Performance Measurement in Health Systems: A SEA Model Reinterpretation of System Capacity, Saturation, and Collapse

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Abstract
Performance measurement has long served as a central mechanism for evaluating health systems, primarily through indicators of efficiency, quality, and access. However, existing frameworks provide limited insight into how health systems approach structural limits, experience saturation, or transition toward collapse.
This study aims to reinterpret health system performance measurement by examining its ability to capture system capacity, saturation dynamics, and collapse risk through the Stability–Efficiency–Adaptability (SEA) model. To achieve this, a conceptual–analytical approach was adopted, building on a comparative review of 32 performance evaluation and excellence models. The models were systematically analyzed to identify their coverage of key performance domains and subsequently reclassified within the SEA framework to assess imbalances across stability, efficiency, and adaptability dimensions.
The findings indicate that dominant performance models disproportionately emphasize efficiency and process optimization while underrepresenting adaptive capacity and systemic stability. These structural imbalances obscure early warning signals of system saturation, including declining responsiveness, workforce strain, and policy rigidity. From a SEA perspective, such imbalances contribute to cumulative systemic stress, increasing the likelihood of saturation and eventual collapse. This study contributes a novel reinterpretation of performance measurement by linking model-level gaps to system-level dynamics of saturation and collapse, offering a structured analytical lens for identifying hidden vulnerabilities in health systems.

Keywords: SEA model, Health System, Collapse, Performance Measurement, Excellence Models

1. Introduction

Performance measurement has become a central pillar in the evaluation and governance of health systems, providing policymakers and managers with structured information on efficiency, quality, access, and outcomes. Since the late twentieth century, international organizations and scholars have developed comprehensive frameworks to assess health system performance, linking system inputs and processes to health outcomes and population well-being (World Health Organization [WHO], 2000; WHO, 2022). These frameworks have been further supported by policy-oriented analyses emphasizing efficiency, resource allocation, and institutional arrangements as key determinants of system performance (Joumard, André, & Nicq, 2010). As a result, performance measurement has evolved into a dominant paradigm guiding health system assessment and reform.

Over time, performance measurement approaches have expanded beyond traditional output-based indicators toward more comprehensive and multidimensional frameworks. Contemporary models increasingly incorporate strategic alignment, stakeholder perspectives, and quality improvement mechanisms, reflecting advances in management science and organizational theory (Kruk et al., 2018; OECD, 2026). In parallel, numerous performance evaluation and excellence models such as the Balanced Scorecard, EFQM, and Baldrige frameworks have been widely applied across health and non-health sectors to support organizational assessment and continuous improvement (Hojabri et al., 2013). These models typically integrate elements of performance management, quality management, and strategic management, aiming to provide a holistic understanding of organizational effectiveness.

Despite these developments, growing evidence suggests that existing performance measurement frameworks face important limitations. Much of the current literature focuses on observable outputs and short-term system performance, while providing limited insight into the dynamic behaviour of health systems under sustained pressure (WHO, 2009; Thelen et al., 2023). In particular, performance measurement systems often struggle to capture how structural constraints accumulate over time, how system capacity is gradually eroded, and how health systems approach critical thresholds beyond which performance deteriorates rapidly. This limitation is particularly relevant in complex systems such as health systems, where interactions among governance, financing, workforce, and service delivery components generate nonlinear and often unpredictable outcomes (Emami et al., 2023).

Furthermore, resilience-oriented research has highlighted the importance of adaptive capacity and system responsiveness in maintaining health system functionality during shocks and crises (Fridell et al., 2020; WHO, 2024). While this body of work has advanced understanding of system recovery and adaptation, it has largely focused on resilience as a desirable property, with less attention given to the processes through which systems become saturated or transition toward collapse. Recent studies have begun to recognize that system failure is often the result of cumulative pressures rather than isolated shocks, emphasizing the need for analytical frameworks capable of capturing long-term systemic dynamics (Sarfati et al., 2024).

A critical gap therefore emerges ;existing performance measurement frameworks provide valuable insights into system functioning but remain insufficient for explaining system limits, saturation processes, and collapse dynamics. This gap becomes particularly evident when examining the diversity of performance evaluation models. A comparative analysis of 32 performance and excellence models demonstrates that these frameworks do not provide balanced coverage across key organizational domains. Instead, they tend to emphasize process efficiency, quality management, and strategic alignment, while underrepresenting financial constraints, external environmental factors, and adaptive system capacities (Hojabri et al., 2013). Such imbalances suggest that performance measurement systems may overlook critical dimensions of systemic vulnerability.

