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PRINCIPLE FACTORS FOR SUCCESS OF TRADITIONAL VS. PPP ROAD PROJECTS IN INDIA

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Abstract: *The 12th and the subsequent five-year plan of Government of India emphasis on Public Private Partnership in road projects for the infrastructure development under VISION 2020. The present work explores the available literature pertaining to various road projects under traditional and PPP mode in India and has identified critical success factors that affect the success of the projects. Ten relevant data for completed road projects are collected from various sources. A principle component factor analysis has been deployed which resulted in three success factor for traditional and four for PPP Projects. These factor grouping will be projected size; project demand; pre-construction activities and project revenue.*

Keywords: *Traditional, Public Private Partnership, Factor analysis, Traffic volume, Project delay, Economic freedom, Project revenue.*

1. INTRODUCTION

Inadequate infrastructure has been recognized as a major constraint on rapid economic growth. The Eleventh, five-year plan, had, therefore, emphasized the need for massive expansion in investment in infrastructure based on a combination of public and private investment. The Twelfth five-year plan period (2012-17), the investment requirement in India was estimated at about $ 1 trillion, and more than 50% of the expected investment is expected to come from the private sector.

Since 1996 up to 2011 data collected from MOSPI on national highways projects shows that 289 nos. of the project having length 12,050 Km. has been completed. Out of 289 nos. project 227 nos. (8598 Km.) worth Rs. 32,618 Cr. has been completed on traditional funding with 30.48%, cost overrun and 16.48% time over similarly rest 62 nos. project (3452 Km.) worth Rs. 22,795 Cr. has been completed in PPP

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mode (toll / annuity) with 6.84% time overrun for toll projects and 5% of annual projects. Later on financial constraints due to lender limit of infrastructure funding, non-fulfillment of statutory clearances by the government and non-capacity building of private sector, failure of PPP Projects has started. Thus, projects are stalled time and cost overrun has become a regular feature.

Infrastructure projects especially in road sector either National Highway or State Highway is implemented by Govt. of India, State Govt., or any PSU, there is always time and cost overrun.

Until now it has been found that with a comparison to traditional project time overrun is less in PPP projects, whereas cost overrun is more in PPP Projects due to various financing cost. Earlier, it was the impression that cost overrun is only in a traditional project, but due to failure in PPP Projects in recent years, it has become apparent that although cost overrun is lesser in PPP Projects with a comparison to a traditional one; but there is a cost overrun too in PPP Projects.

The present data collected on completed N.H. Projects in India have been analyzed to derive critical success factors for PPP as well as traditional road projects. Out of selected 100 projects in different states of the country 28 no successfully completed PPP (Toll /Annuity) projects and 72 nos' successfully completed traditional (Plan funding, Multilateral funding) NH projects have been considered.

Infrastructure projects are more often than not, plagued by substantial cost and time overrun. Given the perceived efficiency of the private sector, the hypothesis was that incidence of projects overruns could be lesser in PPP projects as compared to non-PPP Projects. More ever, the overruns should show a decreasing trend over time with the advancements in engineering, construction methodology and project management. Data from national road projects in India was used as a study sample while cost overruns were higher in PPP Projects; time overruns were higher in traditional projects. A three stage least squares regression estimated to address the simultaneity bias also showed that use of PPP increased cost overrun though it did not affect time overrun. (Rajan, 2014)

Planning is known to enhance construction project performance in terms of cost, schedule, and quality. Yet, project teams oftentimes do not incorporate effective planning methodologies, typically citing a lack of time or capability to conduct detailed planning. This article proposes a brief yet rigorous project planning method, known as the pre-contract planning model, which is uniquely implemented by the owner and selected contractor project teams prior to contract award with the intent of increasing project team alignment and facilitating greater risk transfer from owner to the contractor. Results from a multi-case longitudinal study documented the impact of the pre-contract planning model in terms of three success criteria: cost growth, schedule growth, and owner satisfaction, where cost and schedule growth were measured as the percent increase of initial contract values. Projects that implemented the pre-contract planning model were compared with a control group that operated via a traditional project delivery process where the selected contractor directly proceeded to contract award without a formal planning process. Analysis revealed that the pre-contract planning model reduced cost and schedule growth by as much as 54% and 70% percent, respectively, indicating that pre-contract planning may be a viable planning mechanism to be implemented in the construction industry. (Brian C. *et. al.* 2014)

