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Hospital Expansion Agility: Orchestrating Structural Capabilities and Utility Scalability Through Strategic Growth Planning

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Abstract

The shifting paradigm in healthcare services demands that hospitals move beyond a sole focus on construction efficiency, requiring instead agile physical and managerial infrastructures to navigate uncertainty. This study aims to analyze the impact of Structural Retrofitting Capability and Scalable Utility Design on Long-Term Expansion Agility, with Strategic Future Growth Planning serving as a mediating variable within a large-scale private hospital network in Indonesia. An explanatory quantitative method was applied using a census technique targeting 51 expert respondents from project and facility management, analyzed via the Three-Box Method and SEM-AMOS. Descriptive results reveal a behavioral asymmetry: managerial cognition falls into the High category, whereas physical building assets fall into the Medium category. Inferentially, the two physical infrastructure variables along with the strategic planning mediator exert a significant simultaneous effect on Expansion Agility with an R^2 value of 35.6%. Partially, Structural Retrofitting Capability exhibits a positive and significant direct effect on Expansion Agility. Conversely, Scalable Utility Design shows no direct effect; instead, its relationship with Expansion Agility is fully mediated by Strategic Future Growth Planning. It is concluded that structural building robustness independently and directly boosts physical hospital agility during expansion, whereas utility sophistication absolutely requires orchestration from a strategic planning vision to be successfully converted into a long-term business maneuvering advantage.

Keywords: Long-Term Expansion Agility, Structural Retrofitting Capability, Scalable Utility Design, Strategic Future Growth Planning, Dynamic Capabilities View.

INTRODUCTION

Global healthcare systems are undergoing a fundamental transformation that requires hospital infrastructure to evolve from static facilities into dynamic entities responsive to change. The World Health Organization has emphasized the need to rethink hospital architecture so that it can absorb surges in patient demand without sacrificing service quality or patient safety; yet many facilities are still built with rigid designs that fail to accommodate the space-function changes required in crisis scenarios or business expansion (Sebire et al., 2025). This inability of physical infrastructure to adapt has become a principal barrier to optimal long-term hospital performance, pushing the construction paradigm to shift from a focus on initial construction efficiency toward lifecycle adaptive capability.

The phenomenon of premature obsolescence is a crucial problem for healthcare facility managers in an increasingly competitive era. Many hospitals possess structurally sound buildings that are nevertheless functionally irrelevant because they cannot support new medical technologies or evolving clinical workflows (Memari et al., 2023). Hospital designs frequently fail to anticipate patient surges and staff well-being challenges, producing severe operational inefficiency whenever expansion becomes necessary (Sherif & Iskander, 2025). Without an integrated future-proofing strategy from the outset, hospitals remain trapped in a costly, reactive renovation cycle (Memari et al., 2023) confirming that obsolescence is a strategic threat to business continuity, not merely a technical nuisance.

At the national and local level, the integration of civil-engineering practice with healthcare-facility requirements is complicated by tight regulation and limited urban land, which frequently produces a disconnect between the technical design engineers deliver and the operational needs management expects (Sanusi, 2024). Construction flexibility is often sacrificed to reduce initial capital expenditure, even though the future lifecycle cost of renovation can be far higher (Hollander, 2020), and limited understanding of construction modularity slows the space-adaptation process (Rocha & Koskela, 2020).

In strategic management, an organization's capacity to respond to market change quickly and effectively is termed organizational agility. Long-term Expansion Agility is not merely the capacity to survive, but the proactive capacity to execute physical and functional expansion with minimal disruption to core operations (Desalegn et al., 2024); it encompasses speed, precision, and cost-efficiency in executing strategic change (Harraf et al., 2015), dimensions frequently conflated in the healthcare literature with mere adaptability or flexibility.

Empirically, hospital renovation or expansion is frequently obstructed by infrastructure unprepared for change, triggering significant cost overruns; poor early design decisions can exponentially increase operating and maintenance costs over a building's economic lifecycle (Sdino et al., 2021), and total-cost analyses of seismic strengthening confirm that retrofitting an existing structure is often financially unviable if retrofit capability was not designed-in from the start (Fung et al., 2021). Infrastructure unpreparedness for emergency or service-expansion scenarios likewise forces management toward unsustainable short-term fixes (van Heel et al., 2024).