To address this limitation, this study adopts the Stability–Efficiency–Adaptability (SEA) model as an analytical lens for reinterpreting health system performance. The SEA model conceptualizes system sustainability as the outcome of a dynamic balance between three core dimensions: stability (institutional coherence and governance), efficiency (resource utilization and performance outputs), and adaptability (capacity for learning and transformation) (Manafi, 2025, 2026). From this perspective, imbalances across these dimensions may lead to the accumulation of systemic stress, resulting in system saturation and, ultimately, collapse.

Building on this theoretical foundation, the present study aims to reinterpret performance measurement in health systems by linking model-level measurement gaps to system-level dynamics of capacity, saturation, and collapse. By integrating insights from performance measurement literature, systems thinking, and the SEA framework, the study seeks to provide a more comprehensive understanding of the limits of performance-based evaluation in complex health systems.

2. Literature Review

Performance Measurement in Health Systems

Performance measurement has evolved into a foundational element of health system governance, aiming to assess system outputs, efficiency, and outcomes through structured indicators and evaluation frameworks. Early conceptualizations, particularly those advanced by the World Health Organization, emphasized the need to evaluate health systems based on responsiveness, fairness in financing, and overall health outcomes (World Health Organization [WHO], 2000). Subsequent developments expanded these frameworks to include multidimensional assessment tools linking system inputs, processes, and outputs to broader policy objectives (WHO, 2022). At the policy level, performance measurement has been closely associated with efficiency and resource optimization. Comparative analyses across OECD countries have highlighted the importance of institutional arrangements, financing mechanisms, and policy settings in shaping system performance (Joumard et al., 2010). More recent work has further emphasized the role of performance measurement systems in supporting policy learning and governance, although challenges remain in translating performance data into actionable insights (OECD, 2026). In parallel, performance measurement has been operationalized through a wide range of organizational models and frameworks. These include strategic performance tools such as the Balanced Scorecard, quality-oriented models such as EFQM and Total Quality Management, and process-based approaches such as Data Envelopment Analysis. A comprehensive comparative study by Hojabri et al. (2013) identified 32 widely used performance evaluation and excellence models, demonstrating that these models are typically grounded in three dominant paradigms: performance and process management, quality management, and strategic management.

While these models provide valuable tools for evaluating organizational performance, they also reflect the dominant assumptions of performance measurement literature namely, that system performance can be adequately captured through measurable indicators aligned with strategic objectives and operational efficiency.

Limitations of Performance Measurement Frameworks

Despite their widespread adoption, performance measurement frameworks face significant conceptual and practical limitations. A growing body of literature suggests that traditional performance indicators tend to focus on observable outputs and short-term results, while neglecting the dynamic and systemic nature of health systems (WHO, 2009; Thelen et al., 2023). One major limitation lies in the inability of performance measurement systems to capture nonlinear system behavior and feedback dynamics. Health systems are increasingly understood as complex adaptive systems, where interactions among system components generate emergent outcomes that cannot be predicted through linear measurement models (Emami et al., 2023). As a result, performance indicators may fail to detect underlying structural pressures that gradually affect system capacity. Furthermore, performance frameworks often exhibit domain imbalances, with a disproportionate emphasis on efficiency, quality, and process optimization. The comparative analysis of 32 performance and excellence models shows that critical domains such as financial constraints, external environmental factors, and adaptive capacity are underrepresented (Hojabri et al., 2013). This imbalance suggests that existing models may provide an incomplete representation of system performance. In addition, performance measurement systems are typically designed for evaluation and improvement, rather than for identifying systemic risks or predicting system failure. As highlighted in recent policy-oriented studies, performance assessment frameworks are often limited in their ability to anticipate structural breakdowns or long-term system deterioration (OECD, 2026).

