

# Ranking of the Factors for Successful Implementation of Integrated Project Delivery in Bridge Construction Projects

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**Abstract**— Project delivery is a comprehensive process including planning, design and construction required to execute and complete a building facility. Determining the project delivery method is one of the most important decisions made by every owner embarking on a construction project. Researches show that integrated project delivery proves to be one of the most effective method for successful completion of a project. But, implementing IPD in Indian construction world is a greater challenge. For that in this study issues which creates a barrier for implementing IPD are identified. Through literature review 31 issues are listed down which influence the adoption of integrated project delivery. These factors are broadly classified in major five categories which are legal, organizational, technological, financial, cultural factors. Then a survey was carried out with the field experts who ever worked on bridge construction projects. Then these data are analysed with the help of Relative Important Index (RII) for importance of their occurrence. With the help of RII method ranking of the issues is done and the most critical factors are found out. Thus, this study provides a base for pure implementation of IPD.

**Key words:** Project Delivery Method, Integrated Project Delivery, Bridge Construction Projects, RII

## I. INTRODUCTION

Choosing a project delivery method has a great impact on the project success. Integrated project delivery has its own characteristics which ensures the project success. Integrated project delivery (IPD) is an innovative way to excel your construction planning reducing waste, cutting costs and improving productivity. The Integrated Project Delivery main goal is to create a team effort integrating owner, architects, engineers, managers and subcontractors. Unlike other project efforts, the Integrated Project Delivery creates a unique bond from day one of the planning stages, binding all major project stakeholders.

### A. Integrated Project Delivery Steps

The IPD process needs to take care of the following areas:

#### 1) Conceptualization

Stakeholders are gather and analyze multiple solutions that can enhance the product being offered. This will create a predictable less-complicated process, with the main goal set to reduce errors and minimize re-design problems.

#### 2) Design

All evaluations from stage one must be incorporated in the design process. Sustainability goals will be set and construction code regulations will be incorporated into the design process. Planning a project carefully with the Integrated Project Delivery will reduce waste and produce potential savings to all participants.

#### 3) Implementation

After a careful design process, the implementation of the project starts with computer modeling and design data analysis. Sometimes IPD integrates BIM and CAD modeling predicting the project outcome. All proposed systems must be analyzed and virtually tested to ensure, that design performance will be achieved.

#### 4) Construction

After all three previous steps are carefully completed, the construction of the project can start. The Construction phase is where the benefits of the integrated model are realized. The project will normally run smoothly, without delays, reducing design conflicts, extra works, change orders, waste, and will be completed on time and within budget.

#### 5) Operation

Initial goals are achieved, reducing operational costs, rental or maintenance costs and will provide great benefits for surrounding neighbours.

Identifying issues which obstruct above operations is the objective of this research and then find out most critical 10 issues which should be first eliminated are evaluated.

Questionnaire was designed based on these factors and survey was conducted. Civil engineers, contractors, consultants, architects who has ever been worked on bridges were selected as respondents for this study. Following fig. 1 shows the pie chart analysis of the respondents who participated in this survey.

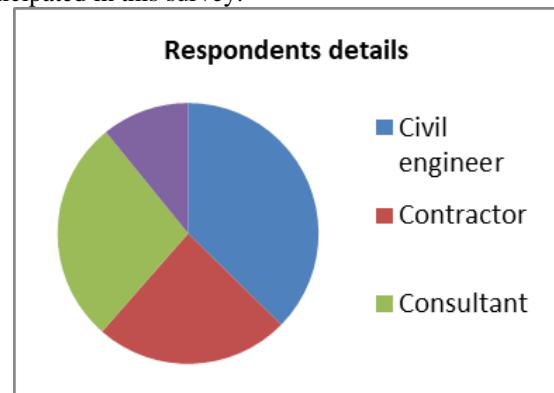


Fig. 1: Percentage of Different Stakeholder's Responses

## II. RESEARCH METHODOLOGY

Basically, this research work includes different phases. First phase of research covers review of literatures. Then questionnaire has been designed for survey. Through non structure interviews and expert opinions questionnaire has been validated and their responses has been taken. Third phase of research includes analysis of collected data with the help of RII method. Following table 1 shows the factors influencing implementation of IPD which are found out from literature survey.

