



### **Critical Success Factors for Implementing Integrated Construction Project Delivery**

Journal:	<i>Engineering, Construction and Architectural Management</i>
Manuscript ID	ECAM-02-2019-0073.R1
Manuscript Type:	Original Article
Keywords:	Construction Planning, Design Management, International Construction, Management, Organization
Abstract:	

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# Critical Success Factors for Implementing Integrated Construction Project Delivery

## Abstract

**Purpose** – Identify the critical success factors (CSFs) to implement integrated project delivery (IPD) systems in the Korean construction industry.

**Design/methodology/approach** – Categorized potential CSFs and analyzed them using factor analysis and multiple regression analysis to choose the best ones based on responses from Korean construction experts.

**Findings** – 29 potential factors were selected and categorized into seven CSFs using factor analysis.

**Originality/value** – Useful as a reference for applying the IPD system in different developing countries and mid-sized construction industries.

~~Due to increasing project complexity, construction projects are carried out both separately and independently using various systems of delivery.~~ For increasing large and complex construction projects to be carried out efficiently, a collaborative execution process needs to be devised to integrate and manage the vast amount of information and production activities. For this to be successful in complex construction projects, an integrated project delivery (IPD) system has been applied, in which all project participants work together as a team from the outset. The aim of this study is to identify the critical success factors (CSFs) to implement IPD systems in the Korean construction industry. To this end, 29 potential factors were selected and categorized into seven CSFs using factor analysis. A multiple regression analysis shows that ~~four of the seven CSFs have significant correlations with the research findings.~~ four factors are essential among seven CSFs to implement IPD systems. They are ‘Reform of contract law and adoption of appropriate IPD agreement form (CSF 1)’, ‘Team building and management for collaborative business process (CSF 2)’, ‘Early involvement and enhanced role of key participants (CSF 3)’, and ‘Improvement and utilization of BIM for collaborative process of

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4 29 IPD (CSF 4)'. Interestingly, some CSFs with typical features including "government leadership"  
5 and "IT technology support" can have a substantial impact on developing the construction  
6 sector and other construction-related industries. The outcomes of the study could be useful as  
7 a reference for applying the IPD system in Korea reflecting specific characteristic of the  
8 construction sector. These CSFs also could be applied in other different developing countries  
9 that have similar structures of the construction industry. In addition, identified CSFs also could  
10 be analyzed and applied in other mid-sized construction industries by the resetting of the  
11 analysis environment in accordance with their specific situation for implementing IPD.  
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18 **Keywords** collaborative working, construction management, construction team,  
19 project delivery.  
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22 **Paper type** Research paper  
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## 26 1. Introduction

27 ~~Due to the trends of large scale and multifunctional project, the construction industry has~~  
28 ~~suffered from various complications, such as cost overruns, schedule delays, quality issues,~~  
29 ~~and limited trust between different project participants (O'Connor, 2009; Lahdenpera, 2012).~~  
30 ~~Almost all participants in construction projects have experienced setbacks caused by~~  
31 ~~inadequate cooperation and poor administration throughout the project. These problems occur~~  
32 ~~due to the competing interests of the project participants, incompatible individual habits, and a~~  
33 ~~lack of substantial real-time information (CURT, 2004). These tendencies have resulted in the~~  
34 ~~need for a new delivery system (Chan *et al.*, 2004; Kent and Becerik-Gerber, 2010), and~~  
35 ~~developing a collaborative project delivery system is currently one of the most significant~~  
36 ~~issues in the construction industry (El Asmar *et al.*, 2013). However, there are limitations in a~~  
37 ~~conventional procurement system resulting from owners, contractors, architects, and other~~  
38 ~~project participants making contracts separately. Thus, collaborative and integrated project~~  
39 ~~implementation is difficult with a traditional procurement method due to a lack of project~~  
40 ~~continuity and information sharing.~~  
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53 The American Institute of Architects (AIA) launched the integrated project delivery (IPD)  
54 technique for construction projects to advance procurement systems using seamless integration  
55 and collaboration between project participants (AIA, 2007a). Based on contractual and  
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4 59 behavioral principles, IPD emphasizes mutual respect and effective communication for the  
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6 60 implementation of a project. Individual accomplishment in this new procurement system is  
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8 61 subject to the sharing of information, knowledge, experiences, frameworks, business structures,  
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10 62 and practices throughout the life of the project (Lahdenpera, 2012). Unlike traditional delivery  
11  
12 63 systems, the main project participants are involved from the initial pre-design stage, including  
13  
14 64 clients, architects, and contractors, who share their own distinct skills and knowledge to reduce  
15  
16 65 project risk (Kent and Becerik-Gerber, 2010).

16  
17 66 However, the IPD system is still not prominent in the global construction industry. Only a  
18  
19 67 small number of case studies have been carried out in the United States (AIA, 2010b). There  
20  
21 68 is limited explicit data on the effectiveness of IPD, it is challenging to encourage emerging  
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23 69 construction industries to apply the IPD system in common practice. In addition, IPD is still in  
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25 70 the test stage in developing construction sectors such as South Korea, and there is a lack of  
26  
27 71 information on actual plans for applying IPD. **Since the IPD was invented assuming the**  
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29 72 **collaboration of the individual construction parts for a single project from early stage as a one**  
30  
31 73 **team, it is highly likely that it will be successful in an overall fully matured and experienced**  
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33 74 **built environment. For countries including South Korea that still do not have enough**  
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35 75 **competency in soft skill such as contract management or risk management, there is careful**  
36  
37 76 **research and practical feedback needed. However, there are still not many actual project cases**  
38  
39 77 **even in a country in which IPD has been developed.** Thus, determining the critical success  
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41 78 factors (CSFs) is necessary to introduce IPD successfully. It is also necessary to determine the  
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43 79 kinds of projects where it is more difficult or impossible to apply IPD.

44  
45 80 The aim of this study is to identify the CSFs needed to implement an IPD in a developing  
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47 81 construction industry. We categorized potential CSFs and analyzed them using factor analysis  
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49 82 and multiple regression analysis to choose the best ones based on responses from Korean  
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51 83 construction experts. This study was carried out based on the Korean construction environment  
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53 84 for the application of IPD. However, our research findings may also be useful in other emerging  
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55 85 construction industries or developing countries that do not yet have a fully mature market  
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57 86 environment.

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## 54 55 88 **2. LITERATURE REVIEW**

## 89 2.1 Project delivery in general

90 Project delivery comprises a series of contractual relationships that coordinate all the  
91 components of a project (Cho *et al.*, 2010). Conventional project delivery systems (PDS) are  
92 based on a transactional contract, and examples include the fixed price lump sum, guaranteed  
93 maximum price, and cost-plus-fee systems. Halpin (2006) and El Asmar *et al.* (2013) consider  
94 a PDS to be an advancement or association of a framework that is needed to fulfill a project.  
95 They considered the establishment of a formal contract and casual connections between project  
96 partners to be important. According to Hanna (2010), a PDS is a framework that characterizes  
97 the relationship between different parties in an agreement, and it PDS plays a fundamental role  
98 in increasing mutual trust and clearly defining relationships between project participants based  
99 on a written agreement.