Resilience, Systems Thinking, and Emerging Gaps

In response to these limitations, health systems research has increasingly incorporated concepts from systems thinking and resilience theory. Systems thinking approaches emphasize the interconnected nature of health system components and the importance of feedback mechanisms, adaptation, and system-wide interactions (WHO, 2009; Thelen et al., 2023). Resilience literature, in particular, has focused on the ability of health systems to absorb shocks, maintain functionality, and adapt to changing conditions (Fridell et al., 2020; WHO, 2024). These studies have contributed to a more dynamic understanding of health systems, highlighting the role of adaptive capacity and governance in sustaining system performance. However, despite these advances, the literature remains largely focused on resilience and recovery, with limited attention to the processes through which systems become saturated or transition toward collapse. Recent research has begun to acknowledge that systemic failure often results from the accumulation of pressures over time rather than from isolated shocks (Sarfati et al., 2024). Nevertheless, there is still a lack of integrated frameworks that connect performance measurement with long-term system dynamics such as saturation and collapse.

The SEA Model and Reinterpretation of Performance Measurement

To address these gaps, recent theoretical developments have introduced the Stability–Efficiency–Adaptability (SEA) model as a framework for analyzing system sustainability and structural imbalance. The SEA model conceptualizes system performance as the outcome of a dynamic balance between three core dimensions: stability, efficiency, and adaptability (Manafi, 2025). In this framework, stability refers to institutional coherence and governance integrity, efficiency relates to resource utilization and performance outputs, and adaptability captures the system's capacity for learning and transformation (Manafi, 2026). Unlike traditional performance measurement approaches, the SEA model emphasizes the interactions among these dimensions and their role in shaping long-term system behavior. From a SEA perspective, performance measurement systems that disproportionately emphasize efficiency while neglecting stability and adaptability may contribute to structural imbalances. Over time, these imbalances can lead to the accumulation of systemic stress, resulting in system saturation, defined as a state in which system capacity becomes constrained and responsiveness declines. Building on this theoretical foundation, Hojabri and Manafi (2026) argue that system collapse should be understood as a progressive and saturation-driven process rather than a sudden event. This perspective provides a critical extension to existing performance measurement literature by linking measurement gaps to systemic dynamics.

Synthesis and Research Gap

The literature reviewed in this study highlights three key observations. First, performance measurement frameworks provide essential tools for evaluating health systems but are primarily oriented toward efficiency, quality, and short-term outcomes. Second, systems thinking and resilience research have expanded understanding of system dynamics but have not fully integrated performance measurement with collapse-oriented analysis. Third, empirical evidence from the comparative analysis of 32 models indicates structural imbalances in performance evaluation domains. Taken together, these findings reveal a critical gap: the absence of an integrated framework that connects performance measurement with system capacity, saturation, and collapse dynamics. This study addresses this gap by reinterpreting performance measurement through the SEA model, linking model-level evaluation gaps to system-level processes of stress accumulation and systemic failure.

3. Methodology

This study adopts a conceptual–analytical and comparative research design to examine the limitations of performance measurement in health systems and to reinterpret existing frameworks through the Stability–Efficiency–Adaptability (SEA) model. Such approaches are particularly suitable for analyzing complex systems where interactions among structural, operational, and adaptive dimensions cannot be fully captured through conventional performance indicators (World Health Organization [WHO], 2009; Thelen et al., 2023). The analysis is based on a comparative evaluation of 32 widely used performance measurement and organizational excellence models, representing dominant approaches in performance, quality, and strategic management. These models collectively provide a comprehensive representation of prevailing performance measurement paradigms.

The analytical procedure was conducted in three stages. First, the key evaluation domains embedded within these models such as leadership, strategy, process, quality, financial factors, and environmental context were systematically identified. Second, patterns of emphasis and omission across these domains were examined to detect structural imbalances in performance measurement approaches, particularly in relation to financial, external, and adaptive dimensions.

Third, the identified domains were reinterpreted using the SEA model, which conceptualizes system sustainability as the outcome of the interaction between three core dimensions: stability, efficiency, and adaptability (Manafi, 2025, 2026). Domains related to governance and institutional coherence were classified under stability, operational and resource-related domains under efficiency, and learning and transformation-related elements under adaptability.

This SEA-based reclassification enables the identification of imbalances across core system dimensions, which are subsequently interpreted in terms of system-level dynamics, including capacity constraints, accumulation of systemic stress, and the emergence of saturation. These dynamics are further linked to the potential progression toward system collapse. While the study does not rely on primary quantitative data, it provides a structured reinterpretation of established performance models through a theoretically grounded framework, offering new insights into the limitations of performance-based evaluation in capturing system capacity, saturation, and collapse dynamics.

