generate benefits (DeLone & McLean, 2003). Dynamic capabilities theory shows how culture undergirds sensing, seizing, and reconfiguring routines, while IS extends data-driven sensing and coordination, thereby carrying cultural strengths into execution (Teece, 2007; Pavlou & El Sawy, 2011). Together, these logics motivate the mediated chain culture → IS →SI that this study will test.

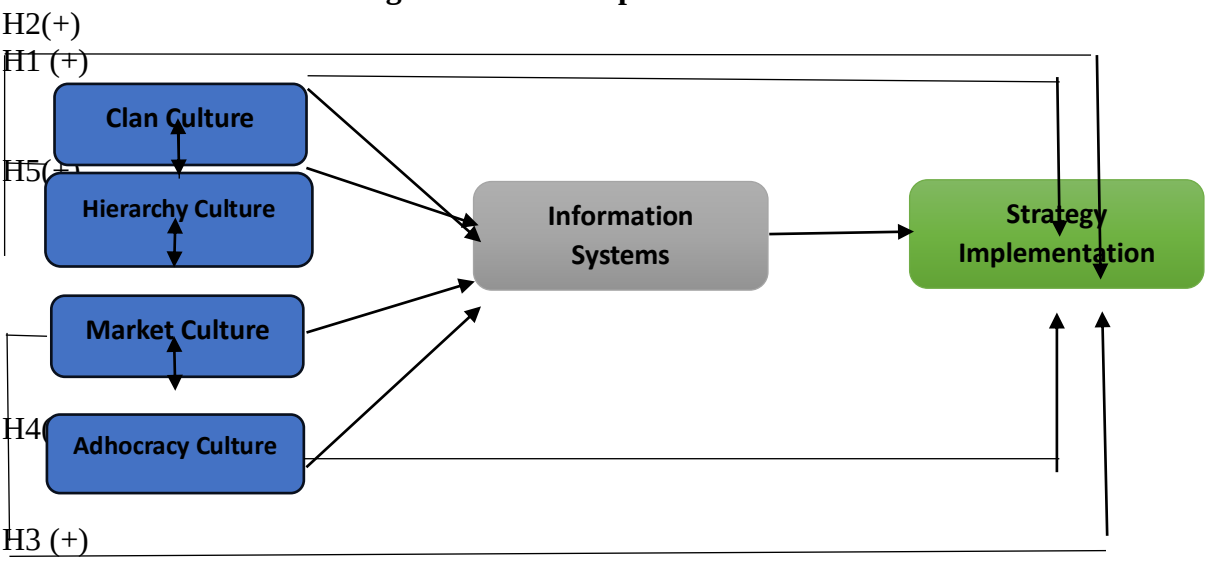
2.8. Conceptual framework

Organizational Culture: A higher-order latent construct capturing shared values and norms that shape routines. Operationalized reflectively via validated CVF typologies (i.e. Clan, Hierarchy, Market, and Adhocracy).

IS: A second-order latent construct capturing the hospital's ability to deliver reliable, integrated, and useful digital support for execution. Modeled with subdimensions such as infrastructure flexibility (connectivity, compatibility, modularity), data/system/service quality, interoperability/integration, user competence and use.

SI: A latent outcome capturing the extent to which strategic intents are translated into coordinated processes and results (e.g., KPI attainment, timeliness, adherence to pathways, cross-unit coordination).

Figure 1. Theconceptual framework



Hypotheses Development

Direct effect:

- H1: Clan culture positively influences SI.
- H2: Hierarchyculture positively influences SI.
- H3: Market culture positively influences SI.
- H4: Adhocracy culture positively influences SI.

Mediation Effect:

- H5: IS mediates the relationship between organizational culture and SI.

3. Research Method

3.1 Research design

This study adopts a cross-sectional, explanatory design using a structured questionnaire to test a mediated model in which IS capability/effectiveness carries the effect of OC to SI. Partial Least Squares Structural Equation Modeling (PLS-SEM) is employed because the model includes a second-order IS construct, mediation, and potentially non-normal indicators.

