

Digital Transformation as a Catalyst for Activity-Based Funding Implementation: A Comparative Case Study of Healthcare Financing Reforms in Saudi Arabia

Ahmad Emad Alhamalawy¹, Mohammad Mokhtar², Ghassan Afram³, Hiba Fattouh⁴, Nabil Mansour⁵

^{1,2,3}Selat, Saudi Arabia; ^{2,4}KLIMA, Egypt; ³Independent Consultant, Egypt; ⁵American University of Beirut, Lebanon

Corresponding author email: nm08@aub.edu.lb

Abstract— Activity-Based Funding (ABF) has gained traction globally to enhance hospital reimbursement by linking payments to volume and complexity of care via Diagnosis-Related Groups (DRGs). Empirical evidence on ABF's effectiveness remains mixed and context dependent. Notably, the Middle East and North Africa (MENA) region lacks rigorous analyses of ABF implementation due to lack of understanding of advanced digital health technologies. This study investigated the role of digital transformation in ABF implementation within Saudi Arabia's healthcare system considering institutional, organizational, and technological factors. A comparative qualitative case study was employed, analyzing policy documents, implementation reports, and stakeholder interviews. The study applied the framework of the principal-agent theory to interpret incentive structures and utilized a digital maturity lens to assess the integration of health information systems supporting ABF. Findings revealed that ABF reforms were initiated and aligned with national development agendas. Saudi Arabia's relatively advanced digital health ecosystem has facilitated more effective cost accounting, data integration, and transparency, enabling smoother ABF rollout. This Saudi context underscores the necessity of aligning stakeholder incentives and building organizational capabilities for data-driven decision-making to realize ABF's efficiency and quality improvement goals. In conclusion, this study contributed to the research dialogue by demonstrating that successful ABF implementation in emerging economies surpasses financial restructuring per se, to leverage digital transformation to overcome systemic barriers. Policymakers are advised to prioritize investments in digital health infrastructure and governance frameworks to support sustainable, value-based healthcare financing reforms in the MENA region.

Keywords—Activity-Based Funding; Diagnosis-Related Groups; Digital Transformation; Healthcare Financing; Principal-Agent Theory.

1. Introduction

This study addresses these gaps by investigating the digitally enabled transition to ABF within Saudi Arabia's distinct institutional landscape. We argue that while ABF holds promise as a mechanism to drive value-based care and system efficiency, its realization is contingent upon strategically managing multifaceted institutional and behavioral challenges. These challenges include aligning

stakeholder incentives, fostering organizational capabilities for data-driven decision-making, and navigating regulatory and infrastructural constraints. Drawing on comparative policy analysis and emerging empirical insights, this study contributes to scholarly discourse by elucidating how digitally-supported ABF reforms can be adapted and optimized in emerging economies. Successful ABF implementation transcends

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mere financial restructuring; it requires an integrated approach that leverages digital transformation as a critical enabler to overcome entrenched systemic barriers and catalyze sustainable health system improvements.

Despite growing ABF adoption in emerging economies, particularly within the Middle East and North Africa (MENA) region, rigorous empirical analyses remain scarce. This gap is especially pronounced for countries such as Saudi Arabia, where large-scale healthcare financing reforms are underway under ambitious national development agendas [6]. Moreover, the transformative potential of digital health technologies as enablers of ABF—through enhanced data integration, cost accounting precision, and process transparency—remains underexplored in these settings [7-9]. While existing literature emphasizes digital transformation's critical role in reconfiguring healthcare value chains and supporting outcome-based funding models, empirical studies linking digital maturity to ABF success are limited, particularly outside high-income contexts.

Activity-Based Funding (ABF) has emerged as a prominent healthcare financing reform strategy worldwide, linking hospital reimbursement to the volume and complexity of care delivered through Diagnosis-Related Groups (DRGs) [1]. Building on over three decades of research in Activity-Based Costing (ABC), this approach provides more accurate cost measurement by tracing expenses to specific healthcare activities rather than relying on traditional volume-based allocations [2]. However, empirical evidence on ABF's impact remains inconclusive and context-dependent. Studies from Ireland and Germany, for example, report increased hospital activity without concomitant reductions in length of stay, underscoring the complex interplay of institutional contexts, incentive structures, and behavioral responses that shape ABF's effectiveness [3-5].

2. Literature Review

Activity-Based Funding (ABF) and Activity-Based Costing (ABC) have evolved as pivotal mechanisms in healthcare management, aiming to enhance cost transparency and resource allocation efficiency. Originating from industrial cost accounting principles, ABF and ABC have been adapted to address the complexities of healthcare delivery, linking funding to patient activities and enabling detailed cost measurement [3]. Their significance lies in promoting value-based care by aligning financial incentives with clinical outcomes, thereby supporting sustainability in increasingly resource-constrained health systems [1]. Concurrently, digital transformation has emerged as a critical enabler, facilitating the integration and operationalization of ABF methodology through advanced data analytics and information systems [22]. Empirical studies underscore the multifaceted impacts of ABF implementation across diverse healthcare contexts, highlighting the fact that its effectiveness is contingent on nuanced implementation strategies that consider institutional dynamics and clinical heterogeneity.

Research reports provide experimental and longitudinal analyses demonstrating that ABF drives hospitals to optimize service delivery, though responses vary depending on institutional readiness and contextual factors [3]. Their 2023 study highlights adaptive strategies hospitals employ to balance cost containment with quality maintenance under ABF regimes [3]. On the other hand, corroborate these findings, emphasizing the role of ABF in incentivizing efficiency gains but cautioning about potential unintended consequences such as service volume distortions [5]. Additionally, [1] extend this discourse by examining ABF's influence on care coordination and patient outcomes, suggesting that while ABF can enhance efficiency, its success hinges on complementary quality metrics and provider engagement. Research reports focus specifically on surgical procedures, illustrating how ABF incentivizes procedure-specific improvements and resource optimization, they also revealing challenges in aligning funding models with clinical complexity [23].

