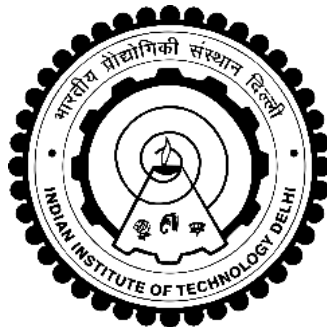


**EVALUATING PUBLIC PRIVATE PARTNERSHIP IN  
METRO RAIL IN INDIA**

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# **EVALUATING PUBLIC PRIVATE PARTNERSHIP IN METRO RAIL IN INDIA**

by

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**Transportation Research and Injury Prevention Programme,**

Submitted

In fulfilment for the award of the degree of Doctor of Philosophy

to the



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## **Certificate**

This is to certify that the thesis titled “**Evaluating Public Private Partnership in Metro Rail in India**” being submitted by **Mukund Kumar Sinha** to the Indian Institute of Technology Delhi, India, for the award of the degree of **DOCTOR OF PHILOSOPHY**, is a record of original bona fide research work carried out by him. Mukund has worked under my guidance and supervision.

To the best of my knowledge, the thesis has reached the requisite standard. The material contained in this thesis has not been submitted, in part or in full to any other university or institute for the award of any degree or diploma.

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**Mukund Kumar Sinha**

## **Abstract**

Metro rail systems are often reckoned as the center stage of sustainable cities, the engines of economic growth, and enablers of good quality of living. They represent the outcomes of mega-projects, that are usually costly and have promising potential to deliver mega-benefits.

Evolution of urban rail or as often called metro rail in India has a distinctive storyline. Though, metro rail in India was started in 1984 in Kolkata by Indian Railways, it was the perceived success of Delhi Metro which inspired other cities to adopt metro rail as a prime mode of urban transport. In 2002, the first metro rail service of 8.5 km metro line was inaugurated in Delhi. Since then, there has been no looking back. Today metro is operational in about 18 cities of India but still a rather small coverage of about 700 km of route length. In addition, approximately 1000 km of metro rails are under various stages of consideration/implementation in another 27 cities of the country and being opened at an increasing pace.

Though, most of the projects have been taken up with complete financial support by the central and the state governments, quite a few have also been tried on the Public Private Partnership (PPP) model. Notable among these have been the Delhi Metro Airport Line and the Mumbai Line 1. Despite a relatively good appetite of the private sector in the country for taking up metro rail PPP projects, these PPP projects have mostly not been seen as success stories on account of various reasons. The termination of the concession in the Delhi Metro Airport Line or the Rapid Metro of Gurugram are examples of failure despite having locations with seemingly high demand which would ensure operational profits for the private sector. The thesis is an exploratory study to delineate challenges and risks based on a systematic research, documentation and evaluation of metro rail projects taken up on PPP. Data on all these projects have been collected and the challenges and issues faced by the projects have been documented.

The risks associated with the construction and operation of metro rail projects are quite pronounced and include construction, finance, management, revenue & economic risks among many others. Most risks are common for both public funded and implemented as well as the PPP metro rail projects. The difference is that while the public projects have the inherent capability of assimilating the losses emanating from financial and revenue risks on account of access to public funds, the private sector buckle under these losses if not supported by the public authorities beyond the concession agreement. The perception of the associated risks by the project authorities also differs significantly for projects undertaken PPP model.

As a part of this research, a survey has been conducted to assess the risk perception of project authorities for all metro rail projects in India. Thereafter, a risk prioritization has been carried out using survey of perceptions and experience of project authorities of PPP and public metro rail using Multi- Criteria Analysis (MCA). The tool used is the Analytical Hierarchy Process (AHP). The analysis has placed revenue risk as the most critical for success of PPP metro rail projects. Correct assessment of the revenue based on forecasted ridership, in a strict pricing regime governed by the Metro Rail Acts, is the most important risk mitigation strategy that needs to be followed by the prospective private entrepreneurs.

It is also deduced that unbundling of the components and bidding out for concession of some of the unbundled components has resulted in a sustained private partnership in some of the metro rail project. These components include the Automatic Fare Collection System and the Operations and Maintenance. While the Metro Rail Policy (2017), issued by the Government of India, makes it mandatory to have at least one component to be bid for private partnership, complete concession of the project on a Build, Own, Operate and Transfer basis may not attract many entrepreneurs in the future.