100 However, in recent years, other academic researchers and industrial experts have argued that  
101 there is limited cooperation and advancement when using a conventional PDS in actual  
102 construction projects (Middlebrooks, 2008; Swarup *et al.*, 2011). Researchers have tried to  
103 develop procurement systems to complement PDS for complex and large-scale projects. Forbes  
104 and Ahmed (2011) suggest that PDS agreements only reward or punish the performance of  
105 individual team members who are bond by a contract without consideration of the effects on  
106 the entire team's performance.

107 According to the American Institute of Architects (AIA) (2010a), relational contracts are  
108 more valuable than transaction contract. They considered that transactional contracts are likely  
109 to lead to avoidance of responsibility and to conflict between contracting parties, whereas  
110 relational contracts help with cooperation, collaboration, and reliance among the principle  
111 project stakeholders. Common difficulties and potential conflicts in transactional contracts can  
112 be reduced by multi-party contracts (Thomsen, 2009). Integrated multi-party contracts have  
113 been used as a way of complementing PDS in ambiguous or complicated projects, which  
114 involve many different project participants and execution systems.

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## 116 2.2 Integrated project delivery

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4 117 Integrated project delivery (IPD) is one promising relational contract<sup>1</sup> system that provides  
5  
6 118 a platform for projects. Comparing to the traditional PDSs tightened by strict terms and  
7  
8 119 condition, since relational contract system is structured by the mutual trust rather than contract  
9  
10 120 clauses, it has fewer changes and a tighter schedule than traditional PDSs (AIA, 2007a). The  
11  
12 121 AIA defines IPD as an approach to project delivery that incorporates people, a framework,  
13  
14 122 business structures, and practices into one system. The greatest difference between IPD and  
15  
16 123 traditional PDSs (excluding integrated multi-party contracts) is the capacity to shift work  
17  
18 124 volume from the introductory periods of the design phase to the construction process, by which  
19  
20 125 all essential contributions are supported by different key stakeholders (Ilozor and Kelly, 2012).  
21  
22 126 From the initial project stage, main project players including owners, architects, and contractors  
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24 127 share their experience, technology, knowledge, and even foreseeable risks and benefits. With  
25  
26 128 integrated multi-party contracts between project team members, relationships can become  
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28 129 more reliable, cooperative, and respectful (AIA *et al.*, 2010a; El Asmar *et al.*, 2013).

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30 130 According to the AIA (2007b), the benefits of IPD include collective backup capabilities  
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32 131 and problem-area identification by different project members, which increases the  
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34 132 effectiveness of project management. Various experts with different technical backgrounds  
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36 133 work together within one system, and even minor issues that do not seem critical initially but  
37  
38 134 have a serious impact later on can be managed in advance. This makes the problems to be  
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40 135 recognized and controlled in advance.

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42 136 An absence of responsibilities, poor group collaboration, and unsatisfying interfaces are  
43  
44 137 some of the issues in a traditional procurement project (Volk *et al.*, 2014). One approach to  
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46 138 these issues is to understand the overall procedure of project improvement. To ensure this, the  
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48 139 application of IPD supported by different project management tools is recommended, such as  
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50 140 a project management information system (PMIS) or building information modeling (BIM).  
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52 141 These management tools are useful for supplementing the issues of collaboration and  
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54 142 integration, and they are expected to realize the concept of IPD practically over the entire life  
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56 143 of the project. Monteiro *et al.* (2014) suggest that the goals of IPD can be fully achieved by  
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58 144 supporting other project management tools (such as BIM). IPD is recognized as a successful

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55 <sup>1</sup> A relational contract is a contract whose effect is based upon a relationship of trust between the parties to  
56 which it pertains.

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4 145 delivery system that can be most effective when it is used with BIM. BIM can be used to  
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6 146 manage rich, object-oriented, intelligent, and parametric digital representation information for  
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8 147 construction projects.

9 148 To carry out a project successfully, there is a need for all project participants to cooperate  
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11 149 as a team, including clients, design teams, quantity surveyors, contractors, and specialists.  
12  
13 150 These individual experts can effectively pool their skills and experiences together in the IPD  
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15 151 system, through which they share the benefits and risks of the project. Using different  
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17 152 management tools, IPD can integrate different types of information, work processes, and  
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19 153 activities into a single project boundary.

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### 21 155 **3. METHODOLOGY**

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24 156 The research process used in this study is shown in Figure 1. The research steps involve  
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26 157 gathering data, maintaining data criteria, and determining the success factors of IPD. The  
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28 158 limitations of the existing project delivery system and potential success factors for IPD were  
29  
30 159 first determined, and then semi-structured interviews and questionnaire surveys were carried  
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32 160 out to **determinate the prerequisites for implementation of IPD that are used as dependent**  
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34 161 **variables in multiple regression analysis** and to ensure reliable data collection. Factor analysis  
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36 162 and multiple regression analysis were then conducted to identify critical IPD factors that can  
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38 163 be used in various developing construction industries.

37 164

39 165 **Insert < Figure 1. Research framework > here**

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43 167 The study began with IPD data and reports published by the AIA, National Association of  
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45 168 State Facilities Administrators (NASFA), and Associated General Contractors of America  
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47 169 (AGC) (e.g. and AIA, 2007b; AIA, 2007a; AIA *et al.*, 2010a). Different studies were then  
48  
49 170 reviewed to evaluate the reliability of data from previous studies. All relevant factors for the  
50  
51 171 implementation of IPD were obtained from AIA reports including Integrated Project Delivery:  
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53 172 Case studies (AIA, 2010b), and other practical factors were included from industrial project  
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55 173 case studies and academic literature. Based on the data, several unique factors to Korea were  
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57 174 included based on practical conditions in the Korean construction sector.



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4 175 A total of 60 potential factors were obtained and used to conduct semi-structured interviews  
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6 176 with 13 Korean construction experts to develop a questionnaire and ensure clarity and  
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8 177 relevance. The interview respondents are in senior managing positions or higher in their  
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10 178 organizations and have an average of over 16.5 years of work experience in the construction  
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12 179 industry. Using their empirical experience and expertise, they reviewed the ~~different essential~~  
13 180 ~~prerequisites potential IPD factors to determine the most influential ones. They also~~ and  
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15 181 determined three dependent variables that are the least or most critical for a successful  
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17 182 application of IPD in the Korean construction industry. These three ~~dependent variables~~  
18 183 ~~indispensable conditions were analyzed using~~ were collected from different references  
19  
20 184 (Middlebrooks, 2008; Kent and Becerik-Gerber, 2010; Raisbeck, et al., 2010) were discussed  
21  
22 185 and finally chosen by semi-structured interviews. ~~seven factor clusters (FCs) (see Table VI).~~

23  
24 186 Pilot surveys were used to gather comments and suggestions for the survey items, item  
25  
26 187 wording, item sequence, and directions. The questionnaires were distributed to different  
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28 188 Korean construction experts comprising key personnel in client organizations (such as owners),  
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30 189 architects, consulting practices, and construction and engineering firms. All respondents were  
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32 190 selected from registered members of the Construction Association of Korea, which is supported  
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34 191 by the government and is the largest construction organization in Korea.