In the present study, it has been inevitably assumed that all the PPP contracting approaches share similar characteristics and that the potential of cost overrun depends on the same (similar) factors. It is evident that large-sized projects, in terms of duration, length and cost are generally more likely to have a cost overrun, whereas in the case of PBC and cost plus time bidding approaches favors large-size project and can be adopted as a sustainable solution in less cost overrun. Hence, work type having high cost or high level of maintenance risk are more likely to result in a cost overrun regardless of PPP approach and similarly low-cost work with less level of implementation risk are less likely to cost overrun irrespective of PPP approach (Panagiotis *et. al.* 2014).

The study is to assess the effect of performance bonding on the valuation of a Built-Operate-Transfer (BOT) project by extending the classical Black-Scholes-Merton (BSM) call option model. As common features in BOT contracts, a performance bond is a penalty imposed on concessionaire who exercises contractual rights to terminate participation in a project. In the real options context, termination rights grant concessionaires the flexibility in managing market uncertainties that can increase the valuation of an infrastructure project, but the penalty impairs their flexibility and reduces valuations. A case study numerically illustrates the BSM model and indicates that performance bonding can destroy the flexibility and project valuations interest in termination rights even when the penalty is moderate. A balancing performance bond and termination rights are necessary because both are important in establishing and maintaining long-term contractual relationships in privatized BOT infrastructure projects. (Huang & Chi-Chi-Pi 2013).

Despite their negative impact on the construction industry, cost overrun has become an almost natural part of building and infrastructure projects. This paper examines the phenomenon as a worldwide problem, identifies its root causes, ranks them and analyzes them. Root because the analysis is not merely an arbitrary expression; rather it is a systematic formal, well-structured methodology, used as part of the total quality management approach. The expand-focus principles and techniques were applied in this research for assembling an initial, as wide as possible, inclusive list of 146 potential causes gathered from the international professional literature as well as from prominent local experts. The survey revealed that, locally, cause number 1 is premature tender documents, cause number 2 is too many changes in owner's requirement or definitions, and cause number 3 is tender winning prices are unrealistically low (suicide tendering) (Yehiel Rosen Feld 2013).

The transportation industry is continually developing large complex projects in an effort to keep the traveling public and goods moving. Investigating successful projects enables practitioners to apply and refine successful practices in order to manage future projects more effectively. This paper investigates the transportation expansion (T-REX) project in the United States and the Highway Durango-Mazatlan Projects in Mexico to discover practices that supported the success of these two large, complex projects. The methodology used in this investigation was case study research with in-depth interviews of project managers. The investigation found that the greatest challenges for both project teams were constantly adapting to a challenging work environment. The common themes that contributed to the success of the projects were (1) Early agency agreement and commitments (2) understanding about the cultural and socio-political circumstances surrounding the project (3) Public outreach and (4) Recognition of circumstances that had an impact on the project (Puerto *et. al.* 2013).

Singh (2010) used empirical correlation models and mapped corresponding cause of overruns to their effects in infrastructure projects. The research involved data from over 800 projects, in various domains such as power, roads, and water projects.

However, the findings were very broad-based given the different sectors to which the projects belonged and thus reduced the specificity associated with the recommendations.

Moreover, the study did not appropriately account for the endogeneity among the study variables. In terms of methodology, a variety of methods have been sued to study the issue of project overruns. Singh (2010) OLS estimates. Attalla and Hegazy (2003) used artificial neural networks and regression in predicting cost deviation in reconstruction projects. Shaheen *et. al.* (2007) used neuro-fuzzy models in analyzing the causes of overruns.

