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Changes in Balanced Scorecard Performance Following Digital Hospital Transformation: A Before and After HIMSS Level 7 Analysis

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ABSTRACT

Purpose – The aim of this study is to examine changes in Balanced Scorecard dimensions by comparing institutional performance indicators from 2019 (pre-HIMSS Level 7) and 2023 (post-HIMSS Level 7). Furthermore, the study aims to present an adapted performance assessment framework that integrates the Balanced Scorecard approach with Health Quality Standards (HQS).

Design/methodology/approach – This study is a descriptive comparative case study based on secondary data from 2019 and 2023 from a single hospital in Türkiye that attained HIMSS Level 7. The Balanced Scorecard framework was expanded to include a sustainability dimension to provide a more holistic assessment. The measurement framework was structured based on adapted HQS indicators, and performance was evaluated using a weighted and standardized scoring system. Rather than developing a new, independently validated measurement instrument, this study applies an adapted performance assessment framework derived directly from official HQS criteria.

Findings – The findings indicate notable changes in the total performance score and across several Balanced Scorecard dimensions between 2019 and 2023. The total performance score increased from 80.8 to 93.4, with particularly notable increases in financial performance, sustainability, and internal process efficiency. However, these findings are based on descriptive comparisons and do not establish a direct causal relationship between digital transformation and performance outcomes.

Discussion – The findings suggest that positive co-changes may occur between digital hospital transformation and selected performance indicators. Advancements in technological infrastructure and employee training activities may be associated with operational efficiency and service quality; however, these relationships were not directly tested in the present study. Human-centered factors, including employee satisfaction, should also be considered when assessing the sustainability of organizational improvements. The study contributes to the literature by demonstrating a multidimensional framework for descriptively assessing changes in hospital performance in the context of digital transformation.

1. INTRODUCTION

Existing research on digital health transformation in hospitals and health systems highlights several critical components, particularly cost, flexibility of care delivery, and patient-centered outcomes (Ibrahim et al., 2022). Digital maturity models are widely used to assess this transformation, as they evaluate a country's capacity to sustain digitalized healthcare services through elements such as information consistency, digital capabilities, and health data exchange capacity (Teixeira et al., 2022). As digital transformation accelerates across healthcare settings, the value of these investments should be reflected in tangible improvements in organizational performance, workforce efficiency, workload management, patient safety, and overall quality of care (Snowdon et al., 2024).

ETHICAL APPROVAL: Permission was received from Selçuk University Faculty of Health Sciences Non-Invasive Clinical Research Ethics Committee (Date: 29/11/2023; Decree No: 2023/1218).

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When considering the development of a highly digitally mature hospital, one of the most globally recognized reference frameworks is provided by the Health Information and Management Systems Society (HIMSS). Founded in 1961 and collaborating with numerous countries and institutions, HIMSS serves as an international organization that supports the effective and sustainable use of information technologies in healthcare (HIMSS, 2025). Understanding the multidimensional effects of digital transformation not only through technological indicators but also within a comprehensive institutional performance framework makes systematic evaluation models essential. In this context, the Balanced Scorecard emerges as a fundamental tool for assessing and improving healthcare performance.

The Balanced Scorecard (BSC), introduced in the 1990s in response to limitations of traditional performance management systems, functions both as a strategic management tool and a performance measurement method designed to help organizations address complex management challenges (Kaplan & Norton, 1996). Kaplan and Norton later defined the BSC as a strategic approach that translates an institution's mission and strategy into a structured set of performance measures, forming the basis of an integrated strategic management system (Kaplan & Norton, 2001).

The model is built around four core perspectives. The financial perspective evaluates the organization's economic performance, while the customer perspective focuses on patient satisfaction, loyalty, and long-term service quality. The internal process perspective examines the effectiveness of operational and clinical workflows, ensuring that both core and support processes meet stakeholder needs. Finally, the learning and growth perspective includes employee training, organizational culture, and continuous learning, which are essential for success in knowledge-based and technologically evolving organizations (Gawankar et al., 2015).

The aim of this study is to examine changes in Balanced Scorecard dimensions by comparing institutional performance indicators from 2019 (pre-HIMSS Level 7) and 2023 (post-HIMSS Level 7) in a single hospital in Türkiye. Using a descriptive and comparative approach, the study focuses on differences in institutional performance indicators observed before and after HIMSS Level 7 implementation rather than estimating a causal effect of digital transformation. Although studies in the literature have examined digital hospital transformation and organizational performance within the Balanced Scorecard framework, many have relied on multi-center data, subjective assessments, or a limited number of performance dimensions. Moreover, comprehensive performance evaluation approaches incorporating a sustainability dimension remain relatively underexplored. This suggests a gap in the literature regarding multidimensional, indicator-based comparisons of institutional performance before and after HIMSS Level 7 implementation, particularly in highly digitally mature hospital settings.

Accordingly, the present study expands the Balanced Scorecard framework by incorporating a sustainability dimension alongside the learning and growth, internal process, customer (patient), and financial performance dimensions. This descriptive comparative analysis, conducted at a single hospital, does not claim a causal relationship; rather, it aims to identify differences in performance indicators before and after HIMSS Level 7 implementation. The study contributes to the literature by integrating the Balanced Scorecard approach with Health Quality Standards (HQS) and proposing an adapted performance assessment framework for the multidimensional evaluation of institutional performance before and after HIMSS Level 7 implementation.

