

# Corporate Debt Financing and Capital Structure Optimization for Large-Scale Infrastructure Investment under Saudi Vision 2030

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*Abstract- The financing arrangements required by the major infrastructure projects described in Saudi Vision 2030 must be such as to draw in a large amount of private capital without ending up with leverage positions that weaken should there be changes in interest rates, construction costs, demand, or the circumstances under which the debt can be refinanced. This study examines how corporate debt financing and the structure of capital can be improved for the Saudi infrastructure sponsors and the project companies in question. In order to bring together the findings relating to leverage, debt maturity, project finance, sukuk and bonds, risk allocation, refinancing, and sustainability-linked finance, a systematic and integrated review of studies and evidence from Saudi institutions published between 2020 and 2025 was conducted. The evidence indicates that there is no single debt ratio which is optimal in all situations. The level of debt that can be taken on in infrastructure projects varies according to the stability and the quality of the contractual terms of the project's cash flows, the degree of construction and operating risk, the strength of the sponsor, the availability of collateral, the matching of maturities, currency exposure, and the credibility of the risk-sharing arrangements. Even though Saudi Arabia's rapidly expanding sukuk and debt markets increase the range of financing alternatives available, the growing volume of issuances also makes it more necessary to maintain disciplined debt service coverage, keep sufficient liquidity buffers, and plan for refinancing. The review proposes a dynamic optimisation framework which treats the capital structure as a decision that should be made throughout the whole lifecycle of the project rather than as a single, one-off decision regarding funding. It recommends combining specific leverage limits for each project, long-term debt, a variety of funding sources, clear risk allocation, and periodic re-optimisation. This approach will help to lower funding costs on a risk-adjusted basis while at the same time protecting the company's solidity and encouraging private sector participation in the infrastructure projects under Vision 2030.*

## I. INTRODUCTION

Saudi Vision 2030 has transformed infrastructure investment from a solely public-capital effort into a broad strategy for economic diversification which covers logistics, tourism, utilities, digital infrastructure, industrial zones, transport, urban development and assets connected with the energy transition. The scale of these projects creates a financing problem no less important than the engineering one: companies need to raise large sums of capital yet must at the same time keep their debt capacity free for later phases and maintain resilience when facing of macroeconomic shocks. That is why Saudi Vision 2030 places equal emphasis on strengthening the financial sector and on involving the private sector together with the delivery of physical infrastructure. The private sector's contribution to gross domestic product was 47% in the third quarter of 2024, as compared with the 65% target for 2030, demonstrating the policy aim of increasing the private sector's role in investment and production (Saudi Vision 2030, 2025).

Debt is attractive because it reduces the amount of equity that has to be committed at the start, increases the return on equity should the project perform better than the cost of borrowing, and enables long-term assets to be paired with long-term liabilities. Yet infrastructure projects require large initial capital expenditures, have long payback periods, involve uncertainty throughout the construction phase, feature concentrated assets, and their cash flows might depend on regulated tariffs, concessions, availability payments, user demand, or government-linked off-take agreements. High levels of leverage can be achieved when the contracts are strong, but it can also cause financial distress should the revenues fall short of expectations or in case refinancing becomes

expensive. Empirical studies in the field of infrastructure have found that the level of leverage is determined by financial risk, the characteristics of the sector, the extent of government involvement, the maturity of the project, and the strength of the surrounding institutions (Jimmy and Falianty, 2021; Lu and Wilson, 2024). Research on project finance also shows that the contractual structure, the allocation of risk, the lenders' control rights, and the sponsor arrangements are all closely related to the financing decisions (Kumar et al., 2021; Demirel et al., 2022; Jiménez et al., 2022).

At the start, domestic banks remain the main providers of credit to companies, while the market for sukuk and debt securities is being deliberately expanded as an alternative method of financing. The market value of corporate sukuk and debt rose from 95 billion Saudi riyals in 2019 to 125 billion Saudi riyals in 2023, the number of companies issuing these instruments having increased three times over during that period (Capital Market Authority, 2024a). In 2024 regulatory reforms were carried out which eased the requirements for issuing such instruments and broadened access to development funds, development banks, and sovereign funds, the objective being to diversify the sources of financing (Capital Market Authority, 2024b). By the end of 2024 the value of listed sukuk and debt instruments had reached 663.5 billion Saudi riyals, this amount representing an increase of 20.6% compared with the previous year (Capital Market Authority, 2025).

Secondly, the investments under Vision 2030 are occurring at a time when the financing needs of sovereign bodies, quasi-sovereign entities, banks, companies, and particular projects are overlapping within both domestic and international markets. The Ministry of Finance had estimated the financing requirements for 2024 at approximately SAR 86 billion and had specifically included alternative forms of government financing for development and infrastructure projects in its borrowing strategy (Ministry of Finance, 2024). The IMF also notes that Saudi Arabia has been making increasing use of the international debt markets as it carries out its large-scale investment programmes, and that well-developed domestic capital markets are important for

achieving a diversification of funding (International Monetary Fund, 2024, 2025).