Raghuram (2004) concluded that tolling of small stretch is not appropriate as corridor management is being preferred in the Indian context. Washington State Transportation Commission (2006) in which ten compiled background papers include analysis of certain illustrative examples of Toll roads, and recommendations are highlighted with suggestions for modifications in successful toll projects. Vandoros and Pantauvakis (2006) in the paper concluded that real options, despite the difficulty in their proper application, may provide better decision-making for evaluating PPP/Private Finance Initiative (PFI) projects at the appraisal stage.

Dey *et. al.* (1994) indicated that changes in the construction environment are the primary barriers to project completion resulting in cost and time trade-off. Arditi *et. al.* (1985) showed a clear connection between delays and cost overrun. The results suggested that mistakes in the initial estimates of cost and time often manifest as overruns.

2. METHODOLOGY

Factor analysis is a very useful method of reducing data complexity by reducing the number of variables being studied. Moreover, factor analysis is a set of techniques which explain much of the original data, more economically. The subjective element of factor analysis could be reduced by splitting the sample randomly into two, and extracting factors separately from both parts. If similar factors result, the analysis could be assumed as reliable or stable. It can also be done separately for 2 groups such as traditional Vs. PPP and check what differences exist in the factors extracted.

There are two stages in factor analysis, Stage-I (Factor extraction process) – It is to identify that how many factors will be extracted from the data.

Most popular method is principle component analysis. There is also a rule-of-thumb based on the computation of an Eigen Values to determine how many factors to extract. Since the objective is to reduce the variables to a fewer number of factors, we usually retain those with an Eigenvalue of 1 or more (A factor must explain at least as much of the variance if not more, than a single original variable).

Stage – II (Rotation of Principle components): This is done by a process of identifying which factors are associated with which of the original variables. The original factor matrix is un-rotated and is a part of the output from Stage-I. The rotated factor matrix comes about in Stage-II, where we request that the computer package performs a rotation and give us a rotated factor matrix. The factor matrix (whether rotated or unrotated) gives us the loading of each variable on each of the extracted factors. This is similar to the correlation matrix, with loadings, having values between 0 and 1. This process is somewhat subjective but results in very useful interpretation.

3. DATA ANALYSIS AND INTERPRETATION

Conceptually, the construct has been divided into three categories, keeping in view the technical aspects, economic aspects and state specific aspects of the considered 100 projects. A total of 10 independent variables has been used in the estimation models, as described below. Data sources for the different variables are given in Table 1.

Table 1
Data sources of variables

Constructs Name	*Data Source*	*Description (Representation)*
Technical Aspect		
Road Length	www.nhai.org	In Km.
Road Cost	www.nhai.org	In Lakh Rs.
Construction duration	www.nhai.org	In months
Traffic volume	www.morth.nic.in	In passenger car unit
Economic Aspect		
Time delay	Indian Highways journal Sept. 2014 (Page 33 to 38)	In months
Road density per lakh population	Indian Roads Congress	In Km. / Lakh population
Road Severity (Road accident death per 1000 accident)	www.nhai.org	In Nos.
State Specific Aspect		
Economic freedom	Centre for Maintaining of Indian Economy CMIE, 2012	In index
Population	Planning Commission	In lakh
Per Capita State GDP	Central statistical office (2012)	In Rupees

• Lakh = 100000

Technical Aspects

1. Road Length: It is an indicator of the size of the project, longer the length, more is the requirement of resources and pre-construction planning. Hence, more is the length, more will be land acquisition and finally chances of increase in cost & time overrun.
2. Road Cost: The cost of construction depends upon length; no. of lines, specification, geographical conditions and time of completion also. Hence, project overrun depends upon road cost. It also makes important factor for deciding the viability of the project.
3. Duration: This indicates the initial estimated time for completing the project and is another indicator of project size. Greater project duration generally increased the resource requirement, which should increase the overrun. Longer projects are also susceptible to changes in the construction environment, such as a change in weather material prices, etc., which can cause overrun.

   Hence due to delay in pre-construction activities, land acquisition, fulfillment of condition precedent by the client or contractor the duration of the project becomes larger. Even after so many ways of calculation of schedule of completion of the project, it is practice to keep the duration of project based on ideal conditions.

