

Analysis of the Perceptions of Beneficiaries and Intermediaries on Implementing IPD in Indian Construction

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Abstract –

Selection of appropriate project delivery system is key for project success. It also gains much importance in a fast developing economy like India where there is a greater emphasis on development of housing and infrastructure involving huge investments. The present practices of project delivery led to inefficiency and distrust among the employer, consultant, contractor, and suppliers. Integrated Project Delivery (IPD) is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively contributes to optimise the project results. However, the adoption of IPD in Indian construction is in its formative stage due to the challenges that are faced by various stakeholders. The objective of this study is to analyse the perceptions of the beneficiaries and intermediaries in the construction sector, on these challenges. An exploratory study has been conducted among various beneficiaries and intermediaries of construction sector in India using a questionnaire survey to gain insight into the perceived challenges. It has been observed that the intermediaries and beneficiaries differ in their perceived challenges, which is also found to be significant in legal issues. An in-depth analysis also revealed that the stakeholders perceived the following challenges significantly different: *Employer's unwillingness to share consultant in the profits of the project (Finance), Resistant to change (Culture), Disengagement agreement of the parties to implement the project on time (Legal), and Unfamiliarity with BIM (Technical).*

Keywords –

Indian construction; Integrated Project Delivery; intermediaries

1 Introduction

India is one of the fastest growing economies in the world and construction is the second largest contributor to Indian economy. There is a consistent drive to develop housing and infrastructure in India that involves huge

investments in built environment projects. However, there are inefficiencies in traditional project delivery methods used in India that hampers the progress. This also has led to distrust among the various stakeholders in the construction sector such as client, consultant, contractor, and suppliers. Integrated Project Delivery (IPD) is an alternate project delivery system that promises to overcome some of the challenges faced in traditional systems [1].

IPD is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively contributes to optimise the project results [2][3][4]. However, the adoption of IPD in Indian construction is in its formative stage due to the challenges that are faced by various stakeholders [5]. The objective of this study is to analyse the perceptions of the beneficiaries and intermediaries in the construction sector, on these challenges. An exploratory study has been attempted among the key stakeholders to assess the critical challenges along the financial, cultural, legal and technical dimensions. Salient findings are reported in this article. It has been observed that there is a significant difference between the perceptions of the beneficiaries and intermediaries in general and the same is predominant in legal aspects of implementing IPD.

2 Literature Review

Choice of project delivery system is key in the success of a construction project. Several project delivery systems being practiced in the field of construction such as Design-Bid-Build (DBB), Design-Build (DB), Construction Manager at Risk (CM@Risk), Engineering Procurement Construction (EPC), Job Order Contracting (JOC), and Partnering & Alliancing [6]–[8]. There are challenges reported in successful implementation of these systems (lack of stakeholders' involvement in the early stages, unbalanced risk & reward sharing, lack of trust & respect, standalone decision-making, unclear project goals, ineffective communication, incompatible technology, improper organisation & leadership as found in Figure 1) [9][10][11].

IPD includes presence of all key factors of the project from outset in an integrated manner, and using their experiences and constructive cooperation in a multilateral contract to have a more successful project and participation in risk and reward for all stakeholders in project life cycle [4][12]. This technology-driven delivery method has been implemented in a number of projects at various parts of the world [1][9]. It has been reported that there are certain challenges in adoption and successful implementation of IPD[13]–[22]. The implementation of IPD in Indian construction is in its formative stage[5], [21]. All such reported challenges/barriers can be classified into four major

categories: financial, legal, technical and cultural aspects [5]. 34 such factors that influence the adoption/implementation of IPD were identified from the existing literature and presented in Figure 2 [5][9][17][18], [19].

Stakeholder engagement and satisfaction is also one of the critical success factors for project delivery. It is implied that there is varied level of acceptance for IPD from difference project stakeholders [5], [23] but there is limited literature on the perspectives of the beneficiaries and intermediaries involved in the construction projects at a macro level.