3.2 Setting and population

The empirical setting is two public MOH hospitals in Tabuk, Saudi Arabia: King Fahad Hospital and King Khalid Hospital. The target population comprises employees in medical (e.g., physicians, nurses, allied health, clinical leaders) and administrative/technical positions (e.g., department managers, planning/PMO, quality & patient safety, HR, finance, health informatics/IT) who are directly involved in strategy execution and/or routine use of hospital IS.

3.3 Sampling frame and selection

Frame construction: For each hospital, HR provides two rosters: medical and administrative/technical staff who (a) are full-time, (b) have ≥6 months' tenure, and (c) are involved in strategy execution or use IS in core workflow. Interns/locums/temporary staff are excluded.

Stratified random selection: Within each hospital, we draw a simple random sample of 150 employees from the combined rosters using a reproducible random number generator, stratified by role (medical vs. administrative) with proportional allocation to each role's share in that hospital's roster. (Example: if Hospital A's roster is 65% medical and 35% administrative, the drawn sample is 65 and 35, respectively.)

Replacements: For non-responses or ineligibility discovered post-selection, pre-generated reserve lists (by stratum) supply replacements to maintain n = 150 per hospital.

3.4 Power and precision

With N = 300, the study has ample power to detect small-to-moderate standardized path coefficients and indirect effects in a three-construct mediation model using bootstrapping ($\alpha = .05$). Precision is enhanced by stratification (role) and equal hospital sample sizes, which facilitate multi-group robustness checks across hospitals.

3.5 Measures and instrument structure

All items use a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Established scales are adapted to the hospital context and reviewed by content experts.

OC: dimensions such as Involvement, Consistency, Adaptability, and Mission. These dimensions yield four typologies (i.e., clan, hierarchy, market, and adhocracy).

IS: subdimensions include Infrastructure flexibility (connectivity, compatibility, modularity), Information quality, System quality, Service quality, Interoperability/integration, User competence, and Use/Infusion.

SI: execution routines and outcomes (e.g., goal/KPI clarity & attainment, cross-unit coordination, timeliness, adherence to clinical/administrative pathways, feedback & corrective action).

3.6 Data collection procedures

Data are collected over a 4-week window using secure Google Forms (unique, one-use tokens). Participation is voluntary; no supervisors handle responses. Reminder waves are scheduled at days 7 and 14. To reduce social desirability, the cover page emphasizes anonymity, aggregated reporting, and the absence of right/wrong answers.

3.7 Bias minimization

Procedural remedies: neutral language, mixed item order, separation of predictor/criterion blocks, anonymity, and clear instructions.

Statistical checks: common method variance (CMV) assessed via full collinearity VIFs, Harman's single-factor test, and a marker variable; non-response bias tested by comparing early vs. late respondents on key constructs.

3.8. Data analysis plan (PLS-SEM)

Screening & descriptives: assess missingness, normality, and correlations by hospital and role.

Measurement model: indicator loadings (≥ .70 preferred), internal consistency (α, CR, ρ_A), convergent validity (AVE ≥ .50), and discriminant validity (HTMT < .85/.90). For ISC as a second-order construct, apply either the two-stage or repeated-indicators approach with consistent PLS.

Structural model: check collinearity (VIF < 5), estimate direct paths OC → SI, OC → ISC, ISC → SI, and the indirect (mediated) effect using bias-corrected bootstrapping (5,000 resamples). Report β, t, p, and 95% CIs, plus R^2, f^2, Q^2 (blindfolding), and PLSpredict for out-of-sample predictive validity.

Mediation assessment: significance of the indirect effect and Variance Accounted For (VAF) to classify partial vs. full mediation.

