*Journal of Economics, Entrepreneurship, Management Business and Accounting, 2026, 4(4),1511-1537.*
https://doi.org/10.61255/jeemba.v4i4.1599

# Linking Health IT and Learning Organization to Sustainable Hospital Performance: Mediating Effect of Adaptive Agility Strategy

Tresia Mahaputeri Nusantari Maghfirah[1*], Denny Bernardus[1], Cliff Kohardinata[1], and Halek Mu'min[2]
[1]Department of Management, Faculty of Business and Management, Universitas Ciputra, Surabaya, 60219, Indonesia
[2]Department of Management, Faculty of Economics and Business, INTI International University, Bandar Baru, 71800, Malaysia

**ABSTRACT**

**Purpose** – This study examines whether Adaptive Strategy Based Agility (ASBA)—a novel construct synthesizing Dynamic Capability Theory and Institutional Theory—mediates the effects of Health Information Technology (HIT) and Learning Organization (LO) on Sustainable Hospital Performance (SHP) in Indonesian hospitals, addressing prior inconsistent findings on HIT's direct performance effects.
**Design/methodology/approach** – Data were collected from 240 respondents (hospital directors and senior management) across 80 hospitals in Jakarta, Bandung, Semarang, and Surabaya, three respondents per hospital, using a seven-point Likert questionnaire. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4 to test seven hypothesized relationships spanning direct effects, antecedent-to-ASBA paths, and ASBA's mediating role.
**Findings/Results** – All five direct paths were statistically significant and positive. HIT and LO each had significant direct and indirect effects on SHP, both classified as complementary (partial) mediation through ASBA, which itself was the strongest single predictor of SHP. The model also showed meaningful out-of-sample predictive relevance via PLSpredict and CVPAT.
**Originality/Value** – The study contributes theoretically by integrating Dynamic Capability Theory and Institutional Theory within a single mediating construct (ASBA), and practically by clarifying how hospitals can convert technological and learning-based resources into sustained performance through deliberate, institutionalized strategic agility.

**ARTICLE INFO**

**Keywords:**
Health Information Technology, Learning Organization, Adaptive Strategy Based Agility, Sustainable Hospital Performance, Dynamic Capability Theory

**Article Information:**
Received: 20/05/2026
Revise: 20/06/2026
Accepted: 22/07/2026

**ISSN:**
2985-3168 (Online)
2985-3222 (Print)

*Corresponding Author at:
Department of Management, Faculty of Business & Management, Universitas Ciputra, CitraLand CBD Boulevard, Jl. Waterpark Boulevard, Made, Kec. Sambikerep, Surabaya, Surabaya 60219, Indonesia.
E-mail address: tmahaputeri@student.ciputra.ac.id (Tresia Mahaputeri Nusantari Maghfirah)

## 1. Introduction

Indonesian hospitals, particularly those in major metropolitan centers such as Jakarta, Bandung, Semarang, and Surabaya, operate under mounting pressure to modernize service delivery while sustaining long-term operational and financial viability. Health Information Technology (HIT), encompassing electronic health records, hospital information systems, and clinical decision support tools, is widely promoted as a strategic lever for achieving this modernization (Han et al., 2019; White-Williams et al., 2016). The prevailing policy assumption is that greater HIT adoption translates directly into superior hospital performance. Empirical evidence, however, does not consistently support this assumption (Cho et al., 2018; White-Williams et al., 2016).

Two studies illustrate this inconsistency directly. (Cho et al., 2018), analyzing 2173 US hospitals, found that HIT adoption had a statistically significant positive effect on hospital efficiency when considered independently of other organizational factors. In contrast, (Feldman et al., 2018), synthesizing evidence across multiple studies, found that HIT's association with core clinical and operational outcomes remains mixed and inconsistent across the literature, with some studies reporting measurable quality and safety gains and others finding no significant improvement. Both sources examine reputable, hospital-focused evidence and rely on established review or quantitative methods, yet point to differing conclusions regarding whether HIT reliably improves hospital performance.

This inconsistency suggests that the effect of HIT on performance may depend on an intervening organizational mechanism that neither study measures directly. Dynamic Capability Theory explains how organizations sense, seize, and reconfigure resources in response to environmental change (Teece et al., 1997; Teece, 2007), while Institutional Theory explains how novel practices become embedded as durable, taken-for-granted organizational routines (P. J. DiMaggio & Powell, 1983; Richard & Tolbert, 2005; Volberda et al., 2021). Neither theory alone, however, explains why technological resources such as HIT sometimes fail to translate into measurable performance gains. This study proposes that Adaptive Strategy Based Agility (ASBA), a novel construct synthesizing both theories into a single capability spanning regulatory sensing, strategic seizing and prioritization, resource reconfiguration, and institutional learning, is the missing mechanism: hospitals that adopt HIT without a theory-consistent pattern of sensing, seizing, reconfiguring, and institutionalizing strategic action around it are expected to show weaker associations with consistent performance benefits, while those that do so are expected to achieve superior and more sustainable outcomes.

Learning Organization (LO) capability, the organizational capacity to create, acquire, and transfer knowledge and to modify behavior accordingly (Lichtenthaler, 2009; Tsang, 1997), is proposed as a second antecedent of ASBA and of Sustainable Hospital Performance (SHP), since the institutional learning stage of ASBA plausibly depends on the same supportive learning environment and reflective practices that define a learning organization. Building on this reasoning, the study examines whether Health Information Technology, Learning Organization, and Adaptive Strategy Based Agility each have a significant positive effect on Sustainable Hospital Performance; whether Health Information Technology and Learning

Organization each have a significant positive effect on Adaptive Strategy Based Agility; and whether Adaptive Strategy Based Agility positively mediates the relationships between Health Information Technology, Learning Organization, and Sustainable Hospital Performance(Bardhan & Thouin, 2013; Bucheli et al., 2024; Payne et al., 1988) .

ASBA is positioned here as conceptually narrower, and more sequence-specific, than the neighboring constructs it most closely resembles. Strategic agility and organizational agility typically describe a firm's general speed and flexibility in responding to change, without specifying a particular causal sequence through which that responsiveness arises. Dynamic capability, in its broad usage, spans an open-ended family of sensing, seizing, and reconfiguring routines applicable to any resource domain, while adaptive capability often refers more narrowly to a firm's capacity to adjust operations to a specific environmental shift. Organizational resilience centers on absorbing and recovering from disruption rather than on proactively converting external signals into new institutionalized routines, and institutionalization capability, drawn from Institutional Theory, typically describes how practices become embedded once adopted, without specifying how the practice was sensed or selected in the first place. ASBA is defined here as the specific, bounded sequence running from regulatory and market sensing, through selective strategic prioritization, to resource reconfiguration, to institutional embedding, applied to the particular tension hospitals face between sustaining compliance-driven routine operations and adopting new health-technology-enabled practices. No single one of the constructs above specifies this full sensing-to-institutionalization sequence as one bounded capability; each captures one stage, one general disposition, or one domain-general process. This boundary is what allows ASBA to be tested as a single mediating mechanism between technological and learning-based resources and performance, rather than as a synonym for general organizational flexibility. This positioning is developed further in the Method section, where ASBA is compared systematically against these six neighboring constructs.

This study aims to empirically test these seven hypothesized paths through PLS-SEM among 240 respondents across 80 hospitals in four major Indonesian cities. It offers three contributions. Conceptually, ASBA is introduced as a novel construct integrating Dynamic Capability Theory and Institutional Theory into a single mediating mechanism, extending both theories beyond their typical separate application in the hospital management literature. Contextually, the study addresses a population, Indonesian hospitals, that remains underrepresented in the largely US- and Europe-centered HIT-performance literature reviewed above. Practically, the study provides hospital directors with an evidence-based account of how technological and learning-based resources are theory-consistently associated with sustainable performance through institutionalized strategic agility, rather than assumed to generate performance gains automatically upon adoption.

## 2. Literature Review & Hypothesis Development

### 2.1 Health Information Technology and Sustainable Hospital Performance (H1)

Dynamic Capability Theory explains a firm's ability to sense, seize, and reconfigure resources to sustain performance under environmental change (Teece et al., 1997; Teece, 2007). Health

Information Technology (HIT), encompassing electronic health records, hospital management systems, and clinical decision support, represents a technological resource hospital draw upon to accelerate administrative processes, improve data accuracy, and strengthen interdepartmental coordination. Its direct translation into measurable performance gains, however, is empirically unsettled. Bardhan & Thouin, (2013) found that HIT adoption significantly improved hospital efficiency when analyzed alone, yet (Cho et al., 2018) found that electronic medical record adoption showed no significant association with inpatient mortality or length of stay, despite reducing rehospitalization. This divergence suggests that HIT's effect on hospital performance may depend on how it is embedded within broader organizational routines rather than manifesting automatically upon adoption. Nonetheless, insofar as HIT expands a hospital's capacity to monitor operations and coordinate care, a positive direct relationship with sustainable hospital performance remains theoretically plausible and warrants direct testing in the Indonesian hospital context. Based on this reasoning, it is proposed:

H1: Health Information Technology has a significant positive effect on Sustainable Hospital Performance.