Moreover, the literature on cost accounting methodologies reveals a progressive refinement from traditional ABC to Time-Driven Activity-Based Costing (TDABC), enhancing accuracy and usability in healthcare settings. Research reports advocate for TDABC as a superior approach that simplifies data collection and better captures time-related resource consumption, thereby improving cost transparency and managerial decision-making [24]. Research findings provide empirical evidence supporting TDABC's capacity to increase value by identifying inefficiencies and informing process improvements, emphasizing its adaptability across various healthcare services [25]. While research findings offer a systematic review highlighting that despite ABC's three-decade history, challenges persist in standardizing methodologies and integrating cost data with clinical outcomes, which TDABC partially addresses through its streamlined framework [2]. Additionally, reports contribute by mapping service-level cost-effectiveness using ABC, demonstrating its utility in pinpointing high-cost activities and guiding resource reallocation [26]. Furthermore, digital transformation acts as a critical enabler for implementing ABF by providing the technological infrastructure necessary for real-time data capture, analytics, and decision support. In this sense, [22] articulates how digital tools facilitate value creation in healthcare by integrating cost, quality, and outcome data, thereby enhancing transparency and accountability. Along the same token, research findings emphasize the role of digital healthcare services in operationalizing activity-based frameworks, highlighting innovations such as electronic health records and process automation that streamline cost measurement and funding allocation [7]. Research findings examine the Saudi Arabian healthcare context, illustrating how digital transformation initiatives underpin ABF adoption by improving data interoperability and enabling performance

monitoring [27]. Further, reports explore the strategic value of digital transformation in value-based healthcare, arguing that digital platforms are indispensable for aligning financial incentives with clinical pathways and patient-centered outcomes [28]. It is worth noting that successful integration of ABF and digital transformation necessitates robust change management strategies to address organizational, cultural, and technical challenges. Research findings identify key imperatives including stakeholder engagement, leadership commitment, and continuous training as critical to overcoming resistance and fostering adoption [29]. Their work highlights that change management must be iterative and adaptive, aligning with evolving technological capabilities and policy environments. Research findings complement this perspective by emphasizing the importance of aligning change initiatives with organizational values and workflows to sustain improvements [30]. Both studies underscore that without deliberate change management, the potential benefits of ABF augmented by digital transformation may remain unrealized, as healthcare professionals require support to navigate complexity and uncertainty inherent in systemic reforms.

Despite the massive number of research studies conducted over the past three decades on ABF reforms, significant gaps remain concerning standardizing costing methodologies, understanding long-term impacts of ABF on clinical outcomes, and developing scalable digital solutions tailored to diverse healthcare settings [2]; [3]. There are also noticeable gaps mainly in implementation and outcomes in the Middle East and North Africa (MENA) region, where existing studies predominantly focus on high-income countries with mature health systems and advanced data infrastructures. The applicability of ABF models and their prerequisites in MENA's diverse healthcare contexts, characterized by varying levels of digital maturity, financing structures, and institutional capacities, remains underexplored. Hence, this study addresses this gap through a comparative case analysis of ABF implementation in Saudi Arabia, providing novel insights into how ABF reforms can be adapted and operationalized in low-middle-income and transitioning health systems. It also examines the role of digital infrastructure and costing methodologies in these contexts, thereby extending the theoretical and empirical discourse on ABF beyond traditional settings.

Healthcare financing mechanisms have evolved substantially over decades, transitioning from predominantly input-based budget allocations toward performance-oriented payment systems, seeking alignment of financial incentives with quality, efficiency, and health outcomes [16] ; [20]. This evolution reflects growing recognition that financing models profoundly shape provider behavior, resource allocation patterns, and ultimately, health system performance [17].

Contemporary healthcare systems employ diverse financing architectures that can be broadly categorized into tax-based public systems, social health insurance (SHI) schemes, private insurance markets, and hybrid models that integrate multiple financing streams [15]. Each of these models however, has its own characteristics, from universal access, cost containment, provider autonomy, innovation capacity, and administrative efficiency, that necessitate careful consideration when approaching financial reform [17]; [18]. Tax-based public financing systems for instance, National Health Service in UK, and Medicare program in Canada, derive revenues from taxation and provide universal coverage through government-owned or contracted providers [17]; [31]. These systems achieve strong cost control through centralized budgeting, while promoting equity through universal access to healthcare [21]. However, tax-based systems, though may achieve comparable or superior health outcomes [31], they encounter challenges related to wait times, limited provider choice, and rigidity that constrain responsiveness to evolving healthcare demands [18].

SHI models, prevalent across continental Europe and East Asia, mandate contributions from employers and employees into semi-autonomous insurance funds that contract with public and private providers [17]. Germany's statutory health insurance system and Japan's employment-based insurance exemplify this approach, which seeks to balance equity through universal coverage with efficiency through regulated competition among insurers and providers [17]. SHI systems typically achieve broad risk pooling while maintaining pluralistic provider markets and patient choice, though they may involve higher administrative complexity and persistent cost pressures driven by demographic aging and technological advancement [19]. The regulatory architecture of SHI systems, including contribution rates, benefit packages, and provider payment mechanisms, critically determines their capacity to contain costs while ensuring adequate access and quality [17]. Private insurance-based systems, most prominently represented by the United States prior to the Affordable Care Act, rely on voluntary purchase of insurance through employer-sponsored plans or individual markets, with limited public coverage for specific populations [17]; [21]. While private systems can foster innovation and offer extensive provider choice for well-insured populations, they typically generate substantial administrative overhead, fragmented risk pools, and inequitable access patterns that leave vulnerable populations underinsured or uninsured [21]. Systematic review evidence from low- and middle-income countries suggests that private healthcare delivery, when inadequately regulated, often exhibits inferior quality and equity outcomes compared to public provision, particularly for disadvantaged populations [21].

