

Balanced Scorecard and Performance-Based Budgeting in Healthcare: A Bibliometric Mapping of Research from 2000 to 2024

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ABSTRACT

Healthcare organizations require performance-management systems that connect strategic objectives, resource allocation, service quality, and evidence-informed decision-making. The balanced scorecard (BSC) and performance-based budgeting (PBB) offer complementary approaches to aligning organizational strategy with financial and non-financial performance. This study mapped the growth and conceptual structure of research on BSC and PBB in healthcare between 2000 and 2024. A bibliometric corpus of 280 articles was compiled from Web of Science, Google Scholar, SID, Noormags, and Ensani. Publication trends, keyword co-occurrence, and thematic clusters were examined using VOSviewer. Publication output increased gradually until 2018 and accelerated thereafter, reaching 43 articles in 2024. BSC occupied the central position in the co-word network and was strongly connected with strategy, performance measurement, management control, information, knowledge management, innovation, technology, healthcare, hospitals, and decision-making. Five thematic areas were identified: strategy and performance measurement; information and decision-making; innovation and technology; operations and supply chain; and public-sector and healthcare applications. The literature has progressively positioned BSC as a strategic performance-governance framework rather than solely a reporting instrument. Its connection with PBB may support more integrated approaches to resource allocation and organizational accountability in healthcare. Digital and artificial-intelligence applications remain prospective research directions rather than findings directly established by this review.

Keywords: *balanced scorecard; bibliometric analysis; healthcare management; performance-based budgeting; performance governance; VOSviewer*

1. Introduction

Healthcare systems operate under persistent pressure to improve service quality, expand accountability, control costs, and allocate limited resources in ways that support strategic priorities. Traditional financial measures alone are insufficient for these purposes because they often emphasize short-term expenditure control rather than the

multidimensional performance of health organizations. The balanced scorecard (BSC), introduced by Kaplan and Norton, responds to this limitation by combining financial and non-financial measures across strategic perspectives such as finance, customers or patients, internal processes, and learning and growth (Kaplan & Norton, 1992, 1996). In healthcare, this multidimensional structure is particularly relevant because hospitals and health systems must balance

cost containment with patient outcomes, clinical quality, workforce development, innovation, and social accountability. Combined BSC-based evaluation models have also been used to clarify and assess the effectiveness of organizational strategies (Anvari et al., 2020).

Performance-based budgeting (PBB) complements the balanced scorecard by linking resource allocation to outputs, outcomes, and strategic priorities. Whereas incremental budgeting may reproduce historical patterns of spending, performance-based budgeting asks whether expenditures contribute to measurable organizational value. When the balanced scorecard is connected to budgeting, performance indicators are no longer merely descriptive; they become operational guides for funding decisions, managerial control, and continuous improvement. This connection is especially important in healthcare settings, where financial choices can directly affect service capacity, care quality, patient satisfaction, staff workload, and long-term sustainability. This interpretation is consistent with performance budgeting literature that defines budgeting as a mechanism for linking funding decisions to expected results and measurable performance information (Robinson, 2007).

Digital decision support adds a further dimension to performance management. Healthcare organizations increasingly use data infrastructures, dashboards, business-intelligence systems, and predictive models to monitor operations and support managerial decisions. Within this manuscript, these technologies are treated as a contextual extension of BSC and PBB rather than as variables directly examined in the bibliometric analysis. Their use requires transparent indicators, human oversight, and appropriate governance (U. S. Food Drug Administration, 2022; World Health, 2024).

Bibliometric methods are suitable for tracing the development, conceptual organization, and thematic evolution of a research field (Donthu et al., 2021; van Eck & Waltman, 2010). Accordingly, this study uses publication trends and keyword co-occurrence analysis to map the healthcare literature connecting BSC with PBB and related performance-management concepts.

The objectives were to: (1) describe publication trends from 2000 to 2024; (2) identify the principal concepts and thematic clusters through keyword co-occurrence analysis; (3) examine how BSC and PBB are positioned within healthcare performance-management research; and (4) identify directions for future work on digital decision support and performance governance.

2. Methods and Materials

This study employed a bibliometric mapping design. The analytical corpus comprised 280 research articles published between 2000 and 2024 and retrieved from Web of Science, Google Scholar, SID, Noormags, and Ensani. Because these sources differ in coverage and metadata structure, the corpus was treated as a cross-database collection rather than a single-index dataset. The analysis focused on titles, abstracts, keywords, affiliations, and cited references.