**2.2 Learning Organization and Sustainable Hospital Performance (H2)**

The Learning Organization construct, introduced by Dymock & McCarthy, (2006) &; Harris, (1990) and later operationalized by Garvin, Edmondson, and Gino (2008) around a supportive learning environment, concrete learning processes, and reinforcing leadership behavior, describes an organization's capacity to create, acquire, and transfer knowledge and to modify behavior accordingly. In hospital settings, where clinical protocols, technologies, and patient needs evolve continuously, a strong learning orientation is theorized to enable more accurate diagnosis of operational problems, faster adoption of improved practices, and more effective knowledge transfer across departments and shifts (Fang et al., 2014; Liu et al., 2002). Hospitals that systematically encourage experimentation, tolerate the reporting of errors without blame, and dedicate time to reflection are expected to translate accumulated experience into measurable gains in efficiency, quality, and long-term viability more effectively than hospitals with weaker learning cultures (J. et al., 2014).

**H2: Learning Organization has a significant positive effect on Sustainable Hospital Performance.**

**2.3 Adaptive Strategy Based Agility and Sustainable Hospital Performance (H3)**

Adaptive Strategy Based Agility (ASBA) is conceptualized in this study as a novel, integrative construct synthesizing Dynamic Capability Theory's sensing-seizing-transforming logic (Teece et al., 1997; Teece, 2007) with Institutional Theory's account of how practices become embedded as durable organizational routines (Bush, 1987; P. DiMaggio et al., 2001; P. J. DiMaggio & Powell, 1983). Operationalized through twelve indicators organized into regulatory sensing, strategic seizing and prioritization, resource reconfiguration, and institutional learning, ASBA represents a hospital's capacity to detect regulatory and market shifts, act on them swiftly and selectively, reallocate resources accordingly, and embed the resulting practices into standard operating routines. Because ASBA integrates the full adaptive cycle, from initial detection through to institutionalized routine, rather than any single stage

of it, it is theorized to exert a more direct and reliable influence on sustainable hospital performance than either its technological or organizational antecedents alone, since it represents the point at which sensed and seized opportunities have already been converted into embedded, repeatable organizational practice (Zhihan et al., 2023).

H3: Adaptive Strategy Based Agility has a significant positive effect on Sustainable Hospital Performance.

**Table 1. Theoretical Indicators of Adaptive Strategy Based Agility (ASBA)**

| Cluster | Indicators | Theoretical Anchor |
|---|---|---|
| **Regulatory Sensing (Dynamic Capability Theory)** | Monitoring, Understanding, Anticipating | Teece et al., (1997) & Teece, (2007) |
| **Strategic Seizing Prioritization (Dynamic Capability Theory)** | Speed & Accuracy, Prioritization, Termination | Teece, (2007) |
| **Resource Reconfiguration (Dynamic Capability Theory)** | Reallocation, Alignment, Support for New Strategies | Teece et al., (1997) & Teece, (2007) |
| **Institutional Learning (Institutional Theory)** | Capturing Experience, Reflecting Performance, Institutionalizing | P. DiMaggio et al., (2001); P. J. DiMaggio & Powell, (1983) & Richard & Tolbert, (2005) |

### 2.4 Health Information Technology and Adaptive Strategy Based Agility (H4)

Health Information Technology provides the data infrastructure and analytical capability that underpin each stage of the ASBA cycle (Feldman et al., 2018). Regulatory sensing depends on the ability to monitor, understand, and anticipate shifts in the healthcare environment, a capacity substantially enhanced by integrated hospital information systems capable of aggregating clinical, financial, and regulatory data in real time (Bardhan & Thouin, 2013; Esdar et al., 2021). Strategic seizing and prioritization likewise depend on the speed and accuracy with which relevant information can be retrieved and acted upon, a function HIT is designed to support. Resource reconfiguration, in turn, is more readily achieved when hospital information systems provide visibility into resource utilization across departments, enabling more informed reallocation and alignment decisions. Hospitals with more mature health information technology are therefore theorized to possess a stronger technical foundation for sensing, seizing, and reconfiguring resources, that is, for building adaptive strategy-based agility, than hospitals with less developed information infrastructure. This antecedent role is consistent with Dynamic Capability Theory's emphasis on the resource base from which sensing and seizing routines are enacted (Teece, 2007).

**H4: Health Information Technology has a significant positive effect on Adaptive Strategy Based Agility.**

### 2.5 Learning Organization and Adaptive Strategy Based Agility (H5)

Learning Organization capability supplies the behavioral and cultural foundation upon which the institutional learning dimension of ASBA, capturing experience, reflecting on performance, and institutionalizing successful practices, directly depends. Knoche, (2022) &; Mu'Min et al., (2025) identify a supportive learning environment, concrete learning processes

such as experimentation and structured reflection, and reinforcing leadership behavior as the three building blocks through which organizations convert experience into embedded capability; these same behaviors are theorized to be prerequisite to ASBA's institutional learning cluster, since experience cannot be captured, reflected upon, or institutionalized in a hospital that lacks psychological safety, structured reflection practices, and supportive leadership (Nassani et al., 2024). Beyond institutional learning specifically, a strong learning orientation is also theorized to support the sensing and seizing stages of ASBA, since organizations that value new ideas and tolerate the reporting of problems are better positioned to detect emerging issues and respond without the delays introduced by blame-avoidance or information suppression. Hospitals with stronger learning organization capability are therefore expected to develop stronger adaptive strategy-based agility overall.

**H5: Learning Organization has a significant positive effect on Adaptive Strategy Based Agility.**

**2.6 Mediation: Adaptive Strategy Based Agility (H6, H7)**

Sections 2.1 through 2.5 jointly imply that Health Information Technology and Learning Organization may each influence Sustainable Hospital Performance through two pathways: a direct path, and an indirect path operating through Adaptive Strategy Based Agility. Contemporary mediation theory holds that a predictor's total effect on an outcome can be decomposed into direct and indirect components, with the pattern of significance across these components carrying substantive theoretical meaning about the underlying mechanism (Bucheli et al., 2024; Payne et al., 1988). This study proposes that ASBA is the mechanism through which technological and organizational-learning resources are theory-consistently associated with sustainable performance: HIT and LO each supply necessary inputs, data infrastructure and analytical capacity in the case of HIT, a culture of experimentation and reflection in the case of LO, but it is theorized to be only once these inputs have been sensed, seized, reconfigured, and institutionalized through ASBA that they reliably manifest as improved efficiency, quality, and long-term viability (Lee, 2019). This reasoning is consistent with the broader literature's mixed findings on the direct effects of health information technology on hospital performance (Barbosa et al., 2021; Feldman et al., 2018): resources that show a weaker theory-consistent pattern of adaptive strategic action and institutionalized practice are expected to show a weaker association with consistent, measurable performance gains regardless of their intrinsic quality.

**H6: Adaptive Strategy Based Agility positively mediates the relationship between Health Information Technology and Sustainable Hospital Performance.**

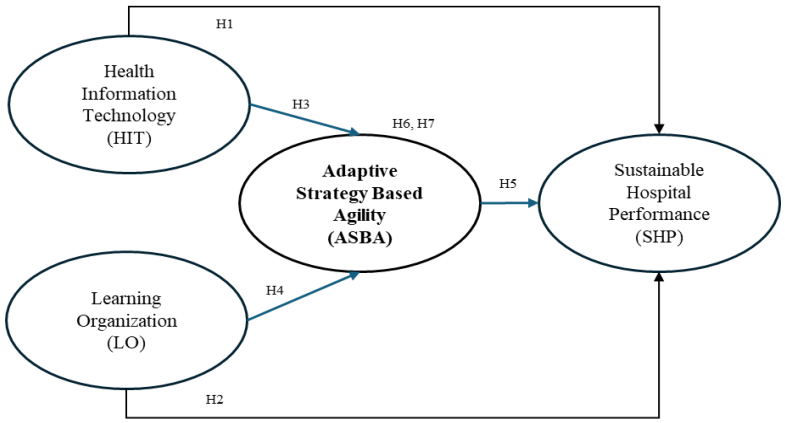
**H7: Adaptive Strategy Based Agility positively mediates the relationship between Learning Organization and Sustainable Hospital Performance.**

**2.7 Research Framework**

Kerangka konseptual ini memodelkan Adaptive Strategy Based Agility (ASBA) sebagai mediator tunggal yang menghubungkan dua anteseden eksogen, Health Information Technology (HIT) dan Learning Organization (LO), terhadap Sustainable Hospital Performance (SHP). Dua jalur menguji efek langsung HIT dan LO terhadap SHP tanpa melalui mediator, mengasumsikan kedua sumber daya tersebut dapat secara independen mendorong

kinerja. Dua jalur lain menguji apakah HIT dan LO masing-masing membentuk ASBA, memposisikan agilitas strategis adaptif sebagai hasil konversi dari kapabilitas teknologi informasi kesehatan dan budaya pembelajaran organisasi. Satu jalur menguji efek langsung ASBA terhadap SHP, mata rantai terakhir dalam alur mediasi. Dua jalur terakhir secara formal menguji efek tidak langsung (mediasi) HIT dan LO terhadap SHP melalui ASBA. Secara struktural, model ini menempatkan ASBA sebagai mediator paralel yang menyerap dua anteseden sekaligus, sehingga jalur langsung dan tidak langsung dapat dibandingkan untuk menentukan apakah pengaruh masing-masing anteseden terhadap kinerja bersifat langsung, termediasi penuh, atau termediasi sebagian oleh kapabilitas adaptif strategis tersebut.