Saudi evidence relating to listed companies also cautions against giving simple advice on the use of leverage. It has been stated that profitability, company size, tangibility, market valuation, governance, and firm performance are connected with financing decisions, although nonlinear relationships show that the advantages of debt may diminish or even reverse when certain thresholds are reached (Makni and Dinga, 2020; Alabdulkarim, 2023; Boshnak, 2023; Shaddady, 2023). In the case of infrastructure, debt capacity depends on the quality of the underlying cash flows, the contractual protections, and the revenue profile.

The aim of this review is to develop a conceptual framework customized to the Saudi situation in order to improve corporate debt financing in relation to large-scale infrastructure investment as part of Vision 2030. The analysis is based on four objectives: first, to determine the principal debt channels available to Saudi infrastructure sponsors and to the project companies; second, to examine the impact of project, sponsor, market, and institutional risks on the level of leverage, the maturity of the debt, and the kind of financial instrument selected; third, to compare corporate balance-sheet debt with project finance, sukuk, bonds, and sustainability-linked structures; and fourth, to propose decision rules that connect lower risk-adjusted capital costs with refinancing resilience, investor diversification, and long-term private-sector participation.

## II. REVIEW METHODOLOGY

A structured integrative review was selected because the research question covers areas including corporate finance, project finance, infrastructure governance, Islamic capital markets, and Saudi policy. The aim of this approach was to combine and examine the mechanisms and decision rules rather than to calculate a single pooled effect. The evidence considered was restricted to the period from 2020 to 2025 so as to reflect the current financing situation and the most recent phase of Vision 2030's implementation. The search involved employing terms such as capital structure, corporate debt, infrastructure finance, project finance, PPP leverage, project bonds, sukuk,

refinancing, debt maturity, Saudi Arabia, Vision 2030, green finance, and infrastructure risk. Peer-reviewed articles from well-known journals in the fields of finance, economics, project management, and infrastructure were given priority, and official publications from Saudi Arabia and the IMF were also consulted when it was necessary to obtain primary institutional evidence on market size, regulatory changes, borrowing strategies, or the implementation of programmes.

The sources were only included when they addressed at least one of the five areas of analysis: the determinants of leverage; debt pricing and maturity; the allocation of project-finance risk; the development of the debt market and sukuk; or infrastructure financing policy. Sources that provided only descriptive remarks without a clear analytical or institutional basis were excluded. The ultimate collection of evidence comprised 30 sources, 20 of which were academic studies and the remaining 10 being institutional publications. Rather than giving mechanical quality ratings to the various types of evidence, the review used relevance, methodological transparency, recency, and direct relevance to infrastructure financing as the main criteria for evaluating the sources. The findings were then grouped into four synthesis categories: debt capacity, instrument selection, risk allocation, and lifecycle refinancing.

Deliberately, the method does not present a fabricated quantitative ideal debt ratio, since different studies make use of various units of analysis, sectors, legal systems, cash-flow models, and definitions of leverage, and therefore averaging their results would result in false precision. Instead, the review follows an approach that proceeds from theory to decision. It starts by examining the general findings regarding capital structure through the perspectives of the trade-off theory, the pecking-order theory, and the agency theory; it then identifies the particular mechanisms that are applicable to individual projects on the basis of the infrastructure-related studies; and finally applies the evidence from Saudi institutions to determine which financing channels and constraints are currently in operation. This method is consistent with recent reviews of infrastructure financing which point out the importance of the interaction between the financing

structure, the contractual structure, and uncertainty (Kumar et al., 2021). It also allows toward the derivation of practical optimization rules in a manner that is replicable and without placing excessive emphasis on causal certainty.

### III. CONCEPTUAL FOUNDATIONS OF INFRASTRUCTURE CAPITAL STRUCTURE

Capital structure optimisation is generally regarded as an effort to identify a mix of debt and equity which will reduce the weighted average cost of capital without, at the same time, altering the firm's value. The financing arrangement must provide the funds needed for the construction work, keep the company going during the ramp-up phase, fulfill its debt obligations even in the face of operating volatility, leave room for maintenance and for future expansion, and at the same time ensure that the sponsor remains in a position to refinance or raise additional funds for future projects. It is therefore possible for the lowest initial coupon to be inferior to a slightly more expensive one if the more expensive structure has a longer maturity, includes some amortisation flexibility, allows for room within the covenants, or involves lower refinancing risk. The main objective should instead be to minimise the financing cost on a risk-adjusted basis, within the constraints relating to solvency, liquidity, and strategic flexibility.

Debt may lead to lower required returns than equity, it can impose cash-flow discipline, and it can decrease the amount of expensive sponsor capital that is committed to a project. However, beyond a certain point, expected distress costs, covenant restrictions, rating pressure, and the loss of financial adaptability increase. Empirical evidence from Saudi Arabia indicates that firm size, tangibility, profitability, and growth are relevant to leverage decisions, and the nonlinear results show that the value of further debt is not the same at all levels of leverage (Alabdulkarim, 2023; Shaddady, 2023; Shahzad et al., 2021). Boshnak (2023) finds negative relationships between various debt measures and performance for Saudi-listed nonfinancial firms, which stresses the importance of distinguishing between debt capacity and debt availability.