Hybrid or mixed financing models, implemented in countries such as France, Australia, and the Netherlands, integrate public and private financing streams to leverage complementary strengths while mitigating respective weaknesses [17]; [18]. Australia's system, for instance, combines universal public coverage through Medicare with voluntary private insurance that offers supplementary benefits and faster access to elective procedures [18]. Hybrid models aim to balance universal access with consumer choice and innovation, though they risk service duplication, administrative complexity, and potential equity challenges if private insurance creates tiered access [17]; [18]. Hence, Table 3 synthesizes key characteristics, strengths, and limitations of major healthcare financing models based on the reviewed literature. This comparative framework illustrates the multidimensional trade-offs inherent in financing design, with no single model universally superior across all performance dimensions. Rather, optimal financing arrangements depend on country-specific contexts, including economic development level, political institutions, cultural values regarding solidarity and individual responsibility, and existing health system infrastructure [17]; [21].

3. Materials and Methods

This study employed a comparative qualitative case study methodology to investigate the implementation of Activity-Based Funding (ABF) within Saudi Arabia's healthcare system, utilizing a dual-track analysis of national policy frameworks and institutional feasibility studies. Data were aggregated from three primary streams: official policy documents regarding Saudi Vision 2030 and Ministry of Health transformation strategies; quantitative financial data from the King Saud University Medical City (KSUMC) feasibility report, specifically Revenue Cycle Management (RCM) metrics including Net Profit Margins and Internal Rate of Return; and secondary empirical data from Germany and Ireland to serve as international benchmarks. The analytical approach was grounded in Principal-Agent Theory to evaluate incentive structures and the Consolidated Framework for Implementation Research (CFIR) to categorize barriers across inner and outer settings. A digital maturity lens was applied to assess the integration of Electronic Health Records with standardized clinical coding systems (ICD-10, DRG). Qualitative data underwent thematic analysis to identify governance and operational themes, while financial data were subjected to descriptive statistical modeling to validate the economic viability of the transition. A comparative synthesis was subsequently performed to contrast the Saudi centralized, digitally integrated model against fragmented European trajectories, isolating the specific role of digital infrastructure in facilitating ABF adoption.

2.1. Conceptual Framework: Budget-Based vs. Activity-Based Funding

This section provides definitions of budget-based funding (BBF) and activity-based funding (ABF) models and outlines the conceptual framework guiding the transformation process between these two paradigms in healthcare financing. BBF refers to a static allocation model wherein healthcare providers receive predetermined financial resources, typically on an annual basis, regardless of the volume of services delivered or patient outcomes achieved [10, 11]. This approach is often grounded in historical expenditure patterns and fixed budgets, which can engender inefficiencies in resource utilization due to the absence of incentives for productivity enhancement or quality improvement [11]. Under BBF, funding rigidity tends to limit responsiveness to changing healthcare demands, potentially resulting in under- or over-utilization of services without corresponding adjustments in financial support [10]. In contrast, ABF constitutes a dynamic reimbursement system that directly ties payments to measurable healthcare activities [10, 12]. These activities are commonly classified by diagnosis-related groups (DRGs), specific procedures performed, or other defined outputs. By linking funding to actual service delivery and clinical outputs, ABF creates powerful financial incentives for providers to improve efficiency, increase throughput, and elevate the quality of care [12, 13], a model that promotes transparency and accountability that aligns financial flows with patient-centered outcomes and resource consumption.

The transformation from BBF to ABF represents a fundamental paradigm shift in healthcare financing, transcending mere accounting adjustments to encompass comprehensive systemic reform. This transition is conceptualized through three core pillars: (1) the development and adoption of standardized clinical coding and classification systems, such as the International Classification of Diseases 10th revision (ICD-10) for diagnoses and case-mix systems like DRGs; (2) the implementation of a robust health information technology (IT) infrastructure, including interoperable Electronic Health Records (EHRs) that facilitate accurate and timely data capture; and (3) the establishment of rigorous performance monitoring and governance frameworks to ensure accountability and continuous improvement [14]. The standardization of medical coding is critical for this digital transformation approach, particularly in minimizing errors throughout the financial cycle and enabling consistent classification of patient cases [14]. Fig. 1 below visually represents this evolution as a continuum process by illustrating the transition from BBF toward ABF system. This phased approach facilitates capacity building and adaptation, with full transformation from a pure BBF to a mature ABF system potentially requiring six years or more.

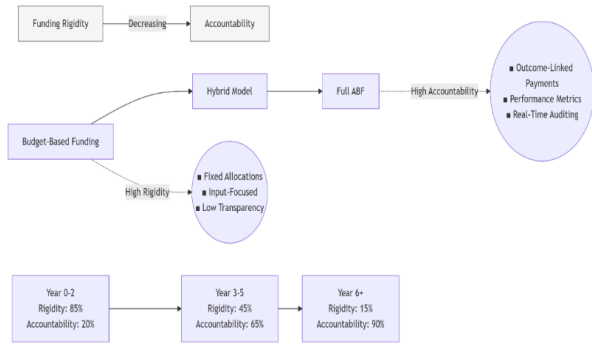


Fig. 1: The Transformation Continuum from Input-Focused (BBF) to Output-Focused (ABF) Financing

Table 1 below provides a high-level summary delineating the core differences among BBF, ABF, and hybrid funding models, highlighting distinctions in funding mechanisms, incentives, accountability structures, and operational dynamics.