Empirically, this gap was confirmed by a preliminary study conducted in 2026 at a large-scale private hospital network in Indonesia. To ensure empirical validity, an initial survey was administered to a targeted panel of 8 internal experts comprising Corporate Project personnel (75%) and Facility Management staff (25%), with extensive exposure to both greenfield (50%) and brownfield/renovation developments (37.5%). As summarized in Table 1, although general perceptions leaned positive, the respondents flagged concrete operational bottlenecks: 37.5% experienced severe disruptive noise, dust, or vibration during renovation, and 37.5% doubted the existing structure's readiness to absorb additional load without complex strengthening. Furthermore, 37.5% cited poor accessibility of ceiling/shaft utility routes for maintenance, while cross-functional coordination between technical and operational teams was identified as a major weakness

(37.5%), highlighting a critical disconnect between physical readiness and strategic needs.

Table 1. Preliminary survey results on the study's key constructs within a large-scale private hospital network (2026)

Variable Surveyed	Mean Approval (%)	Diagnostic Category
Long-term Expansion Agility	71.88	Fairly good, transitional
Structural Retrofitting Capability	75.00	Fairly good, transitional
Scalable Utility Design	78.13	Fairly good, transitional
Strategic Future Growth Planning (mechanism)	84.38	Fairly good, transitional

A workable bridge between hard infrastructure and organizational agility is Strategic Future Growth Planning: strategic management in healthcare must function as a framework for sustainable growth and service excellence rather than an administrative artifact (Soyege et al., 2024), demanding long-term systems thinking to navigate systemic uncertainty and align physical resources with clinical goals (Huebner & Flessa, 2022) and a mature research and planning agenda that ensures every physical investment returns long-term efficiency (Ibrahim et al., 2025). Absent such planning, sophisticated structure and utilities remain an underutilized asset.

Various studies have explored these physical components to address infrastructure adaptability. From an engineering perspective, Karafagka et al. (2025) utilized a risk-based hierarchical framework, finding that structural upgrading preserves critical building integrity. Similarly, Tan et al. (2023) and Yan et al. (2024) systematically reviewed construction processes, demonstrating that structural modularity and prefabricated MEP installations significantly reduce renovation complexity. However, a critical gap remains: existing literature predominantly treats hard physical assets and soft managerial cognition as isolated domains. The assumption that modular structures and scalable utilities automatically generate agility overlooks the necessity of strategic stakeholder orchestration (Tong, 2025; Memari et al., 2023). Therefore, the novelty of this study lies in bridging this socio-technical gap by positioning strategic future growth planning as a mediating mechanism that translates physical capabilities into actual expansion agility. The urgency of this research is driven by the escalating life-cycle costs and operational disruptions caused by rigid, conventional hospital designs.

The Dynamic Capabilities View (DCV), conceptualized by Teece, Pisano, and Shuen (1997), holds that competitive advantage derives from an organization's ability to integrate, build, and reconfigure internal and external competences in response to rapidly changing environments — not from static asset ownership. In this study's model, flexible structure and scalable utilities are positioned as basic resources, whereas Strategic Future Growth Planning is the dynamic capability that orchestrates them into the organizational outcome of Long-term Expansion Agility. This lens has proven useful for explaining how business-model innovation in healthcare organizations is driven by asset flexibility

(Loureiro et al., 2023) and how strategic fit between assets and environment predicts performance especially under high uncertainty (Fainshmidt et al., 2019). Given the practical urgency and the theoretical gap in jointly modeling hard infrastructure and strategic cognition, this study investigates how structural and utility attributes translate directly and through strategic planning into hospital expansion agility at the within the studied healthcare network.