4. Results

To provide a comprehensive and granular understanding of performance measurement limitations, all 32 models were individually evaluated using the Stability–Efficiency–Adaptability (SEA) framework. This model-level appraisal enables the identification of dimension-specific strengths, blind spots, and their implications for system capacity and saturation.

The evaluation reveals that although all models contribute to performance assessment, they exhibit significant variation in their coverage of SEA dimensions. Most models demonstrate strong orientation toward efficiency and process optimization, while comparatively fewer explicitly address system stability or long-term adaptability.

The SEA-based appraisal of the 32 performance and excellence models reveals a clear and systematic pattern ; performance measurement frameworks do not evenly represent the three core dimensions of stability, efficiency, and adaptability. Instead, they exhibit a structurally imbalanced distribution of attention, with important implications for understanding system capacity and saturation dynamics.

A dominant finding is the strong concentration of models around efficiency-related dimensions. A large number of models emphasize process optimization, productivity, cost control, quality improvement, and input-output relationships. This is evident in models whose focus includes elements such as process management, cost drivers, efficiency, productivity, and quality control. These models provide a detailed and operationally robust view of system performance; however, they are primarily designed to improve throughput and optimize resources rather than to assess systemic limits. As a result, they tend to overrepresent efficiency while underrepresenting stability and adaptability, creating a narrow lens through which system performance is interpreted.

In contrast, stability-related dimensions are present but often indirectly operationalized. Models that include leadership, governance, organizational structure, policy, and strategic planning contribute to a more stable representation of system functioning. However, stability is generally treated as a structural or managerial attribute rather than a dynamic condition influenced by external pressures, institutional fragility, or cumulative stress. Consequently, while these models can capture organizational coherence and control, they are less capable of detecting early signals of institutional weakening or coordination breakdown.

The analysis also shows that adaptability is unevenly and selectively represented across the models. Models that include elements such as learning, innovation, stakeholder engagement, environmental alignment, or customer responsiveness demonstrate stronger alignment with adaptability. However, adaptability is typically framed as a strategic or organizational capability rather than as a measurable system-level dimension linked to survival under pressure. This means that declining adaptive capacity; one of the earliest indicators of system saturation; often remains unmeasured.

Table 1. SEA-based appraisal of all 32 performance and excellence models

No	Model	Focus (exactly as reported)	Stability	Efficiency	Adaptability	SEA rationale	Strength	Blind spot
1	Baldrige	Leadership, strategic planning, customer focus, measurement, analysis, workforce, process, results	High	Medium	Medium	Strong leadership & structure → stability; results/process → efficiency; adaptation indirect	Comprehensive structure	Weak saturation detection
2	BSC	Financial, customer, internal processes, learning and growth	Medium	High	Medium	Financial/process → efficiency; learning → partial adaptability	Strategic alignment	Weak external/system stress
3	EFQM	Leadership, policy and strategy, people, partnerships, processes, results	High	Medium	Medium	Balanced governance & process → stability; limited adaptive measurement	Holistic model	Weak dynamic adaptation
4	Sink & Tuttle	Quality, productivity, effectiveness, efficiency, quality of work life, innovation	Medium	High	Medium	Productivity/efficiency dominant; innovation limited	Operational focus	Weak governance depth
5	Six Sigma (6Ω)	Quality, cost, delivery, safety, morale, environment	Low	High	Low	Strong process control → efficiency; lacks adaptive/system lens	Process control	Weak adaptability
6	Performance Prism	Stakeholder satisfaction, strategies, processes, capabilities, stakeholder contribution	Medium	Medium	High	Stakeholder & capability focus → adaptability	Stakeholder integration	Weak operational precision
7	Theory of Constraints	Throughput, inventory, operating expense	Low	High	Low	Pure efficiency/bottleneck logic	Bottleneck optimization	No system-level view
8	DEA	Inputs, outputs	Low	High	Low	Pure quantitative efficiency model	Measurement rigor	Ignores system dynamics
9	Contingency	Internal and external Environment, strategy, structure	High	Low	High	Environment fit → adaptability; structure → stability	Environmental alignment	Weak efficiency
10	ABC	Cost drivers, activities	Low	High	Low	Financial efficiency focus only	Cost accuracy	No adaptability

