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A Study of BOT, EPC and HAM Factor of Road Construction: An Overview

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ABSTRACT: India has the second largest road network in the world, with over 5.53 million kilometer including all expressways, highways, MDR, ODR. Due to insufficient fund the road development fails to meet the growing up needs. The creation of a demand for private sector participation in the development of road. As a general rule, private sector participation in urban infrastructure has recently become more popular in the developing world. The emphasis of the government is expanding to include both the national and state level on the use of PPP model. The public private partnership models that have been used currently in execution of national highway projects are Engineering Procurement & Construction (EPC) built operate transfer (BOT) toll, BOT annuity and hybrid annuity models. This paper focuses on the concept and current status of PPP in India and study of various PPP models.

KEYWORDS: EPC, PPP, BOT, HAM, Road, NHAI, road construction etc.

I. INTRODUCTION

At a distance of 5.3 million kilometres from the capital, India has one of the world's largest road networks which have expanded significantly in recent years. To date, the principal source of funding for road construction projects in India has been the Indian budget. With the expansion of these allocations, the total length of the road network from 0.4 million km in 1950 to 5.3 million km, the 1950-51 network is equivalent to just one quarter of the current network. As traffic growth has increased, road capacity has not kept pace, the development of the road network has remained slow. A method of private-public-public partnership (PPP3) was utilised in order to aid economic growth and provide a face lift to the country's road network in the late 1990s. Many countries across the world have invested in expanding their road networks to the highest possible quality standards, which has improved the country's competitiveness. In some examples, the central government has set in motion a series of institutional initiatives to encourage the involvement of the private sector in the construction of road networks. This sector has played a vital role in the growth of this sector, with the private sector at the forefront. Private companies that not only take responsibility for improving underdeveloped road networks in developing countries, but also prefer it due to the economic benefit it brings to operate there in developed countries. The phrase PPP describes long-term controlled public-private sector partnership to aligning and sharing resources over time with projects to take into account the uncertainty in risk in the partner organisation, to use private resources, and to allocate projects based on their inherent risk.

A PPP is needed in a variety of road infrastructure projects due to a range of factors, ranging from the cost of funding to project completion delays. PPPaying for present and principal plus interest plus principal-only payments for government bonds is required to shift workload from the public sector to the private sector. Also, for the government sector, standard of work is dependent on the legitimacy of the authority it. Furthermore, it is ensured that with the introduction of PPP of the private technologies and innovations in the industry, this improves quality of work. In order to finish on schedule and within the budgetary constraints, the project needs a strong commitment to PPP. There is not enough money available in the government to invest in infrastructure projects because of their low return on investment PPP would be a small in quantity, but will provide a valuable source of funding for the project in some manner. A second layer of risk has been identified by the fact that government investment in funds could occur between the public and private sectors. Through the use of PPP, we will be able to achieve long-term and sustainable economic growth in the road infrastructure sector. There are multiple PPP models that, each having a specific and distinct function and required for a group. The role of the public sector can be accomplished by working in tandem with the private sector as the needed if it's possible to find those project management skills that are required to finish the project can be engaged.



II. LITERATURE SURVEY

Even though road transportation is the most efficient and important mode for many people, not playing a central role in national economic development means the subject must not be included. Individual human exchange with other communities is made easier by a secure and effective road network of interstates and interconnecting all the regions. road transport has gotten a greater percentage of both passenger and freight volumes relative to other modes of transportation because of improved accessibility and dependability when it is important to support a rising economies like India, and with new and increase demand, it is mandatory to increase road network and transportation infrastructure. As a long ago as the 1970s, the Government of India (i.e., the Planning Commission) deemed it essential to establish a comprehensive and logical network of roads across the country to increase productivity and improve the quality of life for Indians.

Maji A. et al. [1] What do we do now that our construction budget for the following the fourth quarter has been zeroed out? (2018) To mark 2018 as the "The Year of Construction" (Theme: India has celebrated the beginning of a new era of construction by announcing Year 19 as "The Year of initiative of Infrastructure"), the Indian government established the Ministry of Road Transport, which will push for growth in developing infrastructure This was a year for refining the benefits that had accumulated over the last four years, dealing with project setbacks, and going at an even greater pace in projects completed in the last year. already completed projects are on the minister is going to aim for a target of at least 12,000 km of total highways built by the year 2016. as of which these road projects more than half a thousand km long, valued at a total of approximately Rs. 48.6 crore, are in various stages of construction, and they are worth approximately the same.