4. Results

4.1. Descriptive Statistics

Based on Table 1, respondents report consistently high levels across constructs: Hierarchy (M=4.207) and IS (M=4.202) are highest, followed by Market (M=4.195) and Clan (M=4.155); SI is lower but still favorable (M=3.965), suggesting execution lags slightly behind culture and systems. Dispersion is modest for most constructs (SD≈0.44–0.57), but Adhocracy is notably variable (SD=0.734), with extreme non-normality (skew=2.908; kurtosis=18.547): this implies pockets of very high innovation alongside much lower scores (or a few outliers), warranting subgroup checks. By contrast, Clan/Hierarchy/Market/IS/SI exhibit a slight negative skew (−0.08 to −0.37) and near-normal kurtosis (−0.31 to 0.44), consistent with mild ceiling effects, as many respondents rate these positively. Confidence intervals are tight (e.g., IS 4.143–4.261), reflecting precision with your N; the wider CI for Adhocracy (4.00–4.17) mirrors its heterogeneity. Practically, the profile indicates strong foundations in culture and digital capability, with improvement opportunities in spreading Adhocracy (innovation/experimentation) more evenly and closing the execution gap so SI catches up with cultural and IS strengths.

Table 1. Descriptive Statistics

Construct	Mean	SD	Skewness	Kurtosis	95% CI Low	95% CI High
Clanculture	4.155	0.435	-0.083	0.036	4.105	4.204
Hierarchyculture	4.207	0.526	-0.369	-0.066	4.147	4.266
Marketculture	4.195	0.467	-0.299	-0.095	4.142	4.248
Adhocracyculture	4.081	0.734	2.908	18.547	3.998	4.165
SI	3.965	0.567	-0.19	0.435	3.901	4.03
IS	4.202	0.519	-0.269	-0.314	4.143	4.261

4.2 Measurement model assessment

Internal consistency: Composite reliability (CR) exceeded the .70 benchmark for all constructs (range = .75–.91), indicating satisfactory internal consistency after accounting for unequal indicator loadings. Cronbach's alpha (α) met or surpassed .70 for Clan culture (α = .76), Hierarchy culture (α = .83), SI (α = .83), and IS (α = .88). Two culture facets fell below the conventional threshold—Market culture (α = .54) and Adhocracy culture (α = .46)—suggesting weaker average inter-item correlations for these blocks.

Convergent validity: Average variance extracted (AVE) reached or slightly exceeded .50 for Hierarchy culture (AVE = .567), SI (AVE = .504), and IS (AVE = .505), supporting convergent validity. Adhocracy culture was marginal (AVE = 0.458), while Clan (AVE = 0.352) and Market (AVE = 0.379) were below the preferred cut-off. A construct-level convergence test using Fisher's method yielded combined p-values < .001 for all constructs, indicating that item–composite correlations are jointly different from zero; however, AVE remains the primary criterion for convergence.

Implications for refinement: Taken together, Hierarchy, SI, and IS are measurement-ready for inclusion in the structural model. Clan and Market require tightening of convergence (e.g., reviewing translations, removing low-loading or conceptually ambiguous items). Adhocracy shows high CR but low α and borderline AVE, an indication of unequal loadings or mixed subthemes (e.g., "innovation" vs. "external orientation"); the block may benefit from pruning weak indicators or modeling the first two-order facets rolled up to a second-order Adhocracy construct (see Table 2).

Table 2. Measurement of quality statistics for the SEM constructs

Construct	Items	AVE	Composite reliability	Cronbach alpha	p-value*
Clan culture	9	0.352	0.830	0.760	<0.001
Hierarchy culture	6	0.567	0.886	0.831	<0.001
Market culture	5	0.379	0.750	0.541	<0.001
Adhocracy culture	8	0.458	0.865	0.459	<0.001
SI	8	0.504	0.887	0.833	<0.001
IS	10	0.505	0.909	0.879	<0.001

Notes: AVE = Average Variance Extracted; CR = Composite Reliability; α = Cronbach's alpha. "p-value" reports a Fisher combined test across item–composite correlations (two-tailed) as a supplemental indicator of convergent signal. **Criteria:** CR ≥ .70; AVE ≥ .50 preferred; α ≥ .70 (guideline).

4.3. Path Coefficients

The pattern of path coefficients strongly supports the study's central mechanism: IS are the principal conduit through which culture becomes execution. The IS → SI path is large and highly significant (β = 0.439, t = 8.380, p < .001), indicating that better-integrated, higher-quality, well-used systems meaningfully translate strategic intent into day-to-day routines, coordination, and KPI attainment as shown in Table 3. Substantively, this means that where digital platforms are interoperable, information quality is high, and users are competent and engaged, hospitals are far more likely to see strategies enacted consistently on the ground.