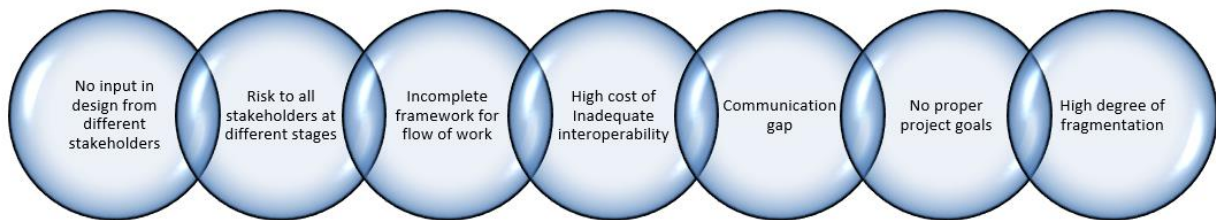


Figure 1. Challenges in Traditional Project Delivery Systems

Factors influencing the IPD adoption	
Finance	
F1	Compensation structure
F2	Employer's unwillingness to share consultant in the profits of the project
F3	Lack of transparency in spending done by the contractor
F4	High bids due to inexperience
F5	Confusion & Misunderstandings regarding accounting of contingency
F6	Lenders may demand 'hard pricing' for implementing IPD
F7	No specific plans for encouraging and rewarding
Legal	
L1	New framework for legal practice is needed
L2	IPD contract types are not tested or understood
L3	Multiparty agreement for entire project lifecycle
L4	No insurance coverage for IPD
L5	No Dispute resolution clause
L6	Contractor's unwillingness to participate in the design phase
L7	Disengagement agreement of the parties to implement the project on time
Technical	
T1	Unfamiliarity with BIM
T2	Interoperability issues
T3	Changes in the original design during construction phase
T4	Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders
T5	Integration of information and knowledge management systems
T6	Early involvement of key participant
T7	Early definition of target goals without fully developed design
Cultural	
C1	Lack of IPD awareness among stakeholders
C2	Training & Skill enhancement
C3	Absence or lack of respect and trust of the project parties to each other
C4	Organisation culture
C5	Resistant to change
C6	Inexperience with each other & IPD
C7	New approach take time
C8	Difficult to measure its benefits
C9	Unwillingness of employers, consultants and contractors to carry out the project in a team with common interests
Others	
O1	Joint ownership of documents
O2	Who owns BIM? Who will pay for it?
O3	Shorter projects cannot spend time on organizational efforts for IPD
O4	Formation of Entity for "Real" IPD

Figure 2. Factors influencing IPD adoption

Beneficiaries are the stakeholders who are getting benefitted directly by the facilities developed; they are owners/clients, customers, developers and facility managers. The intermediaries shall include the design consultants (including architect, structural engineers, MEP engineers), project/construction managers, contractors, suppliers, etc. who are contributing to the development of the facilities (Please refer to Figure 3).

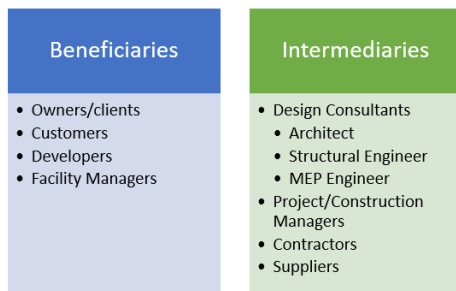


Figure 3. Beneficiaries and intermediaries in construction projects

Both beneficiaries and intermediaries would reap certain common and specific benefits when IPD is implemented. At the same time, the challenges that they face while implementing IPD also would vary due to various reasons ranging from cultural, legal, financial and technical context of the organisation. There is a need

to study this characteristic of contrasting business interests of intermediaries and beneficiaries and its impact on the adoption of IPD. This would enable formulating strategies for improved adoption of IPD in construction projects.

3 Research Methodology

It has been attempted to use a questionnaire survey-based exploratory study to analyse the perceptions of beneficiaries and intermediaries on the factors influencing the implementation of IPD in Indian construction. The research methodology used is presented in Figure 4. An instrument has been designed to collect the data from the respondents (on a 5-point two-sided Likert scale; 5-Strongly Agree & 1-Strongly Disagree) on the agreement of the respondent with respect to the perceived challenges as shown in Figure 2. The respondents have been chosen using independent random sampling technique and drawn from the population of various beneficiaries and intermediaries. There were about 200 such prospective respondents invited to participate in the study and 90 responses were received (corresponding to 45% response rate). After careful scrutiny only 60 (out of 90) valid responses were used for analysis.