Bramhankar [2] describes that the Indian road network fails to meet the country's demand because of under-financing by the public sector is inaccurate. This calls for the participation of the private sector in the construction of roads system development allows for the use of its immense and relevant expertise and financial support. The Indian government takes a more holistic approach to the road sector's problems and is working on several new plans and ideas to resolve them. A public-private partnership (P-company collaboration) allows for greater private sector investment in transportation projects. Several instances over the last three decades prove the PPP to be effective. utilisation of the extension of the Build-Operate-Transfer concept.

Iyer and Sagheer [3]As the majority of public infrastructure is now is in the form of built, but not operated, a Build, Operate, Transfer arrangement has gained broad acceptance. Restricting access to resources or implementing market regulations presents an additional challenge for private contractors because the complicated problems raised in these schemes are problematic for prospective concessionaires. To circumvent these funding issues, and obtain the benefits of private-sector performance, many public agencies have partnered with corporations to contribute to the development of shared facilities. The most popular type of contractual arrangement for project delivery is the Build-Operate-Transfer (BOT) where a private company is given a concession to design, build, finance, and operate a public infrastructure for a set duration prior to being returned to the government in an exchange for money, and expected return. many governments have chosen to grant such incentives on the basis of competitive tendering evaluation of their financial proposal (s). the duration of the government's concession period, the unit tolls (at start of operation), and the revenue percentage to be shared with the government.

According to [4] During the 12th five-year plan (2012-2017), there is great investment in infrastructure interest in India, which means various types of contracts are required to meet the demands. EPC contract is often used for infrastructure and power-related projects. When you use an EPC deal, you already know what you're getting and what you pay.

is aware of the fact that the paucity of permanent bodies in his department forces him to practise on a rebound Due to the design of BOT ventures, investments in long-term systems are often involve complex BOT programmes. We have to get a different perspective on projects over the life cycle. We have to look at projects in different aspects such as regulatory, political, social, and business contexts because all of these shift dramatically over time. Although the social, political, and economic circumstances are uncertain in developing countries, the importance of these religious ideas remains almost limitless. therefore, it is quite important that high levels of risk and uncertainty surround investment in countries where an expropriation and misappropriation are common that a clear detection, appraisal, and evaluation take place at the project feasibility stage occurs. This article explains that using empirical evidence points to claim that



users would benefit from the use of a Decision Support System (DS) when they compare available investment opportunities to a stage by themselves or in combination of their impact

Expanding on the EPC model: even in the process of acquiring property, whether the projects' permission or land are accessible to them is still a concern. Because those problems are present, the contractor expects project delay, which implies a margin wipeout and cost overruns. which means the developers will be very wary of potential loss due to disasters and/ which means they will be careful not to incur more losses such as floods, drought, and storms estimation of costs is more complicated now due to the recent rise in production costs When buying prices and costs are set, customers are less interested in purchasing fixed-price EPC contracts. if (i.E., the financial sector and public perception) have been downhill recently, the bringing back of investor confidence is very significant because (as a whole, as a general rule) the financial sector has not gotten back to where it was earlier. It was farfetched to think that there were a few theories that turned out to be totally inaccurate. there are optimistic things assumed in regards to equity – i.e., the financial institutions are predicting a higher price expectations for equity, a very competitive bidding in the [public] market and a lot of happy birthday gifts from developers were delivered – debt would be about 9-10 dollars on time. In this case, it will be necessary to use the BOT and EPC models to get around this problem.

Garg S. et al. [7 authors] Introducing the new policies of hybrid annuity to governments has lessensin order to expand national infrastructure development greatly at the Government of India, less contracts and less hass toll and/reduced annuity models, it risks have developers and transferors in favour of the HAM options, enables designers and contractors to fund, instal, operate, and transfer enormous networks. Although conventional PPP models have encountered difficulties in addressing a number of these different issues, it hopes to deal with these issues while leveraging Build, Operate, Transfer, and Procure (BOTEC), along with procurement. the government supplies 40% of the construction funding and the remainder is financed through concessionary funds for these HAM projects and the remaining projects are implemented in 5% tranches,s loans provided by NHA are 20% of total and due at the various stages of completion, which translates to 40% by NHA. The developer will raise debt financing to finance no more than the non-government part of the fraction of the budget called 60/Extend, known as 60 percent of the remaining effort Thus, the equity component is fixed at 15% of the project costs instead of being adjustable as it was in the past, so as to make sure the project remains within the bounds of the defined target value.

