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The Impact of Financial Risk Management on Hospital Efficiency: A Systematic Review

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Abstract*:* Hospitals face increasingly uncertain financial conditions due to liquidity constraints, reimbursement delays, and rising operational costs, making Financial Risk Management (FRM) essential for maintaining efficiency and financial stability. This study conducts a Systematic Literature Review (SLR) following the PRISMA 2020 protocol using the ScienceDirect database. The Boolean search "financial risk" AND "risk management" AND hospital AND efficiency identified 493 articles, of which 10 peer-reviewed studies published between 2022 and 2025 met the eligibility criteria. Thematic analysis revealed four key mechanisms through which FRM enhances hospital efficiency: (1) liquidity and solvency management via cash-flow and working capital control; (2) strengthened financial governance and risk-sharing arrangements; (3) use of digital technologies, including automation and artificial intelligence, to reduce inefficiencies; and (4) systemic financial protection through insurance schemes and universal health coverage. Overall, effective FRM improves hospital efficiency, resilience, and long-term sustainability. Future research should employ quantitative and longitudinal designs to better capture the dynamic relationship between FRM and hospital efficiency.
Keywords: Financial Risk Management, Hospital Efficiency, Liquidity, PRISMA, Systematic Review

Introduction

Hospitals operate in increasingly complex and uncertain financial environments. Economic volatility, shifting insurance mechanisms, and post-pandemic fiscal constraints have intensified the challenges of maintaining sustainable healthcare delivery. The COVID-19 pandemic exposed the structural fragility of hospital financial systems, where reimbursement delays, liquidity shortages, and rising operational costs disrupted both efficiency and service continuity (Levinson, 2023). In mixed health systems, hospitals must balance cost containment with quality assurance, positioning Financial Risk Management (FRM) as a critical pillar for organizational sustainability. Consequently, the long-term resilience of healthcare institutions depends not only on clinical capacity but also on the ability to identify, evaluate, and mitigate financial risks that threaten liquidity and operational performance (Ghislandi, 2025).

Financial risk management (FRM) in the hospital sector is defined as a systematic process of recognizing, analyzing, and controlling risks that impact the organization's financial performance and liquidity position. Within healthcare institutions, FRM encompasses budgeting under uncertainty, liquidity control, debt and investment management, and the strategic alignment of financial resources with institutional goals (Audi, Farmer, & Stroud, 2025). Recent studies have emphasized that the function of FRM extends beyond accounting practices it now represents an essential governance mechanism that safeguards hospital solvency during market fluctuations and policy reforms. Effective FRM allows hospital leaders to anticipate financial shocks, maintain optimal liquidity levels, and ensure continuity of operations even when facing reimbursement or cost-recovery challenges (Keesee et al., 2024).

Despite the growing attention to hospital financial performance, the literature remains fragmented. Prior studies have examined either the financial dimension (profitability ratios, return on assets, debt management) or the operational dimension (efficiency, productivity, cost-effectiveness) in isolation, rarely integrating them into a unified framework. As a result, the understanding of how financial risk management mechanisms influence hospital efficiency

remains incomplete and context-dependent. In developing economies, these challenges are compounded by delayed reimbursements, limited fiscal capacity, and dependence on national health insurance systems (Wulandari, 2025). The absence of a comprehensive model linking risk governance, liquidity control, and operational outcomes constitutes a significant theoretical and empirical gap that this study aims to address (Putra, 2024; Susilo, 2025).

In recent years, research has evolved toward exploring new paradigms of FRM in healthcare. Studies in developed economies show that liquidity planning, internal control systems, and cost efficiency are crucial to improving hospital productivity (Ghislandi, 2025; Marchandot, 2025). In contrast, evidence from emerging economies such as Indonesia, Ghana, and India emphasizes the mediating role of financing systems and governance structures (Vukey, 2023; Raisa, 2025). The rise of digital health financing tools, telehealth budgeting, and predictive analytics also represents a new frontier in managing financial risk while maintaining efficiency (Tsuei & Yip, 2025). Collectively, these findings highlight that FRM is no longer a reactive administrative function but a strategic instrument of organizational performance. This shift marks a crucial development in the state of the art, positioning FRM as both a financial safeguard and a driver of sustainable healthcare delivery.

