



# A COMPARATIVE ANALYSIS OF DESIGN-BUILD-OPERATE-TRANSFER AND BUILD-OPERATE-TRANSFER MODELS IN PUBLIC-PRIVATE PARTNERSHIPS

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## Abstract

Study presents a comparative analysis of Design-Build-Operate-Transfer (DBOT) and Build-Operate-Transfer (BOT) models in the context of Public Private Partnerships (PPPs) for infrastructure development. While both models facilitate private sector participation in public infrastructure projects, DBOT integrates the design phase into the project lifecycle, whereas BOT traditionally separates it. The study examines their structural components, financial mechanisms, risk allocation strategies, operational flexibility, and long-term sustainability. Using a descriptive research design and drawing from extensive secondary data, including case studies, academic literature, and institutional reports, the study evaluates both models against critical performance indicators such as cost efficiency, service quality, innovations, stakeholders engagement, and value for money. Theoretical insights from agency and institutional theories underpin the analysis, offering a dual lens on incentive alignment and regulatory environments. Findings indicate that DBOT offers superior integration, risk management, and adoptability, making it suitable for complex, innovation-driven projects. Conversely, BOT is more appropriate for stable, revenue-generating projects with well-defined deliverables. The study contributes to the limited comparative literature on PPP models and provides actionable insights for policymakers, partitioners, and financiers in selecting an optional delivery framework for sustainable infrastructure development.

**Keywords:** Design-Build-Operate-Transfer, Build-Operate-Transfer, Public-Private Partnerships, Infrastructure Development, Private Sector Participation, Optimal Model Selection.

## 1. INTRODUCTION

The global demand for modern, resilient infrastructure consistently outstrips the financial and technical capacity of governments (Kamel et. al., 2022). Public-Private Partnerships (PPPs) have become a crucial strategy to bridge this gap, leveraging private sector capital, expertise, and efficiency for public benefit. Among the diverse PPP models, Build-Operate-Transfer (BOT) has long been a cornerstone for large-scale projects like toll roads and power plants (Markom et. al., 2012). Its core principle – private financing, construction, operation for a defined concession period, followed by asset transfer – offered a solution to public budget constraints. However, traditional BOT often presented challenges (Patil & Laishram, 2016). A critical limitation was the frequent separation of the design phase (handled by the public sector) from the build and operate phases (handled by the private concessionaire) (Wu & Zhang, 2013). This disconnect could lead to costly design flaws discovered during construction, inefficient designs imposing higher long-term operational costs, disputes over accountability, and stifled innovation, as the builder/operator had limited input into the initial concept (Opawole et al., 2018). These issues highlighted the need for models fostering greater integration and lifecycle optimization (Liu et. al., 2014; Mahalingam et. al., 2011). The Design-Build-Operate-Transfer (DBOT) model emerged as a significant evolution to address these shortcomings (Aladag & Isik, 2019; Chang & Chou, 2014). By explicitly bundling the Design responsibility with Build, Operate, and Transfer into a single, long-term contract awarded to a private consortium, DBOT fundamentally shifts the paradigm (Lozano & Sanchez-Silva, 2019). A single entity is now

accountable for conceiving an asset it will construct, finance, operate, and maintain (Button, 2016; Cherkos et. al., 2020). This integration aims to align incentives across the project lifecycle (Larsson et al., 2022), the private party is motivated to design for buildability, operational efficiency, and long-term maintainability, potentially unlocking innovation and reducing interface risks and disputes. Alongside DBOT, the Build-Own-Operate-Transfer (BOOT) model remains prevalent (Akhtar et al., 2023; Chowdhury et. al., 2020) While sharing the core BOT structure, BOOT introduces a key nuance, the private entity typically holds legal ownership of the asset during the concession period (Markom et al., 2012b). This ownership can facilitate financing but raises distinct considerations regarding asset control, residual value, and condition at transfer, contrasting with DBOT where the public sector usually retains ultimate ownership, granting only a concession or lease (Parrado & Reynaers, 2018; Lavlinskii et. al., 2016). Despite their widespread application and the theoretical advantages of DBOT's integrated design, a nuanced understanding of their core structures and a rigorous comparison of their practical effectiveness is essential yet often lacking. Policymakers, practitioners, and financiers face critical choices between these models, with significant implications for project success, risk allocation, cost efficiency, and ultimate public value. Clear answers to two fundamental research questions are therefore vital:

*RQ1; What are the Fundamental Components of DBOT and BOT Models in PPP?*

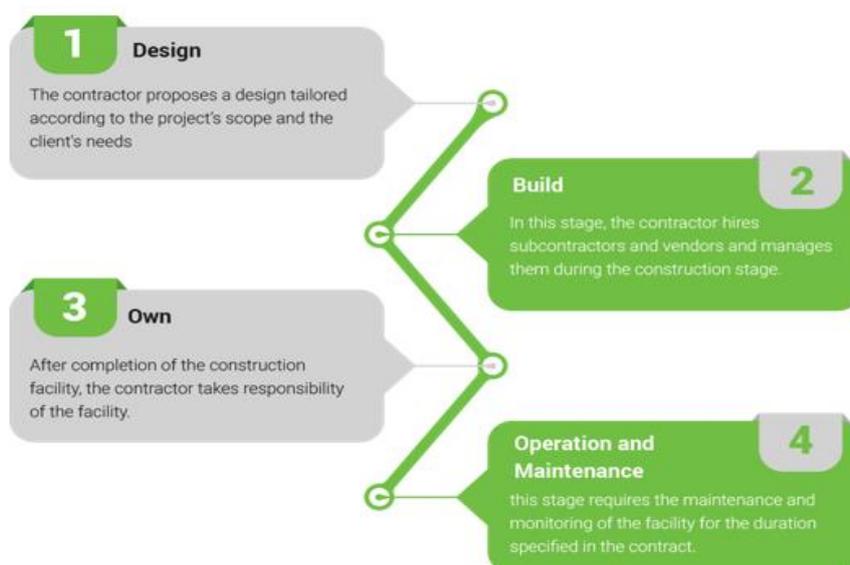
This research will dissect the core contractual, financial, risk allocation, and operational elements defining each model, moving beyond superficial similarities to clarify their distinct structural DNA, particularly the implications of integrating design in DBOT.

*RQ2; How does the Effectiveness of the DBOT Model Compare to the BOT Model in PPP?*

Beyond structure, this study will compare DBOT and BOT across crucial dimensions, project delivery (time/cost predictability), operational performance (efficiency, quality), innovation adoption, lifecycle cost efficiency, risk management efficacy, and overall Value for Money (VfM) (Malek & Gundaliya, 2021).

## 1.1. Key Features of DBOT & BOT Model

### 1.1.1 DBOT Model:



**Fig 1: Overview of DBOT Model**

*Source: METCO Engineering*

The Design-Build-Operate-Transfer (DBOT) model is a form of PPP where a private entity is responsible for the entire life cycle of a project, including design, construction, operation, and eventual transfer back to the public sector (Huang, et. al. 2016).

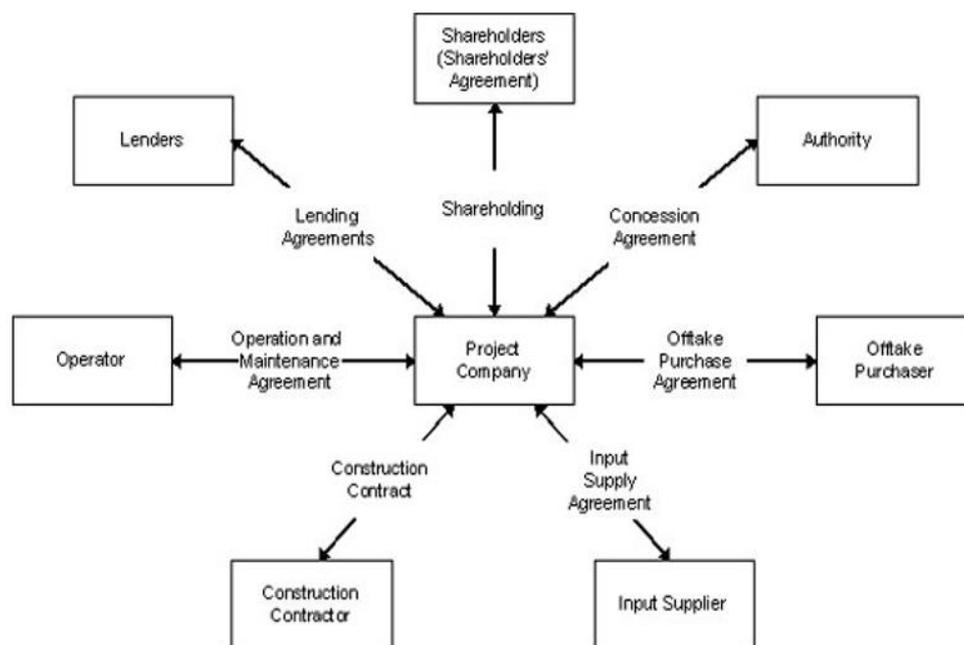
**1.1.2. Design:** The private body will design the works specific to the infrastructure project. These Works will include detailed plans and specifications to achieve the intended objectives and requirements of the project.