Table 1. Comparison of Funding Models

Model	Budget-Based	Activity-Based	Hybrid
Key Features	Fixed budget allocation determined historically and politically [15]; funding independent of service volume [16]	Funding directly linked to service volume and case-mix complexity through DRG or similar classification systems [16]; payment per episode of care [17]	Blended payment combining elements of budget-based, activity-based, and capitation funding [17]; block funding with fee-for-service with capitation [18]
Advantages	- Cost control through predetermined spending limits [17] - Predictable financial planning for providers [19] - Administrative simplicity in allocation [15]	- Promotes operational efficiency and resource optimization [16] - Enhances transparency in cost accounting and service delivery [20] - Creates accountability through measurable activity metrics [16] - Reduces waiting times by incentivizing throughput [16]	- Balances competing incentives by mitigating weaknesses of single-payment models [17] - Provides financial stability through base funding while rewarding activity [18] - Flexibility to tailor incentive structures to local contexts [16] - Can incorporate quality and outcome metrics alongside volume [20]
Challenges	- Lacks efficiency incentives, encouraging passive behavior [16] - Fails to reward productivity or quality improvements [20] - Perpetuates historical inequities in resource distribution [15]	- Risk of patient selection ("cream-skimming") favoring less complex cases [16] - Potential for upcoding and gaming of classification systems [16] - High data infrastructure and administrative requirements [15] - Quality concerns related to premature discharge or undertreatment [16]	- Increased administrative complexity in design and implementation [17] - Requires sophisticated governance and monitoring systems [16] - Risk of conflicting incentives if components not properly aligned [18] - Potential for provider confusion regarding payment rules [15]
Evidence Source	[16]; [17]; [15]; [19]; [20]	[16]; [17]; [20]; [15]	[17]; [18]; [16]; [20]; [15]

BBF has been identified as administratively simple but inefficient, as [16] note that historical budget allocations "fail to provide incentives for efficiency or quality improvement," while research emphasizes that such systems "perpetuate historical inequities" in resource distribution [15], others acknowledge the cost control advantage but highlights the trade-off with rigidity [17]. Though [16] provide a review of ABF implementation documenting both benefits in increased throughput and reduced waiting times, and risks in cream-skimming and quality concerns, their review reveals "heterogeneous outcomes" dependent on implementation design and complementary regulations. Research reports extend this analysis to results-based funding in development contexts, finding "modest positive effects" on service utilization but persistent concerns about sustainability and equity [20]. In this context, [17] and [18] both highlight hybrid models as pragmatic solutions that balance competing objectives, where Australia's mixed public-private system exemplifies how "blended financing can leverage complementary strengths" while requiring "sophisticated governance mechanisms" to prevent fragmentation and inequity [18]. For a more granular examination, Table 2 below presents a detailed comparative analysis across several key dimensions, contrasting the operational logic and practical implications of BBF versus ABF.

Table 2. Comparative Analysis of Budget-Based Funding (BBF) vs. Activity-Based Funding (ABF)

Dimension	Budget-Based Funding (BBF)	Activity-Based Funding (ABF)	Key Implications
Funding Logic	Fixed annual allocations irrespective of outcomes [15]; [16]	Payments tied to DRG measurable activities [16]; [17]	ABF links revenue directly to workload [16]
Performance Incentives	No direct link to quality or outputs ([16]; [20])	Direct financial rewards for higher efficiency (LOS) [16], & better patient quality [20]	ABF hospitals can achieve 18-22% higher productivity [16]
Data Requirements	Less IT tracking complexity [15]; [19]	Requires integrated HER [15], standardized clinical coding systems (ICD, DRG) [16], and rigorous cost accounting infrastructure [19]	ABF necessitates a 3-5x investment in IT infrastructure and data analytics capabilities [15]; [21]
Flexibility	Rigid allocation with minimal annual adjustment	Highly responsive to epidemiological changes and	ABF systems adapts quickly to public health crises & evolving

	mechanisms [15]; [19]	disease burden shifts [19] • Demographic transitions [19]	population health needs [16]; [18]
Accountability	Limited transparency in resource allocation [20]; [17]	Granular tracking Cost per case [16], quality and safety indicators [20], and resource utilization efficiency [16]	Enhanced data transparency [16]; [20]

4. Results

Saudi Arabia's ABF reform is emblematic of a highly centralized, digitally-enabled, and strategically orchestrated health system transformation aligned with the health agenda of Saudi Arabia Vision 2030. The Kingdom's approach reflects a deliberate top-down governance model that leverages digital infrastructure as a foundational enabler to operationalize ABF within a complex multi-payer environment. From a principal-agent perspective, Saudi Arabia's reform addresses classic agency dilemmas by instituting rigorous accountability mechanisms embedded in its "gated" Accountable Care Organization (ACO) framework, a key component of Vision 2030. Subsequently, the Ministry of Health's phased "smart route" requires healthcare entities to sequentially demonstrate capabilities in budgeting, accounting, governance, and cash flow management (Gate 3 to Gate 4), thereby aligning provider incentives with system-wide efficiency and quality objectives. This structured pathway operationalizes the theoretical imperative of aligning principal (payer) and agent (provider) interests through transparent financial and performance metrics, as highlighted by [1]. To support implementation, digital transformation is considered as central to this model. Mandatory platforms such as the National Platform for Health Information Exchange Services (NPHIES) and the Saudi Billing System (SBS) create an integrated digital ecosystem that supports real-time data capture, coding accuracy, and financial reconciliation. While this forms the digital backbone for implementation, it is also facilitating granular activity-based costing and performance monitoring, addressing key implementation science prerequisites of having a robust IT infrastructure and data quality [24]; [7]. The Kingdom's investment in digital health, exemplified by the Seha Virtual Hospital and national Centers of Excellence, further extends ABF's reach by enhancing care coordination and specialist service delivery.