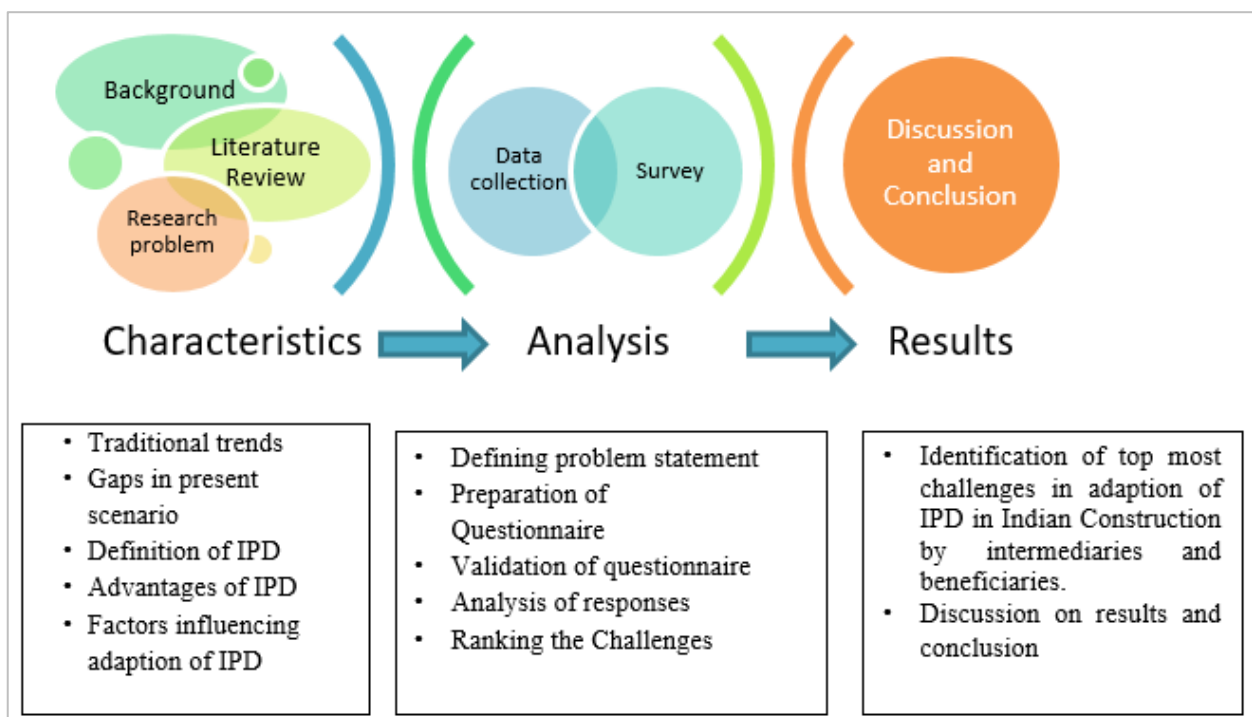


Figure 4. Research methodology

Relative Importance Index (RII) is used to prioritise the factors influencing the challenges to implement IPD.

$$RII = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N} \quad (1)$$

where

w - weighting given to each factor by the respondent, ranging from 1 to 5.

*n*₅ - number of respondents rated a factor as Strongly Agree;

*n*₄ - number of respondents rated a factor as Agree;

*n*₃ - number of respondents rated a factor as Neutral;

*n*₂ - number of respondents rated a factor as Disagree

*n*₁ - number of respondents rated a factor as Strongly Disagree.

A - highest weight (i.e. 5 in the study) and

N - total number of responses.

The RII ranges from 0 to 1. Higher the RII, greater the challenge.

Cronbach's Alpha has been used to measure the internal consistency of the instrument and reliability of data. Two-tailed t-Test (two sample unequal variance) at 5% significance level is used for hypothesis testing.

H₀: *There is no difference in perception between the Beneficiaries and Intermediaries on the relative importance of challenges in implementing IPD*

H₁: *There is difference in perception between the Beneficiaries and Intermediaries on the relative importance of challenges in implementing IPD*

4 Results and Discussion

Out of 60 valid responses, 30 belong to beneficiaries group and remaining belong to intermediaries group. The beneficiaries group respondents are primarily clients and the intermediaries consists of designers, contractors and suppliers. Sanitised data set received from all the 60 respondents is checked for reliability using Cronbach's Alpha, which is found to be 0.773. It indicates that the internal consistency of the instrument is good and the data collected using this instrument is reliable to conduct further investigation.