The fact that sponsors may still choose to use the funds which they generate on their own and debt rather than new equity is explained by the pecking-order theory. Financing is then given a strategic character in that the sponsor's equity and the development capital can assume the risk associated with the early stages of development; once the contracts have matured, bank or project debt can be used to finance the construction; and when uncertainty has declined, bonds or sukuk can be used to refinance the mature operating assets. This step-by-step approach to the financing process is more useful than a fixed financing hierarchy because information asymmetry and risk change considerably during the course of a project's life.

Firms that have a high level of debt are able to restrict the use of their discretionary cash and separate the risks from the sponsor, yet this setup can cause disagreements between shareholders and lenders as to dividends, further borrowing, maintenance expenditures, or the amount of risk being taken. To handle these conflicts, project finance employs security packages, reserve accounts, covenants, cash waterfalls, step-in rights, and limitations on distributions. As Demirel et al. (2022) point out, private financiers in the infrastructure sector use a variety of control mechanisms in order to protect their returns when facing uncertainty, and Kumar et al. (2021) emphasize that project finance is fundamentally a contractual and governance structure, not simply a way of securing debt.

In a study they carried out in 2021, Jimmy and Falianty found that financial risk has a significant impact on infrastructure leverage and that sector sensitivity varies. Lu and Wilson (2024) show that more developed infrastructure and institutional settings are associated with a higher level of commercial debt, longer-term investment, and a smaller share of equity in infrastructure projects. Hou and Ran (2024) find that project size, contract duration, the number of sponsors, the degree of urbanization, and regional openness are important and nonlinear factors in determining the capital structure of public-private partnerships. A utility that is fully established and has contracted revenues can sustain a different level of debt when compared with a greenfield development in a destination where demand initially is uncertain.

In their 2021 study, Richter and his colleagues found that when setting the prices of project bonds both traditional credit factors and the characteristics of the project as well as its sustainability are taken into account. Guedes and Pinto, in their 2023 report, said that project-finance bonds can have higher spreads than comparable corporate bonds, indicating that the risk isolated by ring-fencing does not automatically result in a decreased borrowing cost. Spohr and others (2024) demonstrate that the financing premiums in public-private partnerships are able to serve as fair compensation for the transfer of risk rather than merely amounting to an overpayment. Although a higher spread at the project level might seem high, it could be economically justified in that it helps to protect the sponsor's corporate rating and makes certain that the risks connected with construction or demand remain separate.

#### IV. SAUDI VISION 2030 FINANCING CONTEXT

In Saudi Arabia, the situation concerning financing is undergoing a shift from a system based on banks to one that is more diverse and includes domestic and international sukuk, conventional bonds, project finance, development finance, and instruments related for sustainability. The Capital Market Authority has treated the development of sukuk and debt instruments as a strategic priority in order to have a wider variety of issuers, improve liquidity, and adopt more efficient methods of issuing (Capital Market Authority, 2024a, 2024b). The rapid increase in the number of listed debt instruments by 2024 indicates that the market is becoming a more dependable source for refinancing as well as a channel for primary funding (Capital Market Authority, 2025).

Sukuk are especially important because they have the possibility of connecting infrastructure financing with the Kingdom's Islamic finance system and with a wider group of investors from the region. As Boukhatem stated in 2022, stability concerning the exchange rate, foreign debt, and debt service payments is essential for the development of the Saudi sukuk market, indicating that any future growth of the market depends on macro-financial credibility. Shalhoob, in 2023, notes the considerable potential for green sukuk in the context of Vision 2030, while at the same time

pointing out the challenges related to definitions, measurement, awareness, and institutional capacity.

The International Monetary Fund said that in 2024 Saudi Arabia became the largest issuer of dollar-denominated debt among the emerging markets, excluding China, and also the biggest global issuer of dollar sukuk; this trend has been caused by the issuance carried out by the central government, the PIF, banks, and corporations (International Monetary Fund, 2025). Though borrowing internationally lengthens the term of the loans and results in a greater diversification of investors, it also gives rise to problems concerning market timing, currency, and the benchmark interest rate. Even though the riyal's peg to the US dollar reduces part of the exchange-rate uncertainty when borrowing in dollars, sponsors who primarily earn their revenue in riyals still have to consider basis risk, hedging costs, and the possibility that global interest rate cycles could result in difficulties when refinancing.

By the end of 2024, the Public Investment Fund stated that the value of its assets under management reached 3.424 trillion Saudi riyals and that it had carried out a capital deployment of 213 billion Saudi riyals in the priority sectors of the Vision Realization Program (Public Investment Fund, 2025). The National Infrastructure Fund has the responsibility of providing innovative financial solutions and of drawing in private capital, such as that needed for renewable hydrogen and solar projects (National Infrastructure Fund, 2024). Funds of this kind can improve the bankability of projects through anchor investment, subordinated capital, guarantees, structured credit enhancement, or by taking on risks at an early stage.