2. CONCEPTUAL FRAMEWORK

2.1.Digital Hospital

Countries and organizations worldwide have been compelled to adapt to major transformations driven by globalization and rapid technological advancements. Following significant changes in the manufacturing sector, businesses have increasingly developed strategies to maintain sustainable competitive advantage under challenging market conditions (Koçel, 2018). In healthcare, digital transformation is primarily motivated by the need to enhance quality, improve efficiency, and reduce costs while simultaneously strengthening patient care, patient experience, workforce performance, and value creation. As hospitals, as key actors on the supply side of the healthcare system, adopt these new managerial approaches, a modern transformation grounded in Industry 4.0 principles has contributed to the emergence of digital hospitals.

A digital hospital refers to a healthcare environment in which patients, caregivers, and healthcare professionals actively benefit from information and communication technologies. However, the mere use of

information technologies is not sufficient for a hospital to be classified as a digitally mature hospital (Işık, 2019). Rather, digitally mature hospitals are characterized by the integration of technological, administrative, and operational systems. These systems may include hospital information management systems, communication and archiving technologies, automatic identification and data capture tools, medication tracking systems, electronic medical record systems, smart energy and building management infrastructure, telemedicine, tele-education, consultation tools, as well as quality, human resources, and service management systems (Republic of Türkiye Ministry of Health, 2019).

2.2.HIMSS–EMRAM Model

The Health Information and Management Systems Society (HIMSS) is a globally recognized non-profit organization operating in the field of health informatics. Established in 1961, HIMSS aims to support the effective, safe, and sustainable use of information and communication technologies in healthcare, contribute to health IT policy development, and strengthen healthcare delivery. Through its research, education, consulting, and evaluation activities, HIMSS serves as an international organization supporting digital transformation efforts in healthcare systems (HIMSS, 2025).

Developed by HIMSS Analytics, the Electronic Medical Record Adoption Model (EMRAM) is an eight-stage framework designed to assess and monitor the digital maturity of healthcare institutions. First implemented in the United States in 2005, EMRAM provides a structured roadmap for evaluating hospitals' progression from paper-based systems toward highly integrated digital infrastructures. Its stepwise implementation requirements, including the deployment of clinical decision support systems and closed-loop medication management, are intended to support standardized processes and enhance patient safety (Kharrazi et al., 2018).

In Türkiye, the digital transformation of hospitals accelerated with the establishment of the General Directorate of Health Information Systems and the initiation of the "Digital Transformation in Health" project under the Ministry of Health's 2010–2014 strategic plan (Republic of Türkiye Ministry of Health, 2019). Public hospitals in Türkiye have increasingly adopted the HIMSS-EMRAM model as a framework for guiding and assessing their digitalization processes (Işık, 2019). Hospitals that achieve a digital maturity level are subject to periodic validation processes, indicating that digital maturity should be regarded as a status that must be maintained rather than a permanent designation (Uslu et al., 2024).

As of 2023, Türkiye had eight hospitals that had achieved HIMSS Level 7, representing the highest level of digital maturity within the EMRAM framework, as well as three additional hospitals at the 0–EMRAM equivalent of Level 7. Moreover, 57 hospitals had reached HIMSS Level 6, while 17 hospitals were at the 0–EMRAM Level 6 stage (Republic of Türkiye Ministry of Health, 2023). These figures indicate the continued development of digital hospital capacity in Türkiye and demonstrate the growing adoption of digital maturity frameworks within the Turkish healthcare system.

2.3.Balanced Scorecard Analysis and Performance Assessment

Performance measurement is essential for organizations because it provides a basis for decision-making, management, and strategic planning. Balanced Scorecard analysis enables organizations to assess past and current performance while supporting the development of future strategies aligned with organizational objectives (Lebas, 1995; Lavy et al., 2010).

Table 1. Basic Questions Indicating the Necessity of Performance Measurement

No.	Basic Questions Indicating the Necessity of Performance Measurement
1	If you cannot measure it, you do not understand it,
2	If you cannot understand it, you cannot control it,
3	If you cannot control it, you cannot improve it,
4	If they know that you want to measure it, they will try to improve,
5	If you do not measure the results, you cannot distinguish success from failure,
6	If you cannot see success, you cannot reward it,
7	If you cannot reward success, you are probably rewarding failure,
8	If you cannot realize success, it may not be possible to maintain it,
9	If you cannot see success/failure, you cannot learn from it,

10	If you cannot realize failure, you repeat the previous mistakes and keep wasting the resources,
11	If you cannot relate the results to the consumed resources, you do not know what the real cost is,
12	If you do not know what the real cost is, you cannot tell whether you should do it or outsource it,
13	If you cannot tell the exact/real cost, you cannot get the best value for your money when forming a contract,
14	If you cannot demonstrate results, you may undermine your communication with stakeholders to get the necessary support because you cannot express value for money,
15	If you cannot document that the business process, material, or people you used is the most suitable for achieving the desired results, your performance will be questioned,
16	If you cannot demonstrate that you are on equal terms or better footing than in the past or compared to another provider, there may be questions about your accountability,
17	If you don't have data on who is happy/unhappy with your performance and why, you may change when you shouldn't, or worse, stay on a course that seems right on the surface but is actually wrong.

Reference:(Gawankar, Kamble and Raut, 2015).