Factors	Sub factors
Legal issues	Different criteria for service procurement
	Risk allocation
	Minimizing adversarial relationships
	Checks and balances
	Regulatory and statutory requirements
	State budget and funding cycles
Organizational issues	Project management
	Organizational culture
	Work processes
	Completion on schedule
	Attaining highest overall quality
	Capitalizing on a well defined scope
	Potential for changes during construction
	Level of in house management experience
	Stability of owner's requirements
Technological issues	IT infrastructure
	Information management protocol
	Interoperability
	Integration
	Skilled personnel
Financial issues	IPD compensation structure
	Sharing cost saving and overruns
	Profit pooling
	Completion with budget
	Early estimates
	Delaying or minimizing expenditure rate
	Payment method
Cultural issues	Integrating project personnel
	IPD training
	Trust building activities and tools
	Management experience
	Project management resources

Table 1: Factors influencing implementation of IPD  
Now, all 31 factors are analysed by RII method which is explained below.

#### A. Relative Important Index (RII)

This technique is used by many researchers like (1994) to rank the causes of delay in construction projects of Fugar et al., (2010), Kometa et al., Ghana.

Formula to calculate RII is as given below:

$$RII = \frac{\sum W}{AN}$$

Where ,W = Weightage given by the respondents (ranging from 1 to 4),

A = Highest weight,

N = Total Number of respondents.

### III. DATA COLLECTION & ANALYSIS

Questionnaire distribution and collection has been done by hand-to-hand method, by direct visit or after taking prior appointment with the respondent in personal. Data has been collected in the form of questionnaire survey as a personal opinion of the internal/key stakeholders of construction project within scope of study.

Sr. No.	Respondent	Sent	Received	Percentage
1	Architect	17	09	52.94
2	Consultant	39	23	58.97
3	Civil Engineer	44	31	70.45
4	Contractor	28	20	71.42
	Total	128	83	64.84

Table 2: Data Collection

#### A. Data Analysis

The collected data has been analysed using the RII method to rank the issues according to their importance of occurring.

RII method has been discussed in above from that following results has been derived.

- Top 10 Perception Factors Ranking By RII Method:  
As per Architect's point of view

Factors	RII Ratings
Relationship between project participants which minimize dispute and maximize productivity	0.944444
On schedule completion of project	0.944444
Completion of project with estimated budget	0.888889
Management experience of participants	0.861111
Approval from regulatory and statutory bodies.	0.833333
Willingness of owner of organization to take a lead	0.833333
IT infrastructure to support efficient inter organizational information exchange and is capable of receiving, storing, retrieving and coding information.	0.833333
Skill and experience of project management resources	0.833333
Sharing of risk and rewards among project participants	0.805556
Interoperability for uninterrupted information transfer	0.805556

Table 3: Top 10 Factors as per Architect's opinion

- Top 10 Perception Factors Ranking By RII Method  
As per Consultant's point of view

Sub Factors	RII Ratings
Completion of project with estimated budget	1
On schedule completion of project	0.978261
Skill and experience of project management resources	0.913043
Sharing cost savings and overruns between project team members	0.880435
Interoperability for uninterrupted information transfer	0.815217
Awareness of new work processes among participants	0.804348

IT infrastructure to support efficient inter organizational information exchange and is capable of receiving, storing, retrieving and coding information.	0.804348
Integration of software for successful implementation of IPD.	0.782609
Level of collaboration between project personnel	0.76087
Attaining highest overall quality which refers to design features, equipment and material specifications, safety requirement, and project life cycle consideration.	0.75