34 192 The structure of the questionnaire was divided into two main parts. Part 1 included six  
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36 193 general questions to acquire general information and determine the overall recognition of IPD  
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38 194 in the Korean construction industry. In part 2, the respondents were asked to rate all the  
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40 195 potential IPD success factors and to suggest ways in which introducing and implementing IPD  
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42 196 could be successful in Korea. We used a five-point Likert scale (ranging from 1 = strongly  
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44 197 disagree to 5 = strongly agree). The responses were used to determine how critical individual  
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46 198 IPD factors would be in implementation. Statistical analyses were carried out on the results  
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48 199 using the Statistical Package for Social Sciences (SPSS).

48 200 Factor analysis is an advanced statistical technique that is used to examine the underlying  
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50 201 patterns or relationships of a large number of variables and to determine whether the exhaustive  
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52 202 list of variables can be condensed or summarized with a smaller set of explainable components  
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54 203 (Norusis, 2012). This is useful when representing relationships involving numerous interrelated  
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56 204 components. Factor analysis was mainly used to categorize and reduce the initial 60 IPD factors



205 to a more manageable number of CSFs. The factors were extracted and rotated to obtain a  
206 minimum quantity of aspects and acquire an accurate understanding of what is represented by  
207 the factors.

208 Based on the results of factor analysis, a multiple regression analysis was performed to test  
209 the relationship between the seven factor clusters (FCs; independent variables) FCs and  
210 three prerequisites (dependent variables) for a successful application of IPD. ~~to analyze the  
211 contributions of individual factors to IPD introduction. The results show the independent  
212 variables (FCs) showed which CSFs are positively related to successful IPD introduction in  
213 Korea that have a positive correlation with dependent variables (three prerequisites for IPD)  
214 according to the beta coefficient and *t*-test. This study hypothesizes that successful FCs  
215 (independent variables) should satisfy the prerequisites (dependent variables). Thus, only FCs  
216 that have significant correlation with three prerequisites (dependent variables) will be  
217 recognized as CSFs for IPD application. Multiple regression analysis indicated correlations  
218 between the seven FCs (independent variables) and three successful application conditions  
219 (dependent variables).~~

220

## 221 4. DATA COLLECTION AND ANALYSIS

### 222 4.1 Data collection

223 During data collection, 362 questionnaires were distributed to Korean construction experts  
224 by e-mail or in person. A total of 118 valid responses (approximately 32%) were received for  
225 data analysis. The responders consisted of 14 clients, 22 architects, 32 general contractors, 13  
226 project managers, 10 construction engineers, 9 manufacturers and suppliers, 6 project  
227 inspectors, 9 academic or research institutions, and 3 other engineers, as summarized in Table  
228 I .

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230 **Insert < Table I . Information from respondents to a questionnaire survey > here**

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232 As shown in Table II, the success factors of IPD are ranked in order of agreement according  
233 to their mean values. The mean values and standard deviations of each factor were derived

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4 234 from the total sample to determine the level of agreement. Mean values that are greater than  
5 235 the average value of all factors (3.129) are recognized as critical. Finally, 29 factors among the  
6 236 initial 60 items were determined as critical for IPD implementation. The 29 selected IPD factors  
7 237 were categorized into 7 FCs using factor analyses. After multiple regression analyses, four  
8 238 CSFs for IPD were determined among seven IPD FCs, as shown in Figure 2.  
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15 240 **Insert < Table II. Respondents' ratings of IPD success factor > here**  
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18 241  
19 242 **Insert < Figure 2. Analysis procedures to identify CSFs > here**  
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#### 22 243 23 244 *4.2 Factor analysis*

25 245 Factor analysis is a series of methods for identifying groups of related variables, and it is an  
26 246 ideal technique for reducing numerous items into a more easily understood framework (Norusis,  
27 247 2012). Factor analysis was applied to explore the data groupings. The 29 selected IPD factors  
28 248 were subjected to factor analysis using SPSS 22.0. For reliable factor analysis, the Bartlett test  
29 249 of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were used.  
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36 251 **Insert < Table III. Results of Bartlett's test and KMO measure > here**  
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41 253 As shown in Table III, the result of the Bartlett test was 617.036, and the associated  
42 254 significance level was 0.000. All variables had a significant correlation of at least 5%. This  
43 255 implies that no other variables need to be excluded from the analysis. The KMO measure of  
44 256 sampling adequacy is 0.742, and since it is higher than 0.5, the samples meet the fundamental  
45 257 requirement for factor analysis (Norusis, 2012).  
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52 259 **Insert < Table IV. Final statistic of principal component analysis > here**  
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5 261 As shown in Table IV, shows the final statistics of the principal component analysis (PCA),  
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7 262 in which the seven extracted FCs comprise 58.45% of the variance. The varimax rotation of  
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9 263 PCA was used to interpret the FCs. as shown in Table V. Each IPD success factor belongs to  
10  
11 264 one of the seven FCs, and the loading on each factor exceeds 0.60. Only 23 of the 29 IPD  
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13 265 factors were clustered into the seven FCs. The varimax rotation result of six factors was less  
14  
15 266 than 0.60. The seven FCs and their relevant features are labeled as follows:

16 267 FC 1: Reform of the contract law and adoption of appropriate IPD agreement form.

17 268 FC 2: Team building and management for collaborative business process.

18 269 FC 3: Intensified planning and management from early project stage.

19 270 FC 4: Early involvement and enhanced role of key participants.

20 271 FC 5: Mutual respect and trust with government support.

21 272 FC 6: Improvement and utilization of BIM for collaborative process of IPD.

22 273 FC 7: PMIS for collaborative decision making and a networked sharing system.

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30 275 **Insert < Table IV. V. Component analysis and matrix after varimax rotation > here**

### 31 276 32 33 277 *4.3 Correlation analysis*

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36 278 ~~Correlation analysis was conducted to investigate the relationships between independent~~  
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38 279 ~~variables (the seven FCs) and dependent variables determined from the interviews, as shown~~  
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40 280 ~~in Table VI. Three dependent variables were recognized as fundamental criteria when deciding~~  
41  
42 281 ~~whether the seven analyzed FCs are critical for IPD implementation in Korea.—~~

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46 283 **Insert < Table VI. Results of correlation analysis > here**

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51 285 ~~—The correlation analysis results show that there is a significant positive correlation between~~  
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53 286 ~~the dependent variables and seven FCs. “Impact of IPD adoption on overall construction~~  
54  
55 287 ~~industry” was correlated with five independent variables (FC1, FC2, FC4, FC5, and FC7),~~  
56  
57 288 ~~“Understanding and experience about IPD system” was correlated with four independent~~

289 ~~variables (FC1, FC2, FC5, and FC7), and “Synergy effect between IPD and BIM” was~~  
290 ~~significantly correlated with five independent variables (FC1, FC2, FC4, FC5, and FC7).~~

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#### 292 *4.4 4.3 Multiple regression analysis*

293 Stepwise multiple regressions were carried out to test how much correlation between the  
294 three dependent variables and seven FCs as independent variables using SPSS 22.0. In  
295 accordance with the hypothesis of this study in which only successful independent variables  
296 (FCs) will be recognized as the SCFs for implementation of IPD in Korea, 7 FCs were analyzed  
297 to see how significant correlation were with three dependent variables using multiple  
298 regression analysis. Since the purpose of this study is not to recognize whether a certain  
299 independent variable may become the CSF but to recognize what independent variables can be  
300 CSFs for IPD implementation, multiple regression analysis was used to find out multiple CSFs.