Turning to what builds IS, three culture profiles matter. Clan culture shows the strongest association with IS (β = 0.337, p < .001), followed by Market (β = 0.195, p < .001) and Adhocracy (β = 0.143, p = .009). In practical terms, environments characterized by mentoring, trust, and collaborative problem-solving (Clan) appear to create the social conditions for adoption, integration and meaningful use of hospital IS. A measured external focus on targets, benchmarking, and responsiveness (Market) also helps, likely by prioritizing

the performance payoffs of digital tools. Innovation-oriented norms (Adhocracy) contribute as well, though more modestly, by encouraging experimentation and learning with new digital workflows. By contrast, Hierarchy culture does not significantly predict IS (β = 0.100, p = .124), suggesting that rule-bound routines and formal authority, on their own, are insufficient to produce the kind of IS capability that enables strategy execution.

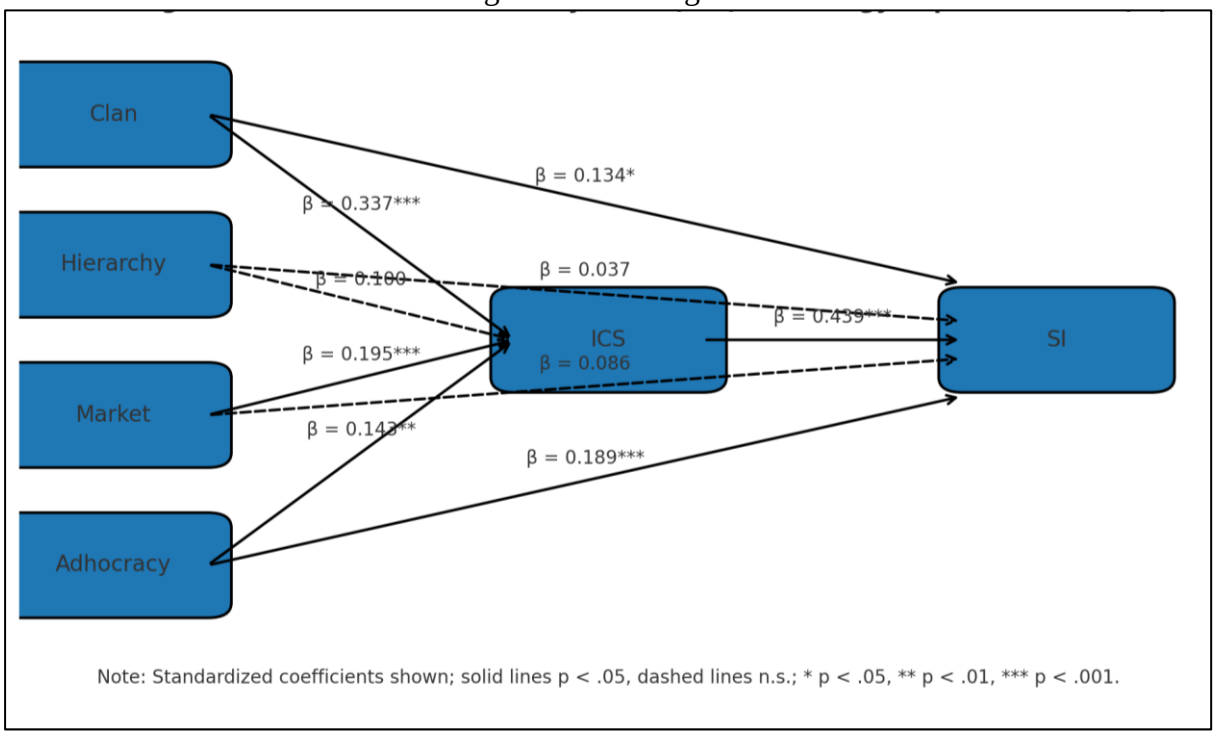
When IS is included as a mediator, selected culture types still retain direct effects on SI. Adhocracy exhibits a clear, positive direct path to implementation (β = 0.189, p < .001), and Clan remains significant though smaller (β = 0.134, p = .040). This indicates partial mediation for these two cultures: they enhance strategy execution both indirectly—by first strengthening IS—and directly—by fostering engagement, local problem-solving, and cross-unit coordination that shorten the distance from plan to practice. Market's direct path to SI is marginal (β = 0.086, p = .092), implying most of its contribution is channeled through IS rather than operating independently on execution. Hierarchy remains negligible (β = 0.037, p = .521), reinforcing the interpretation that formal structure must be complemented by collaborative and innovative norms to produce execution gains.