**1.1.3. Build:** Upon completion of the design, the private entity will construct the project. The build stage involves procurement of all relevant materials, hiring of contractors, as well as organizing any activity for construction to ensure that the construction is made under the applicable parameters determined below.

**1.1.4. Operate:** The private partner operates and maintains the infrastructure after construction over an agreed period, which is often the long-term concession period. Thus, during this period, the private partner will be responsible for the in-and-out running of the facility and routine maintenance while also triggering some larger maintenance operations.

**1.1.5. Transfer:** The private partner subsequently hands back the infrastructure to the public sector at the end of the agreed concession period. The transfer is usually done along with all the knowledge, expertise, and enhancement achieved by the private partner during its operation (Levainen & Korthals Altes, 2005; Murphy, 2008). To sum up, the DBOT model consolidates all-encompassing powers of the private partner during the project cycle with the shift of operational risk to the private partner, long-term concession period for recovery of investment and profit by the private partner, while maximum efficiency and innovation is ensured throughout the project life span (Petersen, 2014).

**1.2. BOT Model:** Another form of PPP is the Build-Operate-Transfer (BOT) model whereby a private party undertakes financing, design, construction, and operation of a public infrastructure project (Muhammad, et. al., 2016).



**Fig 2: Overview of BOT Model**

*Source: PPPLRC- World Bank*

**1.2.1. Build:** The private entity, often a consortium or special purpose vehicle (SPV), is responsible for the construction of the infrastructure project. This involves securing financing, procuring materials, and overseeing the construction process.

**1.2.2. Operate:** Following construction, the private entity operates and maintains the infrastructure for a specified concession period. The private partner is responsible for day-to-day management, maintenance, and, in some cases, facility upgrades.

**1.2.3. Transfer:** At the end of the concession period, ownership and operation of the infrastructure are transferred back to the public sector. The transfer may involve the facility in good condition, potentially with some residual value, depending on the terms of the agreement (Adeoye and Islam, 2019; Costantino and Pellegrino, 2015; Parlak and Hashi, 2021). Finally, the private entity bears the financial and operational risks during the concession period, revenue is generated through user fees, tariffs, or other revenue-sharing mechanisms, with emphasis on the economic viability of the project, as the private entity aims to recover investments and earn profits and flexibility in project financing, allowing the private sector to leverage its financial resources and expertise (Lam & Yang, 2020)

## 2. RELATED STUDIES

Winata & Gultom (2024) examined how different contract models (BOT, SBOT, DBFOM) affect the governance and performance of PPP toll roads in Indonesia, finding that SBOT and DBFOM contracts have lower costs and shorter completion times than BOT contracts due to better incentive structures and control mechanisms, highlighting the importance of contract choice in minimizing transaction costs and mitigating risks.

Similarly, Alqahtani, et. al., (2024) explored the critical success factors for PPPs in sustainable housing projects in Saudi Arabia, prioritizing fourteen significant factors and identifying the Build-Operate-Transfer model as the most effective modality, to enhance project sustainability and effectiveness under Vision 2030.

Likewise, Farrell & Vanelslander (2015) analyse the similarities and differences in PPP structures between airports and seaports in low- and middle-income countries, finding that while similarities generally outweigh differences, key divergences exist in private sector partners, PPP models, competitive tendering, and facility bundling.

In the Same way, Akhtar et, al., (2023) identified the various execution modes and their respective risks for public-private partnership (PPP) infrastructure projects by categorizing them into four groups and seven stages of the PPP life cycle, using insights from 34 PPP experts worldwide. In similar fashion, Attarzadeh et, al., (2017) Proposed a model to evaluate early fund generation options and calculate guaranteed revenue bounds for PPP-BOT projects, aiming to mitigate revenue risk and enhance negotiation flexibility for both public and private sectors.

In parallel, Lozano & Sanchez-Silva (2019) presented a model to maximize the utility of public and private entities in infrastructure projects by optimizing system performance and maintenance decisions through a combination of game theory, simulation, optimization, and agent-based modeling. Identically, Nikjoo et. al., (2012) evaluated PPP models in public hospitals globally based on performance indicators to select suitable models for Iranian hospitals, providing evidence for policymakers to address financing issues and improve performance.

Correspondingly, Dabarera et. al., (2019) identified the Build–Own–Operate–Transfer model as the most suitable PPP model for road construction in Sri Lanka, but notes that it may not be attractive to investors due to high payback periods and suggests that including other infrastructure is necessary for feasibility. Similarly, Le et. al., (2020) investigated the significance of risks in Built Operate Transfer (BOT) transportation projects in Vietnam, identifying key risks and providing insights for stakeholders and policymakers to improve project success and risk management. Likewise, Anwar et, al., (2017) explored the use of PPPs to address urbanization challenges and achieve Sustainable Development Goal 11 in South Asian cities like Dhaka and Lahore, providing a new approach for policy makers and identifying risk factors in 3P projects.