A single conglomerate or one which is supported by the state could offer financing for a variety of different projects, meaning that every new decision by the company to take on debt uses up part of its rating headroom and affects the cost of future debt. Makni and Dinga (2020) show that the debt policy of companies in Saudi Arabia is endogenous and that it can have nonlinear relationships with firm value, while Alabdulkarim (2023) finds profitability and the characteristics of assets to be important in determining the level of leverage. Shaddady (2023) reaches a similar conclusion, demonstrating an inverted-U

relationship between leverage and shareholder distributions.

Alhejaili (2024) says that for the development of green finance in Saudi Arabia to be successful, there must be a greater integration of sustainability objectives, regulation, market readiness, and disclosure. Bistuer-Talavera et al. (2024), when looking at the energy transition, find that debt is the main type of financing, but that increasing the variety of funding sources can help to reduce the risk. Concerning the infrastructure plans within Vision 2030, green or sustainability-linked debt can broaden the investor base and connect financing with environmental performance, provided that the key performance indicators are material, measurable, and independently verifiable.

## V. OPTIMIZING DEBT FINANCING FOR LARGE-SCALE INFRASTRUCTURE

The first choice to make is where the debt should be placed: on the corporate balance sheet or in a project special-purpose vehicle. Debt on the corporate balance sheet is more efficient if the sponsor has a strong credit rating, diversified cash flows, and if the project's risks can be handled within the group; it can simplify the documentation and, in some cases, secure lower interest rates since the lenders have access to the whole corporate balance sheet. The drawback, however, is that it leads to a concentration of risk, so that construction delays, a delayed opening, or poor operating performance will have a direct impact on the sponsor's leverage and thus reduce its ability to finance other Vision 2030 initiatives. On the other hand, project finance isolates the assets and cash flows, disperses the risks by means of contracts, and can protect the sponsor against full recourse. It may still be worthwhile, despite its higher transaction costs and possibly higher interest rate, if the risk isolation allows for greater portfolio capacity (Guedes and Pinto, 2023).

A good approach is to employ corporate debt when the risk of the project is only moderate in relation to the sponsor's cash flow and to move towards project frameworks with limited recourse as the size of the project, the level of uncertainty, or the concentration of the portfolio increases. This is because, during the development and early construction phases, sponsor support is needed since lenders cannot depend on an

operating asset that has not yet been proven. Once the completion tests have been carried out and steady revenues have been achieved, the financing can be refinance with long-tenor project debt, sukuk, or bonds, thereby releasing the corporate guarantees and making it possible to recycle the sponsor's capital. Hou and Wang (2022) show that there is value in viewing the refinancing capital structure as a dynamic decision that is linked to changing capital requirements rather than as a fixed initial decision.

The second point concerns the leverage ceiling. Debt capacity must be based on stressed cash flow rather than on market appetite or on the level of leverage of similar companies. The key indicators include the debt service coverage ratio, the loan life coverage ratio, interest coverage, free cash flow after maintenance, reserve adequacy, and the maximum debt-to-capital ratios. In addition to the base-case models, downside scenarios should be included for escalation in construction costs, for delayed completion, for a shortfall in demand, for pressure from tariffs, for inflation in operating costs, for shocks to interest rates, and for wider refinancing spreads. As Lara-Galera et al. (2025) demonstrate, the spreads on loans for transport infrastructure are closely linked to the risk encountered by creditors, especially demand risk. The result is that leverage and pricing should be addressed together: an increase in debt will raise lender risk and the spread, thereby抵消ing the apparent advantage of substituting equity.

Since infrastructure assets produce value over long periods, short debt terms lead to a mismatch of maturities and a need to refinance. Debt with a long term that amortizes usually enhances resilience since the repayments match the cash generated by operations. An ideal structure could involve a stable long-term component together with parts that can be refinanced following either the completion of construction or the achievement of performance targets. Moreover, the maturities should be spread out within the corporation's portfolio to avoid having to refinance a number of projects at the same time when market conditions are adverse.

The fifth option is concerned with the choice of instruments. Bank loans provide flexibility in negotiation, have value in terms of the relationship built, allow drawdowns during the construction phase, and make it easier to modify the covenants. Domestic sukuk can offer a long maturity, give access to Islamic investors, and lessen reliance on bank capacity. International bonds and sukuk can broaden investor access and allow benchmark curves to be established, whereas green or sustainability-linked instruments might draw in dedicated pools of capital. The reforms to the Capital Market Authority intended to simplify the offerings should, over time, reduce the difficulties involved in issuing securities, and the growing listed market will enhance the feasibility of refinancing mature assets (Capital Market Authority, 2024b, 2025).