Based on the background above, this study addresses: (1) whether Structural Retrofitting Capability, Scalable Utility Design, and Strategic Future Growth Planning simultaneously affect Long-term Expansion Agility; (2) and (3) whether each physical variable (*structure; utility*) individually affects Expansion Agility; (4) and (5) whether each physical variable individually affects Strategic Future Growth Planning; (6) whether Strategic Future Growth Planning affects Expansion Agility; and (7) and (8) whether Strategic Future Growth Planning mediates the effect of each physical variable on Expansion Agility.

This study aims to analyze the effect of structural capability and utility scalability on hospitals' long-term expansion agility, with strategic future growth planning as a mediator, within a large-scale private hospital network. The specific objectives mirror the aforementioned problem statements. Theoretically, the study is intended to enrich construction-management literature in the healthcare-facility context and provide empirical evidence that technical/physical design is itself a dynamic resource for organizational agility. Practically, it provides the studied hospital network and other private healthcare operators with a data-driven basis for drafting project Terms of Reference that mandate retrofit and utility-scalability standards. Furthermore, it supports the development of coordination guidelines between project teams and medical operations to mitigate service-disruption risks during brownfield renovations.

METHOD

This study used a quantitative approach with an explanatory design intended to test hypotheses and explain causal relationships among variables. The analytical method was covariance-based Structural Equation Modeling (SEM) processed in AMOS, chosen to confirm the fit between the theoretical model built on the Dynamic Capabilities View and empirical field data, and to test both partial and simultaneous effects among variables.

Location, Time, Population, and Sample

The study was conducted at the Head Office of A large-scale private hospital network in Indonesia, over two months from June to July 2026. The population comprised all leaders and expert staff managing physical assets and strategic planning within the hospital network, specifically the Corporate Project, Corporate Strategic Planning and Facility Management, and Hospital Facility Management teams — totaling 51 people. A saturated sampling (census) technique was used, with inclusion criteria requiring at least a Senior Engineer/Specialist/Project Manager/Head of Department position, a minimum of four years' professional experience (including experience within studied hospital network), and have prior involvement in either greenfield or brownfield hospital projects. All 51 population members met the criteria and were retained as the final sample.

Data Collection Procedure

Data were collected through field observation, internal document review (e.g., Change Request logs), and a closed electronic questionnaire, following six stages: (1) field observation and preliminary document review to map technical and strategic issues; (2) synthesis of the theoretical and conceptual framework; (3) an initial Focus Group Discussion (FGD) with representative Project Managers and Heads of Facility/Unit to align terminology in the instrument grid; (4) a pilot data collection; (5) validity/reliability analysis of the pilot data, followed by distribution of the finalized closed questionnaire to the actual 51 respondents; and (6) tabulation and processing of the collected data in AMOS.

Research Variables and Measurement

Four latent variables were measured on a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree), each broken down into several theory-derived dimensions and indicators, as summarized in Table 2.

Table 2. Summary of variables, conceptual definitions, and measurement dimensions

Variable	Conceptual Definition	Dimensions	Items
Long-term Expansion Agility (Y)	Proactive organizational capacity for physical and functional expansion with minimal operational disruption.	Strategic Responsiveness; Physical Scalability; Functional Versatility; Operational Continuity; Lifecycle Efficiency.	10
Structural Retrofitting Capability (X1)	Capacity of the structural system to be modified without total demolition.	Structural Load Redundancy; Geometric Grid Adaptability; Technical Modifiability; Vertical/Horizontal Expansion Readiness.	10
Scalable Utility Design (X2)	Capacity of MEP (mechanical, electrical, plumbing) systems to be adapted or expanded without total system replacement.	Modular Zoning; Utility Spare Capacity; Accessibility for Maintenance/Upgrade; Smart Interoperability.	9
Strategic Future Growth Planning (Z)	Collaborative managerial process aligning physical capacity with the organization's long-term growth vision.	Adaptive Growth Vision; Real Options Thinking; Scenario-Based Planning; Resource Allocation Discipline; Medico-Technical Integration.	13