From the above studies it is evident that very limited studies are Compared the Models of PPPs, in this study addresses a gap in the literature, While BOT/BOOT is widely studied and the benefits of integration are often theorized, rigorous comparative analysis specifically contrasting the effectiveness of DBOT against the established BOT framework is inadequate. By systematically unravelling the components of DBOT and BOT and providing an evidence-based assessment of their relative strengths and weaknesses across key performance indicators, this study aims to provide actionable insights. It helps to empower stakeholders to make strategic decisions when structuring future PPPs, ultimately contributing to the delivery of better-designed, more efficiently operated, and sustainably financed infrastructure that delivers permanent public value.

### 3. METHODOLOGY

This research has descriptive research design to study and compare DBOT (Design-Build-Operate-Transfer) and BOT (Build-Operate-Transfer) contracts in PPP infrastructure projects (Osei-Kyei, & Chan, 2018). The study is based on secondary data sourced through systematic reviews of literature, case studies, and project reports.

The academic databases of Scopus and ScienceDirect were used to collect relevant peer-reviewed articles and research papers. The search process was guided by the keywords "DBOT model", "BOT model", "PPP infrastructure", "project performance", and "risk allocation". Furthermore, insights were drawn from documents published by governments and international institutions as well. Some of the very important ones are reports by the World Bank and Asian Development Bank. The analysis intends to compare DBOT and BOT across various dimensions such as project design responsibility, risk allocation, financing structure, operational efficiency, and value for money.

Special emphasis is on integration of design in the DBOT model which lacks the integration in classical BOT. Two theories that support the study include Agency Theory and Institutional Theory. Agency Theory helps to explain what incentive and accountability are put in place between the public and private parties. Institutional Theory deals with how the legal, political, and regulatory environments affect the efficiency of any given PPP model.

### 4. THEORETICAL FRAMEWORK

To critically analyse the structure and effectiveness of PPP models—DBOT and BOT—this study draws on two prominent theoretical lenses Agency Theory and Institutional Theory (Dimaggio and Powell, 1983; Garen,1994). This study integrates Agency Theory and Institutional Theory to analyze the effectiveness of DBOT and BOT models in PPPs. Agency Theory highlights the principal-agent relationship, where the public sector (principal) delegates

infrastructure development to private entities (agents) (Garen,1994). In traditional BOT models, the public sector often controls the design phase, creating misaligned incentives, cost overruns, and operational inefficiencies. In contrast, DBOT integrates design, build, and operate responsibilities under a single private entity, promoting better alignment, reducing information asymmetry, and improving accountability throughout the project lifecycle.

Institutional Theory complements this view by emphasizing how PPP models are shaped by broader institutional environments, including legal frameworks, cultural norms, and governance systems. While DBOT may perform better in environments that support innovation and integrated planning, BOOT or BOT models may persist in systems influenced by institutional inertia, regulatory rigidity, or normative pressures (Dimaggio and Powell, 1983).