4.1 Overall Analysis

RII of the factors influencing the use of IPD is calculated using Equation (1) based on the responses from all the subjects. The ranking of the factors based on the RII is presented in Figure 5. It can be observed that *Lack of transparency in spending done by the contractor* is rated as the most critical challenge for the implementation of IPD in Indian construction. This can be related to the systemic characteristic of Indian construction sector, which is not highly professional and transparent that leads to lack of trust among project

stakeholders. The second most rated factor is *New approach takes time*. This shows the apprehension of the stakeholders to adopt a new approach. There are three factors rated at rank three; they are:

- *Training & Skill enhancement*
- *Lack of IPD awareness among stakeholders*
- *IPD contract types are not tested or understood*

FC	Factors	RII	Rank
F3	Lack of transparency in spending done by the contractor	0.81	1
C7	New approach takes time	0.79	2
C2	Training & Skill enhancement	0.76	3
C1	Lack of IPD awareness among stakeholders	0.76	3
L2	IPD contract types are not tested or understood	0.76	3
T4	Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders	0.73	4
F1	Compensation structure	0.71	5
T6	Early involvement of key participant	0.71	5
O3	Shorter projects cannot spend time on organizational efforts for IPD	0.71	5
L3	Multiparty agreement for entire project lifecycle	0.70	6
F5	Confusion & Misunderstandings regarding accounting of contingency	0.70	6
C6	Inexperience with each other & IPD	0.70	6
T3	Changes in the original design during construction phase	0.70	6
F6	Lenders may demand 'hard pricing' for implementing IPD	0.70	6
C5	Resistant to change	0.69	7
T7	Early definition of target goals without fully developed design	0.69	7
F4	High bids due to inexperience	0.69	7
C9	Unwillingness of employers, consultants and contractors to carry out the project in a team with common interests	0.69	7
L4	No insurance coverage for IPD	0.68	8
O1	Joint ownership of documents	0.68	8
C3	Absence or lack of respect and trust of the project parties to each other	0.68	8
C4	Organisation culture	0.68	8
T5	Integration of information and knowledge management systems	0.68	8
L1	New framework for legal practice is needed	0.67	9
L7	Disengagement agreement of the parties to implement the project on time	0.67	9
T2	Interoperability issues	0.67	9
O2	Who owns BIM? Who will pay for it?	0.67	9
O4	Formation of Entity for "Real" IPD	0.67	9
F7	No specific plans for encouraging and rewarding	0.67	9
L6	Contractor's unwillingness to participate in the design phase	0.66	10
F2	Employer's unwillingness to share consultant in the profits of the project	0.65	11
T1	Unfamiliarity with BIM	0.65	11
C8	Difficult to measure its benefits	0.62	12
L5	No Dispute resolution clause	0.61	13

Figure 5. Overall ranking of factors by all the respondents

As the IPD demands high skill levels for implementation, stakeholders feel that they may have to focus on training before embarking on IPD system. Also, IPD is found to be not so familiar with the stakeholders. There is also some concern about the type of contracts (typically multi-party) that are quite different from the contracts used in the traditional delivery systems. It has been observed that there is some hesitations on the use of IPD due to the fact that the early involvement of other stakeholders might have adversarial impact on the design as *Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders* rated as the next big challenge.

Among the least challenging factors *No Dispute resolution clause* is found to be least critical. This may be due to the presence of such dispute resolution clauses in most of the contracts used. In addition, the following factors seems to be of less significance to the stakeholders:

- *Difficult to measure its benefits*
- *Unfamiliarity with BIM*
- *Employer's unwillingness to share consultant in the profits of the project*

This shows that BIM is gaining wider attention and the stakeholders have systems in place for performance measurement of newer project delivery systems. Also, it can be noticed that profit sharing between the consultant and the client is not reported as critical.

It has been attempted to identify the highly important factors within the categories and the results are presented below.