However, the existing literature still lacks integrative models that connect financial governance, liquidity dynamics, and efficiency outcomes within the same analytical framework. Most studies remain descriptive or context-specific, offering limited insights into how these mechanisms interact across varying healthcare systems. Furthermore, few studies have examined this relationship using comparative approaches that combine evidence from developed and developing countries. There is thus a need for research that unifies these perspectives developing an integrative model of FRM that captures both the structural (governance) and operational (efficiency) dimensions of hospital management. This research is particularly relevant for Indonesia, where hospitals operate under the constraints of the National Health Insurance system while striving to balance efficiency with liquidity pressures (Susilo, 2025; Winoto, 2025).

Accordingly, this study aims to bridge these theoretical and empirical gaps by systematically reviewing recent global and Indonesian evidence on the relationship between financial risk management and hospital efficiency. Specifically, the objectives of this systematic review are to identify key financial and operational mechanisms linking FRM and hospital efficiency, assess contextual differences between developed and developing healthcare systems, and propose an integrated conceptual framework for future research and policy development in hospital financial governance. By addressing these objectives, the study contributes to advancing an evidence-based understanding of how FRM enhances both liquidity resilience and operational efficiency, thereby informing strategies for sustainable hospital management in diverse health systems.

Furthermore, this study emphasises that the relationship between financial risk management and hospital efficiency is dynamic and mutually reinforcing, and therefore cannot be understood in isolation. Effective financial risk management enables hospitals to maintain liquidity stability, anticipate fiscal shocks, and allocate resources more rationally, which in turn directly enhances operational efficiency and service quality. In the context of differences between healthcare systems in developed and developing countries, this review demonstrates that the success of FRM implementation is highly dependent on institutional capacity, financial governance, and public policy support. Accordingly, the integration of managerial approaches, healthcare financing regulation, and technological innovation is essential for building a sustainable FRM framework. This further underscores the position of financial risk management not merely as a risk mitigation tool, but as a strategic driver of long term hospital efficiency and resilience.

This study not only bridges empirical fragmentation but also offers a conceptual model that explicitly integrates financial risk governance, liquidity management, and operational efficiency within a unified analytical framework. The proposed model conceptualizes how risk governance mechanisms (structural dimension) interact with liquidity controls (financial dimension) to produce measurable efficiency outcomes (operational dimension), moderated by contextual factors such as policy environment and digital capability. This conceptual contribution represents the novelty of this review, as it advances theoretical understanding by positioning Financial Risk Management (FRM) as a multi-level construct-linking micro-level hospital finance, meso-level

governance structures, and macro-level health financing systems. Hence, the study provides both an analytical bridge for future empirical testing and a conceptual foundation for policy innovation in hospital financial management.

Methods

This study employs a Systematic Literature Review (SLR) method guided by the PRISMA 2020 framework, with the purpose of synthesizing and evaluating peer-reviewed evidence on the relationship between Financial Risk Management (FRM) and hospital efficiency. The SLR approach was selected to systematically identify, analyze, and interpret the evolving patterns of research concerning FRM mechanisms, liquidity control, and operational performance within healthcare institutions. The use of a single database ScienceDirect ensures methodological precision and high-quality publication standards, as Elsevier-indexed journals represent validated sources in healthcare management and finance research. Limiting the search scope to ScienceDirect aligns with the study's goal of consolidating robust empirical findings within a controlled, reputable academic environment. The methodological rigor of this review was ensured by adopting the PRISMA 2020 guidelines, which provide a transparent and replicable process for identifying, screening, and synthesizing evidence. The steps followed ensured consistency and minimized potential bias in article selection.

Data Sources and Search Strategy

All literature was retrieved from ScienceDirect (Elsevier) using the Boolean search string "financial risk" AND "risk management" AND hospital AND efficiency. The search was limited to articles published from 2022 to 2025 to capture recent theoretical and empirical advances, including the post-pandemic healthcare contexts that shape modern FRM. Filters applied within ScienceDirect included article type research articles and review articles, subject areas around (1) Business, Management, and Accounting, (2) Social Sciences, (3) Economics, Econometrics, and Finance, and (4) Medicine and Dentistry. To enrich contextual relevance, several complementary Indonesian studies (Putra, 2024; Susilo, 2025; Wulandari, 2025) were referenced only for narrative comparison, but not included in the primary ScienceDirect dataset.