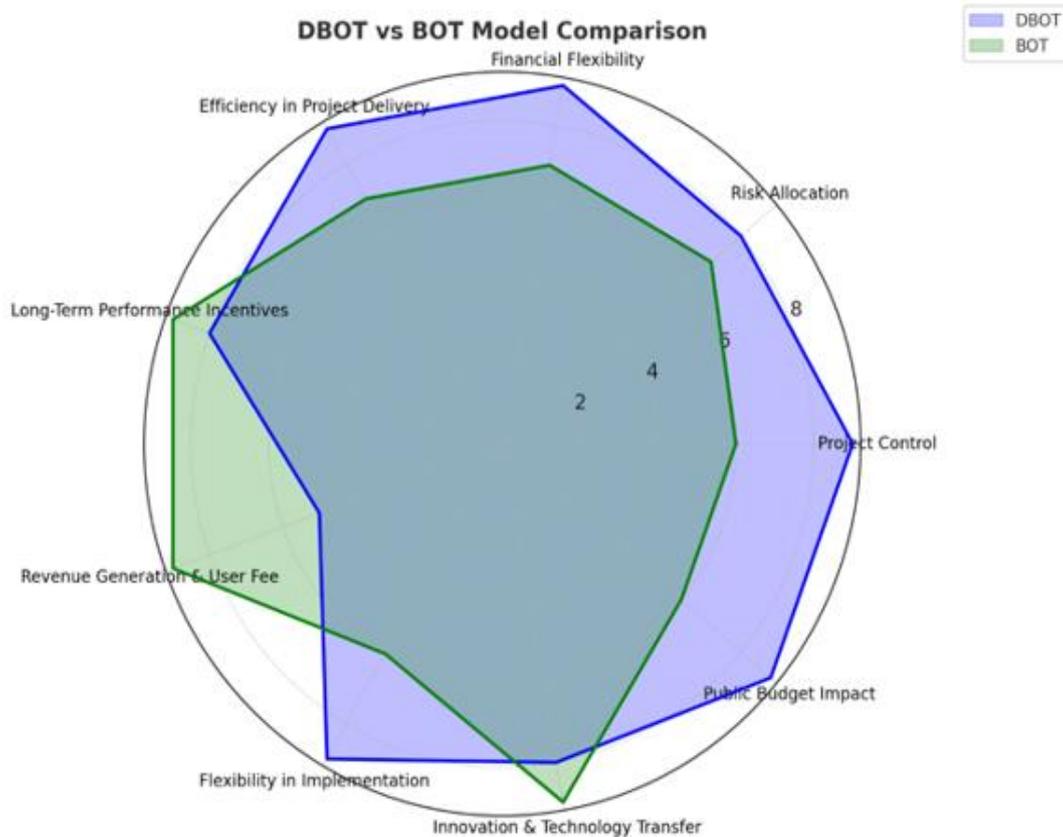
Combining both theories provides a comprehensive lens to assess PPP model effectiveness across different contexts. By integrating Agency Theory and Institutional Theory, this research adopts a multi-level analytical lens to compare DBOT and BOT models. Agency Theory enables a granular understanding of contractual structure, risk allocation, and incentive alignment, while Institutional Theory expands the analysis to include regulatory, normative, and socio-political influences that shape the effectiveness and adaptability of each model.

**Table 1: Comparisons of Key Factors of DBOT and BOT model**

Factors	DBOT	BOT
Risk Allocation	Design and Construction Risks Handled by the private entity, ensuring quality and timely delivery. Operational Risks Managed by the private party during the concession period. Transfer Risk Responsibility lies with the private partner at the end of the concession.	Construction Risks Borne by the private entity, covering delays and cost overruns. Operational Risks Private partner ensures efficient and effective project operation. Transfer Risk Addressed during the concession agreement with responsibilities defined.
Project Control	Provides the public sector with comprehensive control over the entire project life cycle, ensuring alignment with public goals and standards (Levitt 2018).	BOT offers flexibility for private entities to exercise control over design and construction, potentially fostering innovation and efficiency.
Long-Term Performance Incentives	Encourages sustained performance throughout the concession period, fostering innovation, maintenance, and upgrades.	Private entity has an incentive to maintain efficient operations to maximize revenue, ensuring ongoing service quality.
Revenue Streams	The Government pays the private company regularly based on how well the project is working and maintained	The Private Company earns money by charging users for Service and May also Pay a fee to the government for operating the project.
Public Sector Control and Involvement	The public sector stays involved in all stages, ensuring more control and active participation in the project.	The public sector has less control during operations, giving the private partner more freedom in daily management.
Government Support	The public sector may provide regular availability payments, offering financial stability.	The project mainly depends on user fees, with less reliance on direct government fundings.
Stakeholder engagement	Stakeholder engagement happens throughout the entire project. The public sector stays involved to address concerns and ensure smooth collaboration	Stakeholder engagement is mainly during operations, focusing on users and community. Public sector involvement may be limited during construction.