Table 4: Top 10 factors as per consultant's opinion

- Top 10 Perception Factors Ranking By RII Method:  
As per Civil Engineer's point of view

Sub Factors	RII Ratings
Completion of project with estimated budget	0.959677
On schedule completion of project	0.862903
Relationship between project participants which minimize dispute and maximize productivity	0.854839
Willingness of owner of organization to take a lead	0.83871
Checks and balances for design services, project inspection, construction observation, finance procurement.	0.814516
Skill and experience of project management resources	0.814516
Approval from regulatory and statutory bodies.	0.798387
Size and type of project	0.798387
Management experience of participants	0.782258
Awareness of new work processes among participants	0.774194

Table 5: Top 10 Factors as per Civil Engineer's Opinion

- Top 10 Perception Factors Ranking By RII Method:  
As per Contractor's point of view

Sub Factors	RII Ratings
Completion of project with estimated budget	0.975
On schedule completion of project	0.925
Skill and experience of project management resources	0.925
Early estimates even before design is complete	0.8375
Awareness and skill of workers to operate new technologies.	0.7875
Management experience of participants	0.775
Awareness of new work processes among participants	0.7625
Interoperability for uninterrupted information transfer	0.7625
IT infrastructure to support efficient inter organizational information exchange and is capable of receiving, storing, retrieving and coding information.	0.75
Delaying or minimizing expenditure rate	0.7125

Table 5: Top 10 Factors as per Contractor's Opinion

- Top 10 Perception Factors Ranking By RII Method  
As per All Respondent's point of view

Sub Factors	RII Ratings
Completion of project with estimated budget	0.975
On schedule completion of project	0.925
Skill and experience of project management resources	0.925
Relationship between project participants which minimize dispute and maximize productivity	0.8375
Interoperability for uninterrupted information transfer	0.7875
Awareness of new work processes among participants	0.775
IT infrastructure to support efficient inter organizational information exchange and is capable of receiving, storing, retrieving and coding information.	0.7625
Sharing cost savings and overruns between project team members	0.7625
Willingness of owner of organization to take a lead	0.75
Awareness and skill of workers to operate new technologies.	0.7125

Table 7: Top 10 factors as per all respondent's opinion

#### IV. CONCLUSION

From this research we can conclude that completion of project with estimated budget and on schedule completion of project are most important factors which assures successful implementation of integrated project delivery. In this study architect, consultant, contractor and civil engineer all respondents' personal opinion is also evaluated. As per opinion of each respondent results have been computed through RII method. Thus, this research can be used as a framework while implementing IPD. Here, in fig. 2 top 10 factors as per all respondent's opinion have been shown in a graph form.

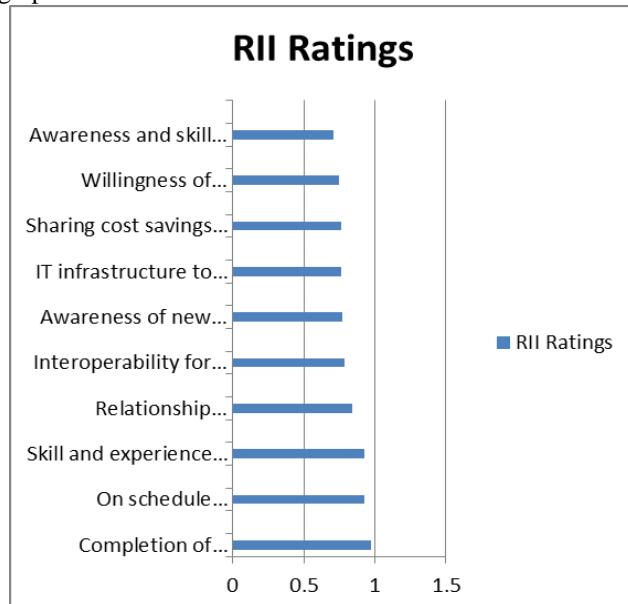


Fig. 2: Chart of top 10 Factors

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