The inclusion criteria were defined as follows (1) articles published in ScienceDirect-indexed journals between 2022–2025, (2) studies focusing on financial risk management, hospital efficiency, liquidity management, or healthcare governance, (3) peer-reviewed empirical or conceptual papers with measurable findings, (4) written in English and available in full text. The exclusion criteria were defined as follows: (1) editorials, notes, or short commentaries, (2) non-healthcare settings (e.g., insurance firms, general finance), (3) duplicate publications or preprints without peer review, (4) these criteria ensure the review integrates only high-quality, peer-reviewed literature that directly addresses the conceptual intersection of FRM and efficiency in hospital contexts.

Selection Process

The selection process followed the PRISMA 2020 four-phase protocol include Identification, Screening, Eligibility, and Inclusion to ensure transparency and replicability in study selection. Identification phase is an initial ScienceDirect query produced 493 articles. After applying filters for publication year (2022–2025), subject areas, and article type (research and review), 73 articles remained for further review, and only 35 were available in full text. Screening for titles and abstracts were screened to remove irrelevant studies that did not address both financial risk management and hospital efficiency. Screening for titles step excluded 58 articles, and 2 articles more excluded at screening for abstracts, primarily those focusing on financial markets or insurance models outside the healthcare sector. So, next for eligibility step just 12 articles. Eligibility step remaining 12 full-text articles were examined for methodological clarity, presence of empirical findings, and explicit focus on hospital financial or operational contexts. Thirteen articles were removed because they lacked measurable outcomes or did not connect FRM and efficiency directly.

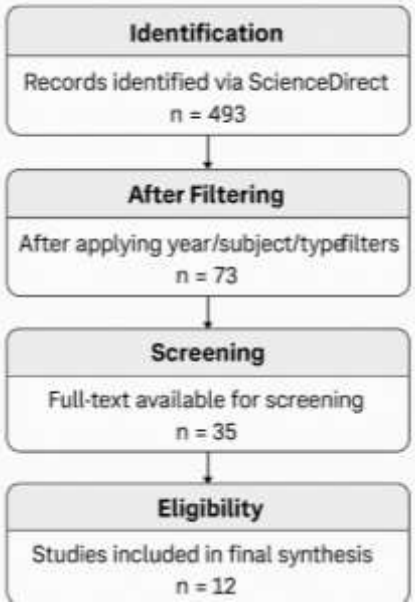

Fig.1 PRISMA diagram.

Inclusion step filtered total of 10 eligible studies were retained for final synthesis. These studies represent a balanced mix of quantitative, qualitative, and mixed-method designs published across high-impact Elsevier journals such as Health Policy OPEN, Sustainable Operations and Computers, Journal of Manufacturing Systems, Technological Forecasting and Social Change, Health Policy and Planning, Intelligence-Based Medicine, Technology in Society, SSM – Population Health, The Lancet Regional Health – Global, and Information & Management. This process ensures that the reviewed literature provides a robust and representative overview of the evolving relationship between financial risk management and hospital efficiency.

Data Extraction and Analysis

Data extraction involved identifying authors, publication year, study context, methodology, and main findings. Each article was analyzed to extract financial risk indicators (liquidity ratio, solvency, capital adequacy, working capital), efficiency indicators (operating margin, cost per bed, bed occupancy rate, DEA scores), and key conclusions regarding FRM–efficiency relationships. The synthesis employed a thematic narrative analysis, identifying major themes and mechanisms explaining the link between financial risk management and efficiency.

Results and Discussion

The systematic review synthesized evidence from ten peer-reviewed studies published between 2022 and 2025, all retrieved exclusively from the ScienceDirect database. These studies covered a diverse range of healthcare systems and financial contexts, from low- and middle-income countries such as Malaysia and Malawi to advanced European systems like Spain, Hungary, and the Netherlands. Collectively, they provide an integrative understanding of how Financial Risk Management (FRM) frameworks influence hospital efficiency through different mechanisms liquidity stabilization, cost reduction, governance reform, and digital transformation.