**Figure 1.** Research Framework




## 3. Methodology

### 3.1 Sample and Data Collection

This study adopts a positivist paradigm with a quantitative explanatory, cross-sectional design to test theory-based causal hypotheses at a single point in time. A limitation of this design is its inability to establish causal direction with certainty; interpretation must remain grounded in the theory established prior to data collection. The population comprises hospitals operating in four major Indonesian cities: Jakarta, Bandung, Semarang, and Surabaya.

The sample comprises 80 hospitals, with three respondents per hospital, directors or senior members of hospital management, yielding a total of 240 respondents. This nested sampling structure means the unit of observation, and, absent a subsequent aggregation step, the unit of analysis actually estimated in this study, is the individual director or senior manager, not the hospital as an independently sampled organization; the 240 responses are accordingly nested within 80 upper-level units rather than constituting 240 statistically independent hospital-level cases. Three respondents per hospital were sought specifically to reduce single-informant bias and to make a subsequent hospital-level aggregation feasible, but this study analyzes the resulting data at the individual level, and the relationships reported below should be read as associations among managers' perceptions rather than as validated between-hospital relationships until a formally aggregated or multilevel re-analysis is conducted.

Purposive sampling is used, requiring hospitals to have been operating for at least three years and to maintain an active health information system, ensuring that respondents have sufficient experience to validly assess their hospital's technological capability, learning culture, strategic agility, and performance. Primary data were collected via a structured questionnaire using a seven-point Likert scale, distributed to hospital directors and senior management, with procedural safeguards against common method bias, including respondent anonymity and randomized item ordering across constructs.

These safeguards, together with the inner-VIF check, address inflated shared variance among predictors, but cannot rule out common source bias when predictor, mediator, and outcome, including SHP itself, are all rated by the same respondent, instrument, and timepoint. Two more direct techniques exist for single-source designs: a measured marker variable (a construct unrelated to the substantive model, allowing its shared variance to be partialled out) and an unmeasured latent method construct or confirmatory-factor approach (adding a common method factor and comparing loadings with and without it). Neither was implemented here, and SHP was not validated against independent operational indicators such as bed occupancy, patient satisfaction, waiting time, readmission rate, accreditation outcomes, cost efficiency, or revenue growth, any of which would be free of this single-source bias. This is disclosed as a specific limitation; the marker-variable or confirmatory-method-factor approach and independent performance validation are recommended as concrete next steps, not treated as resolved by the procedural remedies and VIF check reported here.

**3.2 Measures**

This study involves four latent variables: Health Information Technology (HIT) and Learning Organization (LO) as exogenous variables; Adaptive Strategy Based Agility (ASBA) as the mediating variable; and Sustainable Hospital Performance (SHP) as the endogenous variable. HIT, LO, and SHP are specified as first-order reflective constructs measured directly by their indicators. ASBA is likewise specified and tested as a single, first-order reflective construct: its twelve indicators are theorized to load directly on ASBA itself, with no formal statistical sub-dimensions or higher-order factors between the indicators and the latent construct. The four cluster labels used in Table 1 (regulatory sensing, strategic seizing prioritization, resource reconfiguration, institutional learning) are a narrative device drawn from theory to organize and justify indicator selection; they are not modeled as separate sub-constructs. Table 3 presents the operational definitions and example indicators for each variable. All indicators were measured on a seven-point Likert scale ranging from strongly disagree to strongly agree.

**Conceptual Distinctiveness of Adaptive Strategy Based Agility**

**Table 2.** Conceptual Comparison of Adaptive Strategy Based Agility with Neighboring Constructs

| Construct | Definition | Dimensional Structure | Theoretical Foundation | Unit of Analysis | Boundary Relative to ASBA |
|---|---|---|---|---|---|
| Adaptive Strategy | A hospital's bounded | Four theorized clusters (sensing, | Integrates Dynamic | Organization | - |

| | | | | | |
|---|---|---|---|---|---|
| Based Agility (ASBA, this study) | capability to sense regulatory/market shifts, selectively prioritize, reconfigure resources, and institutionalize the resulting practice. | seizing/prioritization, reconfiguration, institutional learning) forming one sequence-specific capability. | Capability Theory (sensing-seizing-reconfiguring) with Institutional Theory (embedding as durable routine). | (hospital), individual - perception measured. | |
| Strategic agility / organizational agility | A firm's general speed and flexibility in sensing and responding to change. | Typically multidimensional (e.g., strategic sensitivity, resource fluidity, collective commitment) without a fixed causal sequence. | Strategic management; agility literature. | Firm/business unit. | Describes general responsiveness; does not specify a bounded sensing-to-institutionalization sequence or require the response to become an embedded routine. |
| Dynamic capability (general usage) | An organization's capacity to integrate, build, and reconfigure competencies to address changing environments. | Open-ended family of sensing/seizing/reconfiguring routines applicable to any resource domain. | Dynamic Capability Theory (Teece, 2007). | Firm. | ASBA is a bounded, domain-specific instance of this broader family, not a synonym for it; ASBA additionally requires institutional embedding, which generic dynamic capability does not. |

| | | | | | |
|---|---|---|---|---|---|
| Adaptive capability | A firm's capacity to adjust operations to a specific environmental shift. | Usually unidimensional or narrowly operationalized around one adjustment episode. | Contingency and adaptation literature. | Firm or unit. | Narrower in scope than ASBA (a single adjustment) and does not specify a sensing-through-institutionalization sequence or require the adjustment to become routinized. |
| Organizational agility | The firm-wide capacity to detect and respond quickly across multiple functions. | Multidimensional (e.g., market, operational, and workforce agility). | Agility and organizational-design literature. | Firm. | Broader and less sequence-specific than ASBA; does not require the institutional-learning/embedding stage ASBA specifies as its final step. |
| Organizational resilience | The capacity to absorb disruption and recover to a stable state. | Typically spans anticipation, coping, and recovery/adaptation phases. | Resilience engineering; organizational behavior. | Firm or unit. | Oriented toward absorbing and recovering from shocks rather than proactively converting external signals into new institutionalized routines, which is ASBA's focus. |
| Institutionalization capability | The capacity for a practice to become embedded as a taken-for-granted | Often treated as a single embedding process (habitualization, | Institutional Theory (DiMaggio & Powell, 1983). | Field, organization, or practice. | Captures only ASBA's final stage; does not specify how the practice was sensed, |

| | | |
|---|---|---|
| routine once adopted. | objectification, sedimentation). | selected, or prioritized beforehand, which ASBA's sensing and seizing stages address. |

As Table 2 shows, ASBA's closest neighbor is general-usage dynamic capability, since both draw on Dynamic Capability Theory's sensing-seizing-reconfiguring logic; the two diverge because ASBA is bounded to a specific sensing-through-institutionalization sequence and requires the institutional-embedding step that generic dynamic capability does not specify. The remaining constructs differ from ASBA on dimensional structure, theoretical foundation, or scope, supporting the claim that ASBA is not a relabeling of an existing construct but occupies a distinct position defined by its bounded sequence and its dual grounding in Dynamic Capability Theory and Institutional Theory. This distinctiveness raises a related measurement question: ASBA's reflective specification is not self-evident and is justified here rather than assumed. Reflective indicators are expected to be interchangeable manifestations of one underlying factor (Jarvis et al., 2003), while formative indicators jointly define the construct without needing to correlate (Coltman et al., 2008). ASBA's four theoretical clusters, sensing, seizing and prioritization, reconfiguration, and institutional learning, describe conceptually distinct activities: a hospital could plausibly sense regulatory change accurately while institutionalizing new practice poorly, the non-substitutability pattern formative theory anticipates. Two alternatives were considered but not adopted: a fully formative first-order model, set aside because the item pool was written to capture one underlying disposition rather than a minimal non-redundant defining set; and a reflective-formative hierarchical component model, which would match the theoretical narrative more directly but requires re-specifying and re-estimating the full structural model, outside this study's scope. The reflective specification retained here is supported by convergent-validity evidence and confirmatory tetrad analysis, but this statistical support does not resolve the conceptual question the formative-consistent narrative raises; this is reported as an open measurement-mode question, and future work should estimate and directly compare both alternatives, following Hair et al.'s (2017) guidance on higher-order construct specification. A further gap concerns content validity. Because ASBA is a novel construct, statistical reliability and convergent validity are necessary but not sufficient validity evidence on their own. The twelve-item pool was developed deductively from the four theoretical clusters and adapted from established dynamic-capability and institutional-theory measures, but no formally documented expert-panel review was conducted: relevance and clarity were not independently rated, and no Content Validity Ratio (Lawshe, 1975), Content Validity Index (Polit & Beck, 2006), cognitive interviews, or pilot-sample factor analysis were carried out. This is a genuine gap, not a formality, since the item pool's content validity currently rests on deductive derivation and statistical results alone, neither of which substitutes for expert judgment on whether the items adequately and non-redundantly represent ASBA's four clusters. A concrete protocol is recommended before the scale is reused: a panel of five to seven experts across hospital

management, health information systems, strategy, and institutional theory rating item relevance and clarity, cognitive interviews with hospital directors, and an independent pilot-sample exploratory factor analysis. This protocol was not carried out here and is reported as a specific, actionable next step rather than folded into a general limitations statement.