Instrument Calibration and Data Analysis Technique

Prior to full distribution, the instrument was piloted on 30 respondents and tested for validity (Pearson product-moment correlation against r-table = 0.361 at α = 5%) and reliability (Cronbach's alpha, cut-off ≥ 0.70). Two analytical stages followed. First, descriptive statistics employed the Three-Box Method (Ferdinand, 2014): a weighted index was computed for each variable from response-frequency percentages across the four Likert categories, then classified as Low, Moderate, or High using interval boundaries derived from the theoretical minimum (12.75) and maximum (51.00) index values for N = 51. Second, inferential analysis used Path Analysis with composite (average) scores in AMOS rather than a full measurement-and-structural SEM, because the sample size (N = 51) falls below the 100–200 threshold generally recommended for full SEM (Hair et al., 2019). This stage comprised: (a) classical assumption testing — multivariate normality via skewness/kurtosis critical ratios within ±2.58 ($\alpha = 1\%$) and multicollinearity via inter-construct correlations below 0.85–0.90 (Kline, 2016; Hair et al., 2019); (b) model-fit evaluation using Chi-square, RMSEA (≤ 0.08), GFI, CFI, and NFI (≥ 0.90 for the latter three); and (c) hypothesis testing, where the simultaneous effect (H1) was judged from the model's R^2 following Cohen's (1988) benchmarks (weak 0.02–0.12; moderate 0.13–0.25; strong ≥ 0.26), direct effects (H2–H6) were accepted when the critical ratio (C.R.) ≥ 1.96 and $p \leq 0.05$, and mediation effects (H7–H8) were tested via bootstrapped indirect-effect significance ($p \leq 0.05$).

Statistical Hypotheses

1. H1: Structural Retrofitting Capability, Scalable Utility Design, and Strategic Future Growth Planning simultaneously affect Long-term Expansion Agility.
2. H2: Structural Retrofitting Capability positively affects Long-term Expansion Agility.
3. H3: Scalable Utility Design positively affects Long-term Expansion Agility.
4. H4: Structural Retrofitting Capability positively affects Strategic Future Growth Planning.
5. H5: Scalable Utility Design positively affects Strategic Future Growth Planning.
6. H6: Strategic Future Growth Planning positively affects Long-term Expansion Agility.
7. H7: Strategic Future Growth Planning mediates the effect of Structural Retrofitting Capability on Long-term Expansion Agility.
8. H8: Strategic Future Growth Planning mediates the effect of Scalable Utility Design on Long-term Expansion Agility.

RESULTS AND DISCUSSION

Respondent Profile

All 51 questionnaires were returned valid. Respondents were dominated by the Corporate Project division (78.4%), complemented by Corporate Strategic Planning/Facility Management and Hospital Facility Management (21.6% combined) a mix that balances the planner/executor viewpoint with day-to-day operator realities. By position, 35.3% held strategic decision-making roles (Chief/Director, Manager, Project Manager) and 64.7% were senior technical experts (Senior Engineer/Specialist). Professional maturity was high: 82.4% had more than seven years of experience, 94.1% had worked at studied hospital network for more than one year, and 98.0% held at least a bachelor's degree (up to Master's level). Critically, 62.7% had been involved in both greenfield and brownfield projects, giving the sample first-hand exposure to exactly the retrofit and utility-scalability issues under study.

Table 3. Respondent profile (N = 51)

Demographic	Category	Respondents (n)	Percentage (%)
Work Unit/Division	Corporate Project (CP)	40	78.43
	Corporate Strategic Planning and Facility Management (CSPFM)	5	9,80
	Hospital Facility Management (HFM)	6	11,77
	Total	51	100
Position	Chief/Director	2	3,92
	Head of Department/Manager	10	19,60
	Project Manager/ Assistant Project Manager/Lead	6	11,77
	Senior Engineer/Specialist	33	64,71
	Total	51	100
Total Work Experience	< 4 Years	3	5,88
	4 – 7 Years	6	11,77
	> 7 Years	42	82,35
	Total	51	100
Work Experience within the Network	< 1 Year	3	5,88
	1 – 3 Years	25	49,02
	> 3 Years	23	45,10
	Total	51	100
Highest Educational Qualification	Diploma (D3)	1	1,96
	Bachelor's Degree (S1)	32	62,75
	Bachelor's Degree – Professional Program (S1–Professional)	7	13,72
	Master's Degree (S2)	11	21,57
	Total	51	100
Project Involvement During Employment	Involved in new building construction projects (greenfield)	16	31,37
	Involved in renovation/space conversion projects (*brownfield*)	3	5,88
	Involved in both	32	62,75
	Total	51	100