ABF fundamentally relies on classification systems that group patient cases into clinically coherent categories with similar resource consumption patterns [14]. Specifically, DRG is the most widely adopted module within ABF frameworks, which classifies inpatient hospital

cases to enable standardized payment rates adjusted for case complexity and regional cost variations [12]. This classification incentivizes hospitals to manage resources efficiently within fixed payment structures for given diagnoses. However, different countries have developed and refined their own versions of DRG systems to align with their specific healthcare contexts, regulatory environments, and policy objectives. Table 3 below provides a comparative analysis of major DRG systems across countries, illustrating variations in classification granularity, adjustment mechanisms, and implementation approaches [14]. For instance, the United States employs the Medicare Severity DRG (MS-DRG) system, which incorporates severity of illness and comorbidities into payment calculations. Germany utilizes the German DRG (G-DRG) system, which has undergone continuous refinement to balance cost containment with quality incentives, and Australia integrates the Australian Refined DRG (AR-DRG) system, emphasizing transparency and efficiency in public hospital financing. These international variations in DRG systems reflect differing priorities in healthcare financing reform, ranging from cost control and efficiency enhancement to quality improvement and equity promotion.

Table 3. Comparative Analysis of Selected Healthcare Financing Models

Universal coverage: Tax-Based Public in UK, Canada, Australia:	Cost control- kong waiting times	Limited choice, Comparable outcomes at lower cost [31]; [21]
Universal coverage: Social Health Insurance through payroll contributions, in Germany, France, Japan	patient choice- Administrative complexity	Labor market sensitive, Vulnerable to cost drivers balances equity [17]; [19]
Private Insurance: Voluntary premiums in USA	extensive choice- High admin costs	Inequitable, Inferior equity/efficiency higher spending [21]; [31]
Hybrid/Mixed (Combined Sources) in France, Australia and Netherland	Complex, Context-dependent	Leverages strengths [17]; [18]
Activity-Based (ABF): Per Case/DRGs OECD nations	transparency- "Cream-skimming" risk	quality concerns", Mixed depends on strict regulation [16]

Understanding these technical infrastructures is essential for contextualizing Saudi Arabia's ABF implementation within global best practices and identifying opportunities for system optimization. KSA's adoption of standardized DRG classification through the National Platform for Health Information Exchange Services (NPHIES) represents a strategic alignment with international standards while accommodating local healthcare delivery patterns and regulatory requirements [14].

Comparatively, Saudi Arabia's model diverges from more fragmented or incremental reforms observed, for instance, in Germany's DRG reform that though it increased hospital throughput, yet failed to yield commensurate efficiency gains, partly due to insufficient integration of digital and organizational enablers [5]. Similarly, Ireland's experience highlights the limitations of ABF when implementation lacks comprehensive stakeholder engagement and system readiness [3]. Thus, the Saudi's integrated, digitally-driven approach must align with emerging international consensus that successful ABF implementation requires a holistic ecosystem combining financial incentives, digital infrastructure, and governance reforms [1]; [22]. Arguably, this top-down model also presents potential risks, mainly related to strong centralization and reliance on digital platforms, that may constrain local innovation and adaptability at the level of each healthcare center. This would potentially provoke resistance among clinicians, if not accompanied by effective change management and inclusive governance as reported by [1]. They carried on. Report that rapid digital adoption may necessitate vigilant oversight to mitigate risks of data manipulation, underscoring the importance of AI-powered auditing tools and continuous clinician training [1]. Overall, Saudi Arabia exemplifies a sophisticated, digitally-enabled ABF transformation that operationalizes principal-agent alignment and digital transformation theories, positioning it as a regional exemplar with lessons for other emerging economies.

KSMC feasibility study provides a quantitative foundation for evaluating the operational and financial viability of RCM systems within the Saudi healthcare context. Examining these financial projections and economic indicators of KSUMC [32], and contrasting them with the mixed outcomes observed in Ireland and Germany, provide a strategic implementation narrative, equally highlighting the enablers and disablers in various contexts. At the core of KSUMC's financial analysis lies a net profit margin of 26.3%, an internal rate of return (IRR) of 78%, and a payback period approximating 2.5 years [32]. These metrics collectively signify robust profitability and accelerated return on investment uncommon in healthcare IT implementations. Such outcomes underscore the critical role of contextual readiness and stakeholder alignment in facilitating successful adoption. In this context, research findings report that the consolidated framework for implementation research emphasizes the importance of inner setting factors, including organizational culture, resource availability, and implementation climate, in achieving favorable financial outcomes [33]. Consequently, KSUMC's ability to realize a 26.3% net margin suggests that operational efficiencies were effectively harnessed, likely reflecting mature digital infrastructure and streamlined workflows that reduce revenue leakage and administrative overhead. The IRR of 78% further amplifies this narrative, indicating

exceptional economic returns relative to the capital invested, with a short payback period of 2.5 years, aligning with best practices in healthcare IT investment to sustain momentum and secure ongoing institutional support [34]. The payback period also reflects the efficiency of change management processes and the minimization of disruption during RCM system integration, particularly, the 11.8% compound annual growth rate (CAGR) projected for the Saudi RCM market from 2023 to 2030. This growth trajectory is integrally linked to Saudi Arabia's Vision 2030 strategic framework, which prioritizes digital transformation and healthcare sector modernization as pillars for economic diversification and improved population health outcomes [6]. The mandatory health insurance reforms and the National Platform for Health Information Exchange Services (NPHIES) initiative exemplify systemic enablers that create demand for sophisticated RCM solutions. These valuation issues relate to the short-term ROI vs the long-term VBHC returns, and staged benefits of a fully functioning digital health system need to be factored in [35].