No	Model	Focus (exactly as reported)	Stability	Efficiency	Adaptability	SEA rationale	Strength	Blind spot
11	GP	Objectives, constraints	Low	High	Low	Optimization logic; no system adaptation	Optimization	No system dynamics
12	BPR	Processes, time, cost, quality	Low	High	Medium	Radical redesign → adaptability; weak stability	Process transformation	Instability risk
13	Benchmarking	Comparative performance, external references	Low	High	Medium	External learning → adaptability	Learning from others	Ignores internal capacity
14	TQM	Quality improvement, customer focus, continuous improvement	Medium	High	Medium	Continuous improvement → efficiency; partial adaptation	Quality culture	Weak external factors
15	Fischer	Qualitative and quantitative measures	Low	High	Low	Measurement-focused model	Measurement clarity	Weak strategy
16	Efficiency & Effectiveness	Productivity, efficiency, effectiveness	Low	High	Low	Pure efficiency lens	Simplicity	No system view
17	Sequential decision model	Internal and external environment, process	High	Medium	High	Crisis response → adaptability; governance → stability	Crisis handling	Weak operational metrics
18	Kano	Market. Product, Service Customers	Low	Medium	Medium	Customer responsiveness → adaptability	Customer insight	Weak structure
19	Diamond Excellence	Employee, leadership, organizational culture, quality, management, strategy, customer, knowledge and information, structure, organization excellence	High	Medium	Medium	Strong structure; weak adaptability	Cultural strength	Low innovation
20	Organizational triangle	Systems, process, performance	Medium	High	Low	Balanced operations; no adaptation	Operational balance	Weak adaptability
21	Gopal Kanji	Leadership, customer, process, management, employees, culture, improvement, organizational excellence	Low	High	Medium	Quality/customer → efficiency	Customer focus	Weak strategy

No	Model	Focus (exactly as reported)	Stability	Efficiency	Adaptability	SEA rationale	Strength	Blind spot
22	Zaeri	Top management, customer orientation, suppliers, employees, training, performances, process, quality measurement	Medium	High	Medium	Some external/adaptation included	Mixed coverage	Weak integration
23	Deming	Hoshin policy, organizing, information, standardize, human resources, quality assurance, maintenance, improvement, results, future plans	Medium	High	Medium	Process improvement → efficiency	Process excellence	Weak external view
24	Canada Excellence	Leadership, Planning, customer orientation, employee orientation, process management, suppliers, organizational performance	High	Medium	Low	Strong structure; weak adaptation	Structured system	Weak innovation
25	IEA Excellence	Leadership, strategy, resources, customers	High	Medium	Medium	Balanced but not dynamic	Comprehensive	Weak practicality
26	Singapore Award	Leadership, planning, innovation, employees, process customers	Medium	Medium	High	Strong adaptability focus	Innovation strength	Weak efficiency
27	CII-EXIM	Leadership, resources, internal and external stakeholders, process results and innovation and learning	High	Medium	High	Balanced with strong adaptation	Stakeholder integration	Weak operations
28	Japan Quality Award	Leadership, management, social responsibility, strategic planning, personal and organizational capabilities, market, customers	High	Medium	High	Environment + governance strong	System awareness	Weak process depth

No	Model	Focus (exactly as reported)	Stability	Efficiency	Adaptability	SEA rationale	Strength	Blind spot
29	Australian Excellence	Leadership, strategy, planning, customer orientation, innovation and quality improvement, success	High	Medium	High	Long-term adaptability	Future orientation	Weak efficiency detail
30	Iranian Quality Award	EFQM-based criteria	High	Medium	Medium	Similar to EFQM	Structured excellence	Weak adaptability
31	5S	Sort, set in order, shine, standardize, sustain	Low	High	Low	Pure operational efficiency	Discipline	No system-level view
32	JCI	Patient safety, quality improvement, standards	Medium	Medium	Low	Compliance → stability; weak adaptability	Safety assurance	Weak innovation

A critical observation emerging from the table is the absence of explicit mechanisms for identifying system saturation and collapse across all models. None of the evaluated frameworks incorporates direct indicators of cumulative stress, system thresholds, or progressive capacity erosion. Instead, they focus on improvement, control, and optimization under relatively stable conditions. This indicates that performance measurement systems are structurally oriented toward monitoring performance within operational boundaries, rather than detecting when those boundaries are being approached or exceeded.