301 Table V VIII shows the standardized regression coefficient ( $\beta$ ), standard significance (p),  
302 coefficient of determination ( $R^2$ ), adjusted R-square value (Adjusted  $R^2$ ), and variation in the  
303 R-square value ( $\Delta R^2$ ). The size of the sample used in the final outcome is 118. Among the  
304 seven independent variables, only four (FCs), were analyzed with a significant correlation  
305 showing the differences from 0.000 at  $p \leq 0.04$ : “Reform of the contract law and adoption of  
306 appropriate IPD agreement form” (CF1), “Team building and management for collaborative  
307 business process” (CF2), “Early involvement and enhanced role of key participants” (CF4),  
308 and “Improvement and utilization of BIM for collaborative process of IPD” (CF7).

309

310 **Insert < Table V VIII. Multiple regression result > here**

311

312 These four independent variables (CSF1, CSF2, CSF3, CSF4) (CSFs) altogether explained  
313 60.7% ( $R^2=0.607$ ) of the variance of the three dependent variables (Table V VIII). Among the  
314 four CSFs identified, “Reform of the contract law and adoption of appropriate IPD agreement  
315 form” is the strongest CSF, which accounted for 31.5% of the total explanation ( $R^2=0.315$ ,  $p$   
316  $\leq 0.001$ ). This result indicates that IPD can be implemented successfully in Korea if contract

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4 317 law is reformed and an appropriate IPD agreement form is adopted. “Team building and  
5 318 management for collaborative business process” (CSF 2), “Early involvement and enhanced  
6 319 role of key participants” (CSF 3), and “Improvement and utilization of BIM for collaborative  
7 320 process of IPD” (CSF 4) account for 29.6%, 14.3%, and 2.5% of the explanation for the overall  
8 321 implementation success of IPD, respectively.  
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## 14 323 **5. RESEARCH FINDINGS**

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17 324 In this section, the identified CSFs are further described in terms of their practical meaning  
18 325 and usefulness.  
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### 23 327 *5.1 CSF 1: Reform of contract law and adoption of appropriate IPD agreement form (FC 1).*

24 328 CSF 1 consists of three IPD factors (F01, F04, and F05) and accounts for 31.5% of the total  
25 329 variance explained. CSF 1 accounts for the largest part, which is greater than those of the rest  
26 330 of the three CSFs combined. This means that the most critical factor in applying IPD to the  
27 331 Korean construction industry is law amendments and active commitment by the government,  
28 332 at least for public government projects.  
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32 333 BIM-based projects and public-private partnership (PPP) are now very common in Korea,  
33 334 but they were all initially applied and adapted to the market led by the government. Compared  
34 335 to the construction industries in developed countries such as the UK and US, the Korean  
35 336 construction industry is smaller and simpler, so there are limitations on creating and developing  
36 337 innovative systems in the private sector (Lee and Lee, 2009). Whenever new systems such as  
37 338 BTL, Design-Build, and PPP are launched in Korea, they are first applied in public projects led  
38 339 by the government. Thus, the role of the government is crucial in the Korean construction  
39 340 industry.  
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46 341 National contract law should be amended to implement an IPD system in Korea practically.  
47 342 In addition, there is no practical IPD agreement form in Korea, so the US IPD form created by  
48 343 the AIA (2010) could be adapted to the Korean construction industry’s needs. The probability  
49 344 of successful IPD implementation in Korea will increase if the government could set up explicit  
50 345 guidelines to reform Korean law or if it could accept adapted IPD forms from abroad.  
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4 347 *5.2 CSF 2: Team building and management for collaborative business process (CF 2).*

5 348 CSF 2 comprises three IPD factors (F17, F22, and F27), all of which are relevant to appropriate  
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7 349 team building and management for a collaborative business process. CSF 2 accounts for 13.3%  
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9 350 of the total variance (the second largest). In traditional procurement in Korea, contractors tend  
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11 351 to have more responsibility than any other project participant throughout all project stages.  
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13 352 This occurs because all participants tend to rely on the contractor's technology, experience,  
14  
15 353 knowledge, equipment, and capital for the sake of efficiency (Sachs *et al.*, 2004; Cho and  
16  
17 354 Chung, 2011). Thus, an explicit definition of the work scope and responsibility (F22) can  
18  
19 355 make an IPD project seem more reliable and clear to potential participants (El Asmar, 2012;  
20  
21 356 Zhang *et al.*, 2013). By using this definition, contractors can expect the risk they normally bear  
22  
23 357 to be shared, and other project participants can easily access advanced technologies,  
24  
25 358 information, and other benefits through active involvement.

26 359 The increasing authority and role of independent project managers (F17) and developing an  
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28 360 IPD business process model (F27) can help to manage IPD projects with a collaborative  
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30 361 business model in target project performance. In all project stages, particularly in the  
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32 362 construction process, each team member such as a supplier or architect has a different purpose  
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34 363 and interest in the project according to their economic situation and business area (Asmar *et*  
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36 364 *al.*, 2013; Monteiro *et al.*, 2014). These differences are likely to make the project more  
37  
38 365 complicated and difficult to manage. However, if a project manager has authorized leadership  
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40 366 and a successful reference model, the project can be successful while applying the IPD model  
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42 367 in the construction industry within a short period of time.

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44 369 *5.3 CSF 3: Early involvement and enhanced role of key participants (FC 4).*

45 370 There are two IPD factors (F20, F21) involved in CSF 3, which is responsible for 9.1% of the  
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47 371 total variance. IPD is an approach for maximizing a project's value by collaboration, risk and  
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49 372 benefit sharing, and mutual respect between project participants from the initial stage (Song *et*  
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51 373 *al.*, 2011). The involvement of the contractors in the design process and architects in the  
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53 374 construction process (F21) indicate the changing role of all project participants and make the  
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55 375 project more flexible. Thus, the construction industry can be changed to a more favorable  
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57 376 environment to apply IPD (Lee *et al.*, 2012). However, if key project participants including  
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59 377 clients and architects do not have enough competence to adapt to the different roles, acceptance



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4 378 of the changing roles may become the biggest constraint on project success and the ability to  
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6 379 implement IPD at an early project stage.  
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9 381 *5.4 CSF 4: PMIS for collaborative decision-making and networked sharing system (FC 7).*  
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11 382 There are three success factors (F47, F49, F60) involved in CSF 4, which is responsible for 7.0%  
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13 383 of the total variance. In Korea, contractors usually use their own information management  
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15 384 system specified by the PMIS. PMIS can be defined as a web-based database that centralizes  
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17 385 information and represents specific data from the project, as well as non-geometric information  
18  
19 386 (Thomsen *et al.*, 2010). In IPD systems, knowledge and information sharing is recognized as  
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21 387 the most basic and critical factor because without it, the core values of IPD cannot be realized,  
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23 388 such as collaboration and integration between participants. Thus, the capacity of IPD team  
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25 389 members supported by various technologies is critical, including BIM, PMIS, and other  
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27 390 collaboration tools (F49). These IT technologies (BIM or PMIS) can transfer and restore  
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29 391 information and knowledge systematically. Fortunately, the Korean construction industry is  
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31 392 already a favorable environment for projects based on IT technologies (Kim, 2005; Suh *et al.*,  
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33 393 2013). These conditions are favorable for applying IPD systems in Korea.  
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## 36 395 **6. CONCLUSION**

37 396 An extensive analysis was conducted on IPD systems in the Korean construction sector. We  
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39 397 developed an outline of data taken from academic and industrial sectors that highlight key  
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41 398 components for successful implementation of IPD. Questionnaires were used to collect local  
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43 399 knowledge and personal viewpoints on how an IPD system could be successfully implemented.  
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45 400 Among the 60 initial IPD factors, 29 were selected for further investigation through a  
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47 401 questionnaire survey. The extracted IPD factors were categorized into seven FCs based on a  
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49 402 factor analysis. Finally, using multiple regression analysis, four of the FCs consisting of several  
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51 403 IPD factors were identified as CSFs in the implementation of IPD systems.

52 404 Our findings could be used as framework of reference to measure the success of IPD projects.  
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54 405 They could also provide useful guidelines for project stakeholders who are considering IPD  
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56 406 projects. The findings indicate that these CSFs could strongly influence the implementation of  
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58 407 IPD systems in Korea. In addition, developing countries are actively accepting the advantages

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4 408 of managing systems such as BIM and PMIS to enhance their competitiveness in the global  
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6 409 market. Thus, the CSFs for IPD in Korea could be applied to other developing or mid-sized  
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8 410 construction industries without major reform or technical constraints.  
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## 11 412 **7. Acknowledgements**

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14 413 This work was supported by the 2017 Yeungnam University Research Grant.  
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Figure Caption List

Figure 1. Research framework

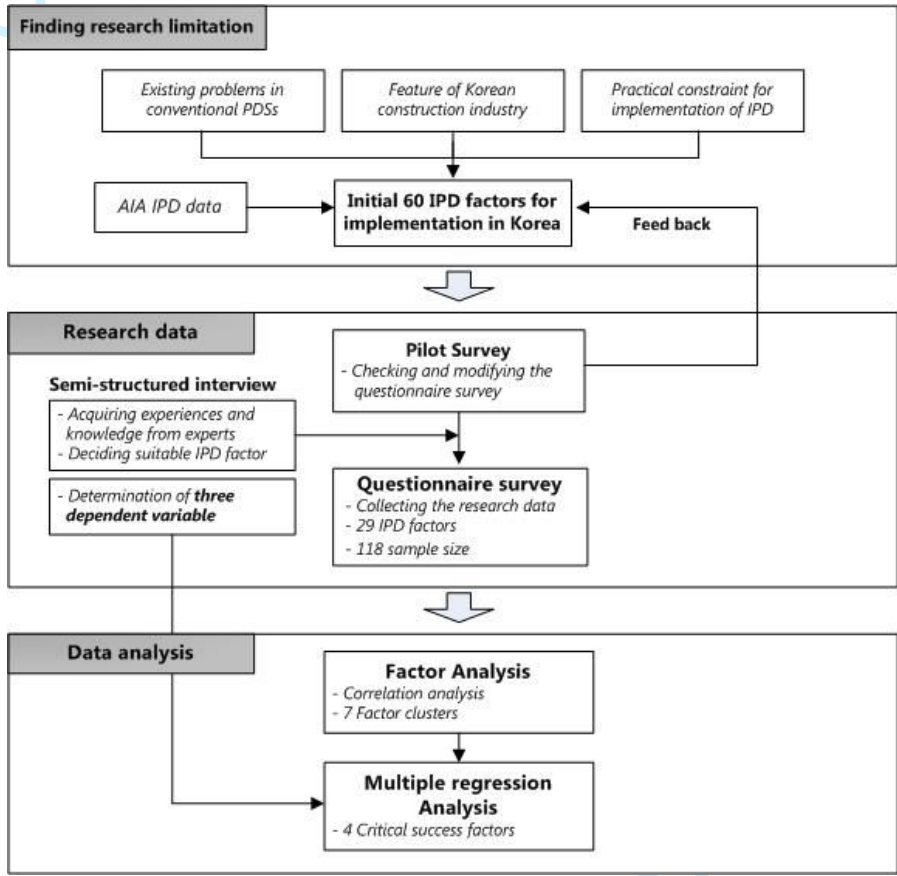
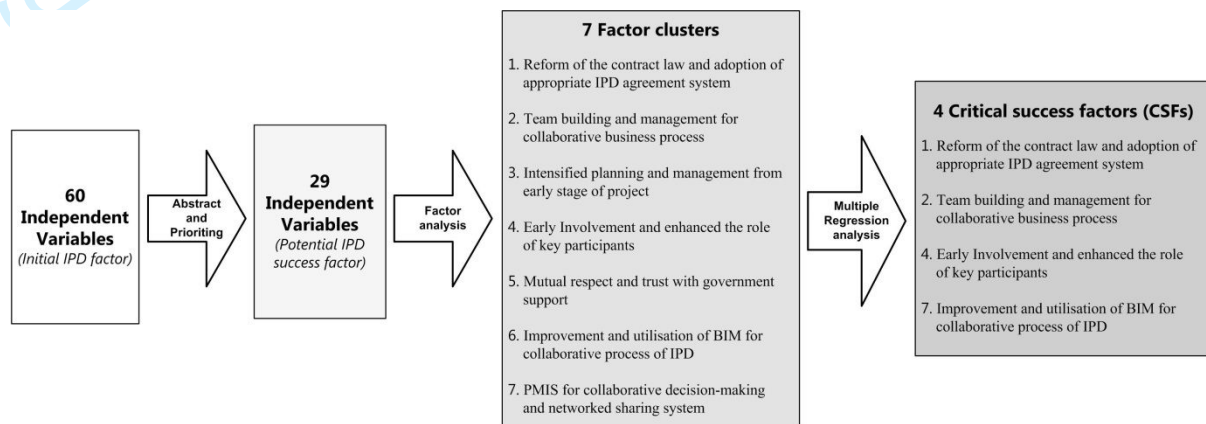




Figure 2. Analysis procedures to identify CSFs



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**Table Caption List**

**Table 1 Information from respondents to a questionnaire survey**

**Table 2. Respondents' ratings of IPD success factor**

**Table 3. Results of Bartlett's test and KMO measure**

**Table 4. Component analysis and matrix**

**Table 5. Multiple regression result**

**Table 1. Information from respondents to a questionnaire survey**

Respondents	Contents	Frequency	Percentage (%)
Occupation	Owner (client)	14	11.86
	Architect	22	18.64
	General contractor	32	27.12
	Project manager	13	11.02
	Construction engineer	10	8.47
	Manufacturer/supplier	9	7.63
	Project inspector	6	5.08
	Working in academic or research institutions	9	7.63
	Others	3	2.55
<b>Total</b>		<b>118</b>	<b>100.00</b>
Present career experience	Less than 3 years	20	16.95
	3 to 5 years	27	22.88
	6 to 10 years	44	37.29
	11 to 15 years	16	13.56
	More than 15 years	11	9.32
<b>Total</b>		<b>118</b>	<b>100.00</b>

**Table 2. Respondents' ratings of IPD success factor**

Success factor of IPD	Mean	Standard deviation	Ranking
F57 Developing customized IPD business process involving BIM technology.	3.706	1.108	1
F05 Introducing multi-party agreement.	3.701	0.958	2
F21 Direct involvement of contractors and engineers in the design phase.	3.688	0.921	3
F39 Introducing IPD system to public projects with IT vitalization policy by the government.	3.657	0.933	4
F11 Establishing risk sharing system between team members.	3.611	1.218	5
F22 Defining work scope and responsibility between team members.	3.609	1.112	6
F47 Developing decision making system for the participation of all team members to contribute their expertise.	3.590	0.984	7
F04 Establishing standard IPD contract form considering Korean construction environment.	3.558	1.191	8
F60 Developing and operating project management information system (PMIS) based on business process of IPD.	3.547	1.103	9
F27 Developing IPD business process model for collaborative work between team members.	3.524	1.020	10
F49 Capacity of IPD team members to fully utilize IPD supporting IT such as BIM or PMIS.	3.523	1.003	11
F37 Reforming relationships from the vertical to horizontal among key project participants.	3.513	0.981	12
F45 Establishing expected project benefit through the implementation of IPD project in	3.511	0.958	13

	Korean construction sector.			
F33	Improving motivation and teamwork between IPD team members from initial project stage.	3.509	0.968	14
F01	Reforming national contract law and amending IPD agreement form.	3.448	1.132	15
F54	Developing integrated real-time information and document sharing system with cloud system.	3.411	1.017	16
F06	Reforming unfair contract structure and practice (especially, design contract).	3.396	1.106	17
F42	Vitalizing the construction management (CM/PM) to support client who suffers from increasing workload and lack expert knowledge in IPD system.	3.351	0.991	18
F17	Increasing authority and role of independent project manager to organize and coordinate IPD team.	3.340	0.983	19
F30	Training experts to support IPD project from the early project stage.	3.336	1.013	20
F26	Determining the design changes and disputable factors from early project stage.	3.327	0.915	21
F56	Establishing work process and data transfer system between IPD team and IT system (BIM or PMIS).	3.321	1.128	22
F55	Improving communication and collaboration between team members through the 3D/4D visualization and modeling technology.	3.294	0.908	23
F23	Enhancing supply chain management plan among key participants from design phase.	3.226	1.164	24
F20	Changing the role of owner (government) in public construction projects.	3.203	0.999	25
F28	Fully trust and mutually respect other industry team members as one team.	3.177	1.104	26
F41	Developing official guideline on the implementation of IPD by a government initiative.	3.172	0.980	27
F35	Quick organization of IPD team at the early project stage.	3.150	1.207	28

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F32	Establishing horizontal decision-making and information exchange system between team members.	3.141	0.943	29
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**Table 3. Results of Bartlett's test and KMO measure**

Bartlett's test of sphericity	Approx. $\chi^2$	617.036
	Sig	.000
	Df	110
KMO measure of sampling adequacy		.742

**Table 4. Component analysis and matrix**

IPD Success factors	Component (factor cluster)							Eigenvalues	Percentage of variance	Cumulative percentage of variance
	1	2	3	4	5	6	7			
<b>1. Reform of the contract law and adoption of appropriate IPD agreement form</b>								<b>6.492</b>	<b>23.417</b>	<b>23.417</b>
F01	Reforming national contract law and amending IPD agreement form.	0.863								
F04	Establishing standard IPD contract form considering Korean construction environment.	0.742								
F05	Introducing multi-party agreement.	0.608								
<b>2. Team building and management for collaborative business process</b>								<b>2.108</b>	<b>7.604</b>	<b>31.021</b>
F17	Increasing authority and role of independent project manager to organize and coordinate IPD team.	0.776								
F22	Defining work scope and responsibility between team members.	0.738								
F27	Developing IPD business process model for collaborative work between team members.	0.715								
<b>3. Intensified planning and management from early project stage</b>								<b>1.884</b>	<b>6.796</b>	<b>37.817</b>
F23	Enhancing supply chain management plan among key participants from design phase.		0.831							
F26	Determining the design changes and disputable factors from early project stage.		0.664							
<b>4. Early involvement and enhanced role of key participants</b>								<b>1.671</b>	<b>6.027</b>	<b>43.844</b>
F20	Changing the role of owner (government) in public construction projects.			0.780						
F21	Direct involvement of contractors and engineers in the design phase.			0.747						
<b>5. Mutual respect and trust with government support</b>								<b>1.598</b>	<b>5.764</b>	<b>49.609</b>

F28	Fully trust and mutual respect other industry team members as one team.	0.862
F33	Improving motivation and teamwork between IPD team members from initial project stage.	0.813
F35	Quick organization of the IPD team at the early project stage	0.766
F37	Reforming relationships from the vertical to horizontal among key project participants.	0.712
F41	Developing official guideline on the implementation of IPD by a government initiative	0.648
F42	Vitalizing the construction management (CM/PM) to support client who suffers from increasing workload and lack expert knowledge in IPD system.	0.615

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**6. Improvement and utilization of BIM for collaborative process of IPD**

**1.332****4.805****54.413**

F54	Developing integrated real-time information and document sharing system with cloud system.	0.795
F55	Improving communication and collaboration between team members through the 3D/4D visualization and modeling technology.	0.761
F56	Establishing work process and data transfer system between IPD team and IT system (BIM or PMIS).	0.740
F57	Developing customized IPD business process involving BIM technology.	0.661

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**7. PMIS for collaborative decision-making and networked sharing system**

**1.120****4.040****58.453**

F47	Developing decision making system for the participation of all of team members to contribute their expertise.	0.807
F49	Capacity of IPD team members to fully utilize IPD supporting IT such as BIM or PMIS.	0.715
F60	Developing and operating project management information system (PMIS) based on business process of IPD.	0.683

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Extraction method: Principal component analysis.

Rotation method: Varimax with Kaiser normalization.

Rotation converged in seven iterations.

**Table 5. Multiple regression result**

Independent Variables (FCs)	Dependent Variables	Impact of IPD adoption on overall construction industry	Understanding and experience about IPD system	Synergy effect between IPD and BIM	$\beta$	p value	R <sup>2</sup>	Adjusted R <sup>2</sup>	$\Delta R^2$
<b>CSF 1</b>	Reform of the contract law and adoption of appropriate IPD agreement form (F01, F04, F05).	<b>.455**</b>	<b>.332**</b>	<b>.489**</b>	<b>.527</b>	<b>.000</b>	<b>.315</b>	<b>.294</b>	<b>.315</b>
<b>CSF 2</b>	Team building and management for collaborative business process (F17, F22, F27).	<b>.329**</b>	<b>.473**</b>	<b>.389**</b>	<b>.421</b>	<b>.000</b>	<b>.448</b>	<b>.411</b>	<b>.296</b>
	Intensified planning and management from early project stage (F23, F26).	.163	-.092	-.024					
<b>CSF 3</b>	Early involvement and enhanced role of key participants (F20, F21).	<b>.415**</b>	.139	<b>.239*</b>	<b>.380</b>	<b>.001</b>	<b>.539</b>	<b>.497</b>	<b>.143</b>
	Mutual respect and trust with government support (F28, F33, F35, F37, F41, F42).	<b>.394**</b>	<b>.274*</b>	<b>.328**</b>					
<b>CSF 4</b>	Improvement and utilization of BIM for collaborative process of IPD (F54, F55, F56, F57).	.077	.054	.188	<b>.294</b>	<b>.002</b>	<b>.607</b>	<b>.581</b>	<b>.025</b>
	PMIS for collaborative decision-making and networked sharing system (F47, F49, F60).	<b>.323**</b>	<b>.447**</b>	<b>.333**</b>					

\*\*Correlation is significant at the 0.01 level (2-tailed).

\*Correlation is significant at the 0.05 level (1-tailed).

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3 First of all, thanks for the comments from the Editor and particular a very supportive from all reviewers. Please find our  
4 responses to the rest of the comments that are useful for improving the quality of the manuscript.  
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13 • **Reviewer #1**

Review comment	Description of review comment	In the text the authors added to the paper in response
Very well written paper with good discussion on findings.		

23 • **Reviewer #2**

Review comment	Description of review comment	Revised parts in the manuscript according to reviewer's comment
Abstract should be more comprehensive..you have 2 types of analysis, factor and regression. The most significant finding should be from regression analysis. Abstract should reveal the significant findings and implication of study.	As reviewer's comment, we elaborate the significant finding from the regression analysis and their implications of study in abstract.	(Line 15-17) <del>Due to increasing project complexity, construction projects are carried out both separately and independently using various systems of delivery.</del> For increasing large and complex construction projects to be carried out efficiently, a collaborative execution process needs to be....  (Line 23-36) A multiple regression analysis shows that <del>four of the seven CSFs have significant correlations with the research findings.</del> four factors are essential among seven CSFs to implement IPD systems. They are 'Reform of contract law and adoption of appropriate IPD agreement form (CSF 1)',

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		<p>'Team building and management for collaborative business process (CSF 2)', 'Early involvement and enhanced role of key participants (CSF 3)', and 'Improvement and utilization of BIM for collaborative process of IPD (CSF 4)'. Interestingly, some CSFs with typical features including "government leadership" and "IT technology support" can have a substantial impact on developing the construction sector and other construction-related industries. The outcomes of the study could be useful as a reference for applying the IPD system in Korea reflecting specific characteristic of the construction sector. These CSFs also could be applied in other different developing countries that have similar structures of the construction industry. In addition, identified CSFs also could be analyzed and applied in other mid-sized construction industries by the resetting of the analysis environment in accordance with their specific situation for implementing IPD.</p>
<p>The first paragraph is not relevant-suggest to delete</p>	<p>As reviewer's comment, we remove the first paragraph from the manuscript.</p>	<p>(Line 41-56) 1. Introduction <del>Due to the trends of large scale and multifunctional project, the construction industry has suffered from various complications, such as cost overruns, schedule delays, quality issues, and limited trust between different project participants (O'Connor, 2009; Lahdenpera, 2012). Almost all participants in construction projects have experienced setbacks caused by inadequate cooperation and poor administration throughout the project. These problems occur due to the competing interests of the project participants, incompatible individual habits, and a lack of substantial real-time information (CURT, 2004). These tendencies have resulted in the need for a new delivery system (Chan et al., 2004; Kent and Beeerik Gerber, 2010), and developing a collaborative project delivery system is currently one of the most significant issues in the construction industry (El Asmar et al., 2013). However, there are limitations in a conventional procurement system resulting from owners, contractors, architects, and other project participants making contracts separately. Thus, collaborative and integrated project implementation is difficult with a traditional</del></p>

		<p><del>procurement method due to a lack of project continuity and information sharing.</del></p> <p>The American Institute of Architects (AIA) launched the integrated project delivery (IPD)...</p> <p>(Line 427-429)  <del>Chan, A. P., Chan, D. W., Chiang, Y. H., Tang, B. S., Chan, E. H. and Ho, K. S. (2004), "Exploring critical success factors for partnering in construction projects", Journal of Construction Engineering and Management, Vol. 130 No. 2, pp. 188-198.</del></p> <p>(Line 434-437)  <del>Construction Users Roundtable (CURT) (2004), Collaboration, Integrated Information and the Project Lifecycle in Building Design, Construction and Operation, Architectural/ Engineering Productivity Committee of The Construction Users Roundtable (CURT), Cincinnati, OH.</del></p>
<p>Page 3, line 62: 'In addition, IPD is still in the test stage in developing construction sectors such as South Korea'-this sentence need more explanation.</p>	<p>As reviewer's comment, we elaborated why IPD is still in the test stage in developing construction sector including South Korea.</p>	<p>(Line 69-79)          In addition, IPD is still in the test stage in developing construction sectors such as South Korea, and there is a lack of information on actual plans for applying IPD. <del>Since the IPD was invented assuming the collaboration of the individual construction parts for a single project from early stage as a one team, it is highly likely that it will be successful in an overall fully matured and experienced built environment. For countries including South Korea that still do not have enough competency in soft skill such as contract management or risk management, there is careful research and practical feedback needed. However, there are still not many actual project cases even in a country in which IPD has been developed.</del> Thus, determining the critical success factors (CSFs) is necessary to introduce IPD successfully. It is also necessary to determine the kinds of projects where it is more difficult or impossible to apply IPD.</p>
<p>Page 4, line 93.. what is relational contracts?</p>	<p>As reviewer's comment, we elaborate the meaning to relational contract and annotate at the end of page 5 in order to avoid unnecessary confusion of reader.</p>	<p>(Line 117-120)          Integrated project delivery (IPD) is one promising <b>relational contract</b> system that provides a platform for projects. <del>Comparing to the traditional PDSs tightened by strict terms</del></p>

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		<p>and condition, since relational contract system is structured by the mutual trust rather than contract clauses, it has fewer changes and a tighter schedule than traditional PDSs (AIA, 2007a).</p> <p>(End of page 5. Annotation) A relational contract is a contract whose effect is based upon a relationship of trust between the parties to which it pertains.</p>
<p>It was not clear how the author develop DV?. Need to explain further on the development of DV in the literature review</p>	<p>As reviewer's comment, we elaborate how the dependent variables are developed.</p>	<p>(Line 159-161) ... first determined, and then semi-structured interviews and questionnaire surveys were carried out to determinate the prerequisites for implementation of IPD that are used as dependent variables in multiple regression analysis and to ensure reliable data collection. Factor analysis....</p> <p>(Line 179-185) Using their empirical experience and expertise, they reviewed the <del>different essential prerequisites potential IPD factors to determine the most influential ones. They also</del> and determined three dependent variables that are the least or most critical for a successful application of IPD in the Korean construction industry. These three <del>dependent variables indispensable conditions were analyzed using were</del> collected from different references (Middlebrooks, 2008; Kent and Becerik-Gerber, 2010; Raisbeck, et al., 2010) were discussed and finally chosen by semi-structured interviews. <del>seven factor clusters (FCs) (see Table VI).</del></p>
<p>Since this study is testing the relationship between IV and DV, the author should include a framework and hypothesis.</p>	<p>As reviewer's comment, we elaborate the framework and hypothesis of research analysis and method.</p>	<p>(Line 208-219) Based on the results of factor analysis, a multiple regression analysis was performed to test the relationship between <del>on</del> the seven factor clusters (FCs; independent variables) <del>FCs</del> and three prerequisites (dependent variables) for a successful application of IPD. <del>to analyze the contributions of individual factors to IPD introduction.</del> The results show the independent variables (FCs) <del>showed which CSFs are positively related to successful IPD introduction in Korea that have a positive correlation with dependent</del></p>



		<p>variables (three prerequisites for IPD) according to the beta coefficient and t-test. This study hypothesizes that successful FCs (independent variables) should satisfy the prerequisites (dependent variables). Thus, only FCs that have significant correlation with three prerequisites (dependent variables) will be recognized as CSFs for IPD application. Multiple regression analysis indicated correlations between the seven FCs (independent variables) and three successful application conditions (dependent variables).</p> <p>(Line 293-300)  Stepwise multiple regressions were carried out to test how much correlation between the three dependent variables and seven FCs as independent variables using SPSS 22.0. In accordance with the hypothesis of this study in which only successful independent variables (FCs) will be recognized as the SCFs for implementation of IPD in Korea, 7 FCs were analyzed to see how significant correlation were with three dependent variables using multiple regression analysis. Since the purpose of this study is not to recognize whether a certain independent variable may become the CSF but to recognize what independent variables can be CSFs for IPD implementation, multiple regression analysis was used to find out multiple CSFs.</p>
<p>Page 7, line 193- 'Multiple regression analysis indicated correlations between the seven FCs (independent variables) and three successful application conditions (dependent variables)'</p> <p>Determination on the relationship between IV and DV is based on multiple regression result. Would like to suggest the author to exclude the correlation result.</p>	<p>As reviewer's comment, we remove the "4.3 Correlation analysis" section in order to avoid confusion of reader.</p>	<p>(Line 277-290)  4.3 Correlation analysis  <del>Correlation analysis was conducted to investigate the relationships between independent variables (the seven FCs) and dependent variables determined from the interviews, as shown in Table VI. Three dependent variables were recognized as fundamental criteria when deciding whether the seven analyzed FCs are critical for IPD implementation in Korea.</del></p> <p>Insert &lt;Table VI. Results of correlation analysis &gt; here</p> <p><del>The correlation analysis results show that there is a</del></p>

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		<p><del>significant positive correlation between the dependent variables and seven FCs. “Impact of IPD adoption on overall construction industry” was correlated with five independent variables (FC1, FC2, FC4, FC5, and FC7), “Understanding and experience about IPD system” was correlated with four independent variables (FC1, FC2, FC5, and FC7), and “Synergy effect between IPD and BIM” was significantly correlated with five independent variables (FC1, FC2, FC4, FC5, and FC7).</del></p>
<p>The multiple regression analysis should be run to test the relationship between 7 IVs to 3 DVs.</p>	<p>As reviewer’s comment, we elaborate the relationship between 7 independent variables and 3 dependent variables in line with the research hypothesis and framework.</p>	<p>(Line 208-219)  <del>Based on the results of factor analysis, a multiple regression analysis was performed to test the relationship between on the seven factor clusters (FCs; independent variables) FCs and three prerequisites (dependent variables) for a successful application of IPD. to analyze the contributions of individual factors to IPD introduction. The results show the independent variables (FCs) showed which CSFs are positively related to successful IPD introduction in Korea that have a positive correlation with dependent variables (three prerequisites for IPD) according to the beta coefficient and t-test. This study hypothesizes that successful FCs (independent variables) should satisfy the prerequisites (dependent variables). Thus, only FCs that have significant correlation with three prerequisites (dependent variables) will be recognized as CSFs for IPD application. Multiple regression analysis indicated correlations between the seven FCs (independent variables) and three successful application conditions (dependent variables).</del></p> <p>(Line 293-313)          Stepwise multiple regressions were carried out to test how much correlation between the three dependent variables and seven FCs as independent variables using SPSS 22.0. In accordance with the hypothesis of this study in which only successful independent variables (FCs) will be recognized as the SCFs for implementation of IPD in Korea, 7 FCs were analyzed to see how significant correlation were with three dependent variables using multiple regression analysis.</p>

		<p>Since the purpose of this study is not to recognize whether a certain independent variable may become the CSF but to recognize what independent variables can be CSFs for IPD implementation, multiple regression analysis was used to find out multiple CSFs. Table V VIII shows the standardized regression coefficient (<math>\beta</math>), standard significance (p), coefficient of determination (R<sup>2</sup>), adjusted R-square value (Adjusted R<sup>2</sup>), and variation in the R-square value (<math>\Delta R^2</math>). The size of the sample used in the final outcome is 118. Among the seven independent variables, only four (FCs), were analyzed with a significant correlation showing the differences from 0.000 at <math>p \leq 0.04</math>: “Reform of the contract law and adoption of appropriate IPD agreement form” (CF1), “Team building and management for collaborative business process” (CF2), “Early involvement and enhanced role of key participants” (CF4), and “Improvement and utilization of BIM for collaborative process of IPD” (CF7).</p> <p>Insert &lt; Table V VIII. Multiple regression result &gt; here</p> <p>These four independent variables (CSF1, CSF2, CSF3, CSF4) (CSFs) altogether explained 60.7% (R<sup>2</sup>=0.607) of the variance of the three dependent variables (Table V VIII). Among the....</p>
<p>Table VII. should be modified-there should be only one model that is one result indicating relationship between 7IVs and 3DVs.</p>	<p>Regression analysis is a set of statistical processes for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. Since this study intended to identify several critical success factors (CSFs) not only one, multiple regression analysis was utilized to recognized multiple independent variables (CSFs) for successful application of IPD in Korea.</p>	
<p>Suggest data in Table III.and Table IV to be combined in Table V .</p>	<p>As reviewer’s comment, we combined tables. We combined Table IV and V. However, Table III remains separately for</p>	<p>(Line 259-263)  <del>Insert &lt; Table IV. Final statistic of principal component analysis &gt; here</del></p>

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	the effective delivery of content.	<p>As shown in Table IV, <del>shows</del> the final statistics of the principal component analysis (PCA), in which the seven extracted FCs comprise 58.45% of the variance. The varimax rotation of PCA was used to interpret the FCs. <del>as shown in Table V</del>. Each IPD success factor belongs to...</p> <p>(Line 269) Insert &lt; Table IV. <del>V</del>. Component analysis and matrix <del>after varimax rotation</del> &gt; here</p>
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