However, these promising indicators also illuminate the prerequisites for replicable ABF success. The feasibility study explicitly identifies digital infrastructure compatibility and institutional alignment as foundational conditions. The high net margin and IRR implicitly reflect the presence of interoperable EHRs, integrated billing systems, and data analytics capabilities that collectively facilitate activity-based costing and reimbursement processes. This contrasts with the heterogeneous experiences reported in Ireland and Germany, where fragmented IT systems and misaligned stakeholder incentives have yielded mixed or suboptimal ABF outcomes [3]; [5]. For example, Ireland's ABF implementation for public patients admitted to Irish public hospitals showed no significant impact on hospital efficiency, with providers failing to react to the new funding mechanisms, resulting in limited improvements in day-case admissions or length of stay [3]. Germany's phased ABF introduction revealed institutional resistance and regulatory complexity that attenuated expected efficiency improvements [5]. Furthermore, the risk factors identified in the KSUMC study, such as regulatory compliance, cooperative health insurance mandates, and NPHIES standards, cybersecurity threats, and staff resistance, further contextualize the implementation challenges inherent in RCM adoption. These risks resonate with the implementation science literature, which highlights the interplay between outer setting pressures (regulatory environment) and inner setting dynamics (organizational readiness) as determinants of sustainability [36, 37]. For instance, compliance with evolving data protection regulations imposes substantial demands on IT security architectures and operational protocols, necessitating continuous risk assessment and mitigation [38]. They also reported that cybersecurity concerns are particularly salient given the sensitive nature

of patient financial and clinical data, requiring robust encryption, access controls, and incident response capabilities [38].

Fig. 2 below presents the financial performance projections for KSUMC's RCM implementation, derived from the feasibility study [32]. The waterfall chart (left panel) illustrates the progression from gross revenue of 191 million SAR to a net profit of 50.2 million SAR, representing a 26.3% net profit margin, a figure substantially higher than typical healthcare IT implementations. The revenue allocation structure (right panel) demonstrates operational efficiency, with cost of revenue consuming 65% of total revenue, operating expenses at 6%, and financing costs at 3%. This financial architecture reflects the presence of mature digital infrastructure, including interoperable EHRs and integrated billing systems, which collectively enable accurate activity-based costing and efficient reimbursement processing. The exceptional profitability validates the feasibility of ABF implementation in contexts characterized by strong institutional alignment and digital readiness.

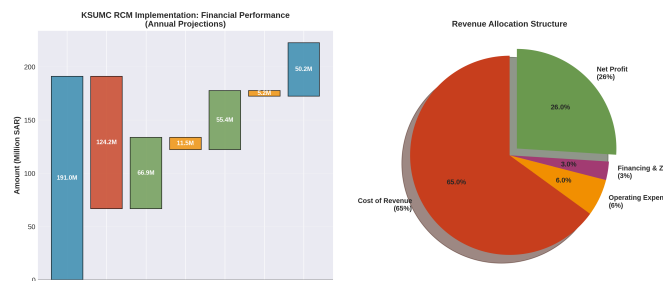


Fig. 2 KSUMC RCM Financial Performance Analysis

Fig. 3 below contextualizes KSUMC's financial performance within the broader Saudi healthcare market dynamics.

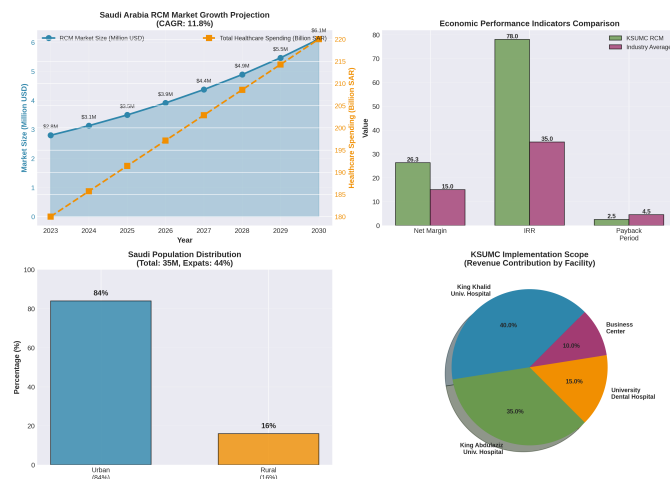


Fig. 3 Saudi Arabia RCM Market Growth and Economic Indicators

The top-left panel projects RCM market growth at an 11.8% compound annual growth rate from 2023 to 2030, driven by Vision 2030 digital transformation mandates and the NPHIES. This growth trajectory aligns with projected healthcare spending reaching 220 billion SAR by 2030, reflecting systemic investment in healthcare infrastructure. The economic performance comparison (top-right panel) demonstrates that KSUMC's metrics, 26.3% net margin, 78% IRR, and 2.5-year payback period, substantially exceed industry benchmarks, suggesting that the Saudi context, characterized by robust digital infrastructure and institutional alignment, creates uniquely favorable conditions for ABF implementation. The population distribution (bottom-left) highlights that 84% urbanization and 44% expatriate composition generate demand for sophisticated billing and reimbursement systems capable of handling diverse insurance arrangements. Collectively, these indicators illustrate that KSUMC's success is both a product of and contributor to Saudi Arabia's broader healthcare financing modernization. Fig. 4 below presents a risk assessment matrix derived from the KSUMC feasibility study, mapping implementation challenges by impact and likelihood.