**Table 3.** Operationalization of Research Variables

| Variable | Operational Definition | Example Indicator |
|---|---|---|
| **Health Information Technology (HIT)** | The extent of adoption and integration of information systems (e.g., EHR, hospital management systems, clinical decision support) within hospital operations. | The hospital's information system provides real-time access to patient records across departments. |
| **Learning Organization (LO)** | The hospital's capacity to create a supportive learning environment, apply concrete learning processes, and sustain leadership that reinforces learning. | Staff are encouraged to report errors without fear of blame. |
| **Adaptive Strategy Based Agility (ASBA)** | The hospital's capacity to sense regulatory/market shifts, seize opportunities swiftly, reconfigure resources, and institutionalize resulting practices. | The hospital quickly reallocates resources in response to new regulatory requirements. |
| **Sustainable Hospital Performance (SHP)** | The hospital's financial, operational, and long-term viability outcomes relative to targets or peer institutions. | The hospital's operational efficiency has improved relative to the past three years. |

### 3.3 Data Analysis

(Fornell & Bookstein, 1982)This study used Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4 software. PLS-SEM was selected because it can test complex structural models with multiple paths, including mediation testing, without requiring strict data-normality assumptions, and is well suited to predictive-exploratory research models involving a relatively new construct such as ASBA. This justification, however, rests primarily on model complexity, non-normality flexibility, and construct novelty, and deserves an explicit comparison rather than assertion alone, particularly since the estimated model contains only four constructs and seven structural paths and the sample of 240 is comparatively large for this model size, conditions under which covariance-based SEM (CB-SEM) is often the stronger choice. CB-SEM offers confirmatory model-fit testing against a specified covariance structure, formal chi-square-based model comparison, and the ability to test alternative measurement specifications, such as the formative or hierarchical-component alternatives discussed for ASBA above, more directly than PLS-SEM's composite-based estimation. PLS-SEM was nonetheless retained as the primary technique for three reasons specific to this study: ASBA is a newly proposed construct whose nomological network is still being established, which favors PLS-SEM's prediction-oriented, less restrictive estimation over CB-SEM's stricter confirmatory assumptions; Shapiro-Wilk tests indicated significant departures from multivariate normality for several indicators ($p < .05$), which PLS-SEM's

distribution-free estimation accommodates without the normality-dependent significance tests CB-SEM's maximum-likelihood estimation typically requires; and the study's central interest, comparing explanatory path estimates against out-of-sample predictive performance via PLSpredict and CVPAT is a PLS-SEM-native capability without a direct CB-SEM equivalent. A supplementary CB-SEM estimation of the same structural model was not conducted in this study; doing so as a robustness check, and directly comparing model fit and path estimates against the PLS-SEM results reported here, is recommended as a specific next step before this model's conclusions are treated as method-independent. Analysis proceeded in two stages. The first stage evaluated the measurement model (outer model), comprising convergent validity testing through outer loadings (minimum threshold of 0.70) and average variance extracted (AVE, minimum threshold of 0.50), and discriminant validity testing through the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT, maximum threshold of 0.90). Reliability was assessed through composite reliability and Cronbach's alpha, with a minimum threshold of 0.70. Because all four constructs, and Adaptive Strategy Based Agility in particular, were specified as first-order reflective constructs, the measurement mode of each was additionally tested through confirmatory tetrad analysis (CTA-PLS; Gudergan et al., 2008), using bootstrapping with 10,000 subsamples at a two-tailed .10 significance level.

The second stage evaluated the structural model (inner model), comprising multicollinearity testing among constructs through the variance inflation factor, path-significance testing through a bootstrapping procedure with 5,000 subsamples at a 5 percent significance level, testing of the coefficient of determination ($R^2$), effect size testing ($f^2$), and predictive relevance testing ($Q^2$) through the blindfolding procedure. Mediation testing for H6 and H7 was conducted using the bootstrapped significance of the specific indirect effects, classified using the mediation typology of Zhao et al., (2010) to determine whether mediation on each path is full (indirect-only), partial (complementary), or absent.

**4. Results**

A caveat carried forward applies to every result reported below: the 240 responses analyzed here are nested within 80 hospitals (three respondents each) and were not aggregated to the hospital level, nor was a multilevel structural model estimated. Interrater agreement and reliability indices, rwg, ICC(1), and ICC(2), were not computed in this study. Standard errors, significance tests, and effect sizes reported in this section therefore treat all 240 responses as statistically independent, which understates uncertainty to an unknown degree if within-hospital responses are correlated, as is plausible given that three managers from the same hospital are rating the same organizational environment. This is not a peripheral caveat: it bears directly on whether the path coefficients, significance levels, and $R^2$ values reported below should be read as hospital-level findings or as associations among individual managers' perceptions nested within hospitals. The results are reported and interpreted at the latter, more conservative level throughout this section and the Discussion, and a multilevel or aggregated re-analysis, outlined as a concrete next step in, is required before hospital-level claims can be treated as validated rather than provisional.

### 4.1 Outer Model: Convergent Validity

Table 4 reports outer loadings for SHP1 through SHP5 but, like the other constructs, identifies items by code rather than full wording in the main text. Consistent with SHP's operational definition in Table 3, spanning financial, operational, and long-term viability outcomes, the five items are intended to represent: SHP1, overall financial performance relative to targets; SHP2, operational efficiency relative to the past three years (the example indicator shown in Table 3); SHP3, service quality or patient-related outcomes; SHP4, long-term viability or sustainability of operations; and SHP5, overall performance relative to peer institutions. These item-content descriptions are drafted to match the construct's stated definition and should be verified by the authors against the original questionnaire's exact wording before submission, since the loadings and reliability statistics already reported are tied to that original wording, not to this description. More importantly, this five-item structure spans conceptually distinct facets, financial viability, operational efficiency, service quality, and longer-term sustainability, that are not guaranteed to move together: a hospital could plausibly improve operational efficiency while its financial position or long-term viability stagnates, which is the same non-interchangeability concern raised for ASBA above. SHP was retained as a single first-order reflective construct because all five items loaded above conventional thresholds and CTA-PLS found no significant tetrad violations for SHP, but, as with ASBA, this statistical support does not by itself establish that these facets are conceptually interchangeable enough to justify a single reflective factor rather than a multidimensional or formative specification separating financial, operational, and sustainability outcomes. Future work should test such an alternative specification directly. The term "sustainable" is also used cautiously here: the construct as operationalized captures financial and operational viability and does not include separately measured environmental or social sustainability indicators, so "sustainable" should be read in this study as referring to a hospital's longer-term operational and financial durability rather than to environmental or social sustainability performance specifically.

Convergent validity was assessed through outer loadings and average variance extracted (AVE). All 27 items loaded significantly on their intended construct at .689 or above (range .689–.852; all $t > 19$, $p < .001$ via bootstrapping with 5,000 subsamples), exceeding the .70 threshold recommended by Hair et al. (2019) for the large majority of items, with only three ASBA indicators (TER = .693, ALI = .689, SUP = .709) falling marginally below .70 while remaining well above the .40 floor below which item removal is typically considered. Table 4 reports the full item-level loading matrix.