Table 1. Debt financing instruments for Saudi Vision 2030 infrastructure: strengths, constraints and optimization roles.

| Financing instrument             | Primary role                             | Capital-structure benefit                                            | Key constraint                                                 | Best-fit use                                                   |
|----------------------------------|------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|
| Corporate term loan              | Sponsor-level funding                    | Fast execution; lower documentation burden                           | Uses corporate rating headroom; concentrates project risk      | Moderate project risk and strong diversified sponsor cash flow |
| Limited-recourse project finance | Ring-fenced construction/operations debt | Isolates project risk; aligns lender controls with project cash flow | Higher transaction cost; intensive covenants and due diligence | Large or concentrated assets with contractable risks           |

| Financing instrument             | Primary role                    | Capital-structure benefit                                                | Key constraint                                          | Best-fit use                                                                           |
|----------------------------------|---------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------|
| Domestic sukuk                   | Long-term market-based funding  | Islamic investor access; bank diversification; potential long tenor      | Structuring, disclosure and liquidity requirements      | Seasoned or contract-backed assets with sufficient issuance scale                      |
| International bonds/sukuk        | Global investor diversification | Deep investor pools; benchmark curve; larger ticket sizes                | Market timing, currency and global-rate exposure        | Large issuers/projects requiring duration and diversified demand                       |
| Green/sustainability-linked debt | ESG-aligned funding             | Dedicated investor pools; strategic signaling; potential pricing benefit | KPI credibility, verification and reporting costs       | Assets with material, measurable environmental outcomes                                |
| Development/catalytic finance    | Risk absorption and crowding-in | Improves bankability; can lengthen tenor or support early risk           | Risk of masking weak economics if used indiscriminately | First-of-a-kind, strategic or transition projects with clear path to commercialization |

The advantages are most evident when the different tranches carry out separate functions—such as providing revolving credit for meeting liquidity needs, offering construction facilities to provide flexibility in drawing down funds, using long-term sukuk or bonds to meet duration requirements, and employing subordinated or development capital to absorb risk. However, a layered financing structure becomes inefficient if several of the instruments duplicate the same exposure or if they result in conflicting security and covenant arrangements.

The fifth point concerns the allocation of risk. Infrastructure debt becomes less expensive and more readily available when the material risks are passed on to those who are able to deal with them. Fixed-price engineering, procurement, and construction contracts can reduce the risk of cost overruns, provided that the counterparties are creditworthy and the scope of the contract is realistic. Long-term offtake agreements, availability payments, minimum-revenue

mechanisms, or regulated tariffs might help to stabilise operating cash flows. Other risks can be managed through the use of insurance, hedging, reserve accounts, and completion support. Demirel et al. (2022) find that financiers employ governance and control mechanisms in order to protect their returns, while Spohr et al. (2024) show that a financing premium can be justified when private capital actually takes on the risk. The aim is not to shift all the risks away from the project company, but rather to assign each risk to the party who has the greatest ability and incentive to control it.

The way that risks are allocated also affects whether the debt is truly non-recourse; a project which is described as having limited recourse may still result in considerable contingent exposure if the sponsor offers completion guarantees, provides liquidity support, makes debt-service commitments, or gives an implicit reputational guarantee. Corporate decision-makers should therefore take into account both accounting

leverage and economic leverage, covering guarantees and contingent liabilities as well. This is particularly important in the case of groups which have several project companies; a balance sheet may look only lightly levered even though hidden support obligations can cause stress to be spread across the projects. When setting limits on portfolio debt, optimization should combine the expected and stressed sponsor support.

The sixth consideration is the structure of the currencies and interest rates. Dollar funding can provide depth and stability, whereas riyal funding tends to match well with domestic revenue. The right combination will depend on the revenue currency, the payments for procurement, the cost of imported equipment, and the expenses involved in hedging. Although fixed-rate debt guards cash flow against rising rates it might prove expensive to refinance or to unwind; on the other hand, floating-rate debt is cheaper at first but passes on the volatility of the benchmark to the project. A multi-layered hedge strategy can ensure that a large part of the debt service is fixed during the construction phase and the early years of operation, before allowing more flexibility as the level of leverage decreases. The aim is not to eliminate all financial risk but rather to make sure that changes in interest rates or exchange rates do not overwhelm the operating margins.

The seventh measure is liquidity protection. Infrastructure failures are more usually the result of timing mismatches than of eventual insolvency. Even if a project is commercially viable it may still go into default if its cash reserves are not sufficient during a

delay in commissioning, when seasonal demand is weak, or during temporary maintenance outages. It is therefore possible to create value through the use of debt-service reserve accounts, committed liquidity facilities, covenant headroom, and conservative distribution tests, even though such arrangements involve costs. The appropriate metric to use is the option value of liquidity under stress. Corporate groups should also keep central liquidity which is not entirely committed to individual projects, in order that they may be able to react to shocks without having to carry out emergency refinancing.

In the end, the capital structure should be re-optimised during the entire project lifecycle. Changes such as the completion of construction, the achievement of operational steadiness, an improvement in the rating, asset appreciation, a shift in regulation, or the emergence of a more mature local debt market can lead to a change in the optimal financing mix. On the other hand, rising costs, weaker demand, or higher interest rates may call for deleveraging. Because the Saudi capital markets are changing so quickly, it is especially important to carry out periodic reviews. A capital structure which was appropriate when banking loans were the main source of financing may turn out to be inadequate when longer-term sukuk, institutional investors, or capital market refinancing become available. Figure 1 shows a lifecycle framework in which the project's economics and the way risk is allocated determine the level of debt capacity, which in turn guides the selection of financial instruments, monitoring, and refinancing.

