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BARRIERS AND CHALLENGES TO IMPLEMENT INTEGRATED PROJECT DELIVERY IN CHINA

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Abstract: Integrated Project Delivery (IPD) improves construction project performance. In China, though IPD is known due to its theoretical advantages and benefits, effective implementation of IPD in construction projects is rare. This may be caused by some existing barriers and problems. The purpose of this study was to explore the barriers to adopt IPD in Chinese construction. Critical factors of IPD implementation were reviewed, and face-to-face interviews with experts were carried out to collect industry views. Nanjing, China was selected as the location to carry out the research. The results revealed that the confidence of using IPD is not strong. In particular, adversarial relationships, legal issues, and lack of owner willingness may block the implementation of IPD in China. It is suggested to adopt positive mechanisms to push for the early involvement of diverse participants. In terms of the contract mechanisms, future studies should involve a standard framework, gradual project procurement process, collaboration-oriented risk and rewards system, and necessary techniques to improve integrative operations.

Keywords: Integrated project delivery, barriers, Nanjing-China.

1 INTRODUCTION

In 2015, the development of the construction industry in China fell to a historical low. Due to inborn fragmented problems, the Chinese construction industry suffered from low productivity, inefficiency, and ineffectiveness. To develop and survive in the context where integrated scientific management develops, participants in Chinese construction need to review their practices and refine their strategies to improve their operations.

The concept of "lean" refers to reducing waste, meeting the requirements of customers, and focusing on value generation (Koskela 1997). IPD is a lean project delivery method that is characterized by bonding the key participants together and incentivizing them to achieve real collaboration for the interest of the project (American Institute of Architecture (AIA) 2007; Forbes and Ahmed 2010), thereby reducing waste and adding value. Previous research on IPD can be briefly classified into two groups: IPD definition and IPD application. Knowledge in the first group is helpful to identify the concepts, advantages, and measurements of IPD (Lahdenperä 2012; El Asmar et al., 2013). The second group of knowledge is useful for knowing the barriers and problems, critical successful factors, and effective mechanisms to address technique issues, contractor issues, and organizational issues in implementing IPD (Ballard 2011; Korb et al. 2016; Lostuvali et al. 2014). Despite the success of IPD projects in foreign countries, the challenges to adopt IPD in China are unknown. Rowlinson (2017) highlighted that business willingness and policies are the main barriers of IPD implementation. In addition, cultural, financial, legal, and

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technological problems are prevalent barriers (Ghassemi and Becerik-Gerber 2011, Korb et al. 2016). In the context of China, less research has been performed on IPD implementation. This paper aims to solve these research problems.

2 IPD

The American Institute of Architects (AIA) and the American Institute of Architects California Council (AIACC) (2010) defined IPD as a method of project delivery distinguished by a contractual arrangement among a minimum of the owner, the constructor, and design professionals that aligns the business interests of all parties.

Since Sutter Health successfully combined lean project delivery with multiparty contracts, IPD has shown its advantages in risk management and cost predictability (Lichtig 2005). IPD was first adopted in healthcare projects and gradually has been implemented in a variety of projects, including office buildings, residential buildings, transportation infrastructure, educational buildings, civic projects, and others.

The most well-recognized characteristics of IPD are: early involvement of key participants, shared risk and rewards, multiparty agreement, collaborative decision making and control, liability waivers among key participants, jointly developed and validated goals, and use of Building Information Modelling (BIM) (AIA and AIACC 2010; Azhar et al. 2015).

Multiparty agreement (MA): In IPD implementation, a multiparty agreement should be established. Such a contract refers to a single contract among multiple parties, including at least the owners, architects, and contractors (AIA 2007; National Association of State Facilities Administrators (NASFA) et al. 2010). Some important subcontractors and suppliers may also be included in the multiparty contract. In this contract, all elements are clearly stated and normally include incentives and risk sharing, payment method, dispute resolutions, and the responsibilities of all involved parties. However, the usage of IPD may deviate from the standard. For example, in Sutter Health's construction of its new Cathedral Hill Hospital in San Francisco, the integrated form of agreement (IFOA) was used, and the owner, architect, design consultant, general contractor, and primary trade contractors were included in the IFOA; while in a project of Lawrence & Schiller Remodel, a new, limited liability company (LLC) was established, formed, and solely owned by the owner, who contracted with the integrated team partners, which included interior designers, the architect, general contractor, electrical contractor, and mechanical contractor (Cheng et al. 2012).

Early involvement of key participants (EIKP): One of the most fundamental advantages of IPD is that all key parties should be present and involved in a project from the earliest design phase (AIA 2007). Early contractor involvement (ECI) is not a new strategy, which was first adopted in 2000 in the project of Blyth Community College for cost review and selection of materials (Mosey 2009). Many researchers have investigated ECI and its use of different procurement forms, including partnering and alliancing (Mosey 2009; Rahman 2012). Since the new millennium, ECI has been adopted widely in different construction environments (Walker and Lloyd-Walker 2012; Whitehead 2009).