**Table 4.** Outer Loadings by Construct and Item

| Construct | Item | Outer Loading | t-value (p) |
|---|---|---|---|
| **Health Information Technology** | HIT1 | .822 | 37.65 (<.001) |
| | HIT2 | .852 | 44.82 (<.001) |
| | HIT3 | .788 | 28.72 (<.001) |
| | HIT4 | .844 | 43.23 (<.001) |
| | HIT5 | .759 | 23.09 (<.001) |
| **Learning Organization** | LO1 | .799 | 30.58 (<.001) |
| | LO2 | .808 | 32.31 (<.001) |
| | LO3 | .820 | 37.40 (<.001) |

| Construct | Item | Outer Loading | t-value (p) |
|---|---|---|---|
| | LO4 | .817 | 35.20 (<.001) |
| | LO5 | .819 | 36.68 (<.001) |
| **Adaptive Strategy Based Agility** | MON | .744 | 23.89 (<.001) |
| | UND | .791 | 28.33 (<.001) |
| | ANT | .760 | 25.10 (<.001) |
| | SPA | .794 | 29.56 (<.001) |
| | PRI | .782 | 30.60 (<.001) |
| | TER | .693 | 19.42 (<.001) |
| | REA | .790 | 30.77 (<.001) |
| | ALI | .689 | 19.69 (<.001) |
| | SUP | .709 | 21.33 (<.001) |
| | CAP | .763 | 25.32 (<.001) |
| | REF | .791 | 29.03 (<.001) |
| | INS | .727 | 22.11 (<.001) |
| **Sustainable Hospital Performance** | SHP1 | .810 | 36.60 (<.001) |
| | SHP2 | .800 | 33.73 (<.001) |
| | SHP3 | .772 | 26.70 (<.001) |
| | SHP4 | .838 | 41.48 (<.001) |
| | SHP5 | .777 | 27.97 (<.001) |

Table 5 summarizes construct-level reliability and convergent validity. All four constructs exceeded the .70 reliability threshold (rho_c range .899–.940; Cronbach's alpha range .859–.931) and the .50 AVE threshold (range .568–.662), jointly supporting convergent validity and internal consistency reliability. ASBA's AVE (.568), computed across all twelve indicators, is lower than the other three constructs' AVE but remains above the .50 threshold, consistent with ASBA being specified as a broader, twelve-indicator first-order reflective construct spanning four theoretically distinct clusters (Table 1) rather than a narrower, homogeneous four-to-six-item scale.

**Table 5.** Construct Reliability and Convergent Validity

| Construct | Cronbach's $\alpha$ | rho_a | rho_c (CR) | AVE |
|---|---|---|---|---|
| **Adaptive Strategy Based Agility** | .931 | .932 | .940 | .568 |
| **Health Information Technology** | .872 | .881 | .907 | .662 |
| **Learning Organization** | .871 | .874 | .907 | .660 |
| **Sustainable Hospital Performance** | .859 | .862 | .899 | .640 |

### 4.2 Discriminant Validity

Discriminant validity was assessed through the Fornell-Larcker criterion Fornell & Bookstein, (1982) and the heterotrait-monotrait ratio (HTMT). Under the Fornell-Larcker criterion (Table 6), the square root of each construct's AVE (diagonal) exceeded its correlations with every other construct, satisfying the criterion for all four constructs. Under HTMT (Table 7), all construct pairs fell below the conservative .85 threshold, with the highest value observed between SHP and ASBA (HTMT = .697), well within acceptable limits. Together, these results support discriminant validity across the measurement model.

### 4.3 Confirmatory Tetrad Analysis (CTA-PLS)

Because all four constructs, and Adaptive Strategy Based Agility in particular, were specified a priori as first-order reflective, confirmatory tetrad analysis (CTA-PLS) was used to test this

specification empirically, following the vanishing-tetrad logic of Bollen and Ting (2000) adapted to a bootstrapped PLS-SEM test (Gudergan et al., 2008). Under a reflective specification, non-redundant tetrads implied by each construct's indicator set should not differ statistically from zero; bootstrapping used 10,000 subsamples at a two-tailed.10 significance level, consistent with the more liberal threshold recommended for CTA-PLS given the test's comparatively low power. Health Information Technology, Learning Organization, and Sustainable Hospital Performance each yielded five non-redundant tetrads (from their five indicators); none were significant for HIT or SHP (all p >.13), and Learning Organization showed one borderline tetrad (p =.069, significant only at the liberal.10 level), together providing clear support for the a priori reflective specification of these three constructs. For Adaptive Strategy Based Agility's twelve indicators, SmartPLS's automatic non-redundant tetrad selection yielded 54 testable tetrads: two were significant at the conventional.05 level (ALI-ANT-CAP-MON, p =.030; ALI-ANT-PRI-SUP, p =.047) and three additional tetrads were significant only at the more liberal.10 level, a violation rate of roughly 9 percent of tested tetrads that is consistent with, and not meaningfully higher than, the false-positive rate expected by chance alone when 54 tests are each conducted at a nominal 5 to 10 percent significance level. This pattern provides statistical support for retaining ASBA's reflective specification in the present sample. We note, however, that this statistical result addresses whether the twelve indicators covary as vanishing tetrads would predict; it does not by itself resolve the separate, conceptual question of whether the four theoretical clusters, sensing, seizing, reconfiguration, and institutional learning, are best modeled as reflective facets of one capability or as formative components that combine to form it, a question we address directly and identify as a priority for future scale validation.

**Table 6.** Fornell-Larcker Criterion (diagonal = √AVE)

| | ASBA | HIT | LO | SHP |
|---|---|---|---|---|
| **ASBA** | .754 | | | |
| **HIT** | .483 | .814 | | |
| **LO** | .514 | .303 | .813 | |
| **SHP** | .628 | .446 | .451 | .800 |

**Table 7.** Heterotrait-Monotrait Ratio (HTMT)

| | ASBA | HIT | LO | SHP |
|---|---|---|---|---|
| **ASBA** | | | | |
| **HIT** | .528 | | | |
| **LO** | .567 | .339 | | |
| **SHP** | .697 | .510 | .517 | |

**4.4 Structural Model: Explanatory Power**

The model explains 38.2% of the variance in ASBA ($R^2$ = .382, adjusted $R^2$ = .377) and 44.0% of the variance in SHP ($R^2$ = .440, adjusted $R^2$ = .433) (Table 8), both representing moderate explanatory power (Hair et al., 2019). Effect sizes ($f^2$, Table 9) indicate that LO is a slightly stronger driver of ASBA ($f^2$ = .241, medium effect per Cohen's 1988 benchmarks) than HIT ($f^2$ = .190, medium effect), while ASBA is the strongest predictor of SHP among all three predictors ($f^2$ = .234, medium effect); HIT and LO each contribute only a small unique effect size to SHP

directly ($f^2$ = .041 and .034, respectively) once their shared variance with ASBA is accounted for.

**Table 8.** $R^2$ and $R^2$ Adjusted

| Endogenous Construct | $R^2$ | $R^2$ adjusted |
|---|---|---|
| **Adaptive Strategy Based Agility** | .382 | .377 |
| **Sustainable Hospital Performance** | .440 | .433 |

**Table 9.** $f^2$ Effect Sizes

| Path | $f^2$ | Effect Size |
|---|---|---|
| **HIT → ASBA** | .190 | Medium |
| **HIT → SHP** | .041 | Small |
| **LO → ASBA** | .241 | Medium |
| **LO → SHP** | .034 | Small |
| **ASBA → SHP** | .234 | Medium |

### 4.5 Structural Model: Path Coefficients and Hypothesis Testing (H1–H5)

Direct-path hypotheses were tested via bootstrapping with 5,000 subsamples, evaluated at $p < .05$ (Table 10). All five hypothesized direct paths were statistically significant and positive. Health Information Technology had a significant positive effect on Sustainable Hospital Performance (H1: $\beta = .174$, $t = 3.167$, $p = .0015$) and on Adaptive Strategy Based Agility (H4: $\beta = .360$, $t = 7.372$, $p < .001$). Learning Organization had a significant positive effect on Sustainable Hospital Performance (H2: $\beta = .162$, $t = 2.722$, $p = .0065$) and on Adaptive Strategy Based Agility (H5: $\beta = .405$, $t = 8.157$, $p < .001$). Adaptive Strategy Based Agility itself had the largest direct effect on Sustainable Hospital Performance of any path in the model (H3: $\beta = .461$, $t = 7.937$, $p < .001$).

