

A Study on the Characteristics of "Early Contractor Involvement Method" in Public Project in Japan

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Abstract: In recent years, Owner, Architects, and Contractor are increasingly collaborating with each other from pre construction phase in construction projects, which is called Early Contractor Involvement (ECI). In Japan, the ECI method has been introduced in several public building projects since 2015. The purpose of this study is mainly to clarify the characteristics of the ECI method in Japan and to compare the contract clauses of the ECI method in the UK and the USA.

The results of the survey are as follows. (1) the ECI method was supposed to make it possible to achieve appropriate quality, cost, and construction period by reflecting Contractor's technology and know-how in the design documents and specifications. (2) According to the database, there were 27 cases of the ECI method in Japan from 2015 to 2021, of which 13 cases for which bidding information could be obtained had a variety of technical proposals, mainly VE proposals, depending on the project characteristics. (3) , Japan's ECI method has very much in common with SBC + PCSA in the UK. On the other hand, ECI Method in Japan differs from in the UK in that Owner, Architect, and Contractor enter into a partnership agreement, which is similar to ConsensusDocs CD541 in the USA. (4) The ECI method in Japan has the following problems: Owner depends on Contractor for cost control, the division of roles among project members is complicated, and more work from Owner than the DBB method are required.

Key words: Public Project in Japan, Collaborative Project Delivery Method, Early Contractor Involvement, Construction Management, New National Stadium Japan

1. INTRODUCTION

In recent years, client requirements and technologies in construction projects have become more sophisticated and complex. As a result, Owner, Architects, and Contractor are increasingly collaborating with each other from pre construction phase. This is called Early Contractor Involvement (ECI), and advanced project delivery methods are being developed in many countries. In Japan, for many years, public projects were based on Design-Bid-Build Method. With the enactment of "Act on Promoting Quality Assurance in Public Works" in March 2014, various project delivery Methods such as "ECI Method" are being introduced. This study mainly investigates "the ECI Method in Japan" in public projects and compares the contract clauses and cases of the ECI Method in Japan and project delivery methods which realize the ECI in the USA and UK, and aims to clarify the characteristics of the ECI Method in Japan.

2. LITERATURE REVIEW

A. Hosseini, et al (2018) described "Early involvement of contractor" as "Involving the contractors' expertise, specifically on constructability, in an early stage of the project can lead to decreased design costs, increased efficiency, finding better solutions and building trust." [1]. D. Philip, (2012) indicated "Codifying and bringing harmony (perhaps even a new co-operative bias to our traditionally 'siloed' industry) requires other pieces of the jigsaw to be secured around BIM: the intelligent client, early contractor involvement and soft landings all combine to create the Goldilocks porridge that is 'just right' for BIM." in NBS National BIM Report 2012 [2].

ECI is the early involvement of contractors based on a variety of approaches, and various project delivery methods are applicable in each country. Wondimu, P.A., et al (2020) conducted a literature review and case studies on ECI approaches around the world and found that "Generally, 25 ECI approaches, 18 from literature and seven from the case projects, are identified during this study"[3].

In the UK, ECI is sometimes defined as a project delivery method that involves two-stage tender. For example, High Speed 2 Ltd., which is a high-speed rail operator in the UK, defined that " Early contractor involvement (ECi) is an approach to contracting that supports improved team working, innovation and planning to deliver value for money. it involves an integrated contractor and designer team, appointed under an incentivised, two-stage contract."[4].

In the case of building construction projects, for example, the combination of JCT's Standard Building Contract (JCT SBC) and Pre-Construction Service Agreement (JCT PCSA) corresponds to the ECI method in the UK, and specifies the scope of work in the pre construction phase and the method of implementing the two-stage tender in combination with methods such as Design-Bid-Build. As will be explained later, the characteristics of ECI method in Japan are similar to those of JCT PCSA [5].