- Financial
 - *Lack of transparency in spending done by the contractor*
 - *Compensation structure*
- Cultural
 - *New approach takes time*
 - *Training & Skill enhancement*
 - *Lack of IPD awareness among stakeholders*
- Legal
 - *IPD contract types are not tested or understood*
 - *Multiparty agreement for entire project lifecycle*
- Technical
 - *Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders*
 - *Early involvement of key participant*
- Others
 - *Shorter projects cannot spend time on organizational efforts for IPD*

4.2 Comparative Analysis

The primary objective of this study is to analyse if

there is any significant difference in the perception of beneficiaries and intermediaries on the factors influencing the implementation of IPD. Hence, the RII is computed using the Equation (1) based on the responses from the respective stakeholders and the same along with the ranking is presented in Figure 6. It can be noticed that *Lack of transparency in spending done by the contractor* and *New approach takes time* have been rated as the most critical factors by both the groups. *Resistant to change* is also reported as the top critical challenge by the beneficiaries. While there is an agreement on the top two factors, difference in perception is observed in the next most critical challenge. Beneficiaries reported that *IPD contract types are not tested or understood* in contrast to the preference of the intermediaries i.e. *Lack of IPD awareness among stakeholders* and *Training & Skill enhancement* as the third most critical challenge. This implies that the beneficiaries are more concerned about the project procurement compared to the intermediaries (like designers, contractors & suppliers) are apprehensive about the development of capabilities and capacity building that are related to the cultural aspects (it may be noted that *Resistant to change*, a top rated challenge by beneficiaries is also a cultural issue). Another interesting observation is that technical factors are not figured in the top three critical challenges by both the groups. This may indicate that both the groups are confident about the technical competence.

Please refer to Figure 7 to understand the least preferred factors between the groups. While the RII of the top rated factors are closer (0.80 & 0.82 by beneficiaries & intermediaries respectively), the RII of the least rated factors are 0.57 & 0.65. This can be interpreted as the intermediaries rated the challenges higher compared to the beneficiaries. This prompted to conduct the hypothesis testing to check these differences perceived by the beneficiaries and intermediaries are significant.

4.2.1 Hypothesis Testing

The two-tailed t-Test (two sample unequal variance at 5% significance level) conducted on the means of all the categories resulted in the rejection of H_0 i.e. there is significant difference between the perceptions of the beneficiaries and intermediaries (Please refer to Figure 8 for test results). It was also noticed that the perceptions of the beneficiaries are significantly different from intermediaries on the legal aspects but not on the other three dimensions. Further, a factor level test revealed that only on the following four factors, both the groups significantly differ:

- *Employer's unwillingness to share consultant in the profits of the project* (F2)
- *Disengagement agreement of the parties to implement the project on time* (L7)

Comparison of Relative Importance of Factors Influencing IPD Adoption

FC	Factors	Beneficiaries		Intemediaries	
		RII	Rank	RII	Rank
F1	Compensation structure	0.70	10	0.73	6
F2	Employer's unwillingness to share consultant in the profits of the project	0.59	19	0.71	8
F3	Lack of transparency in spending done by the contractor	0.80	1	0.82	1
F4	High bids due to inexperience	0.64	16	0.74	5
F5	Confusion & Misunderstandings regarding accounting of contingency	0.69	11	0.71	8
F6	Lenders may demand 'hard pricing' for implementing IPD	0.67	13	0.72	7
F7	No specific plans for encouraging and rewarding	0.65	15	0.69	10
C1	Lack of IPD awareness among stakeholders	0.74	6	0.77	3
C2	Training & Skill enhancement	0.76	4	0.77	3
C3	Absence or lack of respect and trust of the project parties to each other	0.69	11	0.67	11
C4	Organisation culture	0.69	11	0.67	11
C5	Resistant to change	0.57	21	0.82	1
C6	Inexperience with each other & IPD	0.71	9	0.69	10
C7	New approach takes time	0.79	2	0.80	2
C8	Difficult to measure its benefits	0.57	21	0.67	11
C9	Unwillingness of employers, consultants and contractors to carry out the project in a team with common interests	0.71	9	0.67	11
L1	New framework for legal practice is needed	0.62	17	0.73	6
L2	IPD contract types are not tested or understood	0.77	3	0.74	5
L3	Multiparty agreement for entire project lifecycle	0.69	11	0.72	7
L4	No insurance coverage for IPD	0.65	15	0.71	8
L5	No Dispute resolution clause	0.58	20	0.65	13
L6	Contractor's unwillingness to participate in the design phase	0.64	16	0.67	11
L7	Disengagement agreement of the parties to implement the project on time	0.60	18	0.75	4
T1	Unfamiliarity with BIM	0.58	20	0.71	8
T2	Interoperability issues	0.66	14	0.69	10
T3	Changes in the original design during construction phase	0.69	11	0.71	8
T4	Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders	0.76	4	0.71	8
T5	Integration of information and knowledge management systems	0.70	10	0.65	13
T6	Early involvement of key participant	0.73	7	0.69	10
T7	Early definition of target goals without fully developed design	0.68	12	0.71	8
O1	Joint ownership of documents	0.72	8	0.65	13
O2	Who owns BIM? Who will pay for it?	0.68	12	0.67	11
O3	Shorter projects cannot spend time on organizational efforts for IPD	0.75	5	0.66	12
O4	Formation of Entity for "Real" IPD	0.64	16	0.70	9