Validity and Reliability

Pilot testing (n = 30) confirmed all 41 retained items as valid (r-count > r-table = 0.361); only one Long-term Expansion Agility item (Y.5.2, on building asset longevity) was dropped after failing the validity threshold (r = 0.329), leaving 9 valid items for that variable against 10 each for the physical predictors and 13 for Strategic Future Growth

Planning (X1 = 10; X2 = 9; Z = 13; Y = 9 — 41 items total). Reliability testing shows all four constructs comfortably exceed the 0.70 cut-off (Table 4), confirming the instrument's internal consistency.

Table 4. Reliability test results

Variable	Valid Items	Cronbach's Alpha	Result
Long-term Expansion Agility (Y)	9	0.911	Reliable
Structural Retrofitting Capability (X1)	10	0.917	Reliable
Scalable Utility Design (X2)	9	0.948	Reliable
Strategic Future Growth Planning (Z)	13	0.931	Reliable

Classical Assumption Testing

Univariate normality was satisfied for all four variables (all skewness and kurtosis critical ratios within ±2.58), and multivariate kurtosis produced a critical ratio of 2.446 — below the 2.58 threshold — confirming multivariate normality (Table 5). Multicollinearity was not a concern: the highest inter-construct correlation, between Structural Retrofitting Capability and Scalable Utility Design, was only 0.469 (well under the 0.85–0.90 danger zone), with a condition number of 5.876 against a critical threshold of 15. The dataset therefore satisfied the classical assumptions required for path analysis.

Table 5. Normality assessment (AMOS), N = 51

Variable	Min.	Max.	Skewness (C.R.)	Kurtosis (C.R.)
Scalable Utility Design (SU)	2.00	4.00	0.662 (1.931)	−0.072 (−0.105)
Structural Retrofitting Capability (SC)	2.30	4.00	0.759 (2.212)	0.245 (0.357)
Strategic Planning (SP)	2.23	4.00	0.112 (0.327)	−1.159 (−1.689)
Expansion Agility (EA)	2.00	4.00	0.778 (2.268)	0.425 (0.619)
Multivariate	–	–	–	**4.746 (2.446)**

Descriptive Analysis — Three-Box Method

Table 6 summarizes each variable's weighted index and diagnostic category. Strategic Future Growth Planning is the only construct reaching the High category; the two physical infrastructure variables and the dependent variable itself remain Moderate. This produces what can be termed a behavioral asymmetry between managerial cognition and physical reality: The management of the studied hospital network is visionary and proactive routinely scanning the environment and reviewing the physical roadmap, and coordinating well with medical teams yet the buildings' load-bearing reserve and MEP spare capacity have not caught up, leaving asset management comparatively reactive and expansion execution bottlenecked between fast strategic decisions and slower physical adaptation.

Table 6. Three-Box Method results per variable

Variable	Weighted Index (12.75–51.00)	Category	Behavioral Reading
Long-term Expansion Agility (Y)	36.89	Moderate	Agility-in-progress
Structural Retrofitting Capability (X1)	37.95	Moderate	Adaptive but reactive
Scalable Utility Design (X2)	37.03	Moderate	Responsive but reactive
Strategic Future Growth Planning (Z)	41.35	High	Visionary / proactive

Structural Path Model and Model Fit

Figure 1 depicts the estimated path model with standardized coefficients for all eight hypothesized relationships. Because the composite-score path model maps every possible relationship among the four variables, it is just-identified (df = 0, Chi-square = 0.000) a saturated specification whose absolute and incremental fit indices consequently reach mathematically perfect values (Table 7). This perfect fit is an expected property of a saturated model rather than discriminating evidence on its own; the more informative diagnostics for this study are therefore the coefficient of determination (R^2) and the individual path coefficients reported in Sections 3.6–3.8.