Four overarching themes emerged from the synthesis (1) liquidity and solvency management, (2) financial governance and risk-sharing mechanisms, (3) digital and technological risk management, and (4) systemic financial protection and resilience. Each theme reflects a distinct but interrelated pathway through which hospitals achieve efficiency gains by controlling financial exposure and aligning fiscal decisions with operational performance.

Thematic Findings

Theme 1, Liquidity Stability, represents the most direct and measurable pathway linking FRM and hospital efficiency. Studies by Zhou et al. (2022) and Lee et al. (2022) illustrate how risk-sensitive financial control mechanisms such as additive manufacturing, blockchain-based financing, and supply chain finance help mitigate liquidity shocks and maintain operational continuity during crisis periods such as the COVID-19 pandemic.

Hospitals that adopted real-time liquidity tracking and financial automation systems achieved higher resilience and lower transaction costs compared to those relying on traditional reimbursement cycles. Similarly, Silva et al. (2023) demonstrated that incorporating financial risk metrics into supply chain management reduces procurement delays, lowers inventory-related losses, and strengthens the hospital's ability to meet patient demand without excessive expenditure. This relationship is especially crucial in low-resource contexts, where maintaining liquidity equates to sustaining access to essential care. Thus, FRM practices targeting liquidity directly contribute to efficiency by optimizing the cash conversion cycle and minimizing idle capital. From a theoretical standpoint, these findings reinforce the financial management theory that operational efficiency improves when working capital and solvency risks are tightly controlled. Hospitals that monitor liquidity not merely as a financial indicator but as a strategic performance metric are better positioned to balance cost control with service quality.

Theme 2, Financial Governance and Risk-Sharing Mechanisms, emphasizes the governance-driven FRM forms the second major theme. Evidence from Karim & Van der Voort (2023) and Mwale et al. (2024) underscores the importance of risk-sharing arrangements within Public–Private Partnerships (PPPs) in improving hospital sustainability and efficiency. These studies reveal that clearly defined accountability structures, equitable value distribution, and contractual transparency reduce the likelihood of fiscal mismanagement and resource duplication. In the Netherlands, risk-based value sharing in AI-driven healthcare PPPs improved innovation outcomes while maintaining financial stability. In Malawi, PPP-financed hospitals exhibited higher cost-efficiency ratios and reduced fiscal exposure compared to fully public institutions.

Such evidence suggests that efficiency gains emerge not solely from capital inflow but from how financial risks are distributed and governed across institutional actors. Strong governance structures prevent asymmetric information, minimize moral hazard, and align financial incentives with long-term service quality. This is consistent with the agency theory and stewardship theory, which posit that financial risk management enhances organizational performance when governance mechanisms enforce prudent decision-making and accountability. For hospitals, embedding FRM within governance frameworks translates into improved budget adherence, minimized wastage, and sustainable operational models.

Theme 3, Digital and Technological Risk Management, underscores the transformative role of digital innovation in financial risk mitigation and operational efficiency. Studies by Sánchez et al. (2024) and Horváth et al. (2023) demonstrate that the adoption of Healthcare 4.0 technologies including Artificial Intelligence (AI), process automation, and data-driven governance reduces both operational uncertainty and financial inefficiency.

Hospitals with higher digital maturity exhibited better performance indicators, lower administrative overhead, and faster cost recovery. These findings suggest that digital transformation functions as an enabler of FRM, allowing organizations to identify risks early, simulate financial outcomes, and make evidence-based investment decisions. AI systems can model patient inflows, predict financial stress points, and guide efficient resource allocation. In broader terms, digital risk management integrates information technology governance with financial control systems, strengthening the hospital's ability to withstand systemic shocks. The integration of these mechanisms supports the resource-based view (RBV) of the firm, highlighting that intangible assets such as data analytics and digital literacy—serve as strategic resources that enhance both efficiency and resilience.

Theme 4, Systemic Financial Protection and Health Resilience, extends the analytical lens beyond organizational-level FRM to the macroeconomic and policy dimensions of financial protection. Studies by Noh et al. (2022) and Wang et al. (2024) provide compelling evidence that health financing reforms particularly universal health coverage (UHC) and private insurance expansion enhance hospital efficiency by reducing uncompensated care and ensuring predictable revenue streams.