## सार

मेट्रो रेल सिस्टम को अक्सर टिकाऊ शहरों, आर्थिक विकास के इंजन और जीवन की अच्छी गुणवत्ता के समर्थक के रूप में माना जाता है। वे मेगा-परियोजनाओं के परिणामों का प्रतिनिधित्व करते हैं, जो आमतौर पर महंगे होते हैं और बड़ा लाभ देने की आशाजनक क्षमता रखते हैं।

शहरी रेल के विकास या जिसे अक्सर भारत में मेट्रो रेल कहा जाता है की एक विशिष्ट कहानी है। यद्यपि भारत में मेट्रो रेल की शुरुआत 1984 में भारतीय रेलवे द्वारा कोलकाता में की गई थी, यह दिल्ली मेट्रो की कथित सफलता थी जिसने अन्य शहरों को शहरी परिवहन के प्रमुख साधन के रूप में मेट्रो रेल को अपनाने के लिए प्रेरित किया। 2002 में, दिल्ली में 8.5 किमी मेट्रो लाइन की पहली मेट्रो रेल सेवा का उद्घाटन किया गया था। इसके बाद उन्होंने पीछे मुड़कर नहीं देखा। आज मेट्रो भारत के लगभग 18 शहरों में परिचालन में है, लेकिन अभी भी लगभग 700 किमी मार्ग लंबाई का एक छोटा कवरेज है। इसके अतिरिक्त, देश के अन्य 27 शहरों में लगभग 1000 किलोमीटर मेट्रो रेल विचार/कार्यान्वयन के विभिन्न चरणों में हैं और उन्हें बढ़ती गति से खोला जा रहा है।

यद्यपि, अधिकांश परियोजनाएं केंद्र और राज्य सरकारों द्वारा पूर्ण वित्तीय सहायता के साथ शुरू की गई हैं, लेकिन कुछ को सार्वजनिक निजी भागीदारी; (पीपीपी) मॉडल पर भी आजमाया गया है। इनमें उल्लेखनीय दिल्ली मेट्रो एयरपोर्ट लाइन और मुंबई लाइन एक है। मेट्रो रेल पीपीपी परियोजनाओं को शुरू करने के लिए देश में निजी क्षेत्र की अपेक्षाकृत अच्छी भूख के बावजूद, इन पीपीपी परियोजनाओं को ज्यादातर विभिन्न कारणों से सफलता की कहानियों के रूप में नहीं देखा गया है। दिल्ली मेट्रो एयरपोर्ट लाइन या गुरुग्राम की रैपिड मेट्रो में रियायत की समाप्ति, उच्च मांग वाले स्थानों के बावजूद विफलता के उदाहरण हैं जो निजी क्षेत्र के लिए परिचालन लाभ सुनिश्चित करेंगे। थीसिस पीपीपी पर शुरू की गई मेट्रो रेल परियोजनाओं के व्यवस्थित अनुसंधान, प्रलेखन और मूल्यांकन के आधार पर चुनौतियों और जोखिमों को चित्रित करने के लिए एक खोजपूर्ण अध्ययन

है। इन सभी परियोजनाओं पर डेटा एकत्र किया गया है और परियोजनाओं के सामने आने वाली चुनौतियों और मुद्दों का दस्तावेजीकरण किया गया है।

मेट्रो रेल परियोजनाओं के निर्माण और संचालन से जुड़े जोखिम काफी स्पष्ट हैं और इसमें निर्माण, वित्त, प्रबंधन, राजस्व और आर्थिक जोखिम शामिल हैं। अधिकांश जोखिम सार्वजनिक वित्त पोषित और कार्यान्वित दोनों के साथ-साथ पीपीपी मेट्रो रेल परियोजनाओं के लिए आम हैं। अंतर यह है कि जबकि सार्वजनिक परियोजनाओं में सार्वजनिक निधियों तक पहुंच के कारण वित्तीय और राजस्व जोखिमों से उत्पन्न होने वाले नुकसान को आत्मसात करने की अंतर्निहित क्षमता है, निजी क्षेत्र रियायत समझौते से परे सार्वजनिक प्राधिकरणों द्वारा समर्थित नहीं होने पर इन हानियों के नीचे झुक जाता है। पीपीपी मॉडल शुरू की गई परियोजनाओं के लिए परियोजना प्राधिकारियों द्वारा संबद्ध जोखिमों की धारणा भी काफी भिन्न होती है।

इस शोध के एक भाग के रूप में, भारत में सभी मेट्रो रेल परियोजनाओं के लिए परियोजना अधिकारियों की जोखिम धारणा का आकलन करने के लिए एक सर्वेक्षण किया गया है। तत्पश्चात् बहु-मानदंड विश्लेषण (एमसीए) का उपयोग करते हुए पीपीपी और सार्वजनिक मेट्रो रेल के परियोजना प्राधिकारियों की धारणाओं और अनुभवों के सर्वेक्षण का उपयोग करते हुए जोखिम प्राथमिकता निर्धारित की गई है। उपयोग किया जाने वाला उपकरण विश्लेषणात्मक पदानुक्रम प्रक्रिया (AHP) है। विश्लेषण ने पीपीपी मेट्रो रेल परियोजनाओं की सफलता के लिए राजस्व जोखिम को सबसे महत्वपूर्ण बताया है। मेट्रो रेल अधिनियमों द्वारा शासित सख्त मूल्य निर्धारण व्यवस्था में पूर्वानुमानित सवारियों के आधार पर राजस्व का सही आकलन, सबसे महत्वपूर्ण जोखिम शमन रणनीति है, जिसका संभावित निजी उद्यमियों द्वारा पालन करने की आवश्यकता है।

यह भी अनुमान लगाया गया है कि घटकों को अनबंडलिंग करने और कुछ अनबंडल घटकों की रियायत के लिए बोली लगाने के परिणामस्वरूप कुछ मेट्रो रेल परियोजना में निरंतर

निजी भागीदारी हुई है। इन घटकों में स्वचालित किराया संग्रह प्रणाली और संचालन और रखरखाव शामिल हैं। जबकि भारत सरकार द्वारा जारी मेट्रो रेल नीति (2017) निजी भागीदारी के लिए बोली लगाने के लिए कम से कम एक घटक होना अनिवार्य बनाती है, निर्माण, स्वामित्व, संचालन और हस्तांतरण के आधार पर परियोजना की पूर्ण रियायत भविष्य में कई उद्यमियों को संभवतः आकर्षित नहीं कर सकती है।

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## **List of Abbreviations**

ADB	Asian Development Bank
AFC	Automatic Fare Collection
AHP	Analytical Hierarchy Process
BCG	Boston Consulting Group
BEL	Bharat Electronics Ltd
BOOT	Build Own Operate Transfer
BOT	Build Operate Transfer
CA	Concession Agreement
C&AG	Comptroller & Auditor General
CAGR	Compound Annual Growth Rate
CDAC	Centre for Development of Advanced Computing
CISF	Central Industrial Security Force
CPI	Consumer Price Index
DAMEPL	Delhi Airport Metro Express Private Limited
DBFOT	Design Build Finance Operate and Transfer
DBOM	Design Build Operate Maintain
DBOT	Design Build Operate Transfer
DDA	Delhi Development Authority
DIAL	Delhi International Airport Ltd.
DMRC	Delhi Metro Rail Corporation
DPIIT	Department of Promotion of Industry and Internal Trade
EFC	Expenditure Finance Committee
FCA	Forest Conservation Act

FI	Financial Institution
GNCTD	Government of the National Capital Territory of Delhi
HAM	Hybrid Annuity Model
IL&FS	Infrastructure Leasing & Financial Services
IMF	International Monetary Fund
LRT	Light Rapid Transit
L&T	Larsen & Toubro
KMRL	Kochi Metro Rail Limited
KPIs	Key Performance Indicators
MCA	Multi Criteria Analysis
MMOPL	Mumbai Metro One Pvt. Ltd.
MMRDA	Mumbai Metropolitan Region Development Authority
MoEF	Ministry of Environment & Forests
MoHUA	Ministry of Housing and Urban Affairs
MoRTH	Ministry of Road Transport and Highways
MRTS	Mass Rapid Transit System
MTP	Metropolitan Transport Project
NCCM	National Common Mobility Card
NHAI	National Highways Authority of India
NPA	Non-Performing Assets
NPV	Net Present Value
NUTP	National Urban Transport Policy
O&M	Operation and Maintenance
PFI	Private Finance Initiative

PIB	Public Investment Board
PMP	Phased Manufacturing Plan
PPP	Public Private Partnership
PPPAC	Public Private Partnership Appraisal Committee
PSU	Public Sector Unit
RFP	Request for Proposal
RRTS	Rapid Rail Transit System
SPV	Special Purpose Vehicle
TDR	Transferable Development Rights
TfL	Transport for London
TMICC	Traffic Management and Information Control Centre
TOD	Transit Oriented Development
UMTA	Urban Metropolitan Transport Authority
VAG	Versova-Andheri-Ghatkopar
VCF	Value Capture Finance
VGF	Viability Gap Funding