The Balanced Scorecard (BSC) is described as an approach that enables managers to evaluate an organization across multiple dimensions (Ağca & Tunçer, 2006). Developed by Robert S. Kaplan and David P. Norton, the BSC consists of four core perspectives: the financial perspective, customer perspective, internal process perspective, and learning and growth perspective. The BSC can be considered a multidimensional dashboard that integrates key organizational performance indicators within a single framework (Kumar et al., 2024).

BSC analysis and performance measurement adopt a multidimensional approach. While maintaining an emphasis on traditional financial performance measures as outcome indicators of organizational success, the BSC integrates them with measures from three additional perspectives—customer, internal processes, and learning and growth—that are conceptually linked through cause-and-effect relationships and are considered important drivers of long-term value creation (Mio et al., 2022). It also provides a framework for translating an organization's mission and strategy into measurable objectives and performance indicators (Andryani & Indriati, 2024).

The BSC is based on four main perspectives. The financial perspective evaluates the financial performance of the organization, while the customer perspective focuses on patient satisfaction, loyalty, and long-term service quality in healthcare settings. The internal process perspective focuses on improving both core and support processes by examining the effectiveness of organizational processes and their alignment with stakeholder needs. Finally, the learning and growth perspective includes employee training, organizational culture, and continuous learning, as ongoing learning and technological adaptation are important for success in knowledge-based organizations (Gawankar et al., 2015).

In the present study, a sustainability dimension was incorporated into the traditional four-perspective structure of the BSC. The rationale for including the sustainability dimension is based on the premise that digital hospital transformation extends beyond short-term financial and operational outcomes and may also be reflected in resource use, environmental impacts, service continuity, and long-term value creation. In particular, environmental gains such as reduced paper consumption, optimized energy use, and more efficient processes may be relevant to performance assessment in increasingly digitalized healthcare environments. Therefore, the sustainability dimension was incorporated to provide a more comprehensive assessment of institutional performance.

Digital transformation has the potential to improve service quality, optimize resource use, and enhance organizational processes in healthcare settings. However, a strategic framework is needed to support the systematic management and evaluation of such transformation. In this context, the BSC serves as a strategic management tool that helps translate organizational strategies into measurable objectives and actions. Rather than focusing exclusively on financial indicators, the BSC incorporates customer, internal process, and learning and growth perspectives, thereby enabling a multidimensional assessment of organizational performance (Kaplan & Norton, 1992; Tawse & Tabesh, 2023). This feature is particularly relevant to the evaluation of digital transformation, which involves multiple organizational dimensions and stakeholders.

2.4. The Relationship Between Digital Transformation and Balanced Scorecard Dimensions

Digital transformation in the healthcare sector involves the integration of electronic health records, artificial intelligence, and data-driven decision support systems. This process requires organizations to balance the

expectations and needs of different stakeholders. The BSC addresses these perspectives within an integrated framework and can support strategic alignment during organizational transformation (Amer et al., 2022).

Furthermore, the BSC enables digital transformation processes to be monitored through key performance indicators (KPIs). This approach allows organizations to assess changes in areas such as service quality, patient satisfaction, and operational efficiency in the context of digital applications (Hügle & Grek, 2023).

Organizational integration is also important in digital transformation. In particular, electronic health record systems and data-sharing platforms can support horizontal and vertical integration within healthcare services. This highlights that digital transformation involves not only technological change but also organizational and process-level changes (Barnes et al., 2022).

Overall, the BSC can serve as a strategic framework for organizing and monitoring digital transformation processes, potentially making digitalization more systematic, measurable, and sustainable. Therefore, the BSC represents a useful management framework for evaluating multidimensional changes associated with digital transformation (Kaplan & Norton, 1992; Hügle & Grek, 2023).

From a theoretical perspective, digital transformation can also be examined through the Resource-Based View (RBV). According to this approach, organizational resources such as digital competencies, data infrastructure, and human resources can contribute to organizational capabilities and sustainable value creation when they are valuable, difficult to imitate, and effectively integrated into organizational processes (Barney, 1991). In this context, digital maturity can be conceptualized as an organizational capability that may be associated with performance across different BSC perspectives.

2.5. Resource-Based View (RBV) Perspective

The Resource-Based View (RBV) argues that an organization's ability to enhance its institutional capacity, service quality, and overall operational performance is influenced by the characteristics and effective utilization of its strategic resources, particularly resources that are valuable, rare, difficult to imitate, and non-substitutable (Barney, 1991; Wernerfelt, 1984; Peteraf, 1993). In public or university healthcare institutions, where market-based competitive advantage may not represent the primary organizational objective, RBV provides a useful theoretical lens for understanding how internal resources and capabilities can support institutional performance and operational resilience.

In healthcare organizations, digital infrastructure, electronic health record systems, data integration capacity, and the digital competencies of human resources can represent important organizational resources. However, the literature emphasizes that IT assets alone do not necessarily create sustainable value; rather, their contribution depends on their interaction with information systems resources and organizational capabilities (Mata et al., 1995; Wade & Hulland, 2004). Accordingly, performance changes observed in the context of digital transformation should be considered not only in relation to technological infrastructure but also in terms of how such infrastructure is integrated with organizational processes and human resources.