Table 3. Path Coefficients results

Relationship	**VIF**	**β (standardized)**	**T.stat**	**P-value**
Clan→SI	2.617	0.134	2.06	0.04
Hierarchy→SI	2.107	0.037	0.642	0.521
Market→SI	1.601	0.086	1.689	0.092
Adhocracy→SI	1.531	0.189	3.798	0.000
Clan→IS	2.424	0.337	4.85	0.000
Hierarchy→IC	2.09	0.1	1.542	0.124
Market→IS	1.537	0.195	3.53	0.000
Adhocracy→IS	1.496	0.143	2.622	0.009
IS→SI	1.699	0.439	8.38	0.000

Collinearity diagnostics are favorable across all models (all VIF < 3), so the estimates are not distorted by overlapping predictors. This matters because the culture types are conceptually related; the low VIFs indicate that the positive coefficients for Clan, Market, and Adhocracy are not artifacts of redundancy but reflect distinct contributions to IS and SI. The clean collinearity profile makes the case for mediation more credible and reduces concerns about unstable signs or suppressed effects (see Figure 1).

Figure 1. Path diagram



For management in the Tabuk public hospitals, the results suggest a clear sequencing logic. First, cultivate a Clan-plus-Adhocracy mix—visible mentorship, psychological safety, and disciplined experimentation—to unlock clinician and staff engagement with digital tools. Second, use Market-type routines—explicit targets, benchmarking, and feedback—to focus that engagement on measurable performance outcomes. Third, invest in IS capabilities that staff actually experience (interoperability across departments, reliable data, responsive support), because that is the largest single lever for translating culture into execution. Purely hierarchical tightening—more rules, more formal approvals—does not move the digital or execution needles on its own; it should be used as scaffolding, not the engine.

4.4. The mediation Effect

The bootstraps show that Clan and Market cultures influence SI primarily through IS—what mediation textbooks call indirect-only mediation, as indicated in Table 4. Mediation through IS is the main route by which culture translates into strategy execution. The spine IS → SI is strong ($\beta = 0.439$, $p < .001$).

- Clan and Market cultures show significant indirect effects via IS—Clan 0.148 (95% CI [0.047, 0.227]), Market 0.086 ([0.019, 0.155])—with non-significant direct paths; totals are significant (Clan 0.282, Market 0.172). VAFs ≈ .53 and .50, respectively, indicating effects are largely carried by IS.
- Adhocracy shows both a smaller but significant indirect (0.063, [0.011, 0.219]) and a larger direct effect ($c' = 0.189$, $p < .001$); total 0.252, VAF ≈ 0.25 → partial mediation.
- Hierarchy is not supported (indirect, direct, and total all ns).

In Tabuk's public hospitals, the clearest route from plan to performance is to strengthen IS, interoperability, data quality, and user support—because IS is the main conduit to SI. Clan (mentorship/teamwork) and Market (targets/feedback) cultures improve execution mostly through IS, so embed these behaviors inside dashboards, huddles, and digital workflows.

Adhocracy (innovation) boosts implementation both directly and via IS, warranting protected pilots and rapid-cycle improvement tied to system monitoring, while Hierarchy adds little on its own. Practically, align MOH/cluster incentives with IS-visible metrics, create joint clinical–IT governance, and sequence resources as culture → IS capability → performance routines → SI.