4. Traffic: The proposal of the widening of highway depends upon no. of vehicles and types of vehicles passing through the alignment it is explained in passenger car unit. One four wheeler vehicle is considered standard, and rest are calculated based on the multiplying factor. Any project is viable for PPP, depends upon PCU traffic. More traffic causes more revenue hence return on investment is early.

Economic Aspects

5. Time delay: This is a very important indicator, which differentiate the implementation procedure of any project. Usually, it has been found that traditional projects were delayed due to faulty DPR, slow reconstruction activity, tedious land acquisition, environmental clearance delay and change of scope of the project.

   But in PPP project, innovation in design and implementation has made the project less delay and some time on schedule or even before schedule.

6. Road density per lacs population: It is an important indicator, which shows availability of road in km. per lakhs of the population in the concerned state where the project is situated.

7. Road Severity: It is no. of accident death per thousand no. of the accident. This is also an effective indicator. Proper provision of road safety may decrease road accidents. Earlier in traditional projects it is less cared due to unawareness and cost of construction. But nowadays once tolling is part of PPP projects. Highway ambulance, better maintenance and road safety measures are reducing it at first instance. However, due to rash driving and driver's fault still it is a matter of debate for engineers.

State specific indicators

8. Economic freedom index: Every state has its own social development index based on education, health, and other welfare activities. Economic freedom has been prepared to justify the requirement.

9. Population growth: This is similar to the previous indicator of the state population. But states where population growth is more, requires more infrastructure and thus project revenue is also more in the case of PPP Projects.

10. State Gross Domestic Product: This variable is an indicator of the income and the level of demand for transport services in the state. States with a higher per-capita State GDP have a higher level of economic activity and hence, have a stronger demand for road transport infrastructure. It was

Table 2
Factor Analysis for PPP Projects Correlation Matrix

Correlation Matrix

		Length	*Cost*	*Traffic*	*Delay*	*Density*	*EF*	*Population*	*Duration*	*Severity*	*Per Capita SGDP*
Correlation	**Length**	1.000	0.668	0.071	0.210	-0.200	0.259	0.277	0.579	-0.031	0.080
	Cost	0.668	1.000	0.112	0.173	0.022	0.387	0.136	0.754	-0.217	0.315
	Traffic	0.071	0.112	1.000	0.061	-0.127	-0.115	0.103	0.254	0.002	0.432
	Delay	0.210	0.173	0.061	1.000	-0.154	-0.198	0.167	0.253	-0.061	-0.157
	Density	-0.200	0.022	-0.127	-0.154	1.000	-0.165	-0.493	0.042	-0.034	-0.107
	EF	0.259	0.387	-0.115	-0.198	-0.165	1.000	-0.136	0.161	-0.206	0.552
	Population	0.277	0.136	0.103	0.167	-0.493	-0.136	1.000	0.132	-0.016	-0.195
	Duration	0.579	0.754	0.254	0.253	0.042	0.161	0.132	1.000	-0.056	0.353
	Severity	-0.031	-0.217	0.002	-0.61	-0.034	-0.206	-0.016	-0.056	1.000	-0.093
	Per Capita SGDP	0.080	0.315	0.432	-0.157	-0.107	0.552	-0.195	0.353	-0.093	1.000

expected that higher income states would have a more robust environment for the development of infrastructure projects, which would result in lower project overruns.

3.1. Principle Components Method

It is a procedure to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrected variables called principle components. The Principle Components (PC) technique is very popularly used for factor analysis. PC method of factor analysis seeks to maximize the sum of squared loading of each factor expected in turn. It satisfies two conditions:

(i) Principle components are uncorrelated (orthogonal)

(ii) First principle components have the maximum variance; the second principle component has the next maximum variance and so on.

All the 10 variables are on the nominal scale.

