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Innovation In National Highway Development In India- Ppp Way

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Abstract: Public Private Partnership has now become the worldwide mode for execution of Infrastructure projects and has made an alternative to the traditional method item rate contract, to provide economy and social infrastructure. Traditionally in India, the road projects were fully controlled, financed and supervised under the Government (NHAI) but, the cost for such things was uncontrollable and was fully dependent on the fund availability. Also, the maintenance of roads needs huge costs. National Highway Authority of India is having a wide view of creating world class Highway network across the country for achieving multiple goals such as less fuel consumption, elimination of accidents, faster movement of goods and less traffic for passengers, etc. for this they have to make the framework for both government and private sector to work together to achieve the aim by establishment of various PPP models such as Build-Operate-Transfer (BOT) (TOLL), BOT- Annuity and Hybrid-Annuity-Model (HAM). There are some other methods such as Special Purposed Vehicle (SPV) and Incentive Mechanism for the financial and economical support for the PPP projects. The primary intention is an innovation is a concept of improvements in process, products or services. It entails the implementation of new ideas that result in modifications that aid in the resolution of a company's problem. By simply selecting the appropriate type of innovation and its principles for the welfare of the project. This study intimate the analysis of PPP models, incentive mechanism and EPC issue with innovation types and its principles to minimize or overcome the issue and problem.

Index Terms **– Public-Private-Partnership, BOT, HAM, Engineering Procurement and Construction, SPV, Innovation.**

1. INTRODUCTION

Roads and highways were totally developed by government departments and organizations (both federal and state) utilizing their budgets for several decades in the early period. This agreement yielded mixed outcomes and was beset by operational and financial problems. Following the foundation of the NHAI, highway development became the first step in opening up roadways to the private sector. In India, road constructions have always been wholly funded, regulated, and monitored by the government. The availability of finances, their distribution, and release from the government's budget were all factors in the realization of road projects. The government has been unable to devote the necessary finances to the road sector due to the high expenses of road development, building, and maintenance. The growing volume of resource requirements, as well as concerns about management efficiency and consumer response, have prompted the private sector to get more involved. To promote private sector engagement, the Department of Road Transport and Highways has established extensive policy guidelines for private sector participation in the project (Ramakrishna Nallathinga 2019). Due to a lack of public financing, public-private partnerships (PPPs) have become more important in the building of India's national roads. The National Highways Act, 1956 was revised in 1995 with an aim to enable private investment in development, maintenance and operation of Indian highways. The government has taken a number of additional steps in this regard, including declaring the road sector as an industry to make it easier to borrow money on favourable terms and lowering customs tariffs on building equipment. The first wave of such projects including activities such as building and operation of highways started in 1994, with the public authority funding a fixed schedule of payments. The two models of PPP adopted in India for the development of National Highways are BOT (Toll) and BOT (Annuity) (Swapnil 2019).

2. LITERATURE REVIEW

Ajit Singh (2021) Road transportation has been the largest means of surface transport along-with railways. To facilitate and monitor this State Transport Undertakings were formulated in different states. These undertakings faced financial problems, labour unrest and survival problems. Ways to tackle the difficulties along the route of innovation and transformation have been discovered over time. Implementing innovative initiatives brought remarkable improvement in the performance of both the undertakings.

Fikreyesus Demeke cherkos et. Al (2020) Studied the range of characteristics and role of private partners for the approach of public private partnership. In this various agreements has been discussed such as Built-Operate-Transfer, BOT-TOLL, BOT-Annuity and Hybrid-Annuity-Model. From which one be implemented for completion of PPP road projects. Also, discuss the lack of information about selecting the agreement that links projects to be completed. It shows the link between the project and the stakeholder.

Sandeep Ganpat Kudtarkar (2020) Studied the public private partnership in India by examine the various case studies followed by and also few reasons for the failure and risk such as land acquisition, cost overrun, delay life cycle of project, legal dispute etc. It conclude the various failure to avoid for the future projects and avoid such conditions in a successful PPP project in India.