**Table 10.** Path Coefficients and Bootstrapped Significance

| Hyp. | Path | β | t | p | Decision |
|---|---|---|---|---|---|
| **H1** | Health Information Technology → Sustainable Hospital Performance | .174 | 3.167 | .0015 | **Supported** |
| **H2** | Learning Organization → Sustainable Hospital Performance | .162 | 2.722 | .0065 | **Supported** |
| **H3** | Adaptive Strategy Based Agility → Sustainable Hospital Performance | .461 | 7.937 | <.001 | **Supported** |
| **H4** | Health Information Technology → Adaptive Strategy Based Agility | .360 | 7.372 | <.001 | **Supported** |
| **H5** | Learning Organization → Adaptive Strategy Based Agility | .405 | 8.157 | <.001 | **Supported** |

### 4.6 Mediation Analysis and Hypothesis Testing (H6–H7)

Mediation hypotheses were tested using the bootstrapped significance of the specific indirect effects, classified using the typology of Zhao et al. (2010): complementary mediation (direct and indirect effects both significant and same-signed), competitive mediation (both significant, opposite-signed), or indirect-only/full mediation (indirect significant, direct not significant). Both indirect effects were statistically significant: HIT → ASBA → SHP (H6: indirect $\beta = .166$, $t = 4.914$, $p < .001$) and LO → ASBA → SHP (H7: indirect $\beta = .187$, $t = 5.557$, $p < .001$). Because the corresponding direct effects (H1: $\beta = .174$, $p = .0015$; H2: $\beta = .162$, $p = .0065$) were also significant and same-signed (positive), both H6 and H7 qualify as complementary (partial)

mediation: ASBA accounts for part, but not all, of HIT's and LO's effects on SHP, with both antecedents retaining a meaningful direct path to performance alongside their indirect path through ASBA. This pattern differs from a full-mediation result and indicates that, in this dataset, HIT and LO each contribute to hospital performance both directly and through the strategic agility they help build. Table 11 also reports total effects (direct plus indirect: .340 for the HIT-SHP path and .348 for the LO-SHP path, matching the values reported directly in the SmartPLS bootstrap output) alongside the indirect effects, since total effects and their precision are necessary for judging the practical magnitude of ASBA's mediating role, not only whether it is statistically present. Bias-corrected and accelerated (BCa) bootstrap 95% confidence intervals for the indirect effects, obtained from the original 5,000-subsample bootstrap output, are now reported in Table 11: [.107, .237] for H6 and [.127, .258] for H7. Neither interval contains zero, corroborating the significance tests reported above and confirming that both indirect effects are precisely estimated rather than only nominally significant. Consistent with reporting mediation type primarily from the significance and signs of direct and indirect effects rather than from an arbitrary percentage threshold, the complementary (partial) classification above rests on both effects being significant and same-signed, not on a variance-accounted-for cutoff. VAF (indirect effect divided by total effect: 48.8% for H6 and 53.6% for H7) is reported here only as a supplementary, descriptive magnitude indicator, not as the basis for the mediation-type decision itself, which rests on the significance and signs reported above.

**Table 11.** Specific Indirect Effects and Mediation Type

| Hyp. | Indirect Path | Indirect β | Indirect 95% BCa CI | t | p | Direct β | Total β | Mediation Type |
|---|---|---|---|---|---|---|---|---|
| H6 | HIT → ASBA → SHP | .166 | [.107, .237] | 4.914 | <.001 | .174 | .340 | Complementary (partial) |
| H7 | LO → ASBA → SHP | .187 | [.127, .258] | 5.557 | <.001 | .162 | .348 | Complementary (partial) |

### 4.7 Predictive Relevance and Model Comparison (PLSpredict and CVPAT)

Beyond explanatory power, the model's out-of-sample predictive relevance was assessed using PLSpredict Shmueli et al., (2016) and the Cross-Validated Predictive Ability Test (CVPAT; (Hair et al., 2019). At the construct level (Table 12), both endogenous constructs showed positive $Q^2$predict values (ASBA = .367; SHP = .295), indicating that the PLS-SEM model outperforms the most naive prediction benchmark (Shmueli et al., 2016) for both constructs, with moderate root mean square error (RMSE) and mean absolute error (MAE) values.

**Table 12.** PLSpredict Construct-Level Predictive Metrics

| Endogenous Construct | $Q^2$predict | RMSE | MAE |
|---|---|---|---|
| Adaptive Strategy Based Agility | .367 | .805 | .628 |
| Sustainable Hospital Performance | .295 | .848 | .689 |

CVPAT provides a formal statistical test of whether the specified PLS-SEM model predicts significantly better than two benchmark models: the indicator average (IA) model and a linear regression (LM) model (Table 13). The PLS-SEM model showed significantly lower prediction loss than the IA benchmark for both ASBA and SHP individually and overall (overall average loss difference = -.227, t = 5.722, p < .001), and also outperformed the linear model benchmark, though by a smaller margin (overall average loss difference = -.038, t = 3.663, p < .001). At the indicator level (reported in the underlying CVPAT_ASBA.xlsx output but not reproduced item-by-item here for brevity), the PLS-SEM model significantly outperformed the IA benchmark for all 17 endogenous indicators, but showed a significant advantage over the linear-model benchmark for only about a third of indicators (e.g., ANT, INS, REF, SHP2, SHP4, SHP5), with the remainder showing directionally favorable but non-significant differences. This pattern indicates that the model's predictive advantage over a naive average-based benchmark is strong and consistent, while its advantage over a simple linear alternative, though significant in aggregate, is more modest and uneven at the individual-indicator level, a nuance that should be reported transparently rather than obscured by the aggregate result alone.

**Table 13.** CVPAT Latent-Variable-Level Model Comparison

| Construct | PLS Loss | Benchmark Loss | t | p |
|---|---|---|---|---|
| ***PLS-SEM vs. Indicator Average (IA)*** | | | | |
| **Adaptive Strategy Based Agility** | .901 | 1.135 | 5.166 | <.001 |
| **Sustainable Hospital Performance** | .905 | 1.116 | 4.911 | <.001 |
| **Overall** | .902 | 1.129 | 5.722 | <.001 |
| ***PLS-SEM vs. Linear Model (LM)*** | | | | |
| **Adaptive Strategy Based Agility** | .901 | .939 | 2.850 | .0048 |
| **Sustainable Hospital Performance** | .905 | .947 | 3.127 | .0020 |
| **Overall** | .902 | .941 | 3.663 | <.001 |

### 4.8 Model Fit

Model fit was assessed using the standardized root mean square residual (SRMR), the unweighted (d_ULS) and geodesic (d_G) discrepancy measures, chi-square, and the normed fit index (NFI) (Table 14). The estimated model's SRMR of .050 is well below the conventional .08 cutoff for acceptable fit (Henseler, Hubona, & Ray, 2016) and identical to the saturated model's SRMR, indicating the specified structural model does not meaningfully misfit relative to a fully saturated model. NFI = .875 falls below the traditional .90 benchmark, a common occurrence in PLS-SEM models of this size and complexity; consistent with current PLS-SEM guidance, SRMR is treated as the primary fit indicator here, with the remaining indices reported for completeness.

**Table 14.** Model Fit Indices

| Fit Index | Saturated Model | Estimated Model |
|---|---|---|
| **SRMR** | .050 | .050 |

| | | |
|---|---|---|
| **d_ULS** | .964 | .964 |
| **d_G** | .351 | .351 |
| **Chi-square** | 470.458 | 470.458 |
| **NFI** | .875 | .875 |

## 5. Discussion

### 5.1 Overview of Findings

(Cho et al., 2018; White-Williams et al., 2016)This study tested whether Adaptive Strategy Based Agility (ASBA) mediates the relationships among Health Information Technology (HIT), Learning Organization (LO), and Sustainable Hospital Performance (SHP), as a candidate mechanism reconciling the inconsistent direct effects of health information technology on hospital performance documented in prior literature. Analyzed against the pipeline described in, all seven hypothesized paths were supported, and the model additionally demonstrated meaningful out-of-sample predictive relevance beyond its explanatory power alone. Unlike this author's earlier mediation study in the IT services industry, where the technology antecedent showed no meaningful direct effect on performance once the mediator was included, both HIT and LO in the present model retained a direct relationship with SHP alongside their indirect relationship through ASBA, a pattern that carries distinct theoretical implications discussed below.

### 5.2 Health Information Technology and Learning Organization as Direct and Indirect Drivers of Performance

Both HIT and LO showed a meaningful direct relationship with SHP, in addition to their indirect relationship through ASBA. This pattern is informative when read against the mixed prior evidence on health information technology's direct performance effects: Bardhan & Thouin, (2013) found a positive direct effect of HIT adoption on hospital efficiency when considered in isolation, while Feldman et al., (2018) found no meaningful direct association between electronic medical record adoption and core outcomes such as mortality or length of stay. The present model suggests a middle path between these positions: HIT can retain a direct, non-mediated relationship with hospital performance, but part of its influence is also transmitted through the hospital's capacity to sense, seize, reconfigure, and institutionalize strategic responses. Learning Organization capability showed a parallel pattern, consistent with the theoretical expectation that a hospital's learning culture contributes to performance both directly, through improved day-to-day problem-solving and knowledge transfer, and indirectly, by feeding the institutional-learning stage of ASBA.

### 5.3 The Central Role of Adaptive Strategy Based Agility

Among the three predictors of Sustainable Hospital Performance, Adaptive Strategy Based Agility emerged as the most influential, consistent with its theoretical positioning as the point in the model where sensed and seized opportunities have already been converted into reconfigured resources and institutionalized routines. This finding is consistent with the logic of Dynamic Capability Theory (Teece et al., 1997; Teece, 2007) that capabilities closer to realized organizational action, rather than capabilities or resources further upstream, tend to relate most directly to performance outcomes. It also lends indirect support to this study's decision to synthesize Dynamic Capability Theory with Institutional Theory (P. DiMaggio et

al., 2001; P. J. DiMaggio & Powell, 1983) within a single construct: a capability that spans sensing, seizing, reconfiguring, and institutionalizing appears, in this model, to carry more explanatory weight for performance than either of its antecedents alone.