Table 4.The mediation effect

Construct	Indirect a*b	Direct c' (Cultureâ†'SI)	Total (c' +a*b)	Total 95% CI [lo, hi]	Total p
Clan	0.148	0.134	0.282	[0.062, 0.440]	0.007
Hierarchy	0.044	0.037	0.081	[-0.109, 0.229]	0.405
Market	0.086	0.086	0.172	[0.058, 0.266]	0.001
Adhocracy	0.063	0.189	0.252	[0.118, 0.859]	0.000

4.5. Robustness

Results are stable across multiple checks of the model, as shown in Table 5. Using PCA-based scores instead of equal-weight composites leaves the IS → SI path large and significant, and the culture → IS pattern qualitatively unchanged (Clan/Adhocracy positive, Market small–positive, Hierarchy weak). With HC3 robust SEs, IS → SI and Clan/Market → IS remain significant; Adhocracy → IS attenuates to marginal, yet its bootstrapped indirect effect (Adhocracy → IS → SI) stays significant, so mediation conclusions hold. A rank-based (Spearman) specification again yields a strong IS → SI link and positive culture → IS effects, while direct culture → SI paths mostly weaken—consistent with culture acting mainly through IS. Trimming the top 1% by Cook's distance preserves signs and significance of core paths, indicating results are not driven by outliers. Collinearity is low (all VIF < 3), procedural remedies limit common-method bias, and the pattern of significant indirect effects argues against single-source inflation. Therefore, IS capability/use is the robust channel through which collaborative, innovative, and performance-oriented cultures translate into strategy execution; pure hierarchy adds little on its own.

Table 5. SEM Robustness

Check	B	P-VALUE	Signif. CultureIS	Max VIF
Baseline (Equal-weight composites)	0.439	0.001	Clan, Market, Adhocracy	2.617
PCA composites (1st PC)	-0.305	0.001	Clan, Adhocracy	2.811
HC3 robust SEs	0.439	0.001	Clan, Market, Adhocracy	2.617
Rank-based (Spearman)	0.343	0.001	Clan, Hierarchy, Market, Adhocracy	2.945
Trim top 1% Cook's distance	0.325	0.001	Clan, Market, Adhocracy	3.044
Bootstrap mediation (3,000)	0.439	0.001	Clan, Market, Adhocracy (indirect sig.)	2.617

4.6. The hypothesis testing results

The hypotheses tests confirm that culture drives SI chiefly through IS, with selective direct effects. As shown in Table 6, H1 (Clan → SI) is supported (β = 0.134, p = .040) and shows a significant indirect path via IS (a×b = 0.148, 95% CI [0.047, 0.227]), yielding the largest total effect (0.282) and VAF ≈ 0.53, meaning over half of Clan's influence operates through IS. H2 (Hierarchy → SI) is not supported (β = 0.037, p = .521) and its indirect effect is nonsignificant (0.044; CI spans zero), indicating formal control alone does little for execution. H3 (Market → SI) is marginal directly (β = 0.086, p = .092) but shows a significant mediated effect (0.086, [0.019, 0.155]) with VAF ≈ 0.50 and a meaningful total effect (0.172), implying performance/target orientation boosts execution mainly by strengthening IS. H4 (Adhocracy → SI) is supported with the largest direct path (β = 0.189, p < .001) and a smaller but significant indirect effect via IS (0.063, [0.011, 0.219]); VAF ≈ 0.25 and total = 0.252 indicate partial mediation, i.e., innovation/experimentation helps both with and beyond digital enablement. Taken together (H5), the results show that mediation occurs in Clan, Market, and Adhocracy cultures, but not in Hierarchy. This supports the study's main argument: cultures that emphasize collaboration, performance, and innovation enhance execution mainly through the development and use of IS, while bureaucratic structures alone do not have the same effect.