Figure 6. Comparison of relative importance of all the factors influencing IPD adoption by Beneficiaries and Intermediaries

BENEFICIARIES				INTERMEDIARIES			
FC	Factors	RII	Rank	FC	Factors	RII	Rank
F3	Lack of transparency in spending done by the	0.80	1	F3	Lack of transparency in spending done by the	0.82	1
C7	New approach takes time	0.79	2	C5	Resistant to change	0.82	1
L2	IPD contract types are not tested or understood	0.77	3	C7	New approach takes time	0.80	2
C2	Training & Skill enhancement	0.76	4	C1	Lack of IPD awareness among stakeholders	0.77	3
T4	Loss of focus on the aesthetic components of design due to earlier participation of other stakeholders	0.76	4	C2	Training & Skill enhancement	0.77	3
O3	Shorter projects cannot spend time on organizational efforts for IPD	0.75	5	L7	Disengagement agreement of the parties to implement the project on time	0.75	4
L7	Disengagement agreement of the parties to implement the project on time	0.60	18	O3	Shorter projects cannot spend time on organizational efforts for IPD	0.66	12
F2	Employer's unwillingness to share consultant in the profits of the project	0.59	19	T5	Integration of information and knowledge management systems	0.65	13
L5	No Dispute resolution clause	0.58	20	L5	No Dispute resolution clause	0.65	13
T1	Unfamiliarity with BIM	0.58	20	O1	Joint ownership of documents	0.65	13
C5	Resistant to change	0.57	21				
C8	Difficult to measure its benefits	0.57	21				

Figure 7. Comparison of the most and least influencing factors as perceived by the Beneficiaries and Intermediaries

Results of Hypothesis Testing

p* (All the Categories) **0.006**

CC	Categories	p*	FC	Factors	p*	Beneficiaries		Intermediaries	
						RII	Rank	RII	Rank
F	Financial	0.062	F2	Employer's unwillingness to share consultant in the profits of the project	0.012	0.59	19	0.71	8
C	Cultural	0.214	L7	Disengagement agreement of the parties to implement the project on time	0.020	0.60	18	0.75	4
L	Legal	0.020	C5	Resistant to change	0.041	0.57	21	0.82	1
T	Technical	0.784	T1	Unfamiliarity with BIM	0.047	0.58	20	0.71	8

*p-value in two-tailed t-Test (two sample unequal variance) at 5% significance level

Figure 8. Results of hypothesis testing

- Resistant to change (C5)
- Unfamiliarity with BIM (T1)

It is interesting to note that the above four are from four different categories and the intermediaries rated them as on the higher side of importance compared to the beneficiaries.

5 Summary and Conclusions

IPD is gaining wider attention among the stakeholders of Indian construction. An exploratory study conducted among them revealed that *Lack of transparency in spending done by the contractor* is rated as the most critical challenge for the implementation of IPD in Indian construction and the least challenging one is *No Dispute resolution clause*. The comparative analysis between the beneficiaries and intermediaries showed that there is a significant difference in their perception but they agree on *Lack of transparency in spending done by the contractor* and *New approach takes*

time. It is also evident that technical competence is not a major challenge for both the groups. It was also observed that beneficiaries significantly differ from intermediaries on the legal aspects but not on the other three dimensions viz. financial, cultural and technical. The factors on which the groups significantly differ in their perceived challenge in adopting IPD are consistently rated higher by the intermediaries.

As IPD is technology-driven, use of Blockchain and promotion of professionalism can be a possible solutions to overcome the challenges with respect to lack of transparency. In order to address the challenges such as *New approach takes time*, *Training & Skill enhancement* and *Lack of IPD awareness among stakeholders*, capacity & capability building among the stakeholders can be considered. Having understood the perceived challenges and the differences between these groups, the future work would include formulating strategies for addressing these issues for successful project delivery in order to meet the ambitions targets of Indian construction.

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