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The Efficacy of Hybrid Annuity Model: Sanitation Infrastructure

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Abstract

The Hybrid Annuity Model has garnered significant acclaim as a Public-Private Partnership (PPP) framework for highway infrastructure development since its inception in 2016, in response to a waning enthusiasm for PPP initiatives aimed at revitalizing the sector. This model is postulated to amalgamate the advantages of both public and private sectors, as it alleviates the financial encumbrance on concessionaires by permitting governmental investment of 40% of the requisite capital during the construction phase, while facilitating the reimbursement of 60% of the investment to the concessionaire through bi-annual payments over a span of 10 to 15 years, corresponding to the operational and maintenance phase. The objective of this investigation is to conduct a comprehensive analysis of the Hybrid Annuity Model in juxtaposition with road and water infrastructure projects by delineating its inherent strengths and associated issues. Through an extensive review of the literature, the model is comprehensively elucidated, encompassing the historical progression of PPP, the imperative for a novel PPP framework, the advancement of the Hybrid Annuity Model within road infrastructure, the factors contributing to the decline of HAM, modifications in the Model Concession Agreement (MCA) documentation, the procedural adoption of the Hybrid Annuity Model in sanitation initiatives, as well as the benefits and challenges delineated by various scholars in relation to HAM. This study articulates the advent of the Hybrid Annuity Model within the Road and Transport sector and subsequently examines its burgeoning application in the water sector. It encapsulates the merits and obstacles encountered in the implementation of this model within sanitation, particularly in the realm of Fecal Sludge and Septage Management (FSSM).

Keywords: PPP. Challenges in PPP model, Hybrid Annuity Model (HAM), Ham in highway projects, Declining factors of HAM in Highway projects, Sanitation Projects of Ham

INTRODUCTION

Since the inception of the public−private partnership (PPP) framework for the acquisition of publicly financed initiatives within the sanitation domain in India between the years 1996 and 1999, several variants of the model have evolved over the years One such model is Hybrid Annuity Model (HAM), which can be considered to adopt a more equitable methodology for the distribution of financing risks between public and private sectors, underscores the significance of advanced project preparedness, offers incentives for prompt completion, and addresses a multitude of additional concerns. HAM has been successful in drawing interest from the private sector and improving the bankability of road sector projects.

Interest in PPP projects began to wane in fiscal 2013 for a number of reasons, including

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developers' overly aggressive bidding, optimistic traffic forecasts, the economy's recession, and the accumulation of non-performing assets (NPAs) in the banking industry (Akshay & Neerja, 2019) [1]. In response to these challenges, the Indian government in the year 2016 formulated the MCA and implemented Hybrid Annuity Model.

The ham alleviates the fiscal pressures faced by concessionaires and concurrently addresses the constraints inherent in the Build-Operate-Transfer (BOT) toll framework. Initially the BOT model was the most popular model from PPP. The HAM represents a contractual framework meticulously designed to encapsulate all advantageous elements while effectively mitigating the detrimental aspects associated with the Build-Operate-Transfer (BOT) model. The primary emphasis of the HAM model resides in addressing the factors that precipitate the failure of the BOT model, including, but not limited to, the risks associated with revenue generation and the overall financial viability of the project.

Most of the BOT model fails when it comes to project finance, which is when the main changes in the HAM model occur. The HAM model has an equal risk shearing approach, meaning that risks are appropriately distributed, and the government additionally invests 40% of the financial resources provided for the duration of the building phase. (Gatare & Attar, 2017) [6].

Since ham is the most recent model to be applied in India's sanitation sector, there are not many examples of effectively implemented projects or data on the subject. Though the model is favorable for contractors as it mitigates the risk involved in the project, and have been able revitalize the road Infrastructure sector, but in the long run, it may not be as effective as it seems because of the various financial and economic aspects related to it (Jichkar & Paunikar, 2022) [7].

STPs are being constructed in Haridwar and Varanasi under a Hybrid annuity framework. A tripartite contract was established involving NMCG, state agencies, and the Concessionaires. (NMCG, 2017) [11]. The utilization of HAM employed for the operational management of Sewage Treatment Plants projects appears to be imminent. Considering this development, a thorough evaluation of the HAM approach becomes increasingly important. Widely recognized as the most favored paradigm for Public-Private Partnership (PPP) initiatives in the road and water infrastructure sector in recent years, HAM offers a promising avenue for financing and delivering critical wastewater treatment infrastructure.

LITERATURE REVIEW

A thorough analysis of the numerous published and unpublished works of literature, manuals, etc., that are accessible in relation to PPP, Hybrid Annuity Model pertaining to the construction of road infrastructure and sanitation initiatives. The objective is to build basic understanding of the various PPP models and their history and then identify the drawbacks in the PPP model before the introduction of Hybrid annuity structure for road construction and then access its adoption in sanitation projects. It contains critical discussion showing insights and awareness with varying contention, speculation on the topic.

Public Private Partnership's Impact on Road Infrastructure

The NHAI Act of 1998 created the National Highway Authority of India to supervise the construction of national highways. The NHDP evolved in the following phases (Nallathiga, 2019) [9].

- *Phase I:* Augmenting the "Golden Quadrilateral," connecting the four largest metropolises.
- *Phase II:* Augmenting the North-South and East-West corridors.
- *Phase III:* Creating four lanes on high-density national highways, connecting the state capitals with areas of significant economic, commercial, and tourism-related relevance.
- *Phase IV:* Upgrading unidirectional-lane to dual-lane specifications.
- *Phase V:* Expanding four-lane highways to six lanes.
- *Phase VI:* Building 1,000 km of expressways.

- *Phase VII:* Building ring roads, bypasses, underpasses, flyovers, etc.

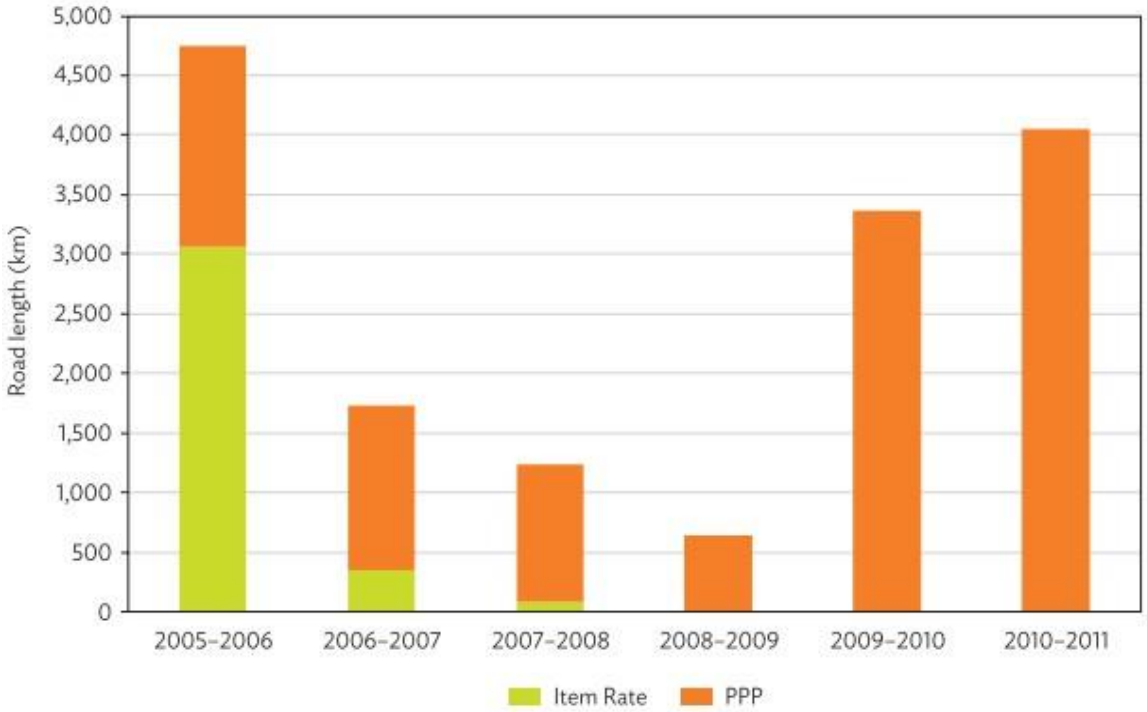


Figure 1. Transition to PPP in National Highways (Shiwakoti & Dey, Asian Development Bank, 2022).

Public Private Partnership Models

The Public-Private Partnership (PPP) represents a synergy between public organizations and private firms aimed at delivering services or projects that are traditionally under public administration. (Figure 1). PPP acknowledges the comparative advantages of each party in executing tasks The fundamental characteristic of PPP is that each party is obligated to do the optimal functionality of public services and infrastructure delivery is thereby enhanced, thereby achieving the maximization of utility in the most economically efficient manner. Such collaborations where public and private sector join forces for a shared objective of infrastructure development are termed as Public Private Partnership (PPP). Depending on the specific framework of Public-Private Partnerships (PPP), the private entity may be mandated to arrange the finance, mobilize resources for the project, improve the effectiveness, efficiencies and quality standards of infrastructure project, etc. The primary objective of PPP is to allocate risks to the parties most capable of managing them while leveraging private sector expertise for enhanced value. Consequently, PPPs are characterized by the distribution of rights, responsibilities, risks, and rewards amidst public and private entities. Furthermore, PPPs serve as a vital mechanism for advancing service delivery and fostering innovation within infrastructure domains. Various forms of PPPs exist, including DBFOT, BOT (HAM), and BOT (Annuity), tailored to project specifics. In contrast to conventional public procurement contracts, PPPs exhibit complexity, necessitating meticulous design, structuring, and execution (Department of Economic Affiars, 2023).

Evolution of Public Private Partnership Models

The PPP framework originated in the 1990s. The primary BOT (Toll) model was applied to road infrastructure. Next came the development of the MCA following the Standard Toll Policy and soon after the framework for SPV (Special purpose vehicle) formation. Model Concession Agreements came about first in 2002 for a project costing more than INR 100 Cr. The BOT (Annuity) model for NH projects was initiated in 2002-03, with NHAI awarding 8 projects. The BOT mode (Toll and Annuity) dominated PPP contracting until 2012. BOT mode (Toll and Annuity) was the prevalent model of PPP contracting till 2012. More than twenty thousand kilometers of National Highways have been awarded under BOT. In March 2013, 241 road projects were identified for completion,

while an additional 348 projects were in progress. A PPP mode for the upkeep of National Highways called the OMT (Operate Maintain Transfer) model followed the other models mentioned above in 2009. The models will be discussed in the coming sections in detail.

Bot (Toll) Mode of PPP

Design, building, maintenance, toll collecting, financing arrangements, and legal ownership are the key duties involved in the development of toll roads. The most popular method for allocating tasks in toll road projects is the Build Operate Transfer (BOT) model. The concessionaire undertakes a major share of responsibility for construction, financing arrangements for projects, carrying out upkeep tasks and collecting tolls while the government maintains legal ownership. In most projects, the responsibility for design is collaboratively distributed, wherein the public entity assumes a predominant role in the initial design phase while the private sector finalizes the intricate details of the design, contingent upon governmental endorsement. Under the terms and conditions specified in a construction contract, the concessionaire would hire a construction business (the contractor) to carry out the construction work (Shiwakoti & Devayan, 2022) [14].

Bot (Annuity) Mode of PPP

The BOT-Annuity model is a PPP approach that does not involve traffic risk. In this version of the plan, the concessionaire will get a predetermined semi-annual annuity from the governmental body. This funding will pay the costs incurred by the concessionaire to carry out the facilities' construction, operation, and maintenance. The concessionaire is not subject to any possible traffic-related hazards under this arrangement. Furthermore, private investors are insulated from the developmental uncertainties linked to the traditional Build-Operate-Transfer (BOT) development methodology, which is characterized by significant costs and prolonged timelines. Construction, technical, operating, and maintenance risks are assumed by the concessionaire under this approach, while the granting government authority bears the other significant risks associated with land acquisition, clearances, permits/approval, traffic risk, and toll collecting risk (Khan S. K., Shiwakoti N.) [15].

Bot (Annuity) Mode of PPP Contracting

The OMT Model, a PPP framework, seeks to delegate the responsibility for road operations and maintenance to private sector through a long-term concession agreement. OMT's fundamental structure is comparable to the Build, Operate, and Transfer Toll model (BOT-Toll), which reduces highway building, operation, and maintenance and tolling to only highway operation, maintenance, and tolling. (Akshay & Neerja, 2019) [1]. Like BOT (toll) contracts, the concessionaire and the government authority sign a concession agreement that covers toll collection, periodic and performance-based maintenance, and the construction of additional project facilities (like bus shelters and toll plazas) that are turned over to the concessionaire under the terms of the OMT contract. Consequently, the following are included in the scope of work for an OMT project:

- Operation and maintenance of the project section.
- Toll collection.
- Building project amenities including bus shelters, Street lights, and toll plazas, among others. any significant maintenance (as may be required in some situations) (Narayan & Rastogi, 2022) [11].

Issues and Challenges in PPP Model

The pipeline for PPP has grown since 2006, but the pipeline for building contracts has decreased. This has corresponded with private sector developers' greater readiness to take on PPPs, along with the growing usage of toll-based forms in PPPs since 2009. When combined, PPP projects for road infrastructure – particularly those involving national highways – became significant. The government also established the "viability gap fund" for less feasible enterprises. Beginning in 2009, a notable increasing trend reached its zenith in 2012. By this point, bidders were paying the government large "concession premiums" for the concession and submitting proposals with "negative viability support". Roads and highway development represents a segment of infrastructure that retains the traditional attributes of all functions – policy formulation, decision-making, execution, and financial

management – concentrated within the governing authority, namely the Ministry of Road Transport and Highways (MoRTH). Notwithstanding the establishment of the National Highways Authority of India (NHAI) as an independent entity in 1998 tasked with the implementation of road and highway initiatives, its operational scope is increasingly intertwined with that of MoRTH, which delineates priorities, formulates policies, and allocates budgets. The sector should have been vertically disaggregated by the creation of separate agencies for the following purposes: (i) establishing standards (planning, construction, and maintenance); (ii) choosing tolls, tariffs, and other pricing policies; and (iii) project development and maintenance. With so many unallocated road projects and unbid projects, NHAI is playing the last role, but it hasn't been able to do so properly or efficiently (anomalies regarding the allocation of projects have been pointed up) (Nallathiga, 2019) [9]. Another factor that prevented some of the initiatives from succeeding and caused other businesses to abandon them was the absence of stable, long-term funding. Despite the fact that financial institutions had engaged in lending during the preliminary stages, their level of exposure to this particular sector was also approaching a state of saturation (considering the sectoral lending restrictions imposed by the RBI's exposure standards); furthermore, there was a developing perception among the financial institutions and lenders involved in the project acknowledge that the risks inherent in the sector are substantial, thereby endangering the viability of bank and institutional lending practices. Essentially a government rule, this also requires granting authority to the relevant officials to make important choices in an emergency (Paul, Agnihotri, & Sawhney, 2014) [12]. The governmental authorities have undertaken several commendable initiatives aimed at addressing the issue, particularly in relation to the provision of sustainable financial instruments through Infrastructure Debt Funds (IDFs) and governmental loans directed towards road construction developers. The consequences of these strategic maneuvers have yet to be realized; nonetheless, certain participants are currently facing a reduction in their operational capital and a marked decline of their capital base due to the diversion of resources to this sector. If such initiatives had been implemented at an earlier juncture when the engagement of the private sector was pursued, it would have significantly impacted these enterprises, which are presently entrenched in a precarious financial situation and have lost interest in further participation (Shiwakoti & Devayan, 2022) [14].

Even while PPP methods have helped projects and investments gain traction, the initial enthusiasm eventually faded. Some dangers were not completely understood by the participants in highway development projects, and they were exposed to some of them, which resulted in project failure (Nallathiga & Shah, PPP in Road Sector, 2014) [10]. Consequently, some projects were initiated but could not be completed. The Model Concession Agreement (MCA) pertaining to infrastructure initiatives, specifically road projects, proved somewhat beneficial in addressing the apprehensions associated with the distribution of project-related risks; however, the emergence of numerous additional risks within the sector necessitates enhancements in various external conditions related to these projects to effectively mitigate such challenges.

Table 1. Various Risk in PPP Projects.

Project-Related Risks (Contracted)	**Project-Related Risks (Outside Contract)**
Completion Risk	Political Risk
Operational performance risk	Economic risks
Market risk	Legal risks
Financial risk	Transaction risks
Environmental risk	Operation risks
Technical risk	

Source: (Thomas, Satyanarayana, & Ananthanarayanan, 2003).

While Build-Operate-Transfer (BOT) models have successfully stimulated project initiation and investment, their initial efficacy has been gradually eroded by the multifaceted risks associated with large-scale infrastructure projects, particularly road development. Other models, such as the EPC and Annuity models, were not considered in this case when the BOT models were adopted. Parallel to this, hybrid models and shadow toll models, which encompass both toll and annuity structures, have

not been extensively tested. Rather than adhering to a uniform policy of implementing the Build-Operate-Transfer (BOT) model, it would have been prudent to allocate projects utilizing various models tailored to specific needs, thereby facilitating an evaluation of which model proves most effective under varying conditions. With a noticeable reduction in the engagement and enthusiasm of private sector participants during the subsequent stages of bidding for BOT projects, the Government initiated a reassessment regarding the potential reinstatement of EPC models. In road development, certain development projects are once more following the EPC path. With significant operation and maintenance projects anticipated shortly, annuity models may potentially be featured today (Nallathiga & Shah, PPP in Road Sector, 2014) [10].

Hybrid Annuity Model

One of three models – Build-Operate-Transfer (BOT)-toll, BOT-Annuity, or EPC contract – is used to award road projects in India. There was an urgent need to revive PPP in the road sector to maintain its development because of the numerous problems and difficulties that both public and private entities experienced while implementing and funding such models (Figure 2). Considering the interests of all parties participating in road sector developments. The Hybrid Annuity Model, a novel contractual model, was approved by the Government's Economic Affairs Committee. According to this approach, the private sector will pay the remaining 60% of the project's cost, with the government covering up to 40%. This shared financing approach aims to alleviate the financial burden on the government. The novel HAM integrates BOT Annuity and EPC paradigms. Hybrid annuity involves a two-stage payment structure: an initial 40% fixed payment, divided into five equal installments, followed by a 60% variable payment upon project completion.

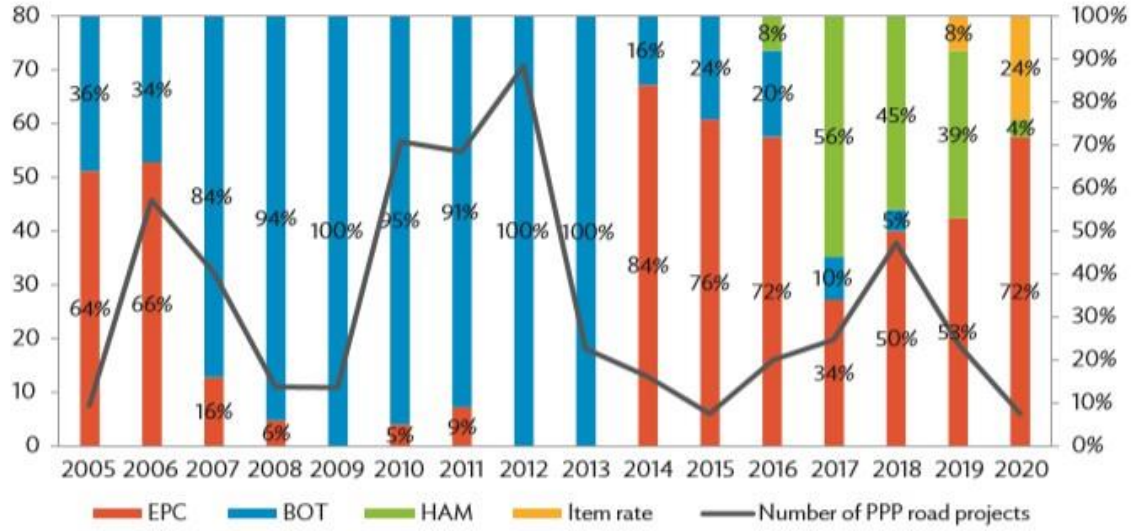


Figure 2. Revival of Private Sector Investment in India's Road Sector (Shiwakoti & Dey, Asian Development Bank, 2022).

The conventional BOT model primarily burdened the contractor with a substantial risk profile, encompassing financing, revenue, operations and maintenance (O&M), and construction risks. Conversely, the government or NHAI assumed responsibility for securing right-of-way clearances and granting toll collection rights to the concessionaire. In stark contrast, the HAM model introduces a significant shift in risk allocation.

In 2012, ham was tested as part of the World Bank-funded Karnataka State Highway Improvement Project. It was subsequently authorized by MORTH in 2016 with a few changes, such as the addition of two bidding factors as opposed to the pilot project's single variable (net present value of bid project cost (BPC) and first-year annual operations cost) (Table 1). To build national roads throughout India, NHAI embraced HAM. At the same time, ADB began facilitating HAM-based project replication

across the country. As of 2021, ADB is funding HAM projects through the Madhya Pradesh Road Sector Project, the Rajasthan Highway Investment Program (Tranches 1 and 2), and the Third Phase of the Highways Improvement Initiative in Karnataka State (Shiwakoti & Devayan, 2022) [14].

Table 2. Risk Sharing Arrangements between Government and the Private Sector in Various Contract Forms (Shiwakoti & Dey, Asian Development Bank, 2022).

Project Risk/Contract Model	Const.	DB	EPC	DBO	DBOT	DBOT-A	HAM
Design	G	P	P	P	P	P	P
Construction	P	P	P	P	P	P	P
Operations	G	G	G	P	P	P	P
Revenue Forecast	G	G	G	G	P	G	G
Revenue Collection	G	G	G	G	P	G	G
Finance	G	G	G	G	P	P	G+P

G Government P Private G+P Government + Private

Const. = construction; DB = design–build; DBO = design–build–operate; DBOT = design–build–operate–transfer; DBOT-A = design–build–operate–transfer annuity; EPC = engineering, procurement, and construction; HAM = Hybrid Annuity Model.

Ham connected long-term de-risked (Table 2) annuity payments to the "construction payment" component of EPC contracts. Compared to previous PPP models like BOT-Toll and BOT-Annuity, this contract type considerably lessened the financial burden on the private sector. Newer players appeared because of the introduction of HAM and an abundance of projects.

Due to its risk-balanced methodology, the model has a lot of promise for the future and continues to play a key role in the GOI's ambitious ambition to allocate over $1.4 trillion in infrastructure investment between FY2020 and FY2025 in accordance with the National Infrastructure Pipeline.

During the bidding round, national enterprises showed a great deal of interest in HAM-based initiatives. It was found that, on average, HAM projects received four to six bids. It was discovered that the average BPC differed from the project expenses predicted by NHAI. While the bid price for the majority of projects by large corporations was 10% more than the projected cost, the BPC was more than 10% cheaper than the NHAI estimated project cost in roughly 40% of projects where smaller bidders had been granted contracts (Akshay & Neerja, 2019) [1]. Although this suggested some aggressiveness in bid pricing, as the model developed, these tendencies gradually diminished.

Ham: Concepts & Features

According to the HAM, the authority must refund a share of the private sector's construction-related funding during the O&M stage. HAM contracts' stakeholder matrix is like those of conventional PPP arrangements.

The cost of a HAM project is ascertained by means of an open competitive bidding procedure. The winning bid is selected based on the life-cycle cost, or the present net value (NPV), encompassing both construction and O&M phases. The term "cost" is considered to encompass both direct costs and indirect costs, as well as profit margins (Jichkar & Paunikar, 2022) [7].

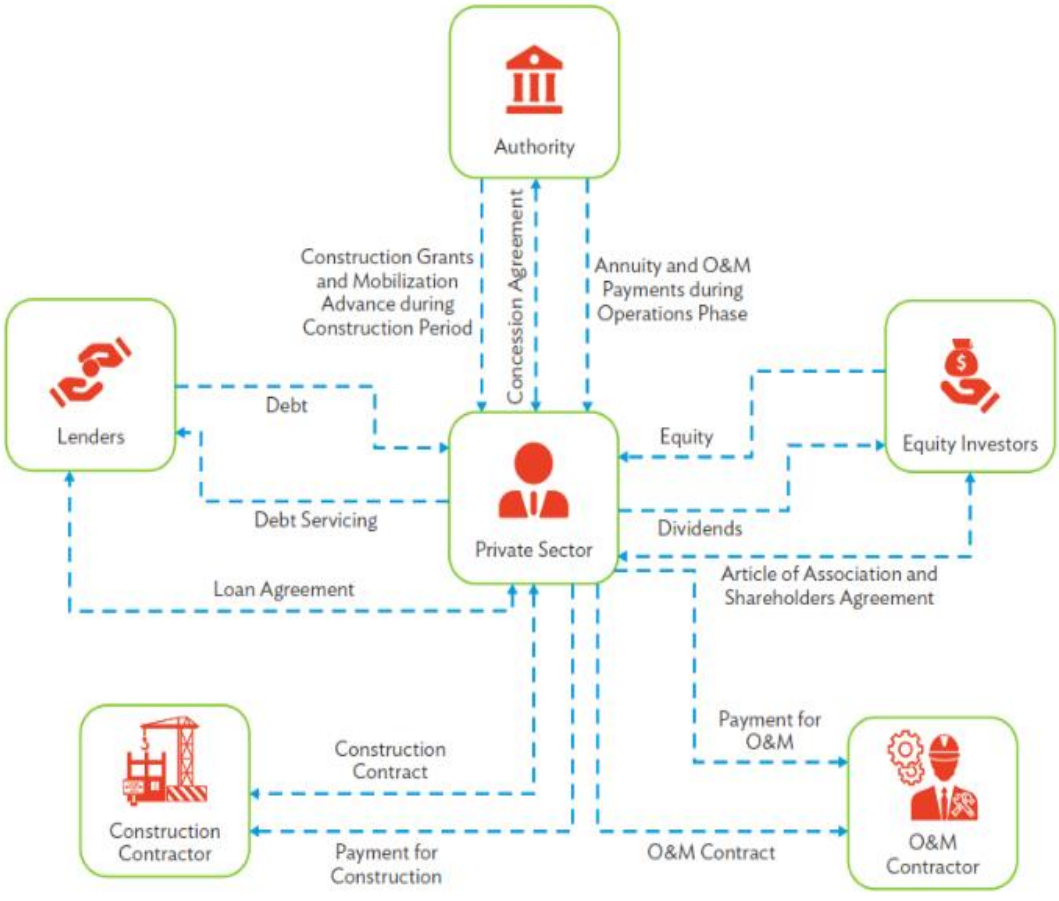
Bidders must submit bids that include bid project cost & the first-year O&M cost. HAM project bids are evaluated based on their life-cycle cost, which is determined by calculating the net present value (NPV) of the quoted cost and the projected O&M costs over the entire operational period (MORTH, 2020) [8].

Fundamental Principles of the Ham Contract Are

i. The totality of design and construction risks is assumed by the concessionaire.
ii. Milestone payments are assigned to the concessionaire, who receives only a portion of the capital expenditure incurred up to that point.

iii. For delayed completion, the concessionaire faces penalties in the form of liquidated damages for each day of delay and deferred annuity payments. Conversely, early completion can result in a bonus payment and accelerated annuity revenue streams, and
iv. Annuity payments cover the remaining deferred capital costs, accrued interest, and ongoing O&M expenses, and are made semi-annually for a predetermined period, provided performance metrics are satisfied.

The project cost during construction is jointly borne by the private sector & the government (Figure 3). The specific cost-sharing ratio is flexible and determined based on project requirements and feasibility. Initially, the government was expected to contribute 40% of the BPC in 5 equal installments, tied to construction milestones. The private sector, on the other hand, would finance the remaining 60% through a combination of equity and debt. For the sake of illustration, assuming a 75:25 debt-to-equity ratio, the authority would need to contribute about $40 million throughout development of a $100 million project that is 40% financed by the government and 60% by the private sector. $15 million in equity and $45 million in debt would need to be contributed by the private sector (Shiwakoti & Devayan, 2022) [14].



O&M = operation and maintenance.

Figure 3. Depiction of Stakeholder Ecosystem in Hybrid Annuity Model Contracts (Shiwakoti & Devayan, 2022).

After the project is finished, the government pays the private investor semi-annual annuity payments to repay the 60% of the project cost that was funded during construction. These payments also include interest that is computed using a declining balance method. Interest only starts to accrue when operations begin. The project cost is subject to adjustments for inflation, changes in scope, legal modifications, and force majeure events. Concurrently with these annuity payments, the government

reimburses the concessionaire for O&M expenses, adjusted for inflation, based on the bid price. These payments are contingent upon the concessionaire's adherence to performance standards outlined in the agreement.

Ham Project Lifecycle: From Procurement to Implementation

- *Procurement:* India's HAM contracts employ a two-stage bidding process. Initially, technical bids are assessed to verify bidder eligibility, including technical and financial capabilities. Subsequently, financial bids are evaluated for those bidders who successfully clear the technical evaluation. Bidder qualifications, such as construction and maintenance experience, are scrutinized against predefined minimum net worth and financial resource requirements to ensure adequate funding for the construction phase.
- *Contract Agreement:* The selected bidder must create a limited liability business (the concessionaire) as a special purpose vehicle (SPV) within 45 days after obtaining the letter of award. After that, the concessionaire and the authority sign a contract in which the concessionaire takes over the rights and responsibilities of the successful bidder. This contract gives the concessionaire the sole authority to build, run, and maintain the project for the duration of the concession (Jichkar & Paunikar, 2022) [7].

The Concession Agreement Is Divided into Three Distinct Phases

i. Development period.
ii. Construction period.
iii. Operation period.

The concession period, encompassing both construction and operation phases, commences on the appointed date and concludes on the transfer date. At this point, the concessionaire's rights and obligations under the agreement cease, whether through fulfillment or termination, and the project and its associated rights and interests are transferred to the authority.

Development Period: Both the parties must fulfill their corresponding preconditions during the initial development phase. The date of which all conditions are met – including financial closure, is referred as the "appointed date. (MORTH, 2020)" [8]. The development phase spans from the effective date of the concession agreement to the appointed date, this phase typically lasts 150 days.

During this stage, the concessionaire guarantees its portion of the funds. The concessionaire must guarantee the first distribution of cash in accordance with the financing arrangements to achieve financial closure. The concessionaire is given access to the site to carry out preparatory tasks including surveys, investigations, and soil testing even if there are no building activities going on during the development period.

The Authority's Obligations During This Period Include

1. Securing rights to over 80% of project site.
2. Obtaining all necessary environmental permits.
3. Securing forest clearance.
4. Approving bridge designs at level crossings.
5. Appointing a 3rd party to oversee the concession agreement.

The Successful Bidder Is Required to Establish an SPV and Under Its Name

i. Sign the concession agreement.
ii. Submit performance security.
iii. Make financing arrangements and achieve financial close.
iv. Sign the escrow and substitution agreements; and
v. Procure all applicable permits, including quarry permits to meet at least 20% of the contract requirements.

To preserve the road's quality and safety in the event of material degradation or damage, the concessionaire is usually expected to maintain the road at the project site – at its own expense – and make sure it is "pothole-free" (2020, MORTH) [8]. The authority must fix the road at its own expense if unanticipated circumstances, such floods or heavy rain, create considerable degradation or damage.

Construction Period: Construction commences only after both parties fulfill their respective conditions. During this period, while the concessionaire is not yet engaged in construction activities, they are obligated to partially finance the project as outlined in the agreement. The building phase starts on the scheduled date and ends until the independent engineer issues a completion or provisional certificate, usually in 2 to $2^{1/2}$ years (Shiwakoti & Devayan, 2022) [14].

Operation Period: Phase 3, the operational phase, commences upon issuance of completion or provisional certificate to the concessionaire. This date, marking the initiation of commercial operations, is known as Commercial Operation Date (COD).

The concessionaire operates and maintains the asset during operational phase in return, the concessionaire receives O&M costs and annuity payments per the agreement.

The O&M term, which is defined as a certain number of years, starts on the date of commercial operation or preliminary commercial operation and ends on the transfer date (Nallathiga, 2019) [9]. This is known as the operating period. In actuality, the operating period usually ranges from seven to fifteen years. While federal government-invested projects usually last 15 years, state government-invested projects frequently choose shorter durations.

Key Features of The Ham

- *Bid parameter:* The bid parameter is the present net value (NPV) of the project's lifecycle costs, encompassing both the initial bid project cost and the estimated O&M costs over the entire operational period. The bid with the lowest NPV is awarded to the developer (Figure 5).
- *Construction Funding:* The authority will provide 40% of the project value to concessionaires in 5 equal installments, tied to specific project milestones. The remaining 60% will need to be financed by the concessionaire using a mix of loan and equity.
- *Escalation provision:* The project cost will be adjusted for inflation based on a Price Index Multiplier (PIM). The PIM is determined by a weighted average of the Wholesale Price Index (WPI) and the Consumer Price Index (CPI-IW), assigned weights of 70% and 30%, respectively. The project value will be adjusted to account for any variation in the value index between the pre-bid and pre-appointed date reference indices appointed date. This adjusted value will be considered the bid project value at the start of construction. The project bid value will be adjusted according to monthly fluctuations in the PIM basis until the completion of the business operations date (COD).
- *Steady annuity payments:* The Authority will make semi-annual annuity payments to the concessionaire upon project completion to cover the remaining balance of bid project cost. These payments are structured to mirror the typical revenue profile of road projects.
- *Secured O&M funding:* O&M payments, along with rent, will be made to concessionaire by the Authority, based on quoted quantities and adjusted for inflation. The concessionaire will remain responsible for project's maintenance until the termination of concession period.
- *Revenue:* The authority shall oversee toll collection and revenue.
- *Concession Period:* The project timeline includes a construction phase tailored to the project and a designated operational phase lasting 15 years.

Declining Factors of Ham

Roads and highways constitute essential infrastructure for national mobility (Figure 4). They support the conveyance of nearly 88% of passenger traffic & 67% of freight across India, with annual growth rates estimated between 10–15% (Jichkar & Paunikar, 2022) [7].

Among various road types, highways linking different regions of the country hold paramount importance. National Highways (NHs), although representing merely 2% of the overall road infrastructure, facilitate approximately 40% of the aggregate road traffic (Nallathiga, 2019) [9]. Highway construction through the PPP model gained significant traction during the epoch of the NH Development Project, Build-Operate-Transfer (BOT) initiatives emerged as the predominant contributors.

The declining trend in the length of awarded HAM projects can be associated with several factors. Developers have faced challenges in securing financial closure, while authorities have encountered delays in land acquisition due to rising costs. Additionally, banks have adopted a more cautious approach to lending for HAM projects, and the COVID-19 pandemic has further exacerbated these issues. As a result, developers have become more risk-averse, particularly given their substantial order books.

Despite the inherent benefits of ham model, its implementation has not been without its challenges. As of now, a significant portion of projects awarded between FY2016 and FY2018 remain incomplete, with 56% completed and 37% still under construction. Moreover, 90% of the HAM projects awarded in FY2019 and FY2020 are yet to reach completion. Financial closures are experiencing delays of 3, 4 months (Figure 6).

A particularly pressing issue is the substantial delay in project commencement, with 40% of projects facing a 1.5-year delay primarily due to land acquisition hurdles. Although HAM contracts include provisions for de-scoping and de-linking to mitigate delays, approval processes have still encountered obstacles. Furthermore, execution-related challenges have surfaced. Despite most projects being awarded to experienced developers, a significant portion has encountered delays of two years or more, with only 55% physical progress achieved (Thomas A, Satyanarayana K) [16].

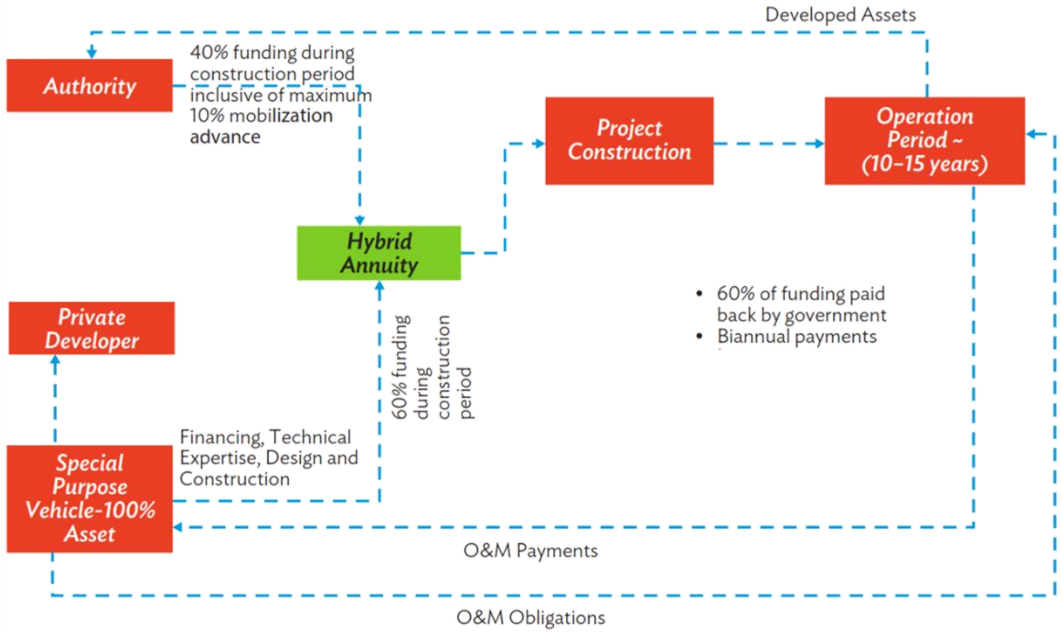


Figure 4. Typical Deal Diagram under Hybrid Annuity Model (*Source:* (Shiwakoti & Dey, 2022)).

The diminished (Table 3) standing of public sector banks, alongside heightened risk perception regarding the infrastructure sector and the implications of the COVID-19 pandemic, has led to their reluctance in increasing both fund and non-fund exposure. In response, the central government has acknowledged this situation and adjusted the financial criteria for bidders in Hybrid Annuity Model (HAM) projects. According to the revised regulations, bidders are now eligible to participate if their net worth in the previous year is 15% of the estimated project cost, a reduction from the prior

requirement of 25% (MORTH, 2020) [8]. Reasons identified by various author, (Garg, 2019) (Jichkar & Paunikar, 2022) [7], (Shiwakoti & Devayan, 2022) [14], for weaking lender base is due to higher and more stringent equity requirements mandated by lenders have resulted in delays in the infusion of funds by promoters in the project. The utilization of up-front equity and debt financing, particularly after the achievement of 30% progress in project execution, has been observed to culminate in significant delays in the completion of various projects.

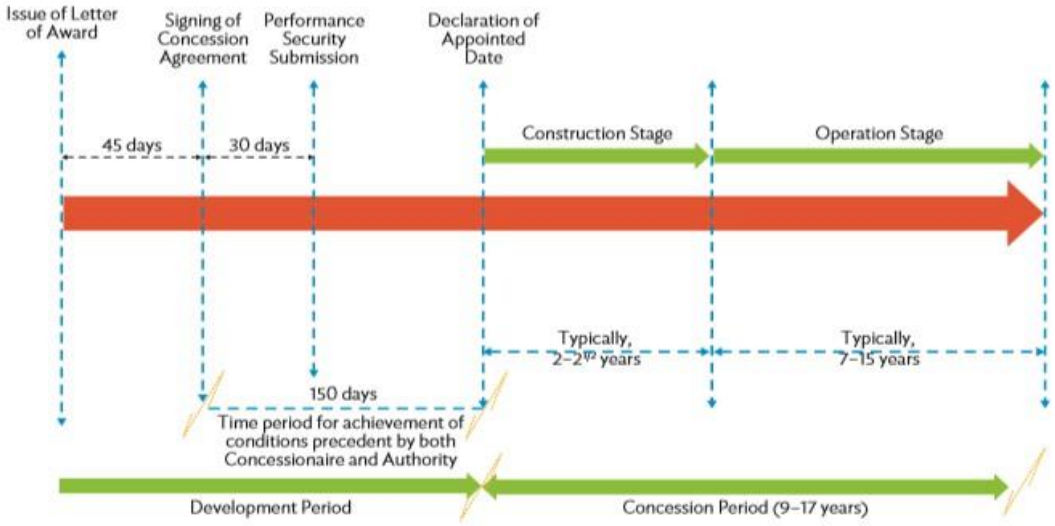


Figure 5. Timeline of Contracts Employing the Hybrid Annuity Model (*Source:* MCA for HAM).

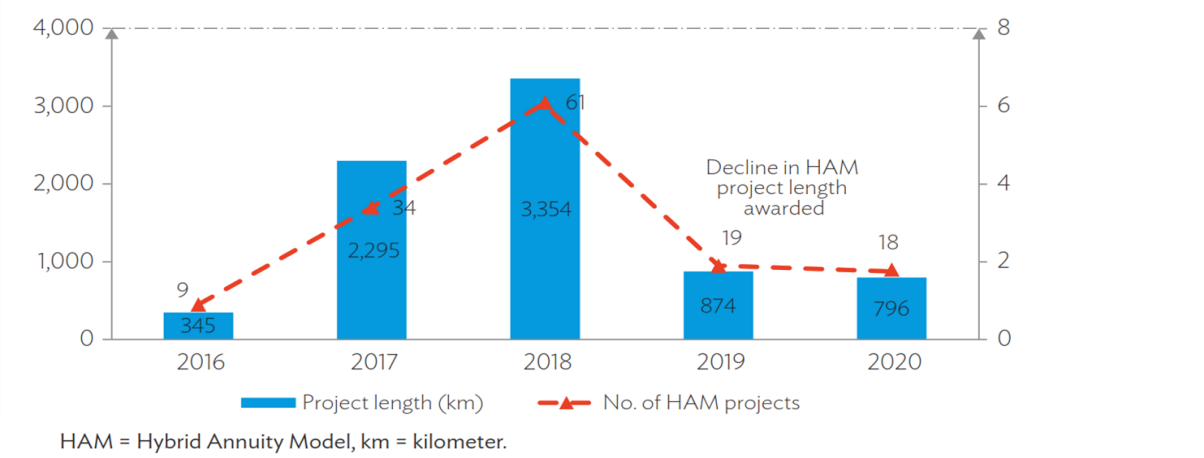


Figure 6. Implementation of Hybrid Annuity Model by NHAI (*Source:* (Shiwakoti & Dey, Asian Development Bank, 2022)).

Six Key Challenges Associated with Hybrid Annuity Model

1. Land Acquisition Delays.
2. Financial Closure Delays.
3. Force Majeure.
4. Approval & Clearance Delays.
5. Government Payment Delays.
6. Scope Changes.

Optimizing Hybrid Annuity Model

The introduction of HAM in 2016 prompted a notable reaction from developers. Approximately 50% of the Public-Private Partnership projects awarded by the National Highways Authority of India

between 2017 and 2019 utilized the Hybrid Annuity Model. However, it was discovered that several elements had a negative impact on the performance of several concessionaires throughout the project's execution. Since then, HAM has undergone several amendments to enhance a few of its initial provisions:

Extended Equity Exit Period

In efforts to streamline Hybrid Annuity Model and encourage engagement of the private sector, MoRTH implemented a significant change in November 2020. Prior to this, Special Purpose Vehicles (SPVs) may have their ownership changed two years after the project started operating under HAM PPP contracts that were approved in 2016. However, the 2020 amendment reduced this waiting period to a mere six month post-commencement (Shiwakoti & Dey, Asian Development Bank, 2022) [14].

This reduction in the holding period reflects the construction industry's growing preference for accelerated equity recycling. By allowing for earlier divestment of equity locked into HAM projects, the government aims to incentivize greater private sector investment and expedite project execution. Moreover, this move is considered to pose minimal risk to authority, the core project operations and maintenance responsibilities remain with the concessionaire during the preliminary period (MORTH, 2020) [8]. Previously granted BOT-Toll and BOT-Annuity projects have already exceeded the two-year ownership requirement and are accessible for secondary market trades. To facilitate the sale of HAM assets on the secondary market, the ownership clause in HAM projects was modified, lowering the holding time from two years to six months after the commencement of commercial operation. (Shiwakoti & Devayan, 2022) [14].

Table 3. Changes to the National Highways Authority of India Hybrid Annuity Model's Technical and Financial Requirements.

Criteria	Original Criteria	Modified Criteria
Financial	The bidder shall have a minimum net worth of 25% of EPC at the close of the preceding fiscal year.	The bidder shall have a minimum net worth of 15% of EPC at the close of the preceding fiscal year.
	The bidder shall have financial resources as a capital cost of more than 10% of the specified estimated project cost.	The bidder shall have financial resources as a capital cost of more than 5% of the specified estimated project cost.
Technical	The bidder is required to have relevant experience in construction as well as maintenance.	The bidder is required to have relevant experience in construction as well as maintenance.
	Construction experience includes relevant core sector experience including civil construction of power sector, commercial setups, airports, industrial parks or estates, logistics parks, pipelines, irrigation, and water supply.	Construction experience includes relevant core sector experience including civil construction of power sector, commercial setups, airports, industrial estates, logistics parks, pipelines, irrigation, water supply, stadiums, hospitals, hotels, smart cities, warehouses, silos, oil and gas, and real estate development.
	EPC = engineering, procurement, and construction.	EPC = engineering, procurement, and construction.
	RFP = request for proposal.	
	RFQ = request for quotation.	

Increase in Milestone Payment Frequency

According to the original HAM, the government funding portion's progress payments would be made in five instalments throughout the course of the construction term, which is normally 24 months, provided that the contract's physical milestones are met. Typically, milestones are reached every six months, and concessionaires are paid after reaching these milestones. To handle the cash flow mismatch, developers turned to working capital facilities. Project delays resulted from lenders' reluctance to provide working capital support to developers, who struggled to cover the shortfall. The overall number of building milestones was raised from five to ten instalments to solve the problem. The concessionaires are experiencing less financial strain because of the higher frequency, which has decreased the need for working capital (Shiwakoti & Dey, Asian Development Bank, 2022) [14].

Interest Payment Pegged to the RBI Bank Rate

The HAM provision was subsequently modified to shift mobilization advances and interest payments from the bank rate to a premium of 125 basis points and the average marginal cost of lending rate (MCLR) of five major banks. In comparison to the bank rate, the majority of bank MCLRs are comparable and elastic (Shiwakoti & Devayan, 2022) [14]. Given that both components are linked to the same benchmark, this is expected to aid in interest rate risk hedging. It is anticipated that improved concessionaire performance will be made possible by appropriate risk allocation through the modification of the index for calculation to the authority.

Termination Payments

Contract terminations of HAM projects occur due to:

- Force majeure.
- Concessionaire default.
- Authority default.

The HAM model improves risk distribution for concessionaires compared to conventional BOT models. It allows for termination payments even if the concessionaire defaults prior to commercial operations. This provision protects the concessionaire and lenders, thereby improving project bankability. Conversely, traditional PPP models generally link termination payments to the concessionaire's financial contributions, as specified in the concession agreements. To enhance the execution of the project, the frequency of progress payment disbursements throughout the construction phase has been augmented from five to ten installments.

Infrastructure Development: Transportation to Sanitation

The government is investigating the Hybrid Annuity Model's potential in the sanitation sector after its successful application in the transportation sector. Traditional financing mechanisms in sanitation have often led to overdesigned infrastructure and suboptimal operations and maintenance (O&M), resulting in non-compliance with effluent standards. Hence, there was a pressing need for a new financial model that could optimize resource allocation, enhance performance and efficiency, and ensure the long-term sustainability of new sewage treatment projects (CWAS, 2018) [3].

National Mission for Clean Ganga (NMCG) has adopted Hybrid Annuity Model (HAM) to finance and implement sewage treatment projects. This public-private partnership (PPP) approach aims to ensure long-term financial sustainability and effective operation and maintenance (O&M) of these critical infrastructure projects.

A Special Purpose Vehicle (SPV) will be responsible for the creation, upkeep, and operation of STP under this paradigm. 40% of the project's cost will be covered by the government at the end of construction, with the remaining 60% being paid in annuities throughout the course of the project, including O&M costs (Desai, 2022) [4].

The fact that this approach links annuity and O&M payments to Key Performance Indicators (KPIs) is one of its main advantages. This methodology guarantees enhanced accountability and a sense of ownership, and operational efficiency of STPs by linking payments to performance metrics.

The literature identifies five primary challenges hindering the widespread adoption of sustainable building practices: cost, information and knowledge gaps, design process limitations, construction process constraints, and material and technological barriers.

STPs Awarded Under HAM

The first sewage treatment facilities (STPs) in India are presently being built in Varanasi and Haridwar using the Hybrid Annuity Model. The state-level executing agencies, Uttarakhand Pey Jal

Nigam and UP Jal Nigam, and NMCG formed a triadic agreement. The concessionaires are working together on these projects.

Private sector participants have shown a great deal of interest in the new HAM for sanitation. Over 30 firms actively participated in the pre-bid meetings for the Haridwar & Varanasi projects. The selection was based on the lowest bid for the project cost, encompassing the development and operation of STP infrastructure for 15-year period. The 50 MLD sewage treatment plant in Varanasi was conferred to a consortium spearheaded by Essel Infra Projects Limited for an expenditure of Rs 153 crore, whereas the 82 MLD sewage treatment plant in Haridwar was allocated to HNB Engineers Private Ltd for a financial outlay of Rs 171 crore. On October 11, 2017, the National Mission for Clean Ganga (NMCG), the Namami Gange program's nodal agency, the private companies, and the corresponding state water authorities formally signed the multilateral agreement (PIB, 2017). Successful implementation and operation of these projects will prevent the outflow of unprocessed sewage into Ganges River.

The wastewater treatment industry has evolved into a large-scale sector. Growing demand for reliable solutions in the Ganga River basin states necessitate a sustainable financing model (Table 4). Hybrid Annuity Model provides a robust framework, ensuring long-term financial resources for crucial investments. This model promotes sustainable, green wastewater businesses. Ghaziabad Municipal Corporation's successful listing of India's first green municipal bond on the Bombay Stock Exchange signifies a positive step towards sustainable urban infrastructure financing.

Salient Features of Varanasi STP Model

The implementation of the HAM for sewage treatment plant (STP) projects under the Namami Gange program was approved by the GOI in January 2016. The UP Jal Nigam under NMCG then released a Request for Proposal (RFP) through a HAM to entice interested private entities to Design, Finance, Build, Operate, and Transfer (DFBOT) 50 MLD STP at Ramana, Varanasi on a PPP basis (Care, 2016) [2].

The RFP Outlines the Following Key Project Features

Project Overview

The primary objective of the project, undertaken by NMCG and Jal Nigam, is to intercept raw sewage flowing into the River Ganga, divert it, and treat it at the Varanasi Sewage Treatment Plant (STP); Use state-of-the-art technologies and internationally accepted best practices for the STP's creation, operation, and maintenance.; To revitalize the Ganga River, show off extensive PSP and private sector investment mobilization.

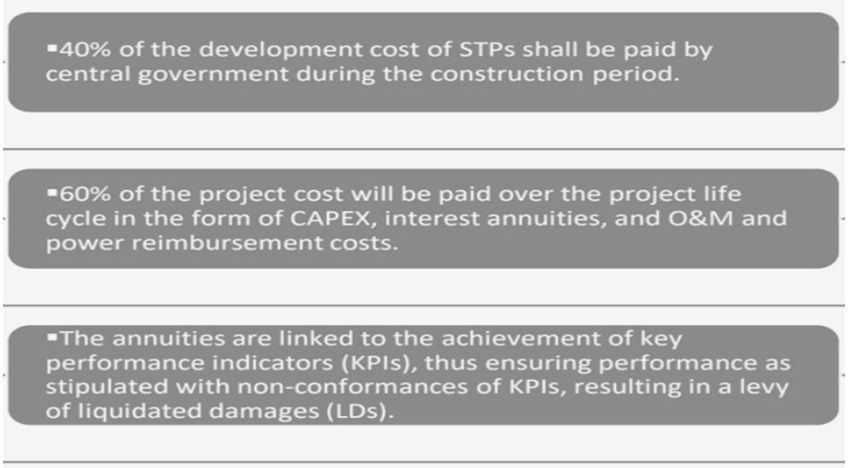


Figure 7. Key Features of the Ham Stp.

Table 4. List of STP projects approved under HAM.

S. N.	Town, State	Existing STP Capacity	Proposed STP Capacity	Remarks
1	Haridwar (Uttarakhand)	Jagjitpur – 27 and 18 MLD	Jagjitpur enhanced to 62 MLD and 6 MLD Sarai	Rehabilitation & Brownfield, O&M of existing STP, New STP, I&D
		Sarai – 18 MLD	Refurbishment of 18 MLD & add 8 MLD by 2028	
		CETP 4.5 MLD	Concession agreement to 9.0 MLD	
2	Rishikesh (Uttarakhand)	15 MLD at IDPL	14 MLD at Sarai	Rehabilitation & Brownfield, O&M of existing STP, New STP, I&D
		Swarg Ashram 30–50 MLD		
		Lakkargarh 60 MLD		
3	Ganga Upstreams towns (Uttarakhand)	Srinagar – 3.5 MLD	Reh.–Brownfield, O&M of existing STP, New STP, I&D	Cluster-based approach for small & medium-scale players
		Devprayag (1.4)		
		Gyanshu (2.0)		
4	Moradabad-Bareilly (Uttar Pradesh)	No existing	STPs with capacity of:	The benefit of economy of scale due to multiple assets
			25 MLD	
			21 MLD	
			20 MLD	
			Two 11 MLD	
5	Allahabad (Uttar Pradesh)	343 MLD	Reh.–Brownfield, O&M of existing STP, New STP, I&D & Septage management	Opportunity for integrated bidder of scale
6	Kanpur (Uttar Pradesh)	473 MLD	Rehabilitation & Brownfield, O&M of existing STP, New STP, I&D & Septage management	Opportunity for integrated bidder of scale
7	Farrukhabad-Fatehgarh (Uttar Pradesh)	Existing STP of 2.7 MLD oxidation pond	STPs with capacity of:	A good entry platform for small & medium-scale players
			28 MLD	
			5 MLD	
			2 MLD	
8	Mirzapur- Ghazipur (Uttar Pradesh)	Existing STP of 14 MLD UASB	STPs with capacity of:	A good entry platform for small & medium-scale players
			21 MLD	
			Two 8.5 MLD each	
			1 MLD (tertiary treatment)	
9	Digha and KakarBagah (Patna, Bihar)	150 MLD	Network (CAPEX & O&M), New STPs, and Septage Management	
10	Mau, Uttar Pradesh	All new assets	STP with capacity of 200 MLD (mechanized)	The largest capacity of a single STP amongst NMCG projects
			STP with a recycling capacity of 140 MLD	
			Rehabilitation & Brownfield, O&M of existing STP	
11	Agra, Uttar Pradesh	Existing STPs of 220 MLD	- 3 STPs with capacity of 166 MLD	Large single STP with a sizable number of brownfield assets
		75 MLD	10 MLD	
			9.38 MLD	

Source: NMCG.

- *Technical specifications:* The 50 MLD Varanasi Sewage Treatment Plant is engineered to accommodate a varied spectrum of sewage influent volumes and loads, conforming to rigorous

influent quality standards. The treatment procedure includes thickening, dewatering, sludge digestion, effluent pumping, preliminary treatment, secondary biological treatment, and storage. The generated grit and digested sludge will be transported to designated disposal sites.

- *Finance details:* The Concessionaire will receive 40% of the overall financial outlay related to the project in installments during Construction Period, linked to the specific construction milestones. Following the Commercial Operation Date (COD), the Concessionaire will receive quarterly payments for Capex Annuity, O&M charges, and actual power consumption. However, if the Concessionaire exceeds the Guaranteed Energy Consumption, they will be obligated to compensate for damages to Jal Nigam.
- *Bid Evaluation criteria:* Four factors (a) the Capex cost; (b) the O&M charges for the first month following COD; (c) the Guaranteed Energy Consumption for each year of the O&M Period; and (d) the land requirement – will be used to evaluate the bid. Bid Price = Bid Project Cost + (O&M Charges x 180) + Power Charges + Land Price is the formula that will be used to get the bid price.
- *Special Purpose Vehicle (SPV):* For the project to be carried out, the chosen bidder must establish a Special Purpose Vehicle (SPV). The responsibility for signing the concession agreement with Jal Nigam and NMCG will fall on this SPV. To pursue projects, the SPV will sign a tripartite memorandum of understanding (MoA) with the state governments that are participating and the relevant urban local bodies (ULBs).
- *Performance-based Contract:* KPI Adherence Reports during the O&M Period are connected to O&M payments. Three KPIs are specified in the contract: treated wastewater discharge quality criteria, treated digested sludge quality standards, and daily availability of the facilities and associated infrastructure.
- *Escrow accounts for payment:* The Escrow Agreement will be signed by NMCG, Jal Nigam, and the Escrow Bank. NMCG will create a revolving escrow account for the project, and all payments will be sent to the concessionaire via this escrow account. Minimum escrow balance: NMCG will keep funds equal to the construction payment owed to the concessionaire for the subsequent milestone prior to COD. For the next two years following COD, NMCG will keep money equal to Capex Annuities, O&M Charges, and the projected Power Charges that must be paid to the concessionaire.
- *Sludge & Treated Effluent disposal:* The private player will have all rights and involvement in the STP by-products and treated effluent discharged. STP By-Products must be disposed of by the concessionaire at the Jal Nigam-designated waste disposal location. Jal Nigam will cover all expenses related to the establishment and upkeep of the waste disposal site. NMCG (2017) Establishing a sludge management facility at the location is the concessionaire's responsibility. It is the concessionaire's right to sell the digested sludge and to keep track of the money made from these sales. Private companies may sell treated wastewater or release it into the Ganga River (Shiwakoti & Dey, Asian Development Bank, 2022) [14].

Hybrid Annuity Model for Sanitation

The GOI National Mission for Clean Ganga (NMCG) (Figure 7), in partnership with state urban local governments, has implemented HAM in sanitation projects. "NMCG has implemented innovative programs like 'One city One operator' to entice developers to invest in the campaign." (Government of India, NMCG, 2020).

- The International Bank for Reconstruction and Development (IBRD) Loan Guarantee mechanism has also provided help to the NMCG. The concessionaire has been given protections. if the authority side has any payment defaults. IBRD works with the government and/or NMCG to close the funding gap and provides guarantees to the special purpose vehicle in the event of a default.
- Projects introduced by NMCG are relatively new in comparison to NH projects, where the authority (NHAI) is an established institution with a well-developed and integrated organizational system.
- Discrepancies in the creation of thorough project reports have been brought to light, resulting in scope modifications and higher project expenses, which in turn cause delays.

- Land acquisition concerns have not caused excessive delays in project beginning, in contrast to road projects. The work scope has been redesigned to address problems and finish projects where land difficulties have been discovered.
- It has been noted that design flaws in projects cause significant delays. As a result, bidders are now doing their research before placing bids on projects, which could lead to asymmetric information and uncompetitive offers.
- Like road projects, certain bids have been found to frontload capital expenditures. Lenders have, however, responded warmly to HAM sanitation initiatives.
- It is not very usual for projects to fall short of expectations because to delayed financial closes. This might be mostly because of the payment safety feature that NMCG included in the concession agreements after the IBRD payment guarantee was implemented (Table 5).

Table 5. Merits & Demerits of HAM STP.

Positive of STP HAM	**Negative of STP HAM**
Interest annuity at 1-year MCLR + 300 BPS	Continuous monitoring of KPIs
Quarterly payments	O&M and power ~55%–65% of life cycle cost
Maintenance of minimum escrow balance	Higher operational risk
Interest free mobilization advances	

CONCLUSIONS & WAY FORWARD

- This research aimed to investigate comprehend the evolution, features, and current trends of PPP and HAM in the Indian sanitation sector. To this end, a comparison between the HAM models of highway and water development was conducted to determine benefits and challenges associated with HAM.
- Initially, a comprehensive overview of PPP and the HAM model in the road sector is presented. The chapter then goes on to discuss the different problems and difficulties that arise in BOT (PPP), which made the adoption of a new model crucial. Additionally, it was shown that HAM is a viable option for road building since it shares the financial risk between private and public entities.
- While the HAM model effectively addresses many of the challenges associated with traditional models like DBOT, concerns remain regarding the sustained availability of government funding to support such large-scale and complex projects.
- Hybrid Annuity Model (HAM) has the capacity to attract private sector investment to the water industry. While this public-private partnership model shows promise, it requires long-term commitment from both public & private sectors to succeed. The NMCG offers a conducive environment for implementing HAM in STPs by providing government payment guarantees through robust institutional arrangements. However, the feasibility and widespread adoption of HAM in the sanitation sector depend on careful consideration of various factors, including long-term financial commitments and effective institutional mechanisms.
- The feasibility of extending Hybrid Annuity Model (HAM) to other sewage treatment projects remains questionable. Several challenges, such as low or nonexistent user fees, stringent contract terms, uneven risk allocation, and limited financial capacity of local governments to ensure timely payments, could hinder the successful implementation of HAM in these projects.
- Only 1 report (2018), 1 article (2022) and 2 research papers (2021) have been published for HAM in Sanitation. These papers do not talk about the challenges in the DBOT model (which was prevalent in STP project before the introduction of HAM) and what may be the potential reasons for the implementation of HAM in sanitation.
- Knowledge Gap in Applying the HAM to Sanitation Projects: A comprehensive understanding of HAM efficacy in the sanitation sector necessitates further research. Currently, data paucity regarding existing HAM projects and their long-term performance hinders informed decision-making. Additionally, a rigorous impact assessment of the recently implemented HAM model

amendments is crucial. This evaluation would offer valuable insights into the revised model's effectiveness in facilitating the successful delivery of sanitation projects.

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