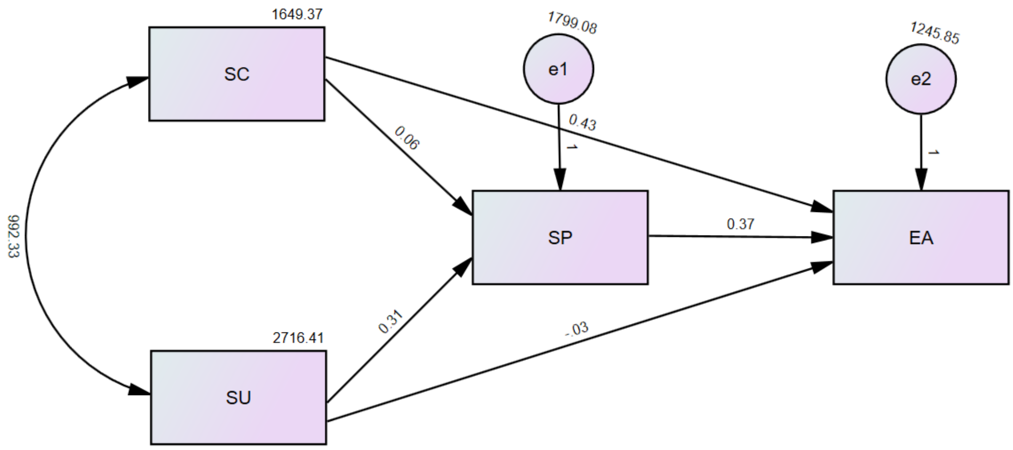

Figure 1. Structural Equation Model (SEM) Using AMOS
(Source: AMOS Output, 2026)

Table 7. Goodness-of-fit indices (saturated / just-identified composite path model)

Goodness-of-Fit Index	Cut-off Value	Model Result	Remark
Chi-Square	Small, ideally = 0	0.000	Perfect fit
RMSEA	≤ 0.08	0.000	Perfect fit
GFI	≥ 0.90	1.000	Perfect fit
CFI	≥ 0.90	1.000	Perfect fit

Goodness-of-Fit Index	Cut-off Value	Model Result	Remark
NFI	≥ 0.90	1.000	Perfect fit

Coefficient of Determination (R^2)

The two physical predictors jointly explain 14.6% of the variance in Strategic Future Growth Planning ($R^2 = 0.146$, Moderate per Cohen, 1988) sensible given that a hospital's strategic roadmap is never dictated solely by building capability, but also by capital availability, regulation, and epidemiological demand mapping. More importantly, the three exogenous variables (Structural Retrofitting Capability, Scalable Utility Design, and Strategic Future Growth Planning) jointly explain 35.6% of the variance in Long-term Expansion Agility ($R^2 = 0.356$, Strong per Cohen, 1988), confirming H1: investment in adaptive structure and scalable utilities is not asset wastage but a substantive contributor over 30% to a hospital's expansion agility; the remaining 64.4% is attributable to factors outside the model, such as contractor quality, material supply-chain reliability, and field project-team competence.

Hypothesis Testing — Direct Effects

Table 8. Direct-effect hypothesis testing (regression weights)

Code	Path	β	S.E.	C.R.	p	Result
H2	Structural Capability → Expansion Agility	0.396	0.139	3.079	0.002	**Accepted**
H3	Utility Design → Expansion Agility	−0.031	0.114	−0.229	0.819	Rejected
H4	Structural Capability → Strategic Planning	0.057	0.167	0.388	0.698	Rejected
H5	Utility Design → Strategic Planning	0.352	0.130	2.376	0.017	**Accepted**
H6	Strategic Planning → Expansion Agility	0.338	0.118	3.158	0.002	**Accepted**

H1 (accepted). The strong, significant R^2 (0.356) confirms that structure, utility, and strategic planning jointly and significantly shape Expansion Agility, consistent with the DCV's holistic logic that agility results from resources and dynamic capability acting in concert rather than in isolation (Teece et al., 1997; Huebner & Flessa, 2022), and with prior findings that design–management gaps are the principal driver of premature healthcare-facility obsolescence (Memari et al., 2023; Kucan et al., 2024).