Eligible records addressed BSC, strategy maps, performance measurement, PBB, resource allocation, cost control, or healthcare management. Conference papers and records outside the thematic scope were excluded. Search concepts were organized around two domains: (1) balanced scorecard and strategic performance management and (2) performance-based budgeting, resource allocation, and cost control. Records were consolidated into a final bibliographic dataset before analysis.

VOSviewer was used to construct the keyword co-occurrence network and identify thematic clusters. The analysis examined annual publication output, the relative prominence and connectivity of keywords, and the conceptual composition of clusters. Findings were interpreted descriptively; no causal effects or pooled estimates were calculated.

To reduce conceptual overstatement, node size was interpreted as relative keyword occurrence and network links as co-occurrence relationships within the analyzed corpus. Cluster labels were assigned by examining the most prominent and conceptually coherent terms in each cluster. The study therefore maps patterns of attention and association in the literature rather than the effectiveness of BSC or PBB interventions.

Table 1

Data sources, eligibility criteria, and analytical scope

Component	Specification
Data sources	Web of Science, Google Scholar, SID, Noormags, and Ensani
Publication period	2000–2024
Core BSC concepts	Balanced scorecard, strategy map, performance measurement
Core budgeting concepts	Performance-based budgeting, resource allocation, cost control
Eligibility focus	Research articles addressing BSC, PBB, performance measurement, resource allocation, or healthcare management
Exclusions	Conference papers and records outside the thematic scope
Final corpus	280 articles
Analytical approach	Annual publication trends, keyword co-occurrence, network visualization, and thematic clustering using VOSviewer
Interpretive scope	Descriptive bibliometric mapping; no pooled effect estimates or causal inference

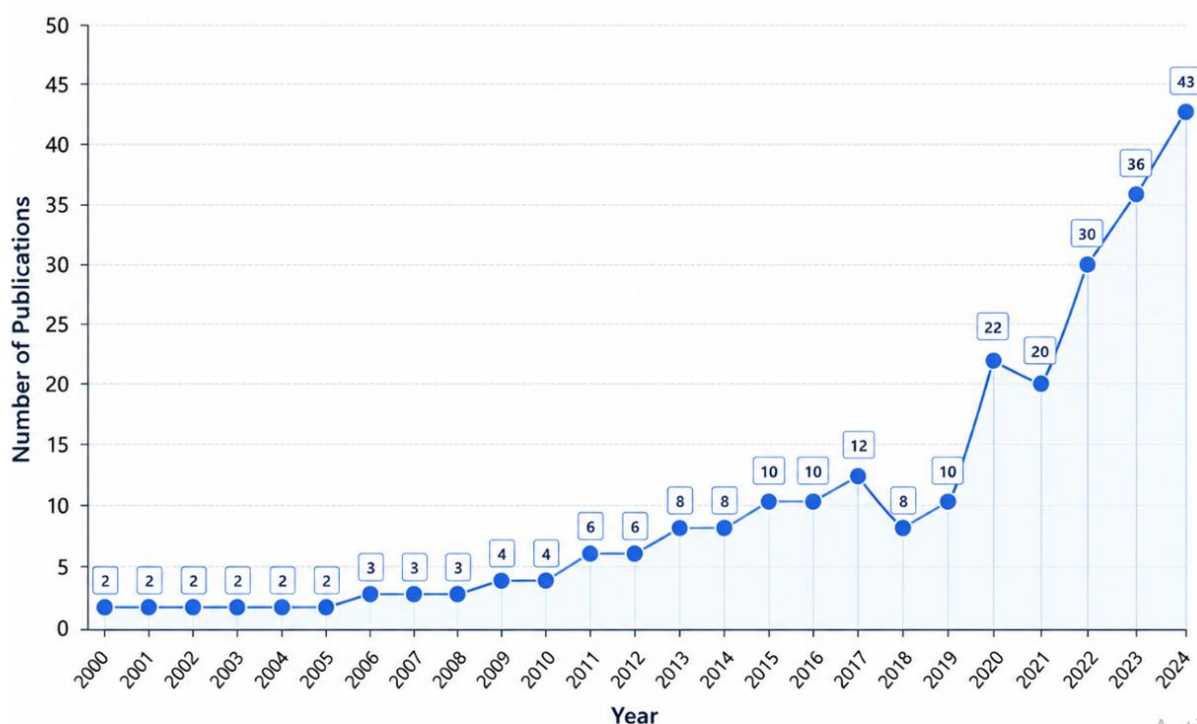
3. Findings and Results

Research on BSC and performance budgeting in healthcare became increasingly visible and conceptually

diverse over the study period. The findings below describe publication volume, keyword relationships, and thematic organization within the 280-article corpus.