From this perspective, the digital maturity of a hospital that has achieved HIMSS Level 7 can be conceptualized as an organizational capability and strategic resource. Such digital maturity involves elements including data integration, effective use of electronic health record systems, and the integration of decision support systems into organizational processes. These capabilities may be relevant to different BSC perspectives. In the financial perspective, changes in resource utilization and financial indicators may be considered; in the internal process perspective, changes in process efficiency may be observed; in the customer perspective, changes in patient service experience may be reflected; and in the learning and growth perspective, changes in organizational learning and digital competencies may be considered.

Importantly, these theoretical relationships were not directly tested as formal hypotheses in the present study. Rather, the RBV provides a plausible conceptual foundation for contextualizing and interpreting the performance shifts observed across the BSC perspectives between the pre- and post-HIMSS Level 7 periods. Thus, the RBV is used as an interpretive theoretical lens rather than as a basis for claiming a causal effect of digital transformation on organizational performance.

3. METHOD

In this section, the purpose of the research, the assumptions and limitations of the research, the ethical aspect of the research, the data collection method and the scoring method are explained.

3.1. Research Design and Analytical Framework

This study was designed as a descriptive comparative case study conducted at a single hospital. It examines changes in institutional performance indicators at a hospital that achieved HIMSS Level 7 by comparing the pre-HIMSS Level 7 period (2019) with the post-HIMSS Level 7 period (2023).

The study is based on two different time points and does not include control variables. Therefore, the research does not aim to establish a causal relationship; instead, it evaluates the performance changes between these two periods using a descriptive approach.

Secondary data were used in the research and obtained from the hospital's corporate information systems. This data consists of performance reports, financial statements, quality indicators, and process management data. The Balanced Scorecard approach was used in the analysis process; in addition to financial performance, patient (customer) dimension, internal processes, and learning-development dimensions, the sustainability dimension was also included in the evaluation. The data were analyzed by comparatively examining corporate records for the years 2019 and 2023. In this context, the differences observed among the indicators were reported descriptively, and indicators related to digital infrastructure, data integrity, and process integration were also evaluated in accordance with EMRAM criteria. The measurement framework in this study was not developed as a new scale or instrument requiring content validity testing (such as Content Validity Index or Content Validity Ratio via expert panels). Instead, it represents an adapted performance assessment framework derived directly from the official Health Quality Standards (HQS) established by the Republic of Türkiye Ministry of Health. The selection and categorization of indicators into Balanced Scorecard dimensions are grounded in official HQS documentation and relevant literature; however, the classification and scoring structure were not independently validated through primary expert evaluations. Consequently, this study is positioned not as a scale-development research, but as an applied performance evaluation using an adapted HQS framework.

3.2. The Aim of the Research

The aim of this study is to examine changes in institutional performance indicators across the Balanced Scorecard dimensions by comparing the pre-HIMSS Level 7 period (2019) with the post-HIMSS Level 7 period (2023) in a hospital that achieved HIMSS Level 7. The study also aims to contribute to the literature by applying an adapted performance assessment framework based on Healthcare Quality Standards (HQS) indicators to evaluate institutional performance using the Balanced Scorecard approach.

3.3. Data Source and Data Collection

The data used in this study were obtained from the hospital’s institutional record systems. The dataset consists of performance reports, financial statements, quality indicators, and process management records.

Data from 2019 (pre-HIMSS Level 7) and 2023 (post-HIMSS Level 7) were analyzed comparatively. All data were secondary data obtained from the hospital’s digital archive and institutional information systems. No surveys, interviews, or other primary data collection methods were used in the study.

The reference weights and indicator scoring rules utilized in this study were retrieved directly from the official Health Quality Standards (HQS) Hospital Set (Version 5; Release 2020) published by the Ministry of Health of Türkiye (General Directorate of Health Services, Department of Health Quality, Accreditation and Health Information System). Each indicator corresponds to specific standard codes defined within the HQS v5 guidelines. The relative importance (weights) assigned to each indicator reflect the institutional scoring allocations mandated by the official HQS evaluation manual.

3.4. Development of the Measurement Tool

All indicators included in the study are derived from the Health Quality Standards (HQS) framework and structured to be consistent with the Balanced Scorecard dimensions. The formulas defined in the HQS system were used as the basis for calculating the indicator values.

The scoring process was carried out in four stages. In the first stage, raw indicator values were calculated based on institutional data. In the second stage, an HQS reference score reflecting the relative importance of each indicator within the relevant performance dimension was assigned. In the third stage, the scores of the indicators under each dimension were summed to obtain the total dimension score. In the final stage, the scores obtained from each indicator were aggregated to calculate the weighted contribution of each dimension to the overall institutional performance score out of a maximum of 100 total points. The total HQS reference points (2,800 points in total) were normalized to a 100-point institutional performance scale based on the official weighted distribution of HQS indicators across the Balanced Scorecard perspectives.

This method ensured that different dimensions were evaluated on a comparable scale. If the indicators exceeded their target values, the scores were limited to the maximum value defined in the relevant HQS system to prevent excessively high values from distorting the analysis (ceiling application). In contrast, lower values for inverse indicators (e.g., error or adverse event rates) were considered higher performance. The final scores are reported as holistic performance indicators for each dimension, enabling comparative performance analysis between 2019 and 2023.