## 5. COMPARATIVE ANALYSIS OF DBOT AND BOT MODEL:

### 5.1. Strengths and Comparative Merits of DBOT and BOT Approaches



**Fig 3: Spider Chart of DBOT and BOT advantage**

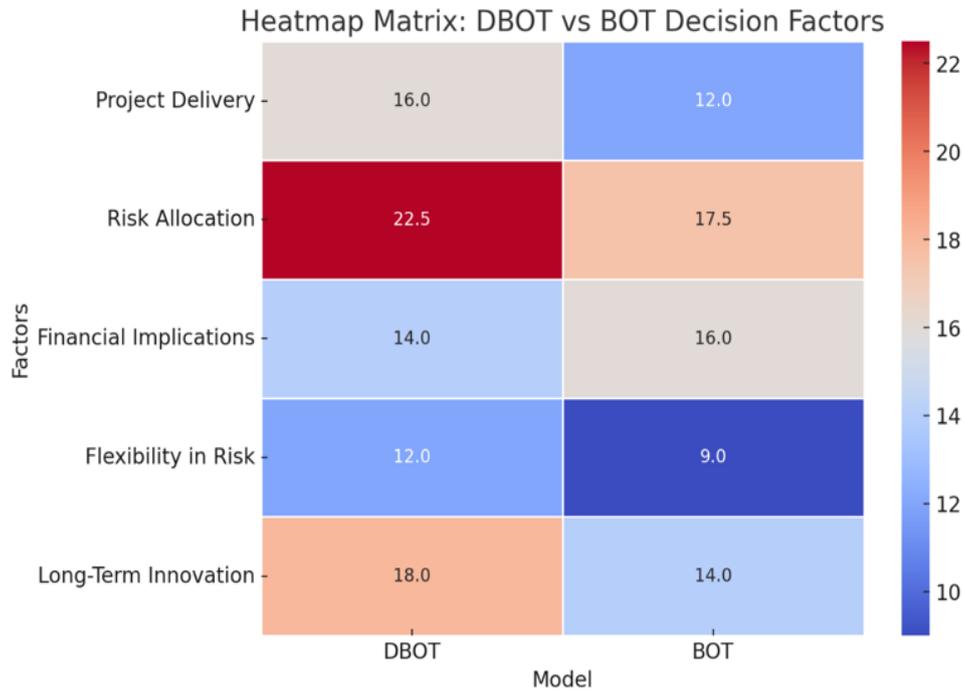
The Spider Chart (Radar Chart) has been devised to indicate the comparison between DBOT and BOT models based on nine aspects, all on a scale of 0-10. Better Project Control represents DBOT because it's mandated with greater involvement by the public sector, while BOT demonstrates more control in the hands of private operators.

Risk Allocation in DBOT remains better since it bears a much greater viewpoint of Financial Flexibility coming from funding by public investments, as opposed to BOT forged by investments from private investors (Koppenjan, 2005).

DBOT commands Efficiency in Project Delivery, which is due to the very strong interactive exercise. In the contrary, BOT exceeds DBOT in Long-Term Performance Incentives and Revenue Generation, because the feed from user fees and private profits. Flexibility in Implementation is more in DBOT, whereas BOT's flexibility is kept hands tied.

BOT leads on Innovation and Technology Transfer as a result of private investments in infrastructure improvements. Public Budget Impact is comparatively less in DBOT. However, BOT can act negatively as it drives the finances and may create problems if the revenues become insufficient. Both models have their pluses and minuses. The choice depends on the particularity and specific needs of the project, tolerance of risk, and priorities of different stakeholders (Zangouinezhad and Azar, 2014).

## 5.2. DBOT and BOT Models in Terms of Project Delivery and Risk Allocation



**Fig 4: Heatmap Matrix for DBOT and BOT Decision Factors**

This heatmap provides an insight into DBOT and BOT models, comparing their performance against the five major decision factors of Project Delivery, Risk Allocation, Financial Implications, Risk-related Flexibility, and Long-term Innovation. Each of the five factors had its weighted score. As for DBOT, it exhibited better overall performance in most aspects, particularly in Risk Allocation (22.5 vs. 17.5) and Long-Term Innovation (18 vs. 14)-ever showing its strength in risk management and continued innovation for the entire lifecycle of the project. DBOT comprises design with construction and operation integration within a delivery approach with more adaptability. BOT ranks higher in Financial Implications (16 vs. 14) and demonstrates that this model is better in revenue generation directly from user fees as opposed to relieving the public sector financial burden during project delivery. However, BOT is constrained in construction and operational phases; thus, it does not manage risk across the whole project. Taken altogether, DBOT is meant for projects with a long duration and innovations driving their implementation, while BOT fits any project focused on revenue generation. The model choice depends on project goals and financial strategies.

## 5.3. The Financial Considerations and Funding Mechanisms of the DBOT and BOT Model

The models are different from each other under DBOT because private entities shall invest equity with non-recourse debt financing in design, construction, and operations for some periods thereafter, while income is obtained directly from payments coming from the public partner in recognition of asset availability/performance with service quality intended to promote mutual cooperation and share risk. Performance-based payment entails responsibility among parties. Long-term sustainability is promoted regarding financial planning. The pooled equity is based in a private consortium or Special Purpose Vehicle (SPV), having nonrecourse debt, although revenues are heavily dependent on user fees, tariffs, and concession fees, whereby demand risk will be spread to the private party. Payments will generally be kept

private and depend more on performance along the lines of operation and financial planning focus through market studies and revenue forecast. The selection depends on the risk profile of the project, revenue potential, and desired level of partnership. Although DBOT promotes public-private collaboration, BOT focuses on private ownership as well as user-driven income (Liang, et, al., 2018).