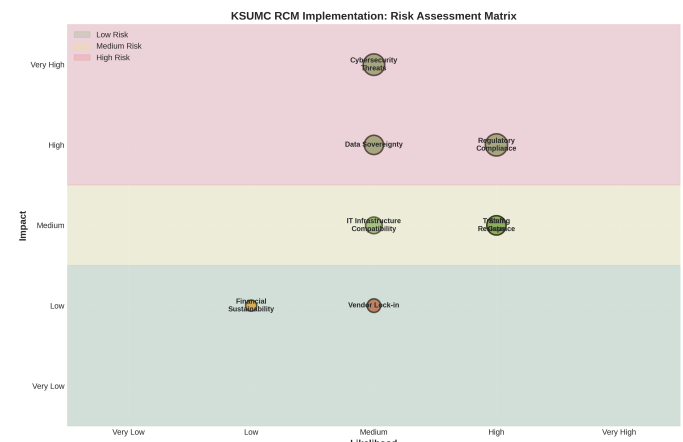


Fig. 4 KSUMC RCM Implementation Risk Assessment Matrix. Source: [32]. Note: Risk factors mapped by impact and likelihood, including regulatory compliance, cybersecurity, staff training, and IT infrastructure challenges.

The analysis identifies regulatory compliance (PDPL, CHI, NPHIES standards) and cybersecurity threats as high-impact, high-likelihood risks requiring immediate mitigation strategies. These findings resonate with implementation science literature emphasizing the interplay between outer setting pressures (regulatory environment) and inner setting dynamics (organizational readiness) as determinants of sustainability [36, 37]. Staff resistance and training gaps emerge as medium-impact but high-likelihood risks, underscoring the imperative for comprehensive change management approaches that address workflow redesign and professional development. Notably, IT infrastructure compatibility presents moderate risk, suggesting that KSUMC's

existing digital maturity provides a foundation for RCM integration, though legacy system interfaces require careful management. Financial sustainability appears in the low-risk zone, validated by the 26.3% net margin and 78% IRR, indicating that economic viability is not a primary concern. This risk profile illustrates that while KSUMC's financial and operational context is favorable, successful implementation hinges on proactive management of regulatory, cybersecurity, and human factors, a pattern consistent with international ABF implementation experiences [3]; [5]. The comparative analysis reveals that while Saudi Arabia pursues ABF reforms underpinned by principal-agent theory and digital transformation imperatives, its divergent institutional contexts and digital capacities critically shape reform design and prospects. Saudi Arabia's top-down, digitally integrated model exemplifies an advanced implementation of ABF principles, leveraging robust IT infrastructure and governance to align incentives and enhance accountability. These findings corroborate broader research trends that underscore the necessity of embedding ABF within comprehensive digital and organizational ecosystems to realize efficiency and quality gains [1]. Similarly, they highlight the enduring challenges of clinician engagement and data quality, which transcend income levels and require sustained policy attention. Ultimately, the Saudi case affirms that ABF is not a remedy but a complex reform whose success depends on strategic integration of financial incentives, digital transformation, and implementation science-informed change management.

5. Discussion

This comparative analysis of ABF reform trajectory in Saudi Arabia offers critical insights that transcend the boundaries of individual case study, advancing scholarly understanding of how institutional context and digital maturity condition the implementation and outcomes of ABF in emerging economies. Additionally, our findings illuminate a fundamental contingency to state that the success of ABF reforms hinges not merely on the adoption of DRG-based payment mechanisms but on the strategic orchestration of institutional alignment, digital infrastructure, and stakeholder engagement within the prevailing resource and governance environment. Saudi Arabia's experience exemplifies a top-down, digitally mature model where institutional alignment is meticulously engineered through phased capability gates, integrated digital platforms, and centralized governance. This approach operationalizes principal-agent theory by tightly coupling provider incentives with accountability mechanisms embedded in a sophisticated digital transformation ecosystem. The Saudi's digital backbone, spanning the National Platform for Health Information Exchange Services and the Saudi Billing System, enables real-time data integration, coding accuracy, and financial reconciliation, thereby addressing key implementation science prerequisites such as data quality, transparency,

and monitoring capacity. This institutional and technological coherence supports a dynamic feedback loop between financial incentives and clinical behavior, mitigating risks of gaming and fostering efficiency gains. In doing so, Saudi Arabia extends findings on the necessity of institutional alignment by demonstrating how digital transformation acts as both a catalyst and an enabler of this alignment, effectively bridging the gap between theoretical incentive structures and practical operationalization [5].