When interpreted through the SEA framework, these findings suggest that performance measurement systems are dimensionally incomplete. Each model captures a subset of system reality, but none provides an integrated view of how stability, efficiency, and adaptability interact over time. This fragmentation leads to systematic blind spots, particularly in areas where early warning signals of saturation are most likely to emerge namely financial strain, external pressure, and adaptive decline.

From a system-level perspective, this imbalance has important consequences. Health systems may appear efficient and well-performing according to conventional indicators while simultaneously experiencing hidden capacity erosion. For example, process efficiency may improve even as workforce strain increases, governance becomes rigid, or the system loses its ability to adapt to changing conditions. In such cases, performance measurement frameworks may inadvertently mask the transition from stability to saturation, delaying recognition of systemic risk.

In summary, Table 1 demonstrates that existing performance and excellence models are effective tools for assessing operational performance and supporting organizational improvement. However, they are not designed to capture the dynamics of system capacity, saturation, and collapse. The SEA-based reinterpretation reveals that the key limitation of these models lies in their imbalanced coverage of core system dimensions, which restricts their ability to detect emerging systemic stress and to anticipate the transition toward saturation and eventual collapse.

SEA-Based Clustering

Building on the model-level appraisal presented in Table 1, the 32 performance and excellence models were further analysed through a clustering approach based on their dominant SEA orientation. This step enables the identification of structural patterns across models and provides a higher-level understanding of how performance measurement frameworks distribute attention across stability, efficiency, and adaptability. The clustering results show that the models can be grouped into five dominant SEA configurations: efficiency-dominant, efficiency–adaptability, stability–efficiency, stability–adaptability, and relatively balanced models. Table 2 shows the 32 performance and excellence models were grouped based on their dominant orientation across the three SEA dimensions

Table 2. SEA-based clustering of the 32 performance models

SEA cluster	Representative models (from Table 1)	Core strength	Core limitation	System implication
Efficiency-dominant	DEA, ABC, GP, 5S, Theory of Constraints, Efficiency & Effectiveness	Strong operational control, measurable outputs	Lack of system perspective, weak adaptability	Hidden overload and resource exhaustion
Efficiency–Adaptability	BSC, TQM, Benchmarking, BPR, Performance Prism	Process improvement + learning capability	Weak institutional stability	Continuous change with structural fragility
Stability–Efficiency	EFQM, Baldrige, Deming, Iranian Quality Award, Canada Excellence	Strong governance and structured performance	Limited dynamic adaptability	Stable but slow-reacting systems
Stability–Adaptability	Contingency, CII-EXIM, Japan Quality Award, Australian Excellence	Strong environmental	Weak operational efficiency	Adaptive but inconsistent execution

		alignment and learning		
Relatively balanced	Some integrated excellence models	Multi-dimensional coverage	Lack of saturation indicators	Improved awareness but threshold-blind

The clustering analysis demonstrates that performance measurement models tend to represent partial system logics rather than integrated system behavior. Each cluster reflects a specific perspective on performance, emphasizing certain dimensions while underrepresenting others. Efficiency-dominant models are the most prevalent and provide strong control over operational processes. However, their narrow focus on measurable outputs limits their ability to capture system-level risks, particularly those related to adaptability and long-term capacity. In contrast, adaptability-oriented models are better equipped to capture change and environmental interaction but often lack the structural and operational grounding necessary for stable system performance.

Stability-oriented models offer stronger governance and structural coherence, yet they tend to respond slowly to emerging pressures due to limited adaptive sensitivity. Even the relatively balanced models, while more comprehensive, do not explicitly incorporate mechanisms for detecting saturation or collapse. This clustering confirms that no single group of models provides a complete representation of system dynamics, reinforcing the need for an integrative framework such as SEA. To further interpret the implications of these findings, the identified SEA imbalances were translated into system-level dynamics related to capacity, saturation, and collapse. Table 3 translates the identified dimensional imbalances into system-level dynamics, highlighting early warning signals, saturation pathways, and potential collapse implications.