H2 (accepted). Structural Retrofitting Capability exerts the strongest, most direct effect on Expansion Agility (β = 0.396; p = 0.002). Floor-slab load capacity, column bay width, and pre-installed rebar stubs act as a hard constraint: once satisfied, physical execution can proceed rapidly without waiting for strengthening works, echoing evidence that structural flexibility determines whether a building is renovated or torn down

(Scuderi, 2019) and that risk-based structural upgrading preserves continuity in critical facilities (Karafagka et al., 2025; Tan et al., 2023).

H3 (rejected). Scalable Utility Design has no significant direct effect on Expansion Agility (β = −0.031; p = 0.819). Ample cabling, shafts, or backup transformers do not, by themselves, make a hospital agile if no strategic instruction directs their use — consistent with the view that modular MEP capacity is a necessary but passive precondition rather than a sufficient driver of agility (Hinker et al., 2018; Scialpi & Declercq, 2023).

H4 (rejected). Structural Retrofitting Capability does not significantly affect Strategic Future Growth Planning (β = 0.057; p = 0.698). Concrete and columns are apparently viewed by management as a completed, static sunk cost rather than a stimulus for more visionary thinking, echoing the sunk-cost framing that keeps flexible-design "real options" under-recognized in facility-investment decisions (Krystallis et al., 2022; Askar et al., 2021).

H5 (accepted). Scalable Utility Design significantly and positively affects Strategic Future Growth Planning (β = 0.352; p = 0.017). Because MEP systems are the element most frequently problematic and most directly entangled with daily operations, their complexity psychologically compels management toward more disciplined environmental scanning and Capex scenario planning (Yan et al., 2024; Oliver & Parrett, 2018; Schoemaker et al., 2018).

H6 (accepted). Strategic Future Growth Planning significantly and positively affects Expansion Agility (β = 0.338; p = 0.002). Disciplined phasing scenarios and effective cross-functional coordination from a project's earliest stage measurably reduce the risk of repeated, disruptive rework during medical-space conversion (Soyege et al., 2024; Gifford et al., 2022; Ibrahim et al., 2025).

Mediation Analysis

Table 9. Mediation (indirect-effect) hypothesis testing

Code	Path	a	b	z	p	Conclusion
H7	Structural Capability → Strategic Planning → Expansion Agility	0.057	0.338	0.022	0.627	Non-mediation
H8	Utility Design → Strategic Planning → Expansion Agility	0.352	0.338	0.136	0.011	**Full mediation**

H7 (rejected — direct-only non-mediation). Because the indirect path is non-significant (z = 0.022; p = 0.627) while the direct effect of Structural Capability on Expansion Agility is significant (β = 0.396; p = 0.002), Strategic Future Growth Planning does not function as a transmission channel for structure's influence the contribution of structural robustness to expansion speed operates on its own, at the level of civil-engineering execution, independent of formal strategic-planning documents.

H8 (accepted — full mediation). The indirect path is significant (z = 0.136; p = 0.011) while the direct effect of Utility Design on Expansion Agility is not (β = −0.031; p = 0.819), meeting the criteria for full mediation (Hair et al., 2019). Sophisticated hospital utilities (e.g., a Building Management System or modular MEP routing) remain a passive, "silent" asset; their agility potential is only realized when paired with visionary management that knows when and how to orchestrate spare utility capacity into the business roadmap (Krystallis et al., 2022; Huebner & Flessa, 2022).

Key Findings

a. The 41-item instrument is valid and reliable, and the dataset is normally distributed and free of multicollinearity, supporting the composite-score path-analysis approach used given the modest census sample (N = 51).
b. A behavioral asymmetry exists between managerial cognition and physical readiness: Strategic Future Growth Planning is High (index 41.35), while Structural Retrofitting Capability, Scalable Utility Design, and Expansion Agility itself remain Moderate (36.89–37.95).
c. Structural Retrofitting Capability is the single strongest, most direct predictor of Expansion Agility β=0.396 (P=0.002) even exceeding Strategic Planning's own direct effect ($\beta = 0.338; P = 0.002$) while Scalable Utility Design shows no independent effect at all.
d. A clear dichotomy separates the two hard-infrastructure variables: structure is a direct, unmediated hard enabler of agility, whereas utility scalability is a dormant resource that only becomes valuable when fully orchestrated through strategic planning.