Mohammed Shakil Malek et. Al (2020) Studied the value for money as a main factor for the project in PPP. It is stated that there are many objectives which are taken under consideration whether it is Value for Money or not. The main factor was to inspect with various tools which will assist to settlement in PPP.

Sandeep G Kudtarkar (2020) Stated the various problems faced by the PPP projects during the post covid-19 pandemic. Why the delays and the termination of PPP programs has been done. They stated the risk of management of stakeholders and lack of skill contractors. This study provides an institutional policy and practical execution of the future PPP programs in India.

B.Amarender Reddy (2020) Urban infrastructure is an important factor to sustain economic growth of the nation. The quality, efficiency and productivity of the infrastructure affect the quality of life, health and live ability of the society. The current research examines Telangana's position in public-private partnerships that enhance environmental sustainability in long-term infrastructure projects.

Zhe Cheng (2019) Stated the innovations must be utilized by the Public-private-Partnership for the welfare of the economy of the country. They stated that the theoretical framework is supervised and the four dimensions such as driving force, subject, process and object should be taken under consideration. It will make the decision making process in PPP policy and makes innovative endowment to the global PPP body.

Lakshya Kumara (2017) This paper investigates financial risk associated with highway infrastructure projects by identifying parameters such as traffic flow and project cost; and further models the risk by analyzing real-world PPP based highway\r projects in India. It applies the Net Present Value (NPV)-at-risk model tool which uses Monte Carlo Simulation to take into account the probability distributions for different input parameters, and gives uncertainty associated with them. Further, the model is applied to 30 real world BOT highway projects to identify critical risks and consider mitigation strategies.

Nagesha Gopalkrishna (2016) Public Private Partnership (PPP) mode is an alternative to the traditional mode of 'item rate of contract' to provide both economic and social infrastructure. A study finds that mean technical efficiency (TE) and scale efficiency scores of PPPs are higher than the other projects. The study cites the possible reasons for this could be because of superior technical and managerial skills of the private sector, scale efficiencies and long-term nature of bundled contract.

Shunso Tsukada (2013) A review of the National Highway Development Program (NHDP) in India has found that the selection of PPP options and faulty selection of policy options were the root causes of delay in the project's development. The article also finds that the entangled nature of inter-agency relationships and the resultant faulty selection led to a chain reaction that slowed down the project.

3. METHODOLOGY

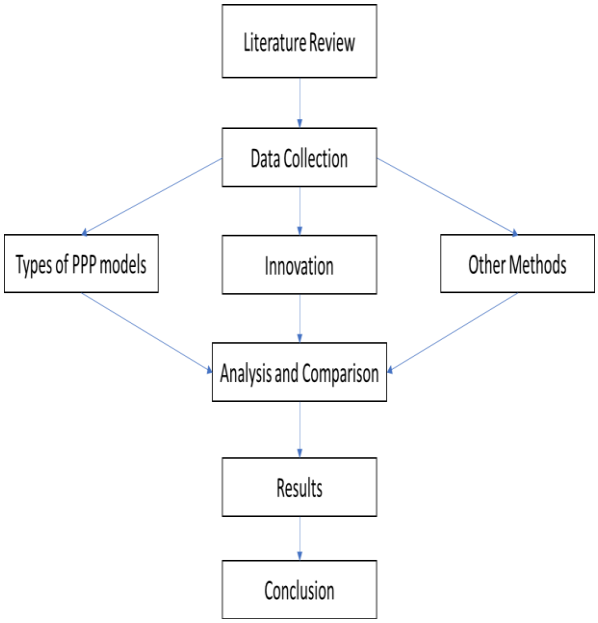

Figure3.1: Flow Chart of Methodology

Types of PPP Models:

1. BOT – This is the simple and conventional PPP model where the private partner is responsible to design, build, operate (during the contracted period) and transfer back the facility to the public sector. The private sector partner's role is to provide funding for the project and to assume responsibility for its construction and maintenance. The public sector will allow it to collect income from users in exchange. The national highway projects contracted out by NHAI under PPP mode is a major example for the BOT model (Jose Tojo, 2016).
2. BOT-TOLL – A private firm must obtain funds to cover construction, operational, and yearly and periodic maintenance costs. A grant is also given to bridge the gap between the investment required and the profits generated, so increasing the project's profitability.
3. BOT-ANNUITY- Private entity raises funds for construction, operational cost and expenditure on annual maintenance. The awarding authorities pay the concessionaire annuity on each annuity payment day, according to the annuity payment schedule. Private entity recovers the entire investment and predetermined cost of return out of annuities (Bhosale Ajaykumar, 2017).
4. HAM- At a conceptual level, construction and operation of infrastructure awarded through BOT route are bundled and transferred to the private sector for fixed period, with the private concessionaire receive either a steady supply of government funding or user fees placed directly on end users, or both. In contrast, HAM recognizes that the government ultimately has to pay for building the public infrastructure from its own sources or if feasible through accruals of user charges from the public to be collected by the government. The government also contributes part of the construction cost, with the rest reimbursed to the private sector over the life of the project. The fundamental difference lies in the government taking over the responsibility of collecting user fees, while paying the private sector for its project investments, as per a predefined payment schedule. HAM aimed to address the concerns of the different project stakeholders (Garg & Mahapatra, 2018).

A Special Purpose Vehicle is a legal entity that has been established to separate an asset, subsidiary or financial transaction from a larger corporation or government agency. Special Purpose Vehicle (SPV) is a subsidiary founded by a parent business to isolate financial risk. Its legal existence as a separate company ensures that it can meet its obligations even if the parent firm fails. A special purpose vehicle is frequently referred to as a bankruptcy-remote entity because of this.

A Special purpose entity can also be established for joint ventures, such as PPP and Viability Gap Funding (VGF) is provided for economic infrastructure in Incentive Mechanism. In order to financially fund infrastructure projects, the Viability Gap Funding Scheme was announced in 2004 and the procedures to implement it in 2005. By subsidizing the capital cost of access to infrastructure delivered through the PPP framework, the initiative strives to provide widespread access (A report by GOI, 2008). To make vital projects fiscally and commercially viable, the government of India has proposed a gap finance plan that would allow private sector participation in the projects, obviating the necessity for such projects and allowing private sector efficiencies in infrastructure development.

Innovation: Improvements in processes, products, and services are all examples of innovation. It entails absorbing new ideas that result in modifications that help a company fulfill its demands and hence increase its competitiveness.

Despite its importance in the development and expansion of the whole economy, applying innovation to the construction industry is not straightforward. Because each construction project is unique, construction companies must tailor their methods and resources to fit the job. Every site is a unique prototype whose design evolves over time. Construction sites are spread out across the country, and employees and equipment are constantly moving. In contrast, the weather and other conditions can make it difficult for consultants to put their previous experience to good use. Innovation is the practical implementation of ideas that result in the introduction of new goods or services or improvement in offering goods or service.

Types of Innovation:

1. ARCHITECTURAL INNOVATION: The architecture of a product can be adjusted in terms of how different components of the system interact or connect with one another, which is known as architectural innovation. Additionally, individual components of the system can be adjusted (incrementally) inside the new design, while the core components' basic technologies stay unchanged.
2. Companies develop knowledge and competencies by completing existing tasks. Organizational experience with current and innovative technologies shapes the company's understanding. It is really beneficial and should be applied to products, but some aspects of that information may not only be ineffective, but may also be detrimental to the organisation. As a result, technological progress is marked by periods of intense experimentation followed by the acceptance of a dominating technology.
3. RADIAL INNOVATION: When we think of innovation, we usually think of radical change. It entails producing groundbreaking technologies and gives birth to new industries (or eats up current ones). For example, the aeroplane was not the first means of transportation, but it was revolutionary in that it allowed commercialized air travel to emerge and thrive.
4. DISRUPTIVE INNOVATION: Disruptive innovation, often known as stealth innovation, entails introducing new technologies or methods into your current market. Because fresh technology is frequently inferior to established market technology, it is sneaky in nature. This newer technology is typically more expensive, has fewer functions, is more difficult to use, and is less attractive. After a few cycles, the modern technology outperforms the old, causing all existing businesses to collapse. It may be too late for established businesses to compete with newer technology by then.

5. INCREMENTAL INNOVATION: The most typical type of innovation is incremental development. It makes use of your existing technology and adds value to your existing market (new features, design improvements, etc.). In some way, almost every company engages in incremental innovation.

Innovation Principles:

1. Co-creating Value with Customers.
2. User involvement in Innovation process.
3. Accessing and Combining Globally.
4. Forming Collaborative Networks and Partnerships.
5. Levering Dynamics between large Companies and Entrepreneurs.
6. Environmental Concerns drive Innovation.
7. Needs in Developing Countries drive Innovation.
8. Welfare System Concerns drive Innovation.
9. Technology’s Role as an Enabler of Innovation.

From the above data, Analyzing the issues, problems and constraints that affect the performance of PPP for National Highway Projects in India and Identify the factors that facilitate the establishment, performance and success of PPP as a mechanism for highway projects in India. By comparing the issues and problems with Innovation types and its principles.

4. RESULT AND DISCUSSION

4.1PPP MODELS WITH INNOVATION PRINCIPLES

Table 4.1: PPP Model with type of Innovation

Sr. No.	MODEL	TYPE OF INNOVATION	DESCRIPTION	ISSUES MINIMISED/ OVERCOME
1.	BOT-TOLL	Architectural innovation	In BOT approach, a private investor builds and operates a road within a defined period and transfers the ownership at no cost to the government at the end of the contract. Construction, operational, and annual and periodic maintenance costs must all be covered by the private business.. But in Architectural Innovation changes the way in which components are linked together while living the basic competencies innovation untouched Component. So by the help of this innovation the gap of investment has been resolved which increases the viability of the project.	Access to finance, Dispute resolution, Inadequate Technical Due to Diligence, Unavailability of equipment and materials & Lack of manpower.
2.	BOT-ANNUITY	Architectural innovation	The roadway is built by a developer, who then operates it for a specified length of time before returning it to the government under a BOT annuity. After the project begins commercial operation, the government begins paying the developer. The payment will be made every six months. Because there was a funding gap, the government provided some funds while the investor provided the remainder.	Access to finance, Dispute resolution, Design changes during implementation, Inadequate Technical Due to Diligence, Unavailability of equipment and materials & Lack of manpower.
3.	HAM	Incremental innovation	In HAM the government contributes 40% of project bid cost in equal installments linked to project milestone achievements. The balance 60% of project cost is initially brought in by the concessionaire who designs, builds, and operates the highway for a period of 15 years after construction. The vast majority of advancements are gradual in nature.. Incremental innovation is when a series of small and seemingly insignificant improvements culminates in large-scale organizational change.	Access to finance, Dispute resolution, Design changes during implementation, Lengthy Regulatory Process, Inadequate Technical Due to Diligence, Unavailability of equipment and materials & Lack of manpower.
4.	SPV	Disruptive innovation	A special purpose vehicle (SPV) is a subsidiary founded by a parent firm to isolate financial risk. Its legal position as a separate company ensures that it will be able to meet its obligations even if the parent firm fails. A special purpose vehicle is often referred to as a bankruptcy-remote entity because of this. Disruptive innovation refers to a concept, product, or service that generates a new value network by entering an existing market or creating an entirely new market.	Access to finance, Dispute resolution & Contractor / Subcontractor Problem.

4.2INCENTIVE MECHANISM WITH TYPE OF INNOVATION

Table 4.2: Incentive Mechanism with type of Innovation

Sr. No.	INCENTIVE MECHANISM	TYPE OF INNOVATION	DESCRIPTION
1.	Viability Gap Funding (VGF)	Incremental innovation	The scheme aims to ensure wide spread access to infrastructure by subsidizing the capital cost of their access. To make essential projects economically commercially viable gap funding scheme from GOI would private sector participation in the projects, facilitating obviate the need for such projects and allow private sector efficiencies in infrastructure development.
2.	Model Concession scheme	Incremental innovation	A concession agreement is a contract that grants a company the right to conduct a specific business within the authority of the government or on the property of another corporation, subject to certain conditions. Contracts between the nongovernmental owner of a facility and a concession owner, or concessionaire, are common in concession agreements.
3.	Jawaharlal Nehru National Urban Renewal Mission (JNNURM)	Incremental innovation	The focus of JNNURM will be on efficiency in urban infrastructure and service delivery systems, community involvement, and ULB/Parastatal agency accountability to residents. The JNNURM's main goal is to construct cities that are economically productive, efficient, egalitarian, and responsive.

4.3EPC ISSUES WITH INNOVATION PRINCIPLES

Table 4.3: Issues with Innovation Principle

Sr. No.	Titles of Issues	Innovation Principles	Description
1.	Access To Finance	Accessing and Combining Globally	In developing country most of the construction projects delayed due delay in payment. If the project become globally then the cash flow can be maintained and issue of finance can be resolved.
2.	Land Acquisition	Co-creating Value with Customers	Land purchase and related environmental/forest clearing difficulties have caused significant project delays. By co-creating with unique solution for the individual land owner and authority then, this problem can be overcome.
3.	Lengthy Regulatory Process	User Involvement in innovation Process	The lengthy process of acquiring regulatory licences, particularly for mining boulders, soil, and sand, is a major obstacle. The state government and local governments are in charge of these permissions. Through their experience and inventiveness, the authority can find a way to speed up the procedure.
		Technology's Role as an Enabler of Innovation	Road development process requires a number of approvals such environment clearance, forest clearance etc. Each of these activities take considerable time and non-adherence to timelines result in cost overruns due to delays. By the use of technology the authority can easily collect and maintain the data which will speed up the regulatory process.
4.	Dispute Resolution	Forming Collaborative Networks and Partnerships	The delays that arise frequently lead to disagreements and, in some cases, arbitration. Due to such delays, proving non-performance is difficult unless choices are made on time. By forming collaborative networks and partnerships with different organization or people, then increasing complexity can be reduced which may led to low dispute.
		Welfare System Concerns drive Innovation	In highway sector, disputes are commonly related to delay in land acquisition, change in scope, utility shifting and reluctance to approve price escalation permitted in the contract.

5. CONCLUSION

I. The issue, problems and constraint that affect the performance of PPP for National Highway project, as NHAI introduced the Model Concession Agreement (MCA) forms various BOT models such as BOT-TOLL, BOT-ANNUITY, but there were several operational and budgetary issues. So, the NHAI has introduce the Hybrid Annuity Model (HAM) to reduce above problems.

II. The issues and problems that affect the Engineering Procurement and Construction for performance of National highway such as access to finance, land acquisition and many more can be minimised and lessen the time by using the innovation principles for completion of project.

III. The factors for the success of PPP as a mechanism for highway projects and the improved performance, we have to apply and consider the Innovation principles such as Accessing and combining globally, forming collaboration networks and paternerships.

IV. The types of Innovation help in the success of using PPP for National Highways in India. Few Innovative features which can be applied in PPP for National Developments are as follows:

   i. Making an Emergency Landing Strip (patch) for aeroplanes on the National Highways.
   ii. Making of Greenways Highways/Expressways which reduces lots of time and money for Land Acquisition.
   iii. Electric Charging Stations at specific distances (in Kms) at the Service Lane/Road. Which will encourage peoples to use Electric Vehicles, which will reduce the Atmospheric Pollution.
   iv. Also, by providing official snack centres of NHAI at all the Toll-plaza's will also increases net income (ex. Just as Railways have IRCTC facilities).
   v. G.P.S Systems for vehicles for toll purposes other than fast tag system and also, it may brings the transparency in the system.

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