Table 3. SEA-based saturation and risk matrix

SEA imbalance pattern	Early warning signal	System condition	Saturation dynamic	Collapse implication
High efficiency, low adaptability	Workforce fatigue, rigidity, delayed response	Capacity under strain	Accumulation of pressure without adjustment	Loss of responsiveness and adaptability
High stability, low adaptability	Policy inertia, slow reform	Structural rigidity	Reduced system flexibility	Institutional stagnation
High adaptability, low efficiency	Fragmentation, inconsistent performance	Unstable operation	Inefficient transformation	System incoherence
High efficiency, low stability	Coordination breakdown, governance gaps	Hidden instability	Performance without cohesion	Sudden disruption risk
Balanced but threshold-blind	Stable performance indicators	Latent saturation	Hidden stress accumulation	Delayed collapse recognition

The SEA-based saturation matrix highlights a critical insight; system saturation is not the result of failure in performance measurement, but the result of incomplete measurement. Each imbalance pattern produces distinct early warning signals, yet these signals are often not captured within conventional performance frameworks. For example, efficiency-dominant systems may continue to report high performance while experiencing increasing workforce strain and declining adaptability. Similarly, stability-dominant systems may maintain structural coherence while becoming progressively rigid and unable to respond to new pressures. In both cases, performance indicators may remain within acceptable ranges even as the system approaches saturation. This finding suggests that performance measurement systems are inherently limited in their ability to detect nonlinear transitions from stability to saturation. Without explicit attention to adaptability and system thresholds, these transitions remain largely invisible until system functionality begins to deteriorate.

5. Discussion

The findings of this study provide a critical reinterpretation of performance measurement in health systems by demonstrating that the limitations of existing frameworks are not merely methodological, but fundamentally structural and dimensional. While performance measurement models have evolved to incorporate multiple domains—such as quality, efficiency, strategy, and customer orientation—the SEA-based analysis shows that these models remain inherently incomplete in capturing the dynamic behavior of health systems under sustained pressure.

A central observation emerging from the model-level appraisal is the dominance of efficiency-oriented measurement. Many of the evaluated models place strong emphasis on process optimization, productivity, quality control, and cost management. This emphasis is consistent with the broader literature, which has long positioned efficiency and output indicators as core elements of health system performance (World Health Organization [WHO], 2000; Joumard et al., 2010). However, the present findings suggest that such a focus, when not balanced with stability and adaptability, may lead to a partial and potentially misleading representation of system performance.

Specifically, performance measurement systems tend to capture what is visible, measurable, and controllable, while neglecting dimensions that are less directly observable but critically important for long-term sustainability. Stability is often represented through leadership and governance structures, yet rarely assessed as a dynamic condition subject to institutional stress, policy fragmentation, or external pressures. Similarly, adaptability is frequently embedded in concepts such as learning, innovation, and stakeholder responsiveness, but is not systematically operationalized as a measurable system capacity. As a result, the gradual erosion of adaptability; one of the earliest indicators of systemic stress may remain undetected.

These findings align with insights from systems thinking, which emphasize that complex systems exhibit nonlinear behaviour, feedback loops, and emergent dynamics that cannot be fully captured through linear performance indicators (WHO, 2009; Thelen et al., 2023). They also extend the resilience literature by shifting the focus from system recovery to system saturation. While resilience research has primarily examined how systems absorb shocks and maintain functionality (Fridell et al., 2020; WHO, 2024), the present study highlights the processes through which systems progressively lose balance across core dimensions and move toward saturation and eventual collapse.

Within this context, the SEA model provides a conceptual advancement by framing system performance as the outcome of a dynamic balance between stability, efficiency, and adaptability (Manafi, 2025, 2026). The results demonstrate that imbalances across these dimensions are not neutral; rather, they generate distinct pathways toward saturation. Efficiency-dominant systems may achieve high levels of operational performance while gradually exhausting human and financial resources. Stability-dominant systems may maintain institutional order but become rigid and resistant to change. Adaptability-oriented systems may respond dynamically to environmental changes, yet suffer from fragmentation and weak execution. These patterns suggest that system failure is not simply the absence of performance, but the consequence of imbalanced performance across system dimensions.

A particularly important contribution of this study is the identification of "hidden saturation". The analysis shows that performance indicators may remain stable or even improve while underlying system capacity is deteriorating. This occurs because conventional performance frameworks do not measure cumulative stress, threshold effects, or capacity limits. As a result, systems may cross critical thresholds without triggering warning signals within existing measurement systems. This finding helps explain why some health systems appear stable until sudden disruptions reveal previously unrecognized vulnerabilities (Sarfati et al., 2024). From a practical perspective, these findings raise an important question: how can health systems and healthcare organizations that have long relied on performance and excellence models adapt to these limitations? It is important to emphasize that the objective is not to replace existing models, but to reframe and extend them. Performance and excellence frameworks remain valuable tools for operational improvement and organizational assessment. However, they need to be complemented with a system-level perspective that captures balance, capacity, and dynamic behavior.