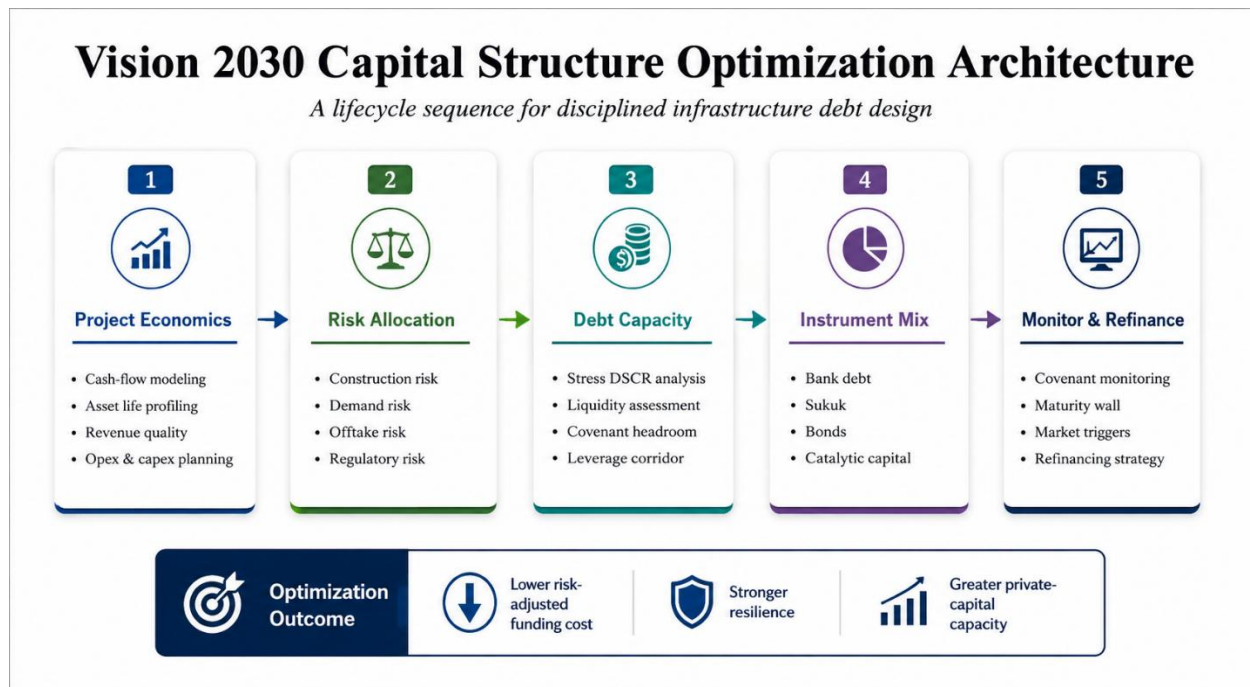


Figure 1. Vision 2030 capital structure optimization architecture.

## VI. SYNTHESIS: A DYNAMIC CAPITAL-STRUCTURE OPTIMIZATION FRAMEWORK

The evidence indicates that a five-stage method of optimization should be adopted. In the first stage, the project's economic features must be established before any financing assumptions can affect its feasibility. The sponsors have to set the minimum level of revenue and margin needed for the asset to generate value and they must do this in order to distinguish genuine project returns from those that are increased as a result of the use of leverage against equity. In the second stage, the technical and commercial uncertainties should be converted into an explicit risk-allocation matrix, the risks relating to construction, demand, operation, regulation, counterparties, currency, and refinancing being assigned to the sponsors, contractors, off-takers, insurers, lenders, or public bodies depending on their ability to control them. The financing team should only decide on the bankable cash flow after such an allocation has been made.

In stage three, debt capacity is established for both the base case and the stressed scenario. The aim is not to reach the highest level that the lender has approved, but rather to define a leverage range which makes sure

that the minimum debt-service coverage, liquidity, covenant headroom, and the sponsor's rating capacity are all maintained. This approach is in line with the evidence that shows the level of leverage used in infrastructure projects depends on the project's financial risk and on its specific characteristics rather than on a single general ratio (Jimmy and Falianty, 2021; Hou and Ran, 2024). It also takes into account the findings of a Saudi company showing that the effect of leverage can be nonlinear (Shaddady, 2023). The framework therefore views leverage as a corridor with a preferred range of operation rather than as a single point estimate.

In the fourth stage the portfolio of instruments is optimised; when making the selection all aspects of the total cost, the tenor, amortisation, the type of security, the covenants, investor diversification, currency, disclosure requirements, the certainty of execution and refinancing possibilities are taken into account. Sukuk should be compared to bank loans and conventional bonds on economic and strategic grounds. Green and sustainability-linked debt should be used in those cases where environmental performance is important to the asset and enables credible differentiation for investors (Shalhoob, 2023; Alhejaili, 2024). Finance meant for development or

acting as a catalyst should be aimed at risks which commercial markets are unable to absorb efficiently and should not be used to hide structurally weak projects.

In the fifth stage, continuous monitoring and re-optimisation are carried out, with the triggers being changes in debt-service coverage, the manner in which the construction contingency is used, the level of reserves, interest rates, credit spreads, project ratings, covenant headroom, and market access. Refinancing should be arranged well in advance of the maturity date, particularly where there are large bullet obligations. If performance improves, the sponsors might decide to refinance the costly construction debt and cancel the guarantees; but if performance fails to meet expectations, an early maturity extension or an equity injection might be cheaper than delaying action until covenant stress occurs. Figure 2 turns these principles into a decision matrix based on the sponsors' balance-sheet capacity and the predictability of the project's cash flow.