Figure 1

Annual publication trend in BSC and performance-budgeting research, 2000–2024



The publication trend shows three broad phases. From 2000 to 2010, annual output remained low, generally ranging from two to six articles. From 2011 to 2018, publication activity increased gradually, reaching approximately 8–12 articles per year. Growth accelerated thereafter: output increased from 10 articles in 2019 to 22

in 2020, declined slightly to 20 in 2021, and then rose to 30 in 2022, 36 in 2023, and 43 in 2024. This pattern indicates a marked recent expansion of research attention to BSC and performance budgeting in healthcare management.

Co-word mapping showed that balanced scorecard occupied the central position in the conceptual network. It

had the largest and most visually prominent node, indicating the highest co-occurrence frequency with other keywords. The network connected BSC to strategy, performance measurement, management control, information, decision-making, innovation, technology, knowledge management, healthcare, hospitals, sustainability, local government, and higher education. This pattern indicates that the balanced scorecard is no longer treated only as a narrow accounting tool. It has become a bridge between strategic management, information systems, operational performance, knowledge-based decision-making, and public-sector health management.

The thematic structure of the network was interpreted through five clusters in the co-word map and four broad

clusters in the thematic clustering map. The co-word clusters included: strategy and performance measurement; information and decision-making; innovation and technology; operations and supply chain; and public sector and healthcare. The thematic clustering map organized the field around balanced scorecard, strategy map, performance measurement, and performance-based budgeting/resource allocation/cost control. These clusters show that the field has moved from simple performance reporting toward integrated performance governance. AI and decision support are therefore relevant as future interpretive directions, but they were not directly tested as empirical variables in the present review.