The nuance of the Saudi case mixed findings from high-income settings such as Ireland and Germany [3]; [5]. Whereas high-income countries grapple with marginal efficiency gains despite advanced infrastructure, Saudi's digital and institutional integration suggests that emerging economies with strong leadership will and digital investment can leapfrog traditional barriers. This comparative lens thus, reframes ABF success as inherently contingent on the interplay between institutional capacity, digital maturity, and phased implementation strategies, rather than the payment model alone. From a policy and managerial perspective, these insights crystallize several actionable lessons for MENA and other emerging economies pursuing ABF reforms. First, a phased, incremental approach that prioritizes pilot testing, capacity building, and digital infrastructure development is essential to manage complexity and mitigate risks. Second, digital transformation emerges as a non-negotiable pillar, not merely a technical adjunct but a strategic enabler that underpins accurate costing, coding integrity, and real-time performance monitoring. Third, sustained clinician and stakeholder engagement is indispensable to overcome resistance, align incentives, and embed reforms within organizational cultures. Fourth, governance structures must be calibrated to balance central oversight with local adaptability, ensuring accountability without stifling innovation. Finally, the integration of advanced costing methodologies such as TDABC can enhance cost transparency and support value-based management, if embedded within a digitally mature and institutionally aligned ecosystem. Collectively, these lessons underscore that ABF is not a plug-and-play reform but a complex socio-technical intervention requiring holistic system transformation. Policymakers must therefore resist the allure of simplistic, rapid implementation and instead cultivate a strategic vision that integrates financial, digital, organizational, and human factors in a coherent reform architecture.

Along the same token, a salient trend across diverse healthcare systems involves the gradual shift from historical budget-based allocations toward activity-based funding (ABF) and other performance-oriented payment mechanisms [16]; [20]. Traditional budget-based funding, which provides fixed prospective allocations independent of service volume or outcomes, has been criticized for generating perverse incentives that reward inactivity,

discourage efficiency improvements, and fail to align provider behavior with population health objectives [16]. In contrast, ABF models create financial incentives for providers to increase throughput, improve resource utilization, and enhance transparency in cost accounting [16]. Systematic reviews of hospital funding models reveal that ABF implementation, driven by policy objectives to enhance efficiency, reduce waiting times, and improve accountability [16], and can improve service utilization and quality indicators in low-resource settings [20]. It is worth noting thus, that for the Saudi health ecosystem, to underscore the importance of complementary regulatory mechanisms, including quality monitoring, risk adjustment, and blended payment models to mitigate potential adverse effects [15];[16].

6. Conclusions

This study's primary contribution lies in articulating the contingent nature of ABF success through a theoretically and comparative analysis that integrates conceptual foundations, global financing contexts, and empirical evidence from Saudi Arabia. It establishes a conceptual framework that delineates the transformation continuum from BBF to ABF, while portraying healthcare financing reform as a phased evolution requiring synchronized development of standardized coding, digital infrastructure, and governance mechanisms. Furthermore, the empirical evidence from KSMC's RCM implementation provides concrete validation of this thesis, demonstrating exceptional financial performance (26.3% net profit margin, 78% internal rate of return) when digital maturity, institutional alignment, and systematic implementation frameworks converge. This case exemplifies the five-stage implementation framework articulated in this study, encompassing system assessment, stakeholder engagement, pilot testing, performance benchmarking, and full-scale deployment. The technical infrastructure analysis examination of DRG systems across international contexts, further underscores the importance of standardized classification mechanisms in operationalizing ABF principles while accommodating local healthcare delivery patterns. Our central argument challenges narratives that treat ABF as a mere financial reform. Instead, it highlights ABF as a complex, multi-dimensional change process that demands synchronized evolution of governance structures, technological capabilities, and organizational culture.

In conclusion, the evidence presented in this study unequivocally demonstrates that activity-based funding represents the optimal healthcare reimbursement model for Saudi Arabia's evolving health ecosystem. The Kingdom's unique confluence of strategic advantages, including top-down institutional alignment through Vision 2030, sophisticated digital infrastructure anchored in the National Platform for Health Information Exchange Services (NPHIES), mandatory cooperative health

insurance creating universal coverage, and substantial financial capacity for system transformation, positions Saudi Arabia not merely to adopt ABF but to operationalize it with exceptional effectiveness. The empirical evidence from King Saud Medical City, demonstrating a 26.3% net profit margin, 78% internal rate of return, and 2.5-year payback period, provides compelling proof that ABF implementation in digitally mature, institutionally aligned contexts delivers transformative financial and operational outcomes that far exceed those observed in fragmented European implementations. Unlike Ireland and Germany, where institutional misalignment and legacy system constraints have yielded marginal or mixed results, Saudi Arabia's strategic orchestration of digital readiness, regulatory coherence, and centralized governance creates the precise enabling environment that ABF requires to fulfill its theoretical promise. This is not merely a technical payment reform but a strategic lever for value-based transformation that aligns provider incentives with national health objectives, enhances transparency and accountability, and positions the Saudi health system to respond dynamically to evolving population health needs. For policymakers across the MENA region and other emerging economies, the Saudi experience offers a replicable blueprint: ABF succeeds when embedded within a comprehensive digital transformation strategy, supported by robust institutional frameworks, and implemented through phased, stakeholder-engaged processes. The path forward is clear, activity-based funding, when strategically implemented within a digitally mature and institutionally aligned ecosystem, represents the most effective mechanism to achieve efficiency, quality, and sustainability in healthcare financing. Saudi Arabia's trajectory demonstrates that emerging economies need not follow the incremental, constraint-bound paths of high-income predecessors; rather, with visionary leadership and strategic investment in digital and institutional infrastructure, they can leapfrog to best-practice models that deliver superior outcomes.

Looking forward, we propose a clear agenda for research and policy action informed by the multi-layered analysis presented. Empirically, longitudinal impact studies that track ABF's effects on efficiency, quality, and equity over extended periods are urgently needed to capture dynamic reform processes. The integration of patient-reported outcome measures within ABF frameworks represents a promising frontier to align financial incentives with patient-centered value, warranting rigorous exploration through controlled trials and quasi-experimental designs.

7. References

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