In Malaysia, Noh et al. found that private insurance significantly improved resource utilization rates and reduced financial strain in private hospitals. Globally, Wang et al. demonstrated that UHC coverage lowers hospital inefficiency and mortality rates by stabilizing payment systems and promoting financial risk pooling. These results align with macro-level health economics theory, suggesting that financial protection mechanisms whether state-based or market-based serve as systemic tools of risk management. They protect hospitals from revenue volatility, encourage investment in quality improvement, and ultimately lead to operational sustainability. Similarly, Elnaiem et al. (2023) positioned financial governance within the broader One Health framework, emphasizing global coordination of risk and financing mechanisms. Their study underscores that resilience and efficiency cannot be separated from financial stewardship, especially under shared health and environmental risks.

Cross-Context Comparison

The comparative analysis across the ten studies reveals that FRM's impact on hospital efficiency is multi-dimensional and context-dependent. The synthesis across all themes reveals that financial risk management affects hospital efficiency through multi-level and interdependent mechanisms. At the micro level, liquidity management ensures solvency and reduces operational disruption. At the meso level, governance and technological systems moderate how financial risks are identified and mitigated. At the macro level, national or international financial protection schemes safeguard institutional efficiency by ensuring stable resource flows. This multi-layered relationship can be visualized as a causal chain like Financial Risk Governance → Liquidity Control → Operational Efficiency → Systemic Resilience.

Hospitals that manage financial risks proactively by combining liquidity analytics, digital tools, and governance structures to achieve more stable performance and greater adaptive capacity. Conversely, institutions that neglect risk-based financial planning are more prone to inefficiencies, cost overruns, and liquidity crises. These comparative insights demonstrate that while the mechanisms differ across contexts, the underlying principle remains constant: sound financial risk management is an indispensable determinant of hospital efficiency and long-term viability.

Comparative Insights and Research Gaps

Despite the consistent directionality of findings, notable variations exist across geographical and institutional settings. In developing economies such as Malawi and Malaysia, efficiency improvements stem largely from financial governance reforms and PPP models, while in advanced systems like Spain and Hungary, efficiency is driven by digital innovation and predictive analytics. However, the review also identifies several research gaps such (1) a lack of quantitative modeling connecting FRM indicators (liquidity ratios, debt-to-equity, cost efficiency scores) directly to hospital performance metrics, (2) limited longitudinal studies exploring how FRM evolves under policy or economic shocks, (3) underrepresentation of integrated models combining micro (hospital-level) and macro (policy-level) financial risk frameworks. Future research should therefore focus on developing hybrid methodologies that integrate econometric modeling, risk simulation, and longitudinal case analysis to capture the dynamic interplay between financial management and hospital efficiency.

Conclusion

This systematic review examined ten peer-reviewed ScienceDirect-indexed studies published between 2022 and 2025 to synthesize how Financial Risk Management (FRM) affects hospital efficiency. Through a rigorous PRISMA-based selection process, the findings

collectively affirm that FRM plays a critical role in determining the financial sustainability, liquidity stability, and operational performance of hospitals. While the studies reviewed span diverse geographical and institutional settings from Malaysia, Brazil, and Malawi to Spain, Hungary, and global systems they converge on the recognition that efficient hospitals are those that manage financial risk proactively and systematically.

The synthesis revealed four primary mechanisms through which FRM enhances hospital efficiency. First, liquidity and solvency management emerged as the most immediate determinant of operational efficiency. Hospitals that implemented structured liquidity controls, cash-flow monitoring, and cost containment measures demonstrated higher service continuity, especially under fiscal or health crises. These practices enable hospitals to reduce dependency on delayed reimbursements, mitigate cash flow disruptions, and optimize working capital. Liquidity management, therefore, functions as both a financial and operational safeguard one that ensures efficiency in the allocation and use of resources.

Second, financial governance and risk-sharing mechanisms were found to strengthen efficiency by improving transparency and accountability in financial decision-making. Evidence from public–private partnership (PPP) arrangements in Malawi and the Netherlands highlighted how balanced financial risk allocation and value-sharing governance reduce inefficiencies and enhance long-term institutional sustainability. Hospitals that embed risk governance within their financial structures not only minimize fiscal exposure but also achieve more predictable performance outcomes. This aligns with agency theory and stewardship theory, which emphasize that efficiency arises when managerial decisions are governed by accountability and prudent risk oversight.