Figure 2

Keyword co-occurrence network in balanced-scorecard research

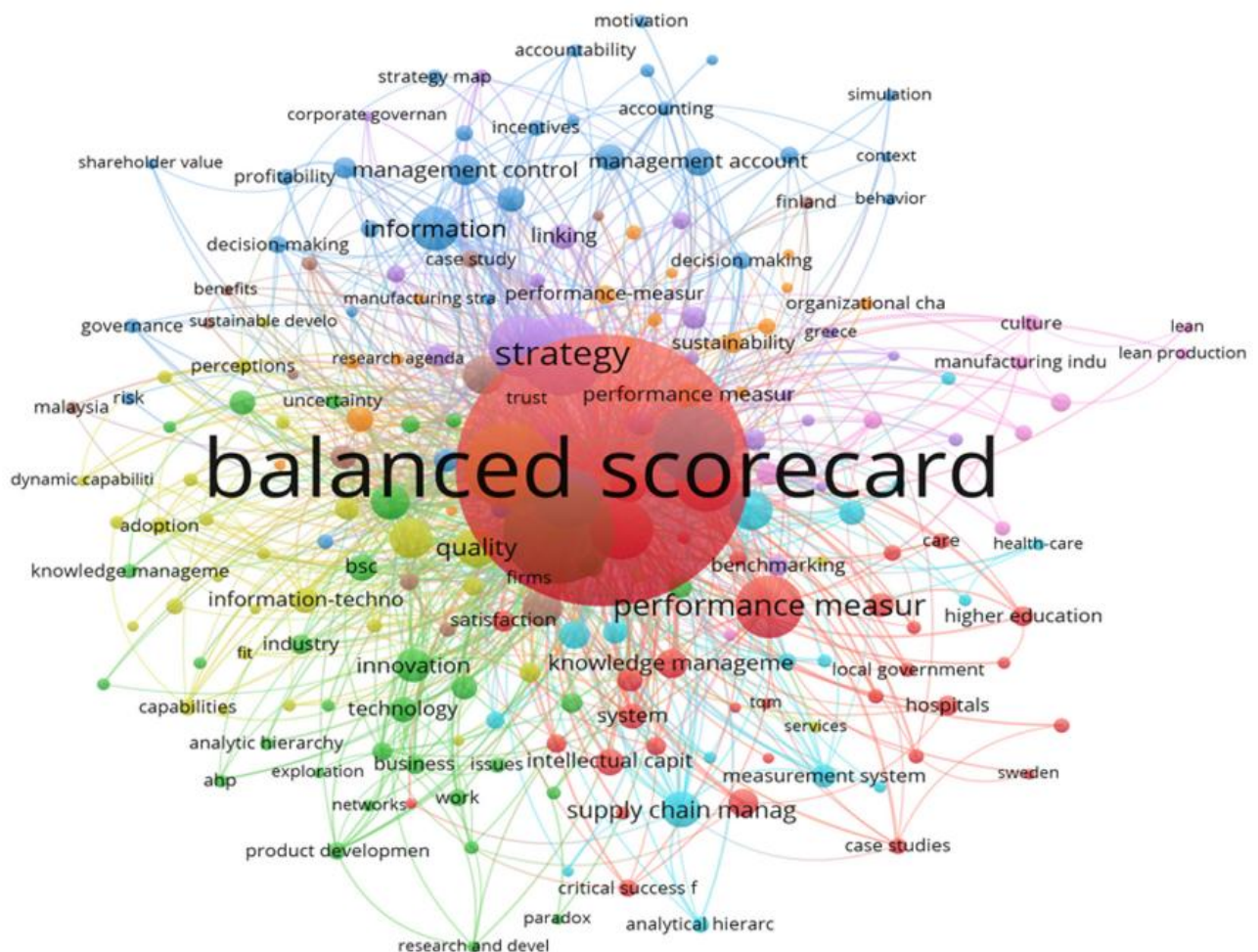


Table 2

Thematic clusters identified in the keyword co-occurrence network

Cluster	Representative keywords	Interpretation
Strategy and performance measurement	strategy; performance measurement; management control; accounting	BSC as a strategic and control-oriented management framework
Information and decision-making	information; decision-making; management accounting; simulation; context	BSC as a support structure for managerial decision processes
Innovation and technology	innovation; technology; knowledge management; AHP; R&D; dynamic capabilities	BSC as a framework connected to digital transformation and organizational learning
Operations and supply chain	supply chain management; benchmarking; performance system; critical success factors; TQM	BSC as an operational improvement and process-management tool
Public sector and healthcare	healthcare; hospitals; local government; higher education; sustainability	BSC as a framework for public, service, and healthcare performance governance

4. Discussion

The findings show that the balanced scorecard and performance budgeting literature in healthcare has developed from a relatively narrow performance-measurement tradition into a broader domain of strategic, financial, informational, and technological management. The centrality of the balanced scorecard in the co-word network confirms that BSC remains the organizing concept of the field. However, the surrounding clusters show that the concept is increasingly interpreted through decision-making, information, innovation, technology, knowledge management, public-sector governance, and healthcare service delivery. This is an important shift. It means that the balanced scorecard is not simply an accounting framework; it is becoming an infrastructure for strategic data interpretation.

Variation across healthcare settings remains important when interpreting this literature. Hospitals, clinics, public-health organizations, insurance systems, and government agencies operate under different institutional arrangements. Consequently, BSC and PBB should be viewed as adaptable governance structures for aligning strategy, indicators, and budgeting rather than universally standardized solutions.

The publication trend is also important. The sharp increase after 2019 shows growing research attention to BSC and PBB in healthcare management. Possible links with digital transformation, post-pandemic pressures, and demand for real-time performance information are plausible contextual interpretations, but they were not directly tested in this bibliometric analysis. The evidence therefore supports identifying digital and AI-enabled performance management as a future research direction rather than as an established finding of the present study.

From a conceptual perspective, BSC may provide a governance structure for organizing outputs from predictive analytics, while PBB may connect selected indicators to resource-allocation decisions. However, the present study did not evaluate AI systems, machine-learning models, or digital dashboards. These applications are proposed as hypotheses and practical directions for future empirical research, not as conclusions derived from the current dataset.

The information and decision-making cluster indicates that the literature connects BSC with information systems and managerial decision processes. This finding justifies further investigation of automated trend detection, forecasting, anomaly detection, and scenario analysis within BSC-based systems. Such work should use explicit empirical designs and report data governance, indicator validity, model interpretability, and human oversight.

The innovation and technology cluster shows that BSC research is linked with knowledge management, technological change, and dynamic capabilities. This supports interpreting healthcare performance management as an organizational learning process. Nevertheless, the bibliometric network alone cannot establish whether digital tools improve outcomes, reduce costs, or strengthen implementation. Those questions require primary empirical studies.