Table 6. *Hypothesis testing results*

Hypothesis	**β (std.)**	**t**	**p**	**Total effect**	**Decision**
H1: Clan → SI	0.134	2.060	0.040	0.282	Supported
H2: Hierarchy→ SI	0.037	0.642	0.521	0.081	Not supported
H3: Market → SI	0.086	1.689	0.092	0.172	Not supported
H4: Adhocracy → SI	0.189	3.798	0 .001	0.252	Supported
H5:					
• Clan → IS → SI	—	—	—	0.282	Supported
• Hierarchy → IS → SI	—	—	—	0.081	Not supported
• Market → IS → SI	—	—	—	0.172	Supported
• Adhocracy → IS → SI	—	—	—	0.252	Supported

5. Discussion

Using data from two MOH hospitals in Tabuk, we found that IS is the primary conduit through which culture translates into SI. The IS→SI path was strong. Clan and Market cultures improved SI mainly via IS (significant indirect effects). At the same time, Adhocracy showed partial mediation, a smaller but significant indirect effect alongside the largest direct path to SI. Hierarchy exhibited neither significant direct nor indirect effects.

These results align with evidence that organizational culture shapes clinical performance in hospitals and public services, with collaborative and adaptive profiles outperforming Hierarchy ones in enabling change (Scott, Mannion, Davies, & Marshall, 2003; Jung, Scott, Davies, & Bower, 2009; Braithwaite, Herkes, Ludlow, Testa, & Lamprell, 2017). The dominance of the systems pathway accords with information-systems success research, where information, system, and service quality drive benefits through use and user satisfaction, and with strategic alignment work showing that shared goals and governance convert digital capability into execution (Petter, DeLone, & McLean, 2008; Urbach & Müller, 2012; Sabherwal & Chan, 2001). The additional direct lift from adhocracy is consistent with dynamic-capabilities views that innovation-oriented routines—sensing, experimenting, reconfiguring—translate into operational gains beyond the IT channel (Eisenhardt & Martin, 2000). At the same time, the broader literature cautions that technology alone produces mixed

results without socio-technical fit and engaged use, reinforcing our mediation logic (Black et al., 2011; Greenhalgh, Wherton, Papoutsi, Lynch, & Hughes, 2017). In the Saudi context, reviews of eHealth initiatives similarly emphasize capability, interoperability, and adoption conditions as prerequisites for improved implementation, mirroring our findings (Hasanain, Vallmuur, & Clark, 2015).

The study advances a culture→IS→execution theory of change with culture-specific pathways: (i) indirect-dominant channels for Clan and Market (culture builds IS; IS builds SI) and (ii) dual channels for Adhocracy (direct plus mediated). This clarifies *how* culture "gets under the skin" of execution—via interoperability, data quality, and routinized digital feedback, while also recognizing non-digital mechanisms (empowerment, experimentation). Conceptually, IS functions as an organizational capability that converts cultural strengths into repeatable execution routines; VAF patterns provide a measurable handle for future comparative studies and refine assumptions of tau-equivalence among culture items (notably for Adhocracy).

Practical implications for Saudi healthcare leaders

Managers should treat IS as execution infrastructure: prioritize interoperability, data quality, and user support (e.g., super-user networks, real-time dashboards embedded in strategy huddles). To power that infrastructure, cultivate Clan behaviors (mentorship, cross-unit help) and Market routines (clear targets, timely feedback) inside the systems—e.g., KPI-linked dashboards, automated audit-and-feedback. Preserve and scale Adhocracy pockets (pilots, rapid-cycle improvement) because they push execution directly and via IS when tied to monitoring. De-emphasize bureaucracy-as-solution: rules and approvals without digital enablement and collaborative/innovative norms are unlikely to shift SI. A practical sequence is: shape culture (Clan/Adhocracy) → invest in IS capability → institutionalize Market-style performance routines → lift SI.

Policy implications

For MOH and Health Clusters, align incentives and performance contracts with IS-visible metrics (pathway adherence, turnaround times) to make execution measurable and improvable at scale. Use accreditation and digital maturity standards (e.g., interoperability, data completeness, use of feedback dashboards) to codify the mediation pathway—not just compliance. Fund integration-first projects (data exchange across departments and with national platforms) before procuring new apps; require joint clinical–IT governance for major initiatives; and resource workforce development that embeds Clan/Adhocracy practices (mentoring, experimentation) into digital rollouts. Cluster-level analytics and cross-hospital benchmarking should focus on leading indicators in IS that predict SI, reinforcing a learning system where culture and technology co-produce sustained execution gains.