The correlation matrix table shows each of the 10 independent variables have a strong correlation with respective other variables. For example, in the case of the length of any project is correlated with cost, duration, economic freedom, the population of the state as well as a delay in completion. Similarly, the cost of any project is correlated to length, duration, delay and economic freedom of the state as well.

Since the no. of completed N.H. projects on PPP model are 28 only until 2011 (November) hence sample size may not be adequate. KMO result comes nearly 0.5, which in another case comes more than 0.5 and, therefore, it is O.K.

Chi-Square value is more than 86, the value of significant is zero for differences no. 45 hence data is reliable.

Table 3
KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.0.553		
	Approx. Chi-Square	86.703
	Df	45
	Sig.	0.000

Factor analysis is carried out to identify a relatively small no. of factor groupings that can be used to represent relationships among a set of many inter-related variables. This technique is applied to the sample data to explore grouping that might exist among principle success factors. Factor analysis helps the decision makers to understand the problem by structuring the hierarchy, and it transfers

Table 4
Communalities

Communalities		
	Initial	*Extraction*
Length	1.000	0.713
Cost	1.000	0.865
Traffic	1.000	0.843
Delay	1.000	0.463
Density	1.000	0.854
EF	1.000	0.854
Population	1.000	0.729
Duration	1.000	0.831
Severity	1.000	0.202
Per Capita SGDP	1.000	0.872

their subjective judgments into meaningful weights and ratios that represent their priorities.

Stage-1: It is factor extraction of identity the no. of factors that will be extracted from data based on principle components analysis. The objectives of this factor analysis are to extract least no. of factors possible that will maximize the explained variance. Initial Eigenvalues close to 1 give high loading and those close to 0 low loading.

Table 5
Total Variance Explained

Total Variance Explained									
	Initial Eigenvalues			*Extraction Sums of Squared Loadings*			*Rotation Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	2.875	28.753	28.753	2.875	28.753	28.753	2.489	24.893	24.893
2	1.794	17.936	46.689	1.794	17.936	46.689	1.704	17.044	41.938
3	1.342	13.424	60.114	1.342	13.424	60.114	1.580	15.800	57.738
4	1.214	12.143	72.257	1.214	12.143	72.257	1.452	14.519	72.257
5	0.978	9.781	82.037						
6	0.745	7.445	89.483						
7	0.408	4.079	93.562						
8	0.289	2.889	96.451						
9	0.197	1.974	98.425						
10	0.158	1.575	100.000						

Since approx. 72% of the variables under the study was covered in 4 components which are considered to be a pretty good bargain as only 28% of the variables were lost in the study. This is a good deal because with only 4 factors (reducing from 10 no.) we have lost only 28% of the information content while 72% is retained by the 4 factors extracted out of the 10 original variables.

Table 6
Component Matrix

	Component			
	1	*2*	*3*	*4*
Cost	0.876		0.304	
Duration	0.824		0.280	0.265
Length	0.760	0.273	0.186	-0.161
Population	0.242	0.725	-0.331	-0.187
Per Capita SGDP	0.534	-0.596	-0.428	0.224
Delay	0.238	0.560	0.255	0.167
EF	0.496	-0.548	-0.223	-0.508
Density	-0.226	-0.439	0.722	0.297
Traffic	0.321		-0.442	0.738
Severity	-0.225	0.169	-0.110	0.333

Table 7
Rotated Component Matrix

	Component				*Remarks*
	1	*2*	*3*	*4*	
Cost	0.879	0.295			
Duration	0.862			0.286	Project Size
Length	0.789	0.133	0.264		
EF	0.169	0.905			Pre-Construction
Delay	0.458	-0.459	0.189		Activity
Severity	-0.186	-0.361		0.191	
Density		-0.147	-0.901	-0.133	
Population	0.208	-0.208	0.798		Project Demand
Traffic	0.113	-0.199	0.100	0.883	
Per Capita SGDP	0.138	0.578		0.717	Project Revenue

Stage-2: Rotated component matrix gives rotation to principle components, which result in interpretation capability to name the factors, from the factor analysis relatively a small number of factor groupings are attempted, that can be used to represent relationships among sets of many interrelated variables. The factor analysis shows that 9 critical success factors can be grouped into four principle factors and be interpreted as follows:

Factor Grouping 1: Represents project size comprises of cost, duration and length.