The public-sector and healthcare cluster highlights a further implication. Healthcare performance management is not identical to private-sector performance management. Hospitals and health systems must consider equity, public accountability, patient safety, service accessibility, and ethical allocation of resources. AI-driven tools in this field therefore cannot be judged only by efficiency or financial savings. They must also support broader public value. The balanced scorecard can help by incorporating non-financial

indicators, while performance budgeting can make those priorities visible in allocation decisions. This is particularly important when resources are scarce and competing goals must be prioritized transparently.

As a bibliometric study, the analysis identifies the intellectual and conceptual structure of the literature. It does not evaluate study quality, implementation outcomes, or the magnitude of organizational effects. These questions require systematic appraisal and primary empirical or meta-analytic designs.

Overall, the balanced scorecard remains the central organizing concept in the mapped literature, while performance-based budgeting links performance information to resource allocation and accountability. The visibility of information, technology, innovation, knowledge management, and decision-making terms suggests an emerging research interface with digital transformation. This interpretation should remain exploratory and should not be presented as direct evidence of AI effectiveness.

5. Implications and Future Research

The practical implication of the review is that future studies may examine digital dashboards and AI tools as components of broader performance-governance systems rather than as stand-alone decision makers. A BSC can define the dimensions to be monitored, and PBB can link selected indicators to strategic resource priorities. However, the effectiveness of this integration must be tested directly in healthcare organizations using transparent designs, validated outcomes, and appropriate governance safeguards.

A second research direction concerns interpretability. Future empirical work should examine whether presenting model outputs within a BSC architecture helps managers and clinicians understand the financial, patient, internal-process, and learning implications of a recommendation. The present bibliometric analysis identifies the conceptual relevance of this question but provides no direct evidence regarding its effectiveness.

A third research direction is to conduct a dedicated bibliometric study using explicit search terms for artificial intelligence, machine learning, business intelligence, digital health, dashboards, predictive analytics, and decision-support systems. Such a design would permit direct measurement of the emergence and centrality of AI-related concepts within the BSC/PBB healthcare literature. The present dataset identifies adjacent concepts such as information, decision-making, innovation, technology, and

knowledge management, but it does not quantify AI-specific development.

6. Conclusion

This bibliometric mapping shows sustained growth in healthcare research linking the balanced scorecard with performance-based budgeting and related governance concepts. BSC occupies the central position in the conceptual network, while PBB connects performance information with resource allocation and accountability. The literature has expanded beyond conventional accounting and control toward information systems, innovation, organizational learning, and public-sector healthcare management. These findings support further empirical investigation of integrated BSC–PBB models and digitally enabled performance-governance systems, while avoiding claims about effectiveness that cannot be established through bibliometric evidence alone.

7. Limitations

This study has limitations. First, combining records from databases with different indexing and metadata standards may introduce uneven coverage and residual duplication. Second, inclusion of regional databases broadens representation but reduces comparability with studies based on a single standardized citation index. Third, keyword-based mapping is sensitive to author terminology, indexing practices, and synonym handling. Fourth, bibliometric centrality reflects visibility and co-occurrence rather than methodological quality or practical effectiveness. Finally, the discussion of digital and AI-enabled management is exploratory because these technologies were not directly analyzed as a distinct search domain.

Authors' Contributions

Ramin Fathollahzadeh Dizaji contributed to conceptualization, data organization, bibliometric interpretation, and initial manuscript preparation. Mehdi Zeynali supervised the study and contributed to methodology, interpretation, and critical revision. Heydar Mohammadzadeh Salteh contributed to theoretical framing, accounting and performance management interpretation, and manuscript revision. Ahmad Mohammadi contributed to review of the healthcare budgeting literature, validation of the analytic narrative, and final manuscript approval. All authors read and approved the final version of the manuscript.

Declaration

Artificial intelligence tools were used only to support language editing, structural organization, consistency checking, formatting, and identification of reporting inconsistencies. The bibliometric findings, tables, and figures were derived from the reviewed evidence base. The authors reviewed and approved the final text and take full responsibility for the accuracy, integrity, and originality of the manuscript.

Transparency Statement

The bibliographic dataset and the VOSviewer files supporting the findings are available from the corresponding author upon reasonable request, subject to database licensing and copyright restrictions.

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None.

Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

This study used previously published bibliographic and aggregate research data. No human participants were recruited, no identifiable personal data were collected, and no clinical intervention was conducted. Therefore, formal human-subject ethics approval was not required. The authors remained responsible for accurate representation of the source material, transparent reporting of the review process, and proper citation of all intellectual sources.

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