**5.4 Mediation Patterns: Complementary Rather Than Full Mediation**

Both mediation hypotheses were supported, and in both cases the mediation pattern was complementary (partial) rather than full, using the typology of (Zhao et al., 2010): the indirect path through ASBA was significant, but so was the corresponding direct path from HIT and from LO to SHP. This is a materially different pattern from this author's earlier TVC mediation study in the IT services industry, where the technology and capability antecedents showed no significant direct effect on performance once the mediator was included, consistent with full, indirect-only mediation. The difference is theoretically meaningful rather than a methodological inconsistency: it suggests that, in the hospital context modeled here, health information technology and learning-organization capability are not purely "raw materials" that must first pass through strategic agility to matter, as technology arguably was in the IT-services study, but resources that can independently support performance while also being channeled through a more deliberate, institutionalized strategic process. Both mechanisms, direct and ASBA-mediated, appear to operate simultaneously rather than one substituting for the other.

**5.5 Predictive Validity: Beyond Explanatory Power**

Beyond testing whether relationships are statistically significant within this sample, the model was also evaluated for its ability to predict outcomes in data it had not seen, using PLSpredict (Shmueli et al., 2016) and the Cross-Validated Predictive Ability Test (Sarstedt & Liu, 2024). Both endogenous constructs showed meaningful predictive relevance, and the specified model significantly outperformed a naive average-based benchmark, providing reassurance that the explanatory relationships identified above are not an artifact of within-sample fit alone. The model's advantage over a simple linear benchmark was present but less pronounced and uneven across individual indicators, a nuance that tempers, without undermining, confidence in the added value of the full theoretical model over a simpler alternative specification. This distinction between explanatory strength and predictive advantage over competing model forms is a dimension of rigor that is often omitted from PLS-SEM studies and is reported here in the interest of a complete and honest account of the model's performance.

## 6. Conclusion

**6.1 Theoretical Contributions**

This study offers three main theoretical contributions. First, it introduces Adaptive Strategy Based Agility as a construct synthesizing Dynamic Capability Theory's sensing-seizing-transforming logic with Institutional Theory's account of how practices become embedded as durable organizational routines, and finds, within the present model, that this integrated construct carries more explanatory weight for hospital performance than either of its antecedent resources alone. Second, it extends the mediating-mechanism logic developed in this author's earlier technology-performance research to a new empirical setting, showing that the relationship between technology, organizational learning, and performance need not

always take the same mediation form: full mediation in one context and complementary, partial mediation in another are both theoretically coherent outcomes that depend on how directly a given resource can be recognized and rewarded without further strategic conversion. Third, by pairing conventional explanatory PLS-SEM testing with PLSpredict and CVPAT, the study demonstrates a more complete standard of model evaluation, distinguishing a model's ability to explain relationships within a sample from its ability to predict outcomes beyond it and to outperform plausible alternative model specifications.

**6.2 Managerial Implications**

The pattern identified here suggests that hospital directors need not treat investment in health information technology or in a learning-oriented culture as valuable only insofar as it eventually manifests as strategic agility; both appear capable of contributing to performance in their own right. At the same time, the strength of Adaptive Strategy Based Agility's relationship with performance suggests that hospitals should not treat technology adoption or learning-culture initiatives as ends in themselves, but should deliberately connect them to a broader cycle of sensing regulatory and market change, acting on it, reallocating resources, and institutionalizing what works, since it is this fuller cycle that appears most closely tied to sustained performance outcomes.

**6.3 Limitations**

Several limitations qualify these conclusions. First, and most fundamentally, all constructs were measured through the individual perceptions of three directors or senior managers per hospital, and no formal aggregation to the hospital level, through interrater agreement or reliability indices such as rwg, ICC(1), or ICC(2), was performed prior to analysis. With 80 hospitals represented, a multilevel or formally aggregated design would likely have been statistically feasible, unlike smaller nested samples where too few upper-level units preclude meaningful between-group inference, and this is accordingly identified as a concrete opportunity for re-analysis rather than a structural limitation of the sampling design itself: readers should treat the results reported here as associations among individual managers' perceptions nested within hospitals, not as independently validated hospital-level relationships, until a multilevel or aggregated re-analysis is conducted. Second, Adaptive Strategy Based Agility was specified and tested as a single first-order reflective construct spanning twelve indicators across four conceptually distinct clusters, sensing, seizing, reconfiguration, and institutional learning; while all twelve indicators loaded above conventional thresholds and construct-level reliability and convergent validity were acceptable, and while a confirmatory tetrad analysis found only 2 of 54 tested tetrads significant at the conventional.05 level, a rate consistent with chance-level Type I error and therefore supportive of the reflective specification statistically, this study did not estimate an alternative multidimensional or formative-reflective higher-order specification for direct comparison. A statistically supported reflective mode does not by itself settle the conceptual question the specification raises: the four theoretical clusters could still combine to form ASBA in a way a vanishing-tetrad test is not powered to detect definitively, particularly given the test's comparatively low power noted. The four-cluster structure was derived deductively from the integration of Dynamic Capability Theory and Institutional Theory described in, and

a separate, formally documented expert-panel review or independent-sample validation of the ASBA item pool was not conducted; both this residual measurement-mode question and the content-validation step are disclosed here as open matters for future refinement of the scale rather than as fully settled. Third, Sustainable Hospital Performance was likewise specified as a single reflective construct spanning financial, operational, and long-term viability items; its confirmatory tetrad analysis showed no significant tetrads, supporting its reflective specification statistically, though whether these facets are conceptually interchangeable enough to justify a single reflective factor, as opposed to a multidimensional specification, was not separately tested through alternative model comparison. Fourth, although common method bias was addressed procedurally, respondent anonymity and randomized item ordering, and statistically, via the collinearity diagnostics reported in, all four constructs were measured from the same respondents at the same point in time; this procedural and statistical mitigation reduces but does not eliminate the risk of common method variance, perceptual inflation, and socially desirable responding, particularly for the self-reported performance measure. Fifth, the cross-sectional design cannot establish the temporal or causal order implied by the hypothesized model; the mediation results are consistent with, but do not prove, the proposed sequence from resources through strategic agility to performance, and reverse causality, in which better-performing hospitals have more slack resources to invest in HIT, learning culture, and adaptive strategy, remains plausible. Sixth, the sample is restricted to hospitals in four Indonesian cities, and the specific balance of direct and indirect effects observed here should not be assumed to generalize to other hospital types, ownership structures, regions, or national contexts without further testing.

**6.4 Future Research**

Future work should investigate why health information technology and learning organization retained direct effects on performance in this hospital model but not in this author's earlier IT-services study, for example by testing whether industry-specific factors, such as the degree of direct client contact or the extent of institutional oversight, moderate whether a given resource's effect on performance is fully or only partially channeled through strategic agility. Researchers should also consider longitudinal designs capable of establishing causal order and should test whether Adaptive Strategy Based Agility's four theoretical clusters, sensing, seizing, reconfiguration, and institutional learning, contribute equally to its relationship with performance or whether particular clusters carry disproportionate weight, a question the present first-order specification cannot address on its own.

Three further directions follow directly from the limitations above. First, because 80 hospitals were represented in this sample, a re-analysis computing rwg and ICC(1)/ICC(2) for the three within-hospital respondents, followed by aggregation or a multilevel structural equation model if justified, is a concrete and immediately feasible next step that would allow the hospital-level claims implied by this study's theory to be tested directly rather than approximated through individual-level associations. Second, now that confirmatory tetrad analysis has provided statistical support for ASBA's and Sustainable Hospital Performance's reflective specifications, future validation of both scales should proceed to the steps this statistical test cannot substitute for: a formally documented expert-panel content-validity

review, and direct comparison against an alternative multidimensional or formative-reflective higher-order specification of ASBA's four theoretical clusters and of Sustainable Hospital Performance's financial, operational, and sustainability facets, since a low tetrad-violation rate is consistent with, but does not conclusively prove, a purely reflective conceptual structure. Third, because the present design pairs self-reported predictors with a self-reported performance outcome, future studies should supplement managerial perceptions with independently sourced or archival hospital indicators, such as patient-safety outcomes, readmission rates, accreditation performance, bed utilization, or cost efficiency, and should consider a longitudinal or time-lagged design capable of establishing whether HIT and learning-organization capability precede the development of adaptive strategic agility, as the cross-sectional design used here assumes but cannot confirm.