#### **5.4. Time Frame and Project Life-Cycle of DBOT vs BOT Models**

The DBOT and BOT models differ in complexity, project type, flexibility, and risk mitigation. DBOT mainly due to the flexibility of accommodating private participation, the larger and more complex projects with variable operational needs that generally take so long for completion would do well under DBOT. BOT may contract and restrict the focus to the construction phase followed by the operation phase where a shorter time frame is adopted to finish with efficiency to the said phases unless otherwise stated (Hodge and Greve, 2016). It is more flexible under DBOT; thus, the project may adapt more to the changes that occur along the project life while under BOT, the degree of change might also be there, but it may be a little more difficult to accommodate post-construction. Accordingly, risk distribution varies between DBOT and BOT in that under DBOT, risk is allocated considering all phases of the project while BOT allocates risk mainly with regard to the operational phase subject to demand variability (Wang, 2015). DBOT and BOT choice ultimately depends on project complexity, project type, project flexibility, and the level of private participation desired. An understanding of these aspects is essential for selecting the most appropriate model for infrastructure development.

#### **5.5. Flexibility and Adaptability in DBOT vs BOT Models**

The DBOT and BOT models differ in flexibility across design, construction, operations, and transfer phases. In DBOT, the private entity has more flexibility to adjust designs and construction as project needs evolve. It can also adapt operations to changing conditions, technology, or user demands, with continuous stakeholder input and adaptable risk strategies. During the transfer, lessons learned can improve future projects (Debela, 2021). In BOT, design and construction flexibility is limited once building starts. Operational flexibility exists but may be restricted by contracts. Stakeholder engagement focuses more on operations, with fewer chances for major changes. Risk strategies can adapt but face contract limits. The transfer phase allows review but few major changes (Cheung et, al., 2012). Overall, DBOT offers more adaptability and stakeholder involvement, while BOT is more rigid but still provides some flexibility. The choice depends on the project's needs, risks, and goals of the public and private partners.

#### **5.6. Project-Specific Factors influencing the choice between DBOT and BOT**

The DBOT and BOT models are both public-private partnership (PPP) models, but they are designed for different types of projects. For example, DBOT works on complex projects such as transport systems or utility-related infrastructure, where design, construction, and long-term operation need to be integrated. Under DBOT, private players enjoy freedom in controlling an entire project lifecycle, which incorporates adaptability and innovation while better risk management. DBOT is used when the public sector wants to shift risks and financing but still be involved. This model also meets the client's requirement for extensive operational expertise through long-time concessions. However, BOT is mainly suitable for stable projects, such as toll roads or power plants, as it emphasizes construction efficiency. Here, the private sector handles construction and operations and earns through user fees or tariffs. Therefore, BOT is less flexible and future changes, but it's okay for predictable needs. Among other things, DBOT





fluctuations (AL-Dabbagh & Gelisen, 2021). Financial risks are to be shared in DBOT, with government guarantees boosting creditworthiness. More private risks are borne by BOT projects and usually mitigated through insurance or guarantees. DBOT offers more latitude to adapting to variations in a project than BOT, which has more contractual restrictions. In DBOT, stakeholder involvement continues throughout the project, unlike BOT, which engages stakeholders during operations. DBOT guarantees revenue stability, risk-sharing, and continuous engagement, while revenues under BOT are largely market-driven income, and thus the revenue risk is entirely on the private right holder. The choice of model depends on the specific objectives of the project and the profile of the risks associated with it.

### **5.9. Impact on Service Quality, Efficiency, and Sustainability of DBOT and BOT Model**

In the DBOT model, the private entity is involved from design to transfer, ensuring high service quality. They can introduce innovations and adapt to changing standards during operations. In BOT, the focus is more on construction quality, with service quality tied to user satisfaction during operations. However, BOT has less flexibility for improvements after construction is completed. Efficiency of DBOT promotes efficiency across the entire project lifecycle, from design to operations. Performance-based contracts encourage the private entity to meet efficiency targets and optimize continuously. In BOT, the focus is on construction efficiency, ensuring timely and cost-effective delivery. Operational efficiency becomes important during the revenue-generating phase, but there's less room for adjustments after construction. Sustainability of DBOT encourages long-term sustainability, as the private entity has incentives to adopt sustainable practices for better long-term performance and financial returns. Sustainable technologies can also be transferred to the public sector at the end of the project. In BOT, the focus is on sustainable construction, using eco-friendly materials and methods. However, long-term sustainability depends on the concession period and the private entity's financial interests. DBOT brings continuous community engagement and generation of jobs during construction and operations for economic growth. In BOT, community impacts are largely during construction periods in which temporary jobs and economic activities were created (Agrawal, 2019). A few service-oriented BOT projects may even extend the scope of employment into the operational phase. At the same time, DBOT can offer more flexibility, sustainability, and community participation than BOT in terms of construction efficiency and operational performance (Chauhan, 2015). The choice between both depends on the projects' objectives, risk appetites, and the kind of outcomes they expect. Clear performance metrics in PPP contracts are essential to maximize the benefits of using either of the models.

## **6. DISCUSSION**

The comparative study of DBOT and BOT models in PPPs points to a more complex scenario in which each model has its unique advantages and disadvantages. Though DBOT is complete and involves the involvement of private financing throughout the life cycle of the project and risk location shared, it also brings about stability and adaptability. This feature of sustained private participation thus facilitates steady quality in service, cost-effective end-to-end efficiencies, and the possibility of long-term sustainability. The only caveat is that upfront costs might be higher and therefore would demand careful evaluation and managing of financial commitments. Private financing being a key feature of the BOT model makes one be able to have flexible and likely lower initial costs at the same time. The value of linking user payments directly to revenues exposes the private company concerned to revenue risks, so that efficient delivery and successful operation of the project become the passion. Flexibility post-construction may not be quite so obvious, but BOT types may be applied in the period of



operations for better adjustments to meet the demand and market conditions of users. There is no one-size-fits-all answer when faced with such decision, as the selection must indeed come down to the consideration of all such project-specific details, risk profiles, and the overall objectives of public and private partners. This calls for deliberation and weighing the most appropriate financial regimes, preferences in risk allocation, as well as future viability for each model in view of the requirements of each project. A well-structured PPP contract and transparent communication and continuing collaboration are defining markers for successful implementation and achieving desired outcomes. In the end, the comparative study would serve as a compass to navigate decision makers in the public and private sectors in weighing each model's strengths and challenges. Continual adaptation to emerging trends as affected by technological advancements and regulatory changes will further influence how effective and efficient DBOT and BOT can be at delivering infrastructure projects within an evolving PPP landscape. Continued research in these areas like, implementation case studies, long-term performance assessment, risk mitigation strategies, technological integration, stakeholder engagement dynamics, comparative cost-benefit analysis, sustainability and environmental impact, and public perception and acceptance can contribute to a more nuanced understanding of the strengths and limitations of DBOT and BOT models, facilitating evidence-based decision-making for future PPP projects.

## 7. CONCLUSION

In summary, comparative studies of the DBOT and BOT model systems face a number of peculiarities, advantages, and issues for either model. The comparative analysis of DBOT models and BOT would depend on project-specific factors, risk aversion to these factors, and the aims desired by the public and private stakeholders. The differentiation between DBOT and BOT models would factor in financial structuring, risk allocation, flexibility, stakeholder engagement, and long-throughputs. DBOT means private financing through the various phases of the entirety of the project, where the public focuses on providing availability payments as a steady income revenue flow for the private partner. This configuration foresees risk-sharing, fostering collaboration, and continued engagement among stakeholders. The time-bound engagement of the private firm provides flexibility for adjustments in design, building, and operation—a hallmark for DBOT-type projects where flexibilities would be required owing to changing requirements within its life span or change of external conditions. In addition, DBOT offers improved service quality, enhanced efficiency in long-term project sustainability with government payment as the main revenue source. Projects structured under DBOT would attract a higher upfront cost but their sustainability over the long-term hinges on knowledge transfer and constant participation from the private sector. The BOT model has its major operational funding during the construction phase with revenue emanating in the operational phase through user fees or tariffs. Direct revenue risk rests with the private sector under this model, while efficient delivery of the project and the success of operation are paramount. Flexibility under BOT may be somewhat constrained, one predominates alteration occurring in the operational phase. Stakeholder engagement in BOT places emphasis on user satisfaction in operations, which may have lesser focus during construction. BOT tends to place greater emphasis on construction efficiency, operational sustainability, and service quality tied to user satisfaction. BOT may have less initial cost than DBOT, whereas BOT projects may expect some degree of government subsidy, especially in the initial years of the operational phase. Knowledge transfer typically occurs at the end of the contract duration, with a much higher degree of implementation with the public sector in control over operations. All the same, the decision for either approach—BOT or DBOT—is determined by several key project-specific



factors, risk allocation measures, and the strategic goals considered by both parties, viz. the public and the private. Each of the models enjoys unique benefits suited to various project requirements. In essence, the decision for BOT against DBOT should be in line with the peculiar needs of each respective project. Moreover, a thorough analysis of financial, operational, and stakeholder considerations shall assist in determining which execution model is relevant and better suited for the particular requirements and objectives of the project. Successful implementation depends on a well-prepared contract under the PPP format, clearly defined risk allocation within the partnership, and active collaboration between public and private stakeholders throughout the project.

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