This approach also removes the apparent conflict between corporate finance and project finance. Rather than being opposing principles, they simply show two different ways of bearing risk and handling debt capacity. Where a company has strong sponsors it can temporarily take on the project risk on its own balance sheet and, as more information becomes available, can then transfer the debt to special vehicles geared to the project or to the capital markets. In the case of companies with weaker sponsors, on the other hand, they may have to rely on separate structures, obtain secured development finance, or include more equity from the beginning. The best way therefore of arranging the financing is to decide at every stage where the risk can be carried most efficiently, rather than to keep a permanent preference for one type of financing.

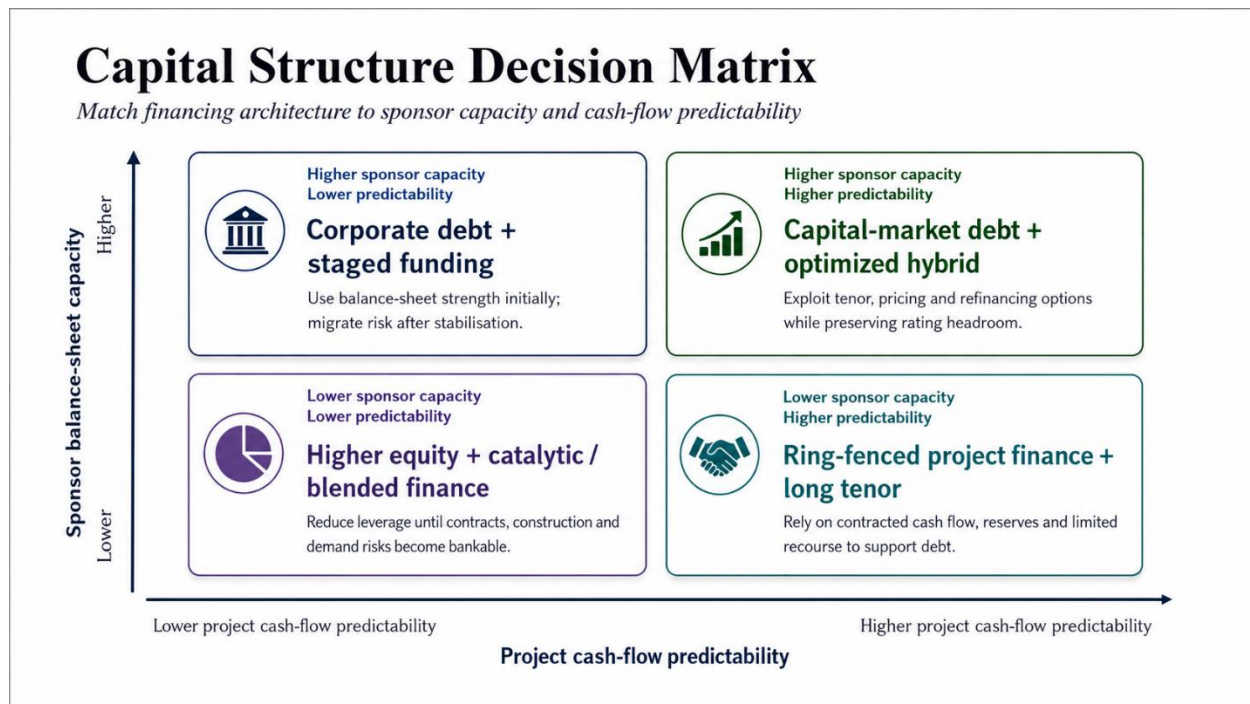


Figure 2. Capital structure decision matrix

Table 2. Capital structure optimization levers and review-derived decision rules.

| Optimization lever          | Review-derived logic                                              | Saudi relevance                                                          | Decision rule / indicator                                                                     |
|-----------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Leverage ceiling            | Debt capacity is conditional on project and financial risk        | Large multi-project sponsors must preserve future borrowing capacity     | Set leverage from stressed DSCR/LLCR and portfolio rating headroom, not lender appetite       |
| Maturity matching           | Long-lived assets require long-duration liabilities               | Vision 2030 assets often have multi-decade economic lives                | Stagger maturities; avoid large simultaneous refinancing walls                                |
| Currency and rate structure | Funding risk can overwhelm operating margins                      | Domestic and dollar markets are both relevant funding sources            | Match debt currency to net cash flow; hedge material benchmark-rate exposure                  |
| Risk allocation             | Lenders price residual construction, demand and counterparty risk | PPP, offtake and availability-payment structures can improve bankability | Allocate each material risk to the party best able to control or absorb it                    |
| Liquidity protection        | Timing shocks can cause default before economic insolvency        | Mega-project ramp-up and phased delivery create cash-timing risk         | Maintain DSRA, committed liquidity and conservative distribution tests                        |
| Contingent liabilities      | Limited recourse may still hide sponsor support obligations       | Groups can accumulate guarantees across multiple SPVs                    | Measure economic leverage including guarantees, support undertakings and correlated exposures |
| Investor diversification    | More channels can reduce bank and refinancing concentration       | Saudi sukuk/debt markets are rapidly deepening                           | Use instrument layers only when they provide distinct tenor, liquidity or investor benefits   |
| Lifecycle refinancing       | Risk and information change after completion and stabilization    | Market reforms can create new refinancing options over project life      | Review financing at milestones; prepare refinancing well before maturity                      |