In the USA, the U.S. Army Corps of Engineers (USCAE) defines "Early Contractor Involvement (ECI) Delivery System is a design-bid-build (DBB) delivery system procured using an options contract. The type of funding must be carefully considered when structuring the base contract which may include only preconstruction services but could include preconstruction services and some construction." [6]. The USACE also refers to the ECI Delivery System as "Integrated Design-Bid-Build" [6]. J.A. Hackenbracht, (2009) states that " ECI is called Construction Management (or Manager) at-risk, CM@R"[7]

In building construction projects, CM@R corresponds to AIA A133-2019 Standard Form of Agreement Between Owner and Construction Manager as Constructor (AIA A133) [8] and ConsensusDocs 500 Owner and Construction Manager Agreement (CD500) [9]. The CM@R system in the USA is similar to the ECI system in the UK in that Construction Manager/ Contractor provides pre construction services such consultation and cost estimation in the pre construction phase, but in CM@R, selection is made in the construction phase in the form of GMP Proposal rather than a two-stage tender. Based on these literature reviews, this time we will compare the terms and conditions of the ECI in Japan, the PCSA in the UK, and the CM@R in the USA.

3. RESEARCH METHODOLOGY

This study was composed of (1) a literature survey on the outline of ECI methods, (2) a literature survey on contract documents using a open database, (3) a comparative analysis of contract contents of ECI methods in Japan, the UK, and the USA, and (4) discussion based on the results of the survey and analysis, the verification report on the New National Stadium and the interviews with Owner and CMR in ECI projects.

Literature on the ECI method was collected from the "Act on Promoting Quality Assurance in Public Works" which legally defines the ECI method in Japan, and guidelines issued by the

Ministry of Land, Infrastructure, Transport and Tourism such as “Guideline for Operation of Technical Proposal and Negotiation Method for Construction Project in MLIT”.

The cases of public building projects applying the ECI method were collected from 2015 to 2021 using a database that the Kensetsushin Shimbun Corporation independently compiles on the information of public and private construction projects including civil engineering and building construction project (<https://ugoki.kensetsunews.com/>). A comparative analysis of technical cooperation services and technical proposals was conducted for the ECI projects for which it was possible to collect bidding information from each public government's website among the cases collected from the database.

A comparative analysis of the ECI method in Japan, JCT SBC + PCSA in the UK, and CM@R in the US, such as AIA A133 and CD500, analyzed in the projects collected from the database, was performed, focusing on the overview such as contract type and payment method, as well as preconstruction services, and the contract contents of the ECI method.

In discussion, the New National Stadium Project Verification Report which explained the problems with Japan's ECI method was referred [11]. In addition, interviews were conducted with public contractor and CMR for 2 cases of the projects selected from the database.

4. FINDINGS AND DISCUSSION

4.1. Overview of the ECI Method in Japan

In Japan's ECI method, Owner conducts public proposal process before the detail design phase. Contractors participated in the proposal submits technical proposals for technical improvements based on the contents of the schematic design documents. Contractor selected by the proposal conclude the technical cooperation agreement with Owner and is given the priority negotiation rights. Contractor reviews the detail design document such as drawings and specifications prepared by Architect and reflect the contents of the technical proposal. Contractor provides cost estimates and negotiate with Owner on the contract contents such as the specifications and the estimated construction price, etc. After Owner and Contractor agree on the contents of the contract at the end of the detail design, they conclude the construction contract, and the actual construction is carried out according to the specifications, price, and construction period decided in the negotiations.

The ECI method is supposed to make it possible to achieve appropriate quality, cost, and construction period by reflecting Contractor's technology and know-how in the design documents and specifications from the detail design phase in public projects where Owner cannot set optimal specifications or where it is difficult to determine the conditions on which the specifications are based. For Owner, the ECI method has the advantage of avoiding unsuccessful bid through prior negotiations with Contractor. Contractor also has the advantage of being able to incorporate their own proposals into the specifications, construction costs, and construction schedule.

Owner, Architect, and Contractor enter into the partnership agreement at the start of the detail design to agree on the division of roles, authority, and responsibilities during the detail design phase. The partnership agreement may be accompanied by a role responsibility matrix and a risk-sharing matrix. In addition, in the ECI method in Japan, Construction Manager (CMR) who supports Owner is often involved. In the partnership agreement, it is clearly stated that Architect and Contractor shall sincerely cooperate with the coordination conducted by Owner and CMR. In Japan, CMR are mainly responsible for providing technical advice and support to Owner, which is quite different from CMRs of CM@R in the USA.