Shared risk and rewards (SRR): Incentive compensation layer (ICL) is incorporated in IPD projects, where a percentage or all of the profit of designers and contractors is put at risk. The project goals are set at an early project stage, and the project participants will receive their profit jointly in terms of the measurement of project performance against project goals (Cohen 2010). The ways to define and calculate risk and rewards are diverse. Badenfelt (2008) suggested that the sharing ratio should be chosen based on past working

relationship and perceived risks, while Zhang and Li (2014) proposed a sharing mechanism in terms of the Nash Bargaining Solution based on target cost.

Collaborative decision making and control (CDMC): In IPD projects, the decisions are made based on mutual agreements among all project teams, instead of solely by the owner. The IPD management team and implementation team, comprising representatives from at least the owner, architect, and contractor, should be built to make decisions collaboratively (Thomsen et al. 2009). Core decisions are mainly made by the project executive team, while the detailed implementation is conducted by the project management team (AIA 2009a).

Liability waiver (LW): The contractual agreements of IPD require a liability waiver among the key participants, except for willful misconduct which occurs if the project participants cannot prove that the misconduct is unintentional (AIA 2009b). Liability waivers have been strictly implemented in alliancing projects in Australia. Despite the fact that LW is a metric to measure the level of integration, the relevant adoption in the IPD context is not as high as alliancing (Lahdenperä 2012).

Jointly developed and validated goals (JDVG): In the IPD context, project participants develop project goals jointly. Project performance criteria are defined based on the input and support of all key participants (NASFA et al. 2010). Given an initial planning budget provided by the owner, project participants develop target cost. In addition to cost target, the design criteria also include quality, schedule, diversity, sustainability, and implementation (Cheng et al. 2012).

Use of BIM: Open and interoperable information exchanges based on BIM can facilitate integration and collaboration between different participants (AIA 2007). In IPD projects, BIM serves as a platform where the information is shared among project participants.

Despite the fact that IPD as a project delivery method emerged 10 years ago, the philosophy of IPD actually has been embraced in the AEC industry even before the first term of IPD emerged (NASFA et al. 2010; Matthews and Howell 2005). NASFA et al. (2010) defined "IPD-ish" as using IPD as a philosophy, a phenomenon that is also called "IPD lite" or "non-multiparty IPD." In IPD-ish projects, not all of the IPD characteristics are achieved, nor is multiparty agreement adopted. In addition, the collaboration level is lower than IPD as a delivery method but higher than traditional procurement methods. Other procurement methods, such as DB, CMR, and DBB can also adopt IPD-ish characteristics.

3 RESEARCH METHOD

The study investigated barriers to implement IPD in China. By face-to-face interviews during December 2016, the perceptions of industry practitioners and academics towards IPD were examined. Through personal networking of research team members, two academics and six industry practitioners representing owners, general contractors and designers in the private and public sectors agreed to have face-to-face interviews in Nanjing, China. Nanjing was selected in that it is representative of Chinese cities experiencing rapid urban development. The questions were divided into three parts: 1) background information on the interviewees; 2) discussion of the extent to which IPD has been implemented in China; and 3) investigation of the barriers and challenges to the adoption of IPD.

4 RESULTS AND DISCUSSION

Two academics and six industry professionals were interviewed through face-to-face meetings. Of eight respondents, four are interested in project management, three interviewees focus on construction and one is a design consultant. Detailed backgrounds for all respondents are shown in Table 1.

Table 1: Profile

Description	Frequency	%
Industry participants	6	75
Academics in university	2	25
Business/interests areas		
Project management	4	50
Construction	3	37.5
Design	1	12.5
Years of experience		
<5 years	4	50
5-10 years	0	0
10-30 years	2	25
>30 years	2	25
Practice adopted		
Early involvement of key participants (EIKP)	3	37.5
Multi-party agreement (MA)	0	0
Shared risk and rewards (SRR)	1	12.5
Collaborative decision making and control (CDMC)	0	0
Jointly developed and validated goals (JDVG)	2	25
Liability waiver (LW)	0	0
Use of BIM	3	37.5

4.1 PRACTICE ADOPTED IN CHINA

Regarding IPD adoption in China, MA, CDMC, and LW have not been implemented despite the fact that some respondents agreed with the importance of these strategies. The other component parts, such as EIKP, SRR, and JDVG, have been adopted to some extent. Use of BIM is the most common element of IPD used in construction projects in China. Results from responses are shown in Table 1. Regarding “Practice adopted,” "Frequency" means the number of interviewees who had participated in projects that implemented the relevant IPD elements.

Respondents reported that **EIKP** is rarely implemented in China. Though several respondents highlighted the benefits of ECI and contractors’ strong willingness to get

involved in the design stage, two owners insisted that the majority of design problems can be handled by designers. Three respondents highlighted that the early involvement of relevant specified experts is generally observed. However, they also mentioned that these experts were contractors who did not get involved in the construction stage. Interviewees stated that **MA** has not been implemented. The lump sum contract is the most commonly used mechanism in China. In addition, the unit price contract is adopted with complex ground conditions. **SRR** is rarely adopted, though one owner mentioned that technology sharing by the architect was adopted in one project in which he had participated. From the owner's perspective, the mechanism is risky and adverse to their benefits. This is consistent with the contractors' viewpoint that the mechanism will push owners to take more risk. **CDMC** is rarely happening. Owner and contractor respondents specified that the owner has total power to make decisions in the early stage, in which contractors are not involved. During the construction stage, change orders still need the approval of the owner or owner's representatives. **JDVG** is less observed, since project goals are developed by owners. Only two respondents claimed that consultants also got involved in project goal development. The typical responses were that the owners would not agree to **LW**, while the contractors are neutral to it. Almost all respondents expressed the view that LW is too risky. The use of BIM is highly adopted. However, BIM is mainly used for technical problem-solving, primarily for clash detection. In addition, respondents noted that BIM models are not shared between project participants.

4.2 BARRIERS TO IMPLEMENT IPD IN CHINA

There are several challenges that impede IPD implementation and explain its low level of adoption, including legal barriers, lack of owner willingness, lack of government support, adversarial relations, lack of IPD experts, and technical problems in the industry and among academics.

Legal barriers: Some respondents stated that IPD implementation is hindered by current construction laws and regulations. First, laws do not allow an owner to enter into a multiparty agreement with the architect and contractor as signatory parties in public projects. Second, early contractor involvement is impeded by the competitive bidding law. Regarding legal barriers, the response from one owner was as follows:

"To put it simply, IPD is not easy to be adopted. It is difficult to get contractors and trade contractors involved in the design stage because it is against the law on public bidding. Regarding multiparty contract, it is also not encouraged. The majority of contractual agreements used in China are modified FIDIC contracts, based on which two-party relationship is built rather than multiparty."

Lack of owner's willingness: Without the owner's willingness, risk will never be shared among all project participants. In the IPD context, the engaged owner is one of the key factors for project success.

In regard to owner willingness, one site manager (contractor) stated:

"We do not mind early involvement and multiparty contract, since our knowledge in design can help us to solve the problems normally occurring in construction. I don't think the architects have problems with this, either. But the owner is not willing to adopt these strategies. They are the ones who decide which business models to be used, make payment and select the parties to work for them. If they do not want to implement IPD, what can we do?"

Lack of support of government: Lack of governmental will is one of the most important barriers, especially in China. One senior project manager stated:

"For example, in recent years PPP has become very popular in China, most probably due to the support of government. The central and local government all introduced new policies to encourage the business leaders to choose PPP. If we can't have the support of government, I am sure there is still a very long way to go [for IPD adoption]."

Mistrust among project participants and adversarial relations among project participants impede communication and sharing. Good communication is built on a basis of trust. One contractor explained why mistrust blocked IPD implementation:

"The current industry atmosphere is not mature enough for IPD adoption. The status of owners and contractors are not equal. It is hard to have mutual respect and trust between them. In this situation, even though the contractors come up with some good ideas to add value, or save money for the owner, I do not think the owner can accept them."

Lack of professional bodies to enhance IPD awareness, thus the understanding of IPD in industry, is rare. In industry, on one side, lack of understanding of IPD for industry participants, especially the construction professionals in the top management level, may result in the slow change of attitudes towards IPD and increase the concern that IPD may not be helpful to improve project performance; thus IPD is not selected as the procurement method. On the other side, even though some flexible managers want to try new business models like IPD, it is rare for industry professionals to help them achieve real integration in projects.

Little academic research relevant to IPD has been conducted. In addition, little education relevant to IPD has been conducted in China. This has led to a lack of IPD awareness among the graduates who would become the key managers and engineers in the construction industry. Although studies might have been undertaken on the policy level, studies on implementation are urgently required.

Technical barrier: Even though the use of BIM is recommended in industry, the BIM-enabled culture and platform are not well established. Without addressing the problem of interoperability among diverse software applications and the interdependencies among participants, the benefits of BIM will not be realized. One structural engineer expressed his view:

"I think the core idea of IPD is integration, is sharing. If the problems related to interoperability cannot be solved, how to achieve integration?"

5 CONCLUSIONS

The findings indicate that in general the level of adoption of IPD in construction projects being executed in China is still low. Some IPD strategies, such as EIKP, SRR and JDVG, have been adopted to some degree, while other IPD components, especially the contractual requirements including MA, CDMG, and LW, have been rarely implemented. In spite of the fact that the use of BIM is commonly recommended in construction projects in China, it is mainly used to solve technical problems rather than achieving integration. It can be concluded that true IPD has not been implemented, but "IPD-ish" practices are emerging. The low level of IPD implementation may be related to poor project performance in China. The results revealed that legal issues, mistrust among key parties, and lack of owner willingness are major barriers to the use of IPD in China. To overcome the legal barriers, the support of government and attention from researchers are necessary. The research also highlights the need to improve the level of awareness of the potential benefits of IPD adoption, thereby enhancing owners' willingness. This can be achieved through

continuous professional development programs done by professional bodies in the built environment.

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