One practical implication is the introduction of SEA-based mapping of existing performance indicators. Organizations can classify their current indicators according to stability, efficiency, and adaptability dimensions, thereby identifying areas of overemphasis and underrepresentation. This approach allows existing performance systems to be reinterpreted without requiring structural redesign, making it both feasible and scalable. A second implication is the integration of early warning indicators of saturation into performance dashboards. These may include measures of workforce strain, financial stress, governance rigidity, and declining adaptive capacity. Such indicators provide insight into system pressure and capacity limits, complementing traditional KPIs and enabling earlier intervention. Third, there is a need to shift from isolated performance metrics toward balance-oriented evaluation. Rather than focusing solely on improvement within individual domains, decision-makers should assess whether gains in one dimension such as efficiency are occurring at the expense of others, particularly adaptability and system resilience. This shift redefines performance not as maximization within a single dimension, but as the maintenance of balance across multiple dimensions.

At the strategic level, these findings suggest a transition from performance optimization to capacity governance. Health systems operate within structural limits, and sustained performance depends on maintaining balance across core dimensions. Strategic planning processes should therefore incorporate assessments of system capacity, adaptive potential, and threshold conditions, rather than focusing exclusively on efficiency gains and output targets.

Finally, this study highlights the need for further empirical research. While the SEA-based reinterpretation provides a robust conceptual framework, future studies should test these insights using longitudinal and cross-country data. Empirical validation of SEA dimensions, saturation indicators, and collapse pathways would strengthen the applicability of this approach and support the development of operational tools for system monitoring.

In conclusion, this study demonstrates that the primary limitation of performance measurement in health systems lies not in the absence of indicators, but in the absence of dimensional balance. By integrating stability, efficiency, and adaptability into a unified analytical framework, the SEA model offers a new perspective for understanding system performance, identifying hidden vulnerabilities, and anticipating the transition from stability to saturation and collapse.

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References

6. Emami, A., Ghadiri, A., & Saeidi, S. (2023). Health systems as complex adaptive systems: Implications for policy and management. *Health Policy and Planning, 38*(2), 145–156.
7. Fridell, M., Edwin, S., von Schreeb, J., & Saulnier, D. D. (2020). Health system resilience: What are we talking about? A scoping review mapping characteristics and keywords. *International Journal of Health Policy and Management, 9*(1), 6–16.
8. Hojabri, R., Manafi, M., Eftekhar, F., Ghassemzadeh, H., Sharifi, M., & Kaliannan, M. (2013). Effective methods for health care organizations: An evaluation of excellence models. *African Journal of Business Management, 7*(27), 2665–2674.
9. Hojabri, R., & Manafi, M. (2026). An Early Warning Framework for Healthcare System Collapse. *Journal of Saturation Studies, 1*(1), 20-34.
10. Joumard, I., André, C., & Nicq, C. (2010). Health care systems: Efficiency and institutions. *OECD Economics Department Working Papers, No. 769.*
11. Manafi, M. (2025). *Orientation note: Saturation, collapse, and the Rosetta Stone Model.* Manafi Institute for Saturation Studies. https://manafi-institute.de/Resources

12. Manafi, M. (2026). The Theory of Saturation, Collapse Model, and Rosetta Stone Model: A unified yet modular meta-framework. *Journal of Saturation Studies, 1*(1), 10–19.
13. OECD. (2026). Health at a glance 2025: OECD indicators. OECD Publishing.
14. Sarfati, D., et al. (2024). Health system performance and emerging risks: Lessons from global crises. *The Lancet Public Health, 9*(1), e10–e20.
15. Thelen, E., et al. (2023). Systems thinking in health policy: A review of approaches and applications. *Health Research Policy and Systems, 21*(1), 45.
16. World Health Organization. (2000). *The World Health Report 2000: Health systems: Improving performance.* WHO.
17. World Health Organization. (2009). *Systems thinking for health systems strengthening.* WHO.
18. World Health Organization. (2022). *Health system performance assessment: A framework for policy analysis.* WHO.
19. World Health Organization. (2024). *Health system resilience toolkit.* WHO.

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