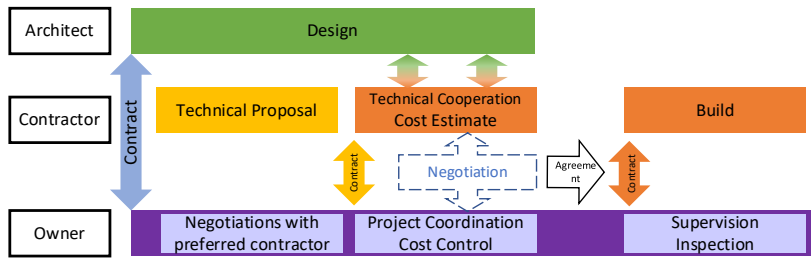


Figure 1. The Overview of ECI Method in Japan

4.2. The Cases of the ECI Method in Japan

Fig. 2 shows the total construction cost of public building projects from 2011 to 2020, which shows an upward trend due to the reconstruction from the Great East Japan Earthquake in 2011 and the Tokyo Olympics in 2020. Fig. 3 shows the number of public building projects in which the ECI method has been introduced from 2015 to 2021, based on the database published by The Kensetsutsushin Shimbun Corporation (<https://ugoki.kensetsunews.com/>). There are only 27 projects that have implemented the ECI method. In addition, only a few local governments have implemented the ECI method more than once so far.

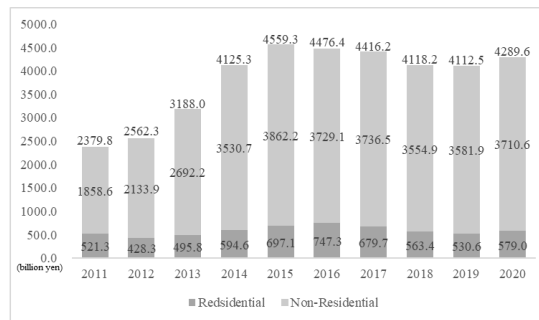


Figure 2. The Total Construction Cost of Public Building Projects from 2011 to 2020

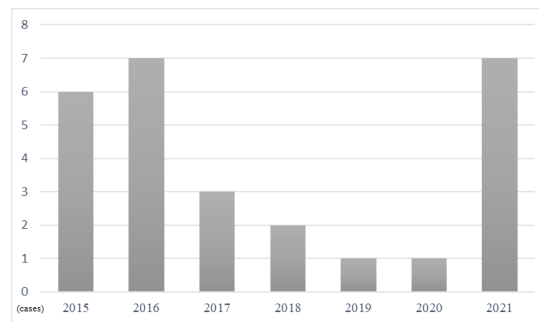


Figure 3 The Number of the ECI Projects in Japan from 2015 to 2021

In 13 of the 27 cases surveyed from the database, bidding notices and contract documents of the ECI Method were available on the website. Table 1 shows an overview of the 13 cases, and Table 2 compares the contents of the technical cooperation services during the detail design phase of the 13 cases. The technical cooperation service basically includes technical evaluation of the design contents, examination of construction implementation policy, submission of technical information, technical proposal (including VE proposal), review of construction process, support for cost management, support for preparation of documents to be submitted to related organizations and attendance at the partnership meetings. In some projects, the technical cooperation service included the preparation of drawings for the technical proposal section. In this case, the contents of the

technical proposals made by Contractor were checked by Architect, approved by Owner, and incorporated into the detail design documents.

Table 1. Overview of the 13 ECI Projects

No.	Year	Local Government	Building Type	Total Floor Area
A	2015	Shirai-shi, Chiba-ken	City Hall	4,660m ²
B	2016	Mito-shi, Ibaraki-ken	Arena	15,910m ²
C	2016	Ohtawara-shi, Tochigi-ken	City Hall	9,900m ²
D	2017	Ohda-shi, Shimane-ken	Hospital	19,360m ²
E	2018	Mito-shi, Ibaraki-ken	Civic hall	2,2974m ³
F	2018	Okinawa-shi, Okinawa-ken	Arena	27,711m ²
G	2019	Yabu-shi, Hyogo-ken	Civic Hall	4,352m ²
H	2020	Tokoname-shi, Aichi-ken	City Hall	9,780m ²
I	2021	Arao-shi, Kumamoto-ken	Hospital	23,418m ²
J	2021	Handa-shi, Aichi-ken	Hospital	40,000m ²
K	2021	Aiduwakayama-shi, Fukushima-ken	City Hall	13,722m ²
L	2021	Kirishima-shi, Kagoshima-ken	Hospital	23,192m ³