Research Limitations

1. The study is confined to a single large-scale private hospital ecosystem; findings reflect the specific capital capacity, work culture, and architectural standards of this network and cannot be generalized directly to other hospital-development organizations with different regulatory or bureaucratic structures.
2. Data rely on self-reported, closed Likert questionnaires, which despite an expert respondent pool — remain susceptible to halo effects and social-desirability bias; triangulation with physical load testing or numerical infrastructure simulation would sharpen future validation.
3. The final census sample skewed toward the Corporate Project division (78.4%), under-representing Facility Management and medical/strategic operator perspectives that bear the long-term consequences of space utilization.
4. The model explains 35.6% of Expansion Agility variance and 14.6% of Strategic Planning variance, leaving a substantial unexplained portion attributable to external determinants such as Capex availability, health- and building-ministry regulation, macroeconomic fluctuation, and human-resource agility.

CONCLUSION

The findings demonstrate that Structural Retrofitting Capability, Scalable Utility Design, and Strategic Future Growth Planning jointly and significantly enhance Long-term Expansion Agility, although their individual pathways differ. Structural Retrofitting Capability has a positive and significant direct effect on expansion agility but does not significantly influence strategic planning, indicating that structural robustness accelerates expansion through its own physical and engineering mechanisms. In contrast, Scalable Utility Design does not directly affect expansion agility but significantly influences Strategic Future Growth Planning, which subsequently fully mediates its effect on expansion agility, suggesting that spare MEP capacity becomes valuable only when strategically incorporated into long-term growth planning. Strategic Future Growth Planning itself has a positive and significant effect on Long-term Expansion Agility by enabling disciplined phasing, cross-functional coordination, and reduced rework in active medical spaces. Overall, the results confirm that long-term expansion agility depends on integrating physical infrastructure flexibility with strategic managerial planning, rather than relying on isolated infrastructure or managerial initiatives.

Theoretical and Managerial Implications

Theoretically, the findings validate the Dynamic Capabilities View (Teece et al., 1997; Loureiro et al., 2023) within hospital-infrastructure management: physical resources alone do not automatically generate organizational performance, as demonstrated most clearly by utility scalability's full mediation through strategic planning. Structure's unmediated direct effect, however, nuances the theory by showing that certain “hard” resources can act as an immediate boundary condition on agility — an organizational-slack logic in which surplus load capacity functions as a shock absorber regardless of whether it is explicitly articulated in strategic documents (Fainshmidt et al., 2019). Managerially, the studied healthcare network and comparable hospital groups: (a) institutionalize a corporate technical standard mandating structural load redundancy and pre-planned connection points across all facility master plans; (b) redesign MEP Terms of Reference around a separation of support and infill principle with explicit spare-capacity thresholds (approximately 20–30%) tied directly to the strategic master plan, so utility investment is not left idle; and (c) adopt Whole-Life-Costing and real-options budgeting methods (Flanagan, 1989; Ellingham & Fawcett, 2007) to counter the sunk-cost bias that currently keeps capital-expenditure committees anchored to lowest first cost.

Recommendations for Future Research

a. Extend the model with additional non-structural physical variables, such as facade flexibility, spatial-regulation coefficients (building coverage/floor-area ratios), and inter-facility zoning proximity.
b. Incorporate contemporary mediating or moderating variables relevant to digital transformation, such as facility digitalization capability (e.g., Building Information Modeling) or organizational change-readiness culture.
c. Broaden the sample and research object to other national private hospital groups and public regional hospitals (RSUD) to test the external validity and generalizability of the structural model.
d. Apply a mixed-methods approach — combining the quantitative design with structured interviews or FGDs involving C-level executives — to probe the

psychological and organizational-political roots of the sunk-cost bias underlying the rejection of H4.

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