3.5. Limitations of the Research

This study has several limitations. First, the research was conducted at a single hospital that had achieved HIMSS Level 7; therefore, the findings may have limited generalizability to other healthcare institutions and settings. Second, the analysis was based on only two time points (2019 and 2023), which limits the assessment of performance trajectories over time and does not allow for the examination of short-term or longer-term changes across multiple periods. Third, the study employed a descriptive comparative design and was not intended to establish causal relationships. Accordingly, the observed changes should be interpreted as differences between the two observation periods rather than as direct effects of digital transformation. Fourth, the study relied exclusively on secondary data obtained from institutional record systems. Therefore, the quality and completeness of the findings are dependent on the accuracy and completeness of the available institutional records.

Finally, the mandatory binary threshold-based scoring system prescribed by the official HQS guidelines represents an additional methodological limitation. Because indicators that do not reach 100% of their designated target are assigned zero points, incremental but potentially meaningful operational improvements may not be reflected in the overall quantitative score. For example, the Hospital Income/Expense Coverage Rate increased substantially from 52.4% in 2019 to 98.0% in 2023, yet this improvement was not reflected in the score because the 100% threshold was not achieved. Future studies could consider continuous or proportional scoring approaches alongside binary regulatory frameworks to capture sub-threshold performance changes more comprehensively.

3.6. Ethical Aspect of the Research

Before starting the research, permission was received from Selçuk University Faculty of Health Sciences Non-Invasive Clinical Research Ethics Committee (Date: 29/11/2023; Decree No: 2023/1218).

3.7. Data Collection Method and Scoring Method

All indicators used in the study were determined based on the Health Quality Standards (HQS) framework and structured in accordance with the Balanced Scorecard dimensions. Standard formulas defined in the HQS system were used as the basis for indicator calculations. The scoring process was carried out in four stages. In the first stage, raw values for each indicator were calculated from the institutional dataset. In the second stage, the indicators were matched with the HQS reference scoring system. In the third stage, the scores of the indicators under each Balanced Scorecard dimension were summed to obtain the total dimension score. In the final stage, the total score of each dimension was integrated into the overall institutional scorecard out of a maximum 100-point scale according to the predefined HQS dimension weights. This method allows for the comparison of different dimensions on a common scale. In inverse indicators (e.g., error, loss, and transfer

rates), lower values were considered as higher performance. To prevent extreme values from affecting the analysis, the upper limit values defined in the HQS system were taken into account. The final scores are reported as holistic performance indicators for each dimension, enabling comparative performance analysis between 2019 and 2023. Perspectives and the HQS indicators evaluated under these perspectives are presented in detail in the table below (Health Quality Standards Indicators, 2020).

Mathematical Formulation of the Scoring System:

To eliminate ambiguity and ensure reproducibility, the calculation of the overall institutional performance score (T) and dimension scores (D_k) follows a two-step mathematical aggregation model:

1. **Indicator Level Evaluation (S_i):**

Each indicator i within dimension k receives a score (S_i) based on a binary threshold criteria specified by HQS:

$$S_i = \begin{cases} W_i, & \text{if Realized Value meets or exceeds Target Value} \\ 0, & \text{if Realized Value fails to meet Target Value} \end{cases}$$

(where W_i represents the official HQS reference report card score / weight assigned to indicator i).

2. **Dimension Contribution Score (D_k) and Total Institutional Score (T):**

The contribution score for a specific perspective k (D_k) is calculated as the sum of the achieved scores of its underlying indicators:

$$D_k = \sum_{i=1}^{n_k} S_i$$

The overall institutional performance score (T) out of a total maximum of 100 points is computed by summing the contribution scores across all five Balanced Scorecard dimensions:

$$T = \sum_{k=1}^{5} D_k = D_{\text{Financial}} + D_{\text{Customer}} + D_{\text{Internal}} + D_{\text{Growth\&Learning}} + D_{\text{Sustainability}}$$

Based on the official HQS 2,800 reference points, the maximum weight allocation ($W_k^{\max}$) for each dimension within the 100-point total scale is distributed as follows:

- **Financial Perspective:** Max 16.2 points (16.2%)
- **Customer Perspective:** Max 23.4 points (23.4%)
- **Internal Perspective:** Max 18.0 points (18.0%)
- **Growth and Learning Perspective:** Max 28.1 points (28.1%)
- **Sustainability Perspective:** Max 14.3 points (14.3%)
- **Total Institutional Maximum Score:** 100.0 points (100.0%)

A notable methodological feature of the scoring system is the application of a binary threshold mechanism (0 or W_i), which is strictly mandated by the official HQS evaluation manual. Under this framework, an indicator receives its full reference score (W_i) only if the benchmark target is met or exceeded; otherwise, it receives zero points (0), regardless of partial progress. For instance, although the Hospital Income/Expense Coverage Rate showed substantial improvement from 52.4% in 2019 to 98.0% in 2023, it received 0 points in both periods because it remained slightly below the 100% target threshold. While this rigid scoring preserves strict alignment with official regulatory standards, it reflects compliance rather than continuous proportional performance shifts.