Third, digital and technological risk management especially in the form of Healthcare 4.0 technologies was consistently associated with improved financial and operational outcomes. Artificial Intelligence (AI), process automation, and blockchain-based financing allow hospitals to detect inefficiencies, forecast demand, and manage financial stress with higher precision. The adoption of such tools supports data-driven decision-making, reduces administrative overhead, and enhances return on investment (ROI). These findings support the resource-based view (RBV), indicating that digital competencies are strategic assets that strengthen both efficiency and resilience. Hospitals that integrate FRM with digital transformation tend to develop dynamic capabilities allowing them to anticipate and adapt to changing risk environments.

Fourth, systemic financial protection mechanisms, including universal health coverage (UHC) and private insurance expansion, were shown to indirectly promote hospital efficiency by ensuring steady revenue flows and reducing uncompensated care. In contexts where healthcare financing reforms were implemented, hospitals reported lower levels of bad debt and better resource utilization. Financial protection at the policy level thus complements institutional FRM by mitigating macroeconomic uncertainty and protecting hospitals from revenue volatility. As demonstrated by studies in Malaysia and global cross-country analyses, health systems that emphasize financial protection through insurance and UHC not only enhance equity but also improve efficiency at both institutional and systemic levels.

Across these four themes, a unifying insight emerges: effective financial risk management creates a reinforcing loop between financial stability and operational efficiency. When hospitals proactively monitor liquidity, govern risks transparently, leverage digital intelligence, and operate within stable financing frameworks, they achieve higher performance and resilience. Conversely, neglecting financial risk leads to inefficiencies, delayed service delivery, and institutional fragility especially during economic downturns or public health emergencies.

Nevertheless, the review also identifies persistent gaps and opportunities for further research. Despite the growing interest in financial governance and efficiency, empirical

modeling of FRM variables such as liquidity ratios, solvency measures, and efficiency indicators remains limited. Most existing studies rely on case-based or qualitative designs, which restrict generalizability. Moreover, longitudinal analyses of FRM adaptation during crises, such as COVID-19 or inflationary shocks, are scarce. These limitations point to the need for integrative, multi-level research frameworks combining hospital-level financial modeling with system-level policy evaluation. Future studies could employ hybrid methodologies, such as panel data econometrics, structural equation modeling, or simulation-based approaches, to quantify how financial risk mitigation translates into measurable efficiency gains.

In this regard, strengthening quantitative analysis in financial risk management research is essential to capture the complexity of the relationships between risk, policy, and hospital performance. A multi level approach enables researchers to examine how managerial decisions at the micro level interact with healthcare financing regulations, insurance schemes, and fiscal stability at the macro level. By integrating hospital financial data, operational efficiency indicators, and health policy variables, future studies can generate more robust and comparable evidence across different contexts. This would not only enhance academic contributions but also provide a more precise analytical basis for policymakers and hospital managers in designing financial risk mitigation strategies that are effective, adaptive, and oriented towards long term sustainability.

In theoretical terms, this review reinforces the interconnectedness of financial management theory, risk governance frameworks, and health economics. It proposes that hospital efficiency is not merely a result of operational optimization but also a function of financial risk awareness embedded within institutional culture. In practical terms, the evidence calls for hospital administrators to embed FRM principles into their daily strategic operations ranging from budgeting and debt management to investment appraisal and cost control. Integrating risk management into every stage of financial planning ensures that hospitals maintain fiscal discipline while delivering high-quality, timely, and equitable care.

Ultimately, the review concludes that Financial Risk Management is a strategic enabler of hospital efficiency and sustainability. Its principles bridge the gap between financial prudence and healthcare excellence, allowing hospitals to operate effectively under conditions of uncertainty. For policymakers, the findings highlight the importance of harmonizing financial governance, digital transformation, and healthcare financing reforms to create an enabling environment for efficient and resilient hospitals. For researchers, the synthesis opens pathways to explore how FRM frameworks can be adapted, quantified, and institutionalized across diverse healthcare systems in both developed and developing economies. In conclusion, this review reaffirms that financial risk management is both a stabilizing and enabling force in the healthcare economy. As hospitals worldwide confront growing financial uncertainty, the integration of risk-based financial governance into institutional strategy will define not only their efficiency but also their resilience in delivering equitable and sustainable care.

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