## VII. POLICY AND MANAGERIAL IMPLICATIONS

Corporate boards and chief financial officers should ensure that the debt policy concerning the Vision 2030 infrastructure is managed at the portfolio level. The boards should approve general limits on leverage, contingent liabilities, maturity, and liquidity, incorporating both the consolidated debt and the support commitments made to the project companies. The investment committees should be provided with

the financing cases that illustrate the downside debt-service coverage and refinancing exposure, and not merely the base-case internal rates of return; otherwise there would be a tendency to approve projects in which the equity returns appear attractive simply because of the use of aggressive leverage.

Saudi market regulators and financial institutions can benefit from the continued development of sukuk and debt instruments since this will help to decrease the concentration of bank lending and provide longer-

duration capital. The regulatory approach is already favourable, featuring simplified conditions for issuing sukuk and a broader range of eligible issuers (Capital Market Authority, 2024b). Yet further advancement in this area will depend on the liquidity of the secondary market, reliable credit evaluation, clear disclosure, the establishment of benchmark curves, and a diverse group of institutional investors. In the fourth quarter of 2024, the Saudi Exchange said that the size of the sukuk and bonds market had reached 633.5 billion riyals, illustrating the level of financing available via market-based methods (Saudi Exchange, 2024).

Public and development organisations should use credit enhancement selectively if they want to draw in private financing without at the same time distorting price signals. The National Infrastructure Fund can serve a particularly useful function when it comes to financing new technologies or projects which are of a first kind, since in these cases commercial lenders face information gaps (National Infrastructure Fund, 2024). Similarly, the PIF's large investment programme can create anchor assets and set market standards (Public Investment Fund, 2025). The objective of the policy should be progressive commercialisation since support is most effective when it enables projects to move towards independent refinancing rather than simply replacing market discipline.

#### VIII. RESEARCH GAPS AND FUTURE AGENDA

Important gaps remain in the evidence. While Saudi research tends to concentrate on the leverage of listed companies, there are still very limited project-level datasets relating to capital structure, covenant design, spreads, refinancing outcomes, and the actual cash flows from infrastructure projects. Future research should establish project-finance panels in Saudi Arabia for the transport, utilities, tourism, digital infrastructure, and renewable energy sectors. Such a study could look at whether the level of leverage which is optimal varies systematically depending on the revenue model, the degree of government support, the type of sponsor, and the stage of the project. Given that recent evidence regarding public-private partnerships has shown the determinants of capital structure to have threshold effects (Hou and Ran,

2024), nonlinear and machine-learning methods might be particularly useful.

Research should also look at conventional bonds together with sukuk on a project by project basis, considering factors such as rating, tenor, security, liquidity, and the amount of the issuance. The next step should be to assess the economic value of guarantees and of contingent sponsor support, since these are frequently omitted from the reported leverage. Finally, the studies should investigate whether green or sustainability-linked labels result in lower all-in funding costs when the costs of verification, disclosure, and covenants are taken into account. If these questions are addressed, Saudi infrastructure finance will move from a simple description of market development to one that is based on evidence in the field of capital-structure engineering.

#### IX. CONCLUSION

Corporate debt financing will remain essential if the infrastructure objectives of Saudi Vision 2030 are to be achieved, but the main problem is not one of maximizing the amount of debt. The real issue is to establish a financing structure that can secure long-term capital without at the same time compromising cash-flow resilience, corporate ratings, liquidity, and the capacity to make future investments. Evidence from 2020 to 2025 shows that the level of leverage is affected by project risk, the characteristics of the sponsor, the quality of the institutional arrangements, the terms of contract protection, and market conditions. The growth of Saudi Arabia's sukuk and debt markets has greatly widened the range of financing options available, together with additional capacity being provided by international markets and catalytic institutions.

The review therefore recommends taking a dynamic, lifecycle approach. Sponsors should evaluate their debt capacity according to stressed cash flow, match the term of the debt to the life of the asset, diversify the instruments without adding unnecessary complexity, assign the risk to appropriate counterparties, consolidate any contingent liabilities, and make sure that refinancing is arranged well before maturity. Corporate and project finance should be used flexibly depending on where the risk is most appropriately shouldered at each stage of

development. By adopting this approach, the capital structure should function as a strategic tool for lowering the risk-adjusted cost of funding and for attracting private capital, rather than being based on a fixed leverage ratio. This practice can also boost market confidence, increase transparency, and assist in keeping borrowing capacity intact over the various national investment cycles. When applied consistently, this method can help to promote more viable, resilient and financially sustainable infrastructure investments in line with Vision 2030.

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