Table 2. Hospital Quality Scorecard (HQS) Performance Indicators, Weights, and Points According to the Balanced Scorecard Approach

Perspective	Indicator Name	Calculation Formula	Target Direction	HQS Refernce Score	Dimension Weight (%)	Threshold (Target Value)
Financial Perspective	1. Hospital Income/Expense Rate	(Total Income/ Total Expense) x100	↑	150	5.4	≥ 100%
	2. The rate of outsourcing payments to total payments	(Outsourcing payments/ Total Payments) x 100	↓	100	3.6	≤ 15%
	3. Operating table usage rate	(Operating Table Hours Used / Total Operating Table Hours) x 100	↑	100	3.6	≥ 75%
	4. The Rate of Bed Occupancy	(Number of Occupied Bed/ Total Number of Beds) x 100	↑	150	5.4	≥ 70%
	5. The Rate of Discarded Blood and Blood Component	(Amount of Blood Discarded/ Total Amount of Blood Used) x 100	↓	100	3.6	≤ 5%
Customer Perspective	1. General Patient Satisfaction Survey Results	Total Score/Total Number of Patients	↑	100	3.6	≥ 96
	2. General Employee Satisfaction Survey Results	Total Score/ Total Number of Employees	↑	100	3.6	≥ 80
	3. Patient Lapse Rate	(Number of Lapse Case/ Total Number of Patients) x 100	↓	150	5.4	< 1%
	4. The rate of Completion of Health Screenings belonging to the employees	(Number of completed health screenings/ Total number of employees who need health screening)	↑	150	5.4	≥ 85%
	5. The Rate of Violence Against the Employees	(Total number of violent incident reported in the year/ Total number of employee) x 100	↓	150	5.4	< 2%
Internal Perspective	1- Corrective and Preventive Action (CAPA) Finalization Rate	(Number of Corrective and Preventive Action performed/ Number of Planned Corrective and Preventive Action) x 100	↑	100	3.6	≥ 90%
	2. The Rate of Employees who Change Department Within the institution	(Number of employees who change department/ total number of employees) x 100	↓	100	3.6	< 2%
	3. Health Information Management System (HIMS) failures average response time	(Number of total Response/ Number of Total Failure) x 100	↓	100	3.6	< 30 min
	4. Appropriate Usage Rate of Surgical Safety Checklist	(Number of appropriate used checklists/ number of total surgical operations) x 100	↑	100	3.6	100%
	5. The rate of Complete Patient File	(Number of complete patient file/ Total number of file) x 100	↑	100	3.6	100%
Growth and Learning Perspective	1- The Rate of Participation of Employees in Trainings	(Number of employees participating in training/ Total number of employee) x 100	↑	100	3.6	≥ 80%
	2- The Rate of Realization of Planned Training	(Number of realized training/ Number of planned training) x 100	↑	100	3.6	≥ 90%
	3. The Rate of Realization of Compliance Training	(Number of Realized Compliance Trainings/ Planned Compliance Training) x 100	↑	100	3.6	100%
	4- The rate of Consumption of Hand Hygiene Materials	(Total score received/ maximum score) x 100	↑	100	3.6	≥ 60%
	5- Health Institution HQS Evaluation Score	(Total score received/ maximum score) x 100	↑	200	7.1	≥ 80
Sustainability Perspective	1. The Rate of Employees Who Quit the Institution	(Number of employees quitting/ Total number of employees) x 100	↓	50	1.8	< 1%
	2. Number of Patients Per Medical Staff	Total Number of Patients/ Total Number of Medical Staff	↓	50	1.8	< 50%
	3. Rate of Patient Transfer	(Total number of transferred patient/ total number of patients) x 100	↓	200	7.1	< 5%
	4- The duration HIMS is Disabled	(Total downtime/ Total time) x 100	↓	100	3.6	< 30 min
	5- Employee quitting the hospital/ Rate of new employees	(Number of employees who quitted/ Number of new employees) x 100	↓	50	1.8	< 1.0
TOTAL SCORE	**25 Indicators**			2800	100	

Note: Dimension weights are calculated based on the HQS reference scores and rounded to one decimal place; therefore, the sum of the rounded weights may slightly exceed 100%.

4. FINDINGS

In this section, in order to examine the dimensions of the balanced scorecard of the HIMSS Level 7 digital hospital for 2019 (the pre-HIMSS Level 7 period) and 2023 (the period when it was a HIMSS Level 7 digital hospital), a comparison of the data regarding the financial perspective, customer perspective, internal operations perspective, growth and learning perspective and sustainability was made.

Table 3. Performance Comparison of a HIMSS Level 7 Digital Hospital Before and After Digital Transformation (2019–2023)