Jackson et al argue that the prejudice from lack of wealth and social status is comparable to the prejudice from a physical differences between two persons who aren't of equal in terms of attractiveness, although Landemar [12] say the bias against people from lack of wealth and physical appearance is like income prejudice in itself, while Landem says physical appearance bias is analogous to socioeconomic status but unlike beauty in itself. Three major motivations are responsible for the proliferation of HAMP policy: (sustainability, emphasis, and treatment) As its first objective, it tackles the problem of excessive squib bids, the latest version deals with the issue of an overstretched concessionaire balance sheets of said entities. Second, it proposes to reduce the risk in private projects by shifting the risk to those who can handle it well by spreading the risk and pooling it with risks that the government can bear. The consequence of this was that the government was forced to assume the majority of the project risks. Thirdly, it's focused on liberating capital and equipment held in reserve by the private sector for deployment into fresh infrastructure development projects by allowing the sector to invest only as much as it sees fit.

In reality, private sector risk distribution issues have often been viewed as troublesome, which is unfortunate because it violates the spirit of PPPs in India. Several issues have emerged in the process of making deals, in the construction industry due to the expansion of the gaming and predatory bidding practises, including litigation, which have had interfered with projects, change orders, renegavelations, contracts, and site disputes. Reduce the perceived exposure to danger for the concessionaire by allocating all of them to a single entity. insuranium transport, danger (Regan et al., 2017), as well as good delivery (under EPC), other tolls take over road EPC and increase delivery to surface activities, while its new regulations include taking over demand risk in public highway and implementing/implementing low risk methods for utility shifting are designed in a complementary manner to these practises in publicly financed projects (Toll, Annuity, Grant). The different models of distribution, EPC, BOT, and HAM illustrate the various primary risk allocations in that they display primary risk levels in visual form as:

Specifically, expanding on the statement by Livemint et. al., I believe that refers to: The origins of theoretical particle physics date back to the theory of "a universal energy structure which replaced the gravitational energy" and mechanical forces, both of atom and solar systems, which had been theorised since the days of ancient Greece, and many were tried without success. In addition, research into the challenges facing HAM have begun to take place.



Conversely, there have been financial difficulties and delays associated with technological progress (Financial Express, 2017b). There have been several projects which have been contracted out and subsequently had to be cancelled in the wake of completion of this operation. It should be noted that the form of concession best-seeking investors has changed as well, which shows that it is better for private investors to pursue contracts in the highway and mass transit sectors (DNA, 2017). The next issue is to be examined is each of these trends, and the main challenge would be and try to solve is to discover what each one has to do with its inherent issues.

III. RESEARCH METHODOLOGY

In this work we studied various highway road construction methods like BOT, EPC and HAM for PPP projects. In our methodology we briefly studied those methods in details and know functionality of each method separately.

BOT (Toll) : We require a private agency to allocate funds for Construction, Operational, and routine upkeep and capital expenditures on an annual and periodical basis. an investment is also helps bridge the profitability gap that exists with projects that has the capacity to realise profitability gains, and closes the profitability gap between them. Non-private company is awarded project is achieved through a systematic process In addition to that, there is a two-stage bidding mechanism During the Request for Quotation, private entities provide the details which will be stated in the Expression of Qualification. All bids that have been pre-qualified are requested to be submitted. This could mean selecting the least profitable of the projects on financial bids, or it could mean the smallest grants awarded on the basis of total profitability. The winning bidder might consider it fair to share the revenue from the project instead of asking for a grant. for the assessment purposes, the project award goes to the bidder who offers the highest award, otherwise project award goes to the bidder with the lowest bid. There are commercial and technological risks associated with construction, service, and repair, as well as financial and operating the project (in a TOT (trading pass) model) that is allocated to the private party. A direct concern that a business has is having to deal with is that it when the primary source of revenue dries up. One of the major challenges for transport planning is predicting future traffic volumes. a traffic forecasting will impact the overall project costs as well as project revenues. If traffic forecasting overestimates the financial danger, it will bring about financial difficulty.

BOT (Annuity) : In the first two stages, a private company must collect funds for construction and operating costs as well as capital spending on a yearly basis. As is made on the annuity payment dates by the authorities, the concessionaire is paid his or her annuity according to the schedule. Everything an annu has paid and the initial investment return is paid in full by the annuity provider is returned. in the BOT (Annuity), the modelling of the Private company is conducted by way of two-stage bidding the parties involved parties put their financial, technological, and managerial needs into development during the first stage of the planning process Financial tenders which are required to include the cost of construction, operating and maintenance expenses as well as a profit share are invited to enter into the process. The contract is awarded to the bidder who can provide the best annuity or liquidity in trade. This is in PPP stands for a semi-annual quarterly stipend/to the private corporation, which the Granting Authority is paying in the variant, which P entity is compensating the entity semi-onally per year. The funds supplied by the private entity would cover the building, operation, and maintenance costs as well as the gains from operations and debt repayment of investment. This scenario represents PPP in which in which risks are private entities' responsibility while land acquisition, service, and maintenance are done by the government, and there is no financial allocation of risks.