**References**

Barbosa, C. L., da Cruz Lima, A., Sobrinho, A. C. L., Calado, R. D., & Lordelo, S. A. V. (2021). Information, Communication and Knowledge for Lean Healthcare Management Guidelines, a Literature Revision. *IFIP Advances in Information and Communication Technology*, *631 IFIP*, 250–257. https://doi.org/10.1007/978-3-030-85902-2_27

Bardhan, I. R., & Thouin, M. F. (2013). Health information technology and its impact on the quality and cost of healthcare delivery. *Decision Support Systems*, *55*(2), 438–449. https://doi.org/10.1016/J.DSS.2012.10.003

Bollen, K. A., & Ting, K. F. (2000). A tetrad test for causal indicators. *Psychological Methods*, *5*(1), 3–22. https://doi.org/10.1037/1082-989X.5.1.3

Bucheli, J. M., Santa, R., Tegethoff, T., & Quintero, K. (2024). The Mediating Role of Eco-Innovation between Adaptive Environmental Strategy, Absorptive Capacity, and Environmental Performance. *Sustainability (Switzerland)*, *16*(15). https://doi.org/10.3390/SU16156504

Bush, P. D. (1987). The theory of institutional change. *J Econ Issues*, *21*(3), 1075–1116.

Cho, N. E., Ke, W., Atems, B., & Chang, J. (2018). How Does Electronic Health Information Exchange Affect Hospital Performance Efficiency? the Effects of Breadth and Depth of Information Sharing. *Journal of Healthcare Management*, *63*(3), 212–228. https://doi.org/10.1097/JHM-D-16-00041

Coltman, T., Devinney, T. M., Midgley, D. F., & Venaik, S. (2008). Formative versus reflective measurement models: Two applications of formative measurement. Journal of Business Research, 61(12), 1250-1262. https://doi.org/10.1016/j.jbusres.2008.01.013

DiMaggio, P., Hargittai, E., Neuman, W. R., & Robinson, J. P. (2001). Social Implications of the Internet. *Annual Review of Sociology*, *27*(1), 307–336. https://doi.org/10.1146/annurev.soc.27.1.307

DiMaggio, P. J., & Powell, W. W. (1983). The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review*, *48*(2), 147. https://doi.org/10.2307/2095101

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Dymock, D., & McCarthy, C. (2006). Towards a learning organization? Employee perceptions. *Learning Organization*, *13*(5), 525–536. https://doi.org/10.1108/09696470610680017

Gudergan, S. P., Ringle, C. M., Wende, S., & Will, A. (2008). Confirmatory tetrad analysis in PLS path modeling. *Journal of Business Research*, *61*(12), 1238–1249. https://doi.org/10.1016/J.JBUSRES.2008.01.001

Esdar, M., Hübner, U., Thye, J., Babitsch, B., & Liebe, J. D. (2021). The effect of innovation capabilities of health care organizations on the quality of health information technology: Model development with cross-sectional data. *JMIR Medical Informatics*, *9*(3). https://doi.org/10.2196/23306

Fang, S. R., Chang, E., Ou, C. C., & Chou, C. H. (2014). Internal market orientation, market capabilities and learning orientation. *European Journal of Marketing*, *48*(1), 170–192. https://doi.org/10.1108/EJM-06-2010-0353

Feldman, S. S., Buchalter, S., & Hayes, L. W. (2018). Health information technology in healthcare quality and patient safety: Literature review. *JMIR Medical Informatics*, *20*(6). https://doi.org/10.2196/10264

Fornell, C., & Bookstein, F. L. (1982). Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory. *Journal of Marketing Research*, *19*(4), 440. https://doi.org/10.2307/3151718

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Thiele, K. O. (2017). Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. Journal of the Academy of Marketing Science, 45(5), 616-632. https://doi.org/10.1007/s11747-017-0517-x

Hair, J. F., Sarstedt, M., & Ringle, C. M. (2019). Rethinking some of the rethinking of partial least squares. *European Journal of Marketing*, *53*(4), 566–584. https://doi.org/10.1108/EJM-10-2018-0665

Han, X., Lowry, T. Y., Loo, G. T., Kuperman, G. J., & Shapiro, J. S. (2019). Expanding Health Information Exchange Improves Identification of Frequ ent Emergency Department Users. *Annals of Emergency Medicine*. https://doi.org/10.1016/j.annemergmed.2018.07.024

Jarvis, C. B., MacKenzie, S. B., & Podsakoff, P. M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. Journal of Consumer Research, 30(2), 199-218. https://doi.org/10.1086/376806

Harris, S. G. (1990). The fifth discipline: The art and practice of the learning organization, by Peter Senge, New York: Doubleday/Currency, 1990. *Human Resource Management*, *29*(3), 343–348. https://doi.org/10.1002/HRM.3930290308

J., *Real, J., R., A., L., Real, J. C., Roldán, J. L., & Leal, A. (2014). From entrepreneurial orientation and learning orientation to business performance: Analysing the mediating

role of organizational learning and the moderating effects of organizational size. *British Journal of Management*, *25*(2), 186–208. https://doi.org/10.1111/J.1467-8551.2012.00848.X

Knoche, H. T. (2022). Thinking about cooperative learning: The impacts of epistemic motives and social structure on cooperative learning environments. *International Journal of Management Education*, *20*(2). https://doi.org/10.1016/j.ijme.2022.100643

Lawshe, C. H. (1975). A quantitative approach to content validity. Personnel Psychology, 28(4), 563-575. https://doi.org/10.1111/j.1744-6570.1975.tb01393.x

Lee, S. (2019). Learning-by-moving: Can reconfiguring spatial proximity between organizational members promote individuallevel exploration? *Organization Science*, *30*(3), 467–488. https://doi.org/10.1287/ORSC.2019.1291

Lichtenthaler, U. (2009). Absorptive capacity, environmental turbulence, and the complementarity of organizational learning processes. *Academy of Management Journal*, *52*(4), 822–846. https://doi.org/10.5465/AMJ.2009.43670902

Liu, S. S., Luo, X., & Shi, Y. Z. (2002). Integrating customer orientation, corporate entrepreneurship, and learning orientation in organizations-in-transition: An empirical study. *International Journal of Research in Marketing*, *19*(4), 367–382. https://doi.org/10.1016/S0167-8116(02)00098-8

Mu'Min, H., Bernardus, D., Kaihatu, T. S., Mu'min, H., Bernardus, D., & Kaihatu, T. S. (2025). Unlocking Digital Success: A TOE Framework Analysis of Digital Marketing Adoption for Enhanced SMEs Competitiveness. *International Journal of Accounting and Economics Studies*, *12*(5), 303–319. https://doi.org/10.14419/n81qcx19

Nassani, A. A., Badshah, W., Grigorescu, A., Cozorici, A. N., Yousaf, Z., & Zhan, X. (2024). Participatory leadership and supportive organisational culture Panacea for job satisfaction regulatory role of work-life balance. *Heliyon*, *10*. https://doi.org/10.1016/j.heliyon.2024.e36043

Payne, J. W., Bettman, J. R., & Johnson, E. J. (1988). Adaptive Strategy Selection in Decision Making. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *14*(3), 534–552. https://doi.org/10.1037/0278-7393.14.3.534

Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. Research in Nursing & Health, 29(5), 489-497. https://doi.org/10.1002/nur.20147

Richard, H., & Tolbert, P. (2005). *Organizations: structures, processes, and outcomes*. Pearson.

Sarstedt, M., & Liu, Y. (2024). Advanced marketing analytics using partial least squares structural equation modeling (PLS-SEM). In *Journal of Marketing Analytics* (Vol. 12, Number 1, pp. 1–5). Palgrave Macmillan. https://doi.org/10.1057/s41270-023-00279-7

Shmueli, G., Ray, S., Velasquez Estrada, J. M., & Chatla, S. B. (2016). The elephant in the room: Predictive performance of PLS models. *Journal of Business Research*, *69*(10), 4552–4564. https://doi.org/10.1016/J.JBUSRES.2016.03.049

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. https://doi.org/10.1002/SMJ.640

Tsang, E. W. K. (1997). Organizational learning and the learning organization: A dichotomy between descriptive and prescriptive research. *Human Relations*, *50*(1), 73–89. https://doi.org/10.1177/001872679705000104

Volberda, H. W., Khanagha, S., Baden-Fuller, C., Mihalache, O. R., & Birkinshaw, J. (2021). Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms. *Long Range Planning*, *54*(5). https://doi.org/10.1016/J.LRP.2021.102110

White-Williams, C., Asi, Y. M., Raffenaud, A., Bagwell, M. T., & Zeini, I. M. (2016). The effect of information technology on hospital performance. *Health Care Management Science*. https://doi.org/10.1007/s10729-015-9329-z

Zhao, X., Lynch, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research*, *37*(2), 197–206. https://doi.org/10.1086/651257

Zhihan, S., Mohammadiounotikandi, A., Ghareh Khanlooei, S., Ehsani, A., & Lee, S. (2023). A new conceptual model to investigate the role of hospital's capabilit ies on sustainable learning. *Heliyon*. https://doi.org/10.1016/j.heliyon.2023.e20890