Factor Grouping 2: Represents pre-construction activity comprises of Economic Freedom Index and delays in completion of project and accident severity.

Factor Grouping 3: Represents project demand comprises of density and population.

Table 8
Factor Analysis for Traditional Projects Correlation Matrix

		Correlation Matrix									
		Length	*Cost*	*Traffic*	*Delay*	*Density*	*EF*	*Population*	*Duration*	*Severity*	*SGDP*
	Length	1.000	0.711	0.144	-0.118	0.220	0.072	-0.141	0.383	-0.062	0.000
	Cost	0.711	1.000	0.134	-0.048	-0.076	-0.241	0.155	0.511	0.208	-0.273
	Traffic	0.144	0.134	1.000	0.344	-0.385	0.054	0.482	-0.073	-0.321	0.280
	Delay	-0.118	-0.048	0.344	1.000	-0.341	-0.256	0.482	-0.255	0.132	-0.042
Correlation	Density	0.220	-0.076	-0.385	-0.341	1.000	0.001	-0.855	0.029	-0.199	0.049
	EF	-0.072	-0.241	0.054	-0.256	0.001	1.000	-0.257	-0.273	-0.414	0.722
	Population	-0.141	0.155	0.482	0.482	-0.855	-0.257	1.000	-0.014	0.219	-0.225
	Duration	0.383	0.511	-0.073	-0.255	0.029	-0.273	-0.014	1.000	0.138	-0.345
	Severity	-0.062	0.208	-0.321	0.132	-0.199	-0.414	0.219	0.138	1.000	-0.624
	SGDP	0.000	-0.273	0.280	-0.042	0.049	0.722	-0.225	-0.345	-0.624	1.000

Table 9
KMO and Barlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.624
	Approx. Chi-Square	376.860
	Df	45
	Sig.	0.000

Table 10
Communalities

	Initial	*Extraction*
Length	1.000	0.794
Cost	1.000	0.826
Traffic	1.000	0.739
Delay	1.000	0.483
Density	1.000	0.725
EF	1.000	0.635
Population	1.000	0.889
Duration	1.000	0.574
Severity	1.000	0.660
SGDP	1.000	0.848

Factor Grouping 4: Represents project revenue comprises of per capita SGDP and traffic.

KMO test is having a value closer to 1, shows the suitability of factor analysis, whereas Bartlett test of sphericity shows the overall significance of the correlations within a correlation matrix. Chi-square distribution with p (p – 1) / 2 d.f., where p is a number of variables. Significance less than 0.05 gives significant correlation among variables.

Commonalities are the proportion of each variable's variance that can be explained by the factors. It is due to correlation among variables.

Table 11
Total Variance Explained

	Initial Eigenvalues			*Extraction Sums of Squared Loadings*			*Rotation Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	2.828	28.284	28.284	2.828	28.284	28.284	2.552	25.525	25.525
2	2.496	24.958	53.242	2.496	24.958	53.242	2.457	24.574	50.099
3	1.850	18.496	71.737	1.850	18.496	71.737	2.164	21.639	71.737
4	0.925	9.254	80.992						
5	0.685	6.849	87.841						
6	0.430	4.299	92.140						
7	0.314	3.144	95.283						
8	0.204	2.039	97.322						
9	0.182	1.821	99.143						
10	0.086	0.857	100.000						

In this case, the initial number of a factor is the same as the number of variables used in the factor analysis. However not all 10 factors will be retained. The number of a factor will be based on a number of eigenvalues of correlation matrix more than 01. In this case, 04 number factors have eigenvalues more than 01 which explain 80% variance while resting 20% variance are due to other 05 factors.

The component matrix table contains the unrotated factor loadings which are due to the correlation between the variables and the factors. Positive and negative correlations have been taken into consideration for grouping of factors. Thus in aforesaid rotated component matrix 10 critical success factors can be grouped into three principle factors and be interpreted as follows:

Factor Grouping 1: Represents project demand comprises of the population, density, and traffic.