6. Conclusion

This study shows that IS are the primary conduit through which OCbecomes strategy-in-action in Tabuk's public hospitals. The IS →SI (SI) link is the strongest structural path ($\beta \approx 0.44$), and three culture types—Clan, Market, and Adhocracy—improve SI chiefly by building and leveraging IS. Specifically, Clan (mentorship, teamwork) exerts its largest influence indirectly through IS (indirect = 0.148; VAF ≈ 53%; total = 0.282); Market (targets, feedback) behaves similarly (indirect = 0.086; VAF ≈ 50%; total = 0.172); and Adhocracy (innovation) has dual channels, combining a meaningful mediated effect (0.063; VAF ≈ 25%) with the largest direct push to execution ($c' \approx 0.19$; total = 0.252). Hierarchy control) does not translate into better execution on its own (no supported direct or indirect effects). Descriptively, culture and IS are rated high (means ≈ 4.1–4.2/5), while SI is slightly lower (≈ 4.0), signaling an execution gap that narrows where IS capability and use are strongest.

The practical message is clear: build the culture that builds the system, then the system builds the strategy. In concrete terms, prioritize interoperability, data quality, and user support as execution infrastructure; embed Clan behaviors (mentoring, cross-unit help) and Market routines (clear targets, timely feedback) inside dashboards and digital workflows; and protect Adhocracy pockets (pilots, rapid-cycle improvement) because they add a direct, non-digital lift to execution when coupled with system-enabled monitoring. Simply adding more rules or approvals (Hierarchy) is insufficient unless paired with collaborative and innovative norms and robust IS.

Theoretically,we specify and test a culture → IS →SI mechanism with culture-specific pathways (indirect-dominant for Clan/Market; dual for Adhocracy) and quantify their shares using VAF, clarifying *how* culture travels into execution.

Empirically. We provide context-rich evidence from three MOH hospitals in Tabuk (N=300) during Vision 2030 transformation, documenting high cultural/IS baselines and an execution gap that narrows where IS is strong.

Methodologically,we combine measurement diagnostics (CR/AVE/α), bootstrapped mediation (3,000 resamples), and robustness checks (PCA scoring, HC3 SEs, rank-based models, outlier trimming), showing the findings are not an artifact of scoring, non-normality, or a few influential cases.

Limitations

The cross-sectional design limits causal claims; self-report Likert data raise common-method concerns despite procedural remedies. Some culture blocks showed modest convergence (e.g., Clan/Market AVE) and uneven reliability (Adhocracy α), suggesting item refinement. External validity is bounded to two MOH hospitals (public sector, Tabuk); private providers, other regions, and different digital maturities may behave differently.

Future research avenues

Panel or quasi-experimental designs (e.g., phased rollouts, DiD) to identify temporal ordering and effect persistence.

Link culture/IS to EHR audit logs, process-mining metrics, lab turnaround, readmissions, pathway adherence and IS-use telemetry to validate outcomes beyond perceptions. Multi-level & comparative: Model unit/department culture and cross-level mediation; compare public vs. private, large vs. small, and accreditation levels; test invariance across clusters/regions.

Qualitative deep dives: Ethnography and key-informant interviews to surface mechanisms (e.g., how dashboards rewire huddles, how psychological safety accelerates digital uptake). Measurement refinement: Prune/clarify weak items, consider second-order culture facets for Adhocracy, and confirm invariance; explore necessary conditions (NCA) or QCA to complement SEM.

Authors' Contributions

Fatmah Mohmmad H. Alatawi conceptualized the research idea, coordinated access to healthcare institutions in Tabuk, and led the theoretical framing of the study. She contributed to the development of the conceptual model, oversaw data collection, and provided critical revisions to all manuscript drafts.

NimatElfadil Ali Mohamedcontributed to the literature review and co-authored the discussion and policy implication sections. She also managed referencing, formatting, and final manuscript editing.

EltayebGasmelseid Ahmed Mohammed was responsible for designing the questionnaire, managing the sampling and survey procedures, and conducting the structural equation

modeling (PLS-SEM) analysis. He also led the robustness testing and mediation assessments, assisted in interpreting the statistical results in light of Saudi healthcare policy, and co-wrote the methods and results sections.

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