		2019			2023		
Perspective	**Indicator Name**	**Indicator Target Value**	**Realized Value**	**Received Score**	**Indicator Target Value**	**Realized Value**	**Received Score**
Financial Perspective	1. The Rate of Income/Expense (Coverage)	100%	52,4%	0	100%	98%	0
	2. The rate of outsourcing payments to total payments	<15%	17,40%	0	15%	15%	3.6
	3. Operating table usage rate	75%	50%	0	75%	75%	3.6
	4. The Rate of Bed Occupancy	70%	72%	5.4	70%	71%	5.4
	5. The Rate of Discarded Blood and Blood Component	<5%	7.8%	0	<5%	4,5%	3.6
Customer Perspective	1. General Patient Satisfaction Survey Results	96	98	3.6	96	98	3.6
	2. General Employee Satisfaction Survey Results	80	85	3.6	85	85	3.6
	3. Patient Lapse Rate	<1%	0.27	5.4	<1%	0	5.4
	4. The rate of Completion of Health Screenings belonging to the employees	>85%	96.2	5.4	85%	90	5.4
	5. The Rate of Violence Against the Employees	<3	2	5.4	<2%	0.67	5.4
Internal Perspective	1- Corrective and Preventive Action (CAPA) Finalization Rate	>90	95	3.6	>90	90	3.6
	2. The Rate of Employees who Change Department Within the Institution	<3	0	3.6	<2%	1	3.6
	3. Health Information Management System (HIMS) failures average response time	<30 min	26.6	3.6	<30 min	11	3.6
	4. Appropriate Usage Rate of Surgical Safety Checklist	100	100%	3.6	100	100	3.6
	5. The rate of Complete Patient File	100	100	3.6	100	100	3.6
Growth and Learning Perspective	1- The Rate of Participation of Employees in Trainings	>90	99.2	3.6	>80%	87	3.6
	2- The Rate of Realization of Planned Training	>90	100	3.6	90	100	3.6
	3. The Rate of Realization of Compliance Training	100	100	3.6	100	100	3.6
	4- The rate of Consumption of Hand Hygiene Materials	>60	65	3.6	>60%	64	3.6
	5- Health Institution HQS Evaluation Score	>85	88	7.1	>80	88	7.1
Sustainability Perspective	1. The Rate of Employees Who Quit the Institution	<5%	5	0	<1%	17	0
	2. Number of Patients Per Medical Staff	83,16%	92.4	0	47,07%	52.3	1.8
	3. Rate of Patient Transfer	<5%	1.8	7.1	<5%	1,27%	7.1
	4- The duration HIMS is Disabled	30 min	23,5 min	3.6	30 min	20 min	3.6
	5- Employee quitting the hospital/ Rate of new employees	2,1%	2.1	1.8	0,9%	0.9	1.8
Financial Perspective Total Score				**5,4**			**16,2**
Customer Perspective Total Score				**23,4**			**23,4**
Internal Perspective Total Score				**18**			**18**
Growth and Learning Perspective Total Score				**21,5**			**21,5**
Sustainability Perspective Total Score				**12,5**			**14,3**
TOTAL SCORE				**80.8**	**TOTAL SCORE**		**93.4**

Note: Target values were determined by the institution. Indicators were evaluated according to the SKS scoring system, and indicators below the threshold were considered as 0 points. The "Received Score" values are written according to Table 2.

Table 3 presents a descriptive comparison of institutional performance metrics between 2019 (pre-digital hospital transformation) and 2023 (post-HIMSS Level 7 transformation) across the five Balanced Scorecard perspectives.

In the Financial Perspective, the dimension contribution score showed a numerical increase from 5.4 in 2019 to 16.2 in 2023 out of a maximum 16.2 points. This change was reflected in three indicators meeting their target thresholds in 2023: the rate of outsourcing payments improved from 17.4% to 15.0% (target: 15%), the operating table usage rate increased from 50.0% to 75.0% (target: 75%), and the rate of discarded blood components decreased from 7.8% to 4.5% (target: <5%). The Hospital Income/Expense Coverage Rate rose

from 52.4% in 2019 to 98.0% in 2023; however, under HQS binary threshold scoring rules, it received 0 points in both periods as it did not reach the 100% benchmark target.

In the Customer Perspective, the total dimension score remained unchanged at 23.4 out of a maximum 23.4 points in both years, with all five indicators meeting their designated targets. General patient satisfaction remained high at 98.0%, while general employee satisfaction remained stable at 85.0% in both 2019 and 2023, satisfying the HQS benchmark threshold.

In the Internal Perspective, the total dimension contribution score was maintained at 18.0 out of 18.0 points across both periods. Among the underlying operational metrics, the average response time for Health Information Management System (HIMSS) failures decreased from 26.6 minutes in 2019 to 11.0 minutes in 2023 (target: <30 min). Compliance with surgical safety checklists (100%) and complete patient file rates (100%) remained fully consistent in both periods.

In the Growth and Learning Perspective, the dimension contribution score remained stable at 21.5 out of 28.1 points. Employee training participation declined from 99.2% in 2019 to 87.0% in 2023, representing a decrease of 12.2 percentage points, while remaining above the benchmark target of 80.0%.**T**he institutional HQS Evaluation Score remained constant at 88.0 points in both evaluation years.

In the Sustainability Perspective, the total dimension contribution score increased from 12.5 points in 2019 to 14.3 points in 2023, reaching the maximum possible score of 14.3 points. This increase was primarily attributable to the Number of Patients Per Medical Staff indicator, whose contribution score increased from 0 points in 2019 to 1.8 points in 2023. For this indicator, the target values were 83.16% in 2019 and 47.07% in 2023, while the realized values were 92.4% and 52.3%, respectively. The Rate of Patient Transfer declined from 1.80% in 2019 to 1.27% in 2023, while its contribution score remained unchanged at 7.1 points, in line with the target of <5%. Similarly, the duration of HIMSS downtime decreased from 23.5 minutes to 20.0 minutes, while the contribution score remained at 3.6 points against the target of 30 minutes. The employee turnover/new employee rate also decreased from 2.1% to 0.9%, while its contribution score remained unchanged at 1.8 points.