Table 2. Comparison of Technical Cooperation Services in 13 ECI Projects

Project	A	B	C	D	E	F	G	H	I	J	K	L
Technical Evaluation of Design Contents	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Examination of Construction Implementation Policy	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓
Examination of Overall Construction Plan	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verification of Temporary Construction Plan	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓
Submission of Technical Information	✓	✓	✓	-	✓		✓	✓	✓	✓	✓	✓
Technical Proposal (including VE proposal)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Preparation of Drawings for Technical Proposal Section	✓	-	-	✓	-	✓	✓	-	-	-	-	-
Review of Construction Process	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Support for Cost Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Preparation of the Overall Construction Cost Breakdown Statement	-	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓
Construction cost breakdown statement for Technical Proposal	-	✓	✓	-	✓	-	✓	-	✓	✓	✓	✓
Support for Overall Construction Cost Management	-	✓	✓	-	✓	-	✓	-	✓	✓	✓	✓
Support for Preparation of Documents to be Submitted to Related Organizations	-	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓
Attendance at the Partnership Meetings	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 3 shows the contents of technical proposals in 13 cases. The content of the technical proposal requested by Owner varies greatly from project to project. The common content among all the projects is the VE proposal, which indicates that Owner expects Contractor to control the cost within the Owner's budget. There were not many projects that requested proposals for examination of structural design such as seismic isolation devices, facility design such as ZEB certification, or special material and equipment such as CLT or medical equipment. In projects where a new building is to be constructed on the site and the existing building is to be demolished afterwards (e.g., hospitals, city halls, etc.), Owner required proposals for the continuity of the function of the existing building, safety measures on site, and noise and dust control. In addition, there were several projects where Owner requested proposals for local economic revitalization. In these projects, Owner asked Contractor to subcontract to local construction companies or to purchase materials and equipment from local companies in the construction phase.

Table 3. Comparison of Technical Proposals in 13 ECI Projects

Project	A	B	C	D	E	F	G	H	I	J	K	L
Examination of Structural Design (including Seismic Isolation Device, etc.)	-	-	✓	-	✓	-	-	-	✓	✓	✓	-
Examination of Facility Design (including ZEB or CASBEE Certification, etc.)	-	-	✓	-	-	-	-	✓	-	✓	-	-
Examination of Special Materials and Equipment (including CLT or Medical Equipment, etc.)	-	-	-	-	✓	-	-	-	-	-	-	✓
Measures for the Site Environment (including Spring Water, Foundation Ground, etc.)	-	-	✓	✓	✓	-	-	-	-	✓	✓	-
Coordination with Separate Construction	✓	-	-	-	-	✓	-	-	✓	-	-	-
Examination of Safety Measures at the Site	-	-	-	✓	-	-	✓	✓	-	-	-	-
Examination of Ensuring the Continuity of Functions of Existing Buildings	✓	-	-	✓	-	-	-	✓	-	-	-	✓
Neighborhood Measures (including noise and dust control)	-	-	-	✓	-	✓	✓	✓	-	-	-	-
Revitalization of Local Economy (including Subcontracting to Local Company)	-	-	-	✓	-	✓	✓	✓	-	-	-	-
Waste Reduction	-	✓	-	-	-	-	-	-	✓	✓	-	-
VE proposal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Others	-	-	-	-	✓	-	-	-	-	✓	-	✓

4.3. Comparison of the ECI Methods in Each Countries

As mentioned in the literature review, this study compares and analyzes the Japanese ECI method with the UK's JCT SBC+PCSA and the US CM@R (AIA A133 and ConsensusDocs CD500). In addition, the ConsensusDocs "541 Addendum to Agreements Between Owner and Construction Manager and Between Owner and Design Professional for Design-Assist Services" was also used for comparison [12]. CD 541 was an agreement between the Owner and Architect, between Owner and Construction Manager that clearly defined the roles and responsibilities of three parties to effectively involve the Subcontractors in Design Assist during the design phase. As shown in Table 4, Japan's ECI method has very much in common with SBC + PCSA in the UK. On the other hand, ECI Method in Japan differs from in the UK in that Owner, Architect, and Contractor enter into a partnership agreement, which is similar to ConsensusDocs CD541 in the USA. However, partnership agreements in Japan used vague expressions such as "the parties shall respond and cooperate sincerely" and often did not clearly state what each entity was to do. In particular, many partnership agreements hardly mentioned the role of Architect. In addition, there was no