Factor Grouping 2: Represents preconstruction activity comprises of economic freedom, delay, road accident severity and state GDP.

Table 12
Rotated Component Matrix

	Component		
	1	*2*	*3*
SGDP	-0.744	0.354	0.412
EF	-0.721	0.219	0.259
Population	0.666	0.657	0.118
Severity	0.640	-0.181	-0.468
Density	-0.495	-0.684	-0.109
Delay	0.375	0.583	
Duration	0.414	-0.552	0.313
Length	0.180	-0.493	0.721
Traffic	0.140	0.577	0.621
Cost	0.541	-0.412	0.603

Table 12
Rotated Component Matrix

	Component			*Remarks*
	1	2	3	
Population	0.918	-0.216		Project Demand
Density	-0.844			
Traffic	0.696	0.445	0.239	
Delay	0.662	-0.115	-0.178	
SGDP		0.908	-0.152	Pre-Construction
Severity		-0.808		Activity
EF	-0.151	0.758	-0.192	
Cost	0.118	-0.180	0.883	
Length	-0.114	0.132	0.874	Project Size
Duration	-0.137	-0.301	0.682	
Cost		0.541	-0.412	0.603

Factor Grouping 3: Represents project size comprised of cost, length, and duration.

4. RESULT AND DISCUSSION

Any road infrastructure project in India when becomes operational keeping in the view from conception to commissioning there is always time overrun and naturally cost overrun. The objective of this paper is whether the use of PPP had any impact on these projects overruns. Since time is money, hence time overrun itself covers more or less cost overrun of any project. Data collected for completed national highway project itself shows less time overrun for PPP project with a comparison from traditional projects. The reason behind the lesser time overrun in PPP Projects may be many, but one of them is initial years in the country when PPP's were being actively considered for developing road projects. The concessionaire had the liberty to innovative design; the limited role of the client over planning and supervision and finally revenue collection during concession period of the project.

The factor analysis of data for national highway projects separately for traditional as well as PPP Projects has shown very understandable results. In the case of traditional projects out of ten independent variables viz. project length, project cost, project duration, economic freedom of state, project traffic, project delay, road density, the population of the state, accident severity and state GDP three important independent variables have been factored. These are project size, project demand and pre-construction activity.

On the other hand, in the case of PPP Projects, same no. of independent variables gives four factors after analyzes, which again project size, project demand, pre-construction activity, and last project revenue. So it is really important to understand that even if all the three important features are available for execution of the project, PPP Projects requires one more factor i.e. project revenue. Selection of any PPP mode of execution of the project without keeping in view project revenue (return on investment for equity and Internal Rate of Return on total project cost) will not be feasible, and it will cause project overrun.

There is various reason for non-fulfillment of project revenue even after conceptualization of the project, for example delay in land acquisition, delay in environmental and other statutory clearances, faulty traffic projection; deficiency in DPR and change in scope; suicidal quoting, lender issue for project financing due to past experience of default; toll collection issue, O&M issue. However, govt. has to show its commitment / willingness / friendliness to resolve the issue, renegotiate the concession agreement, keeping in view no moral hazard, more penalty for concessionaire delay and additional incentive for early completion without any cost implication.

5. CONCLUSION

Over the past decade, there has been considerable effort focusing on finding new ways of contracting for highway maintenance and rehabilitation programs, motivated increasingly by widening funding gaps. To that end, the public-private partnership has been formed to sustainable highway preservation solutions by cutting costs and retaining an acceptable level of service for infrastructure asset, without harming the environment and exhausting natural resources. When compared with house practices, many PPP approaches produce cost savings. The present study has not analyzed various ways of PPP Contracting approaches like traditional maintenance, traditional rehabilitation. Design-build-operate-maintenance cost plus time bidding; performance-based contract, lane rentals, and warranties due to data limitation.

The above study can be explored in the case of road projects in India with a different class of road, local site condition and the social and political context.

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