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The descriptive findings of this study reveal distinct numerical changes in selected Balanced Scorecard perspectives between 2019 (pre-HIMSS Level 7) and 2023 (post-HIMSS Level 7). However, consistent with the descriptive comparative design of the study, these observed changes cannot be causally attributed solely to digital hospital transformation. Rather, the differences across indicators may reflect a complex interplay of organizational factors, including management practices, budgetary adjustments, human resource strategies, and post-pandemic recovery dynamics during the five-year interval.

The comparative results indicate positive co-changes in several performance domains, particularly within the internal process, customer, learning and growth, and sustainability perspectives. Reductions in HIMSS response times, improvements in patient transfer rates, and maintained compliance with surgical safety protocols indicate changes in operational performance. Although these changes coincided with the implementation of advanced electronic health record and decision support systems associated with HIMSS Level 7, attributing these institutional outcomes exclusively to digitalization would be methodologically inappropriate given the absence of a control group and longitudinal panel data.

The literature suggests that health information technologies can contribute to service quality, processing speed, administrative coordination, and data accessibility. Ak (2023) states that digital systems facilitate document workflows and access to remote care services. Digital transformation may also support employee performance and service quality in healthcare organizations through improved access to information, process traceability, data-driven decision-making, and organizational coordination. However, the realization of these potential benefits depends not only on the availability of technological infrastructure but also on its integration with employee competencies and quality management processes (Vial, 2019; Verhoef et al., 2021). The trends

observed in this single-site analysis are generally consistent with these broader patterns reported in the health management literature.

From a Resource-Based View (RBV) perspective, digital infrastructure, integrated data architectures, and technologically competent human resources can represent important organizational resources. Achieving HIMSS Level 7 indicates a high degree of digital maturity. The positive changes observed in process and financial contribution scores may suggest that, when digital capabilities are effectively integrated into organizational workflows, they can contribute to organizational performance across multiple dimensions (Barney, 1991; Wade & Hulland, 2004). However, these theoretical relationships were not directly tested in the present study and should therefore be interpreted as a conceptual explanation rather than evidence of a causal effect.

While operational indicators improved, employee satisfaction declined slightly from 85.0% in 2019 to 80.0% in 2023, and training participation decreased from 99.2% to 87.0%, although both remained above institutional thresholds. This decline in employee satisfaction may reflect, among other factors, potential changes in job roles, adaptation requirements, or increased workload pressures associated with digital transformation. However, the present study did not collect data specifically measuring these mechanisms. Therefore, such explanations should be considered possible interpretations rather than established causal relationships. Future research should examine whether and how digital transformation is associated with employee satisfaction through changes in job roles, adaptation demands, cognitive workload, and workplace stress.

A critical methodological insight emerging from this study concerns the effect of binary regulatory scoring mechanisms on the visibility of performance changes. Under the mandatory HQS evaluation framework, indicators that fail to achieve 100% of their target threshold receive zero contribution points. A notable example is the Hospital Income/Expense Coverage Rate, which increased substantially from 52.4% in 2019 to 98.0% in 2023. Despite this considerable improvement, the indicator received zero contribution points in both observation periods because the 100% threshold was not achieved. This illustrates how binary scoring can mask incremental operational improvements below predefined thresholds. Future healthcare performance assessment models could therefore consider incorporating proportional scoring approaches alongside binary compliance thresholds to capture sub-threshold performance changes more comprehensively.

The integration of a sustainability perspective into the traditional Balanced Scorecard framework enabled a broader assessment of organizational performance, including workforce turnover, patient-to-staff ratios, and resource continuity. In this respect, the adapted framework provides healthcare managers with a multidimensional perspective that extends beyond immediate financial and operational outcomes.

From a managerial perspective, maintaining performance improvements may require continuous staff training, participatory governance, routine monitoring of process compliance, and systematic corrective actions. In addition, digital platforms can be used to collect timely feedback from patients and staff, potentially supporting more responsive strategic decision-making.

This study has several limitations. First, the investigation was conducted at a single hospital that had achieved HIMSS Level 7; therefore, the findings may have limited generalizability to other healthcare institutions and settings. Second, the evaluation was based on secondary data from only two time points (2019 and 2023), limiting the assessment of performance trajectories over time and preventing the examination of short-term or longer-term changes across multiple periods. Third, the descriptive comparative design does not allow causal inferences regarding the independent effect of digital transformation. External factors, including post-pandemic healthcare restructuring, inflation-related financial changes, and administrative policy shifts, could not be statistically controlled. Fourth, the study relied on secondary data obtained from institutional record systems; therefore, the quality and completeness of the findings depend on the accuracy and completeness of the available records.

The adapted measurement framework also has several limitations. The selection of indicators was based on the organizational structure and available data of the study hospital, which may limit its applicability to other healthcare institutions. In addition, threshold-based scoring may result in information loss by failing to reflect incremental improvements below predefined targets. Differences in indicator weighting may also influence the interpretation of overall performance. Finally, the framework has not yet undergone an independent

validity assessment; therefore, its measurement properties and generalizability should be interpreted cautiously. Future studies should test the framework across different healthcare institutions and examine its validity, reliability, alternative weighting approaches, and proportional scoring methods.

In conclusion, this study demonstrates that positive co-changes across Balanced Scorecard and sustainability dimensions may accompany digital hospital transformation. However, these findings should be interpreted as descriptive comparative trends rather than direct causal effects. Sustainable digital transformation in healthcare requires alignment among technological capabilities, human resource development, effective process management, and long-term strategic oversight.

DECLARATIONS

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