Hybrid Annuity Model (HAM) : the project financing model was created in the previous year, back in 2015-16, with the aim of enabling private companies to resume participation in road and bridge construction projects, which had dried up in the years preceding it Both the private sector and the federal government contribute to the same share of the overall expense (40%), with the federal businesses providing the other half of the EPC's needs (emergency production capacity expansion capacity). During the construction phase, 40% of the project cost is provided by the government, with funds released based on the success of the project At this point, the private individual needs to have raised an additional 60% of the funding through equity and loans. The threshold is lower, because the private parties need to bring less of their own money in. In a similar vein, since the loan demand is less when measured against other modes such as PPP, banks would be even more comfortable lending. As the contract requires, the government pays the balance due at specific points in instalments according to how well the player performed, and the asset's results, The whole recovery of the investment is guaranteed as the government bears all the costs, including collecting user fees, while the return of the private participants is not affects the project' Expanding these kinds of ventures gives greater sense of security to both the private investors and banks.



(EPC): Other disadvantages can be mitigated by taking the EPC approach, in which responsibility for design and construction is assigned to the contractor as a fixed costs are assigned over the life of the item instead of as with different units of variable costs based on the size of the project. At the same time, a project is often focused on ensuring that requirements are implemented with a degree of certainty in relation to costs and timing while simultaneously taking the risks of construction in the private sector operations. As a means to allow for a non-honest, fairly priced, and public-oriented roll out of road projects, a transparent, open and competitive model EPC agreement has been devised. This Model EPC Agreement integrates best practises and includes a clear, defined risk distribution and clearly defined incentives and penalties. The Model Agreement requires that the project must use best-and most efficient practises when design and cost of construction are taken into consideration, allowing the contractor to innovate when doing so as they see fit in relation to whether they save time or money when they exceed item rate parameters specified in the government contract. Under the item contracts, the contractor is allowed to design a labour and financial structure that best utilises the work force, machinery, and other resources at specific stages of construction to produce maximum results. The result is a higher level of predictability and cost savings for both the government and the contractor, with a lump-sum contract award. In addition, there is an explicit set of responsibilities for all parties to successfully complete the project on time and minimise conflicts in achieving that goal.

IV. DISCUSSION

In an attempt to improve the highway network in India, the government began a major new National Highway Development Plan (NHDP) in 1997 that focused on using the PPP method. As a large number of stalled road projects were carried out under the PPP model because of the GOI's financial uncertainty, the government introduced the Hybrid Annuity Model (HAM) to revitalise the PPP. The primary goal of the analysis was to better understand the characteristics and developments of HAM in the highway sector in India, so the second one was to derive their potential benefits and associated risks were included. Finally, a quick overview of public-private partnership programmes in India is given, beginning with an introduction of the limited-term initiative. Finally, the Paper provides a lengthy description of the many details of HAM. Then, the DBFOT and risk and contractor interest are contrasted to determine the advantages and liabilities associated with a prospect's DBFOT interest or cap NHA model is applied to all options and HAM projects.

Road construction is one of several possible solutions; we see it as an additional benefit of HAM being that transfers financial risk between governments and the private sector players. Planned to lead to a rise in contract and fix the issues related to toll based and annuity based road projects, which both of which projects already went through several phases of analysis, analyses, for which [has already] significantly. The traditional HAZ resolvents most of project issues such as tolls (and other financial commitment) but something a little more challenging is addressed in earlier models such as by BOT (Think Big). The challenges that might occur in the future, however, have been foreseen and prepared for by scaling funds. Cases where project financing was restricted to a significant degree because annuities were only offered as an option. This might become a major danger if the government begins to tax projects as a whole, and companies are forced to pay it on a project-by-by-project basis, which in turn could lead to a vast sums of money ending up in the wrong hands because of possible bribery or extortion.

The findings of this paper will help the highway agencies as well as private contractors improve project management, and result in substantial project preparation and litigation improvements that help minimise project liability for concerned parties.

V. CONCLUSION

The roads and highways play a key role in development of the country. The Indian government has taken various steps to enhance the condition of the National Highways network. The government of India assented PPP for the development of road network. BOT (Toll), BOT (Annuity) and HAM are the three PPP models that have been used in completing the National Highway projects in India. The selection of the type of PPP models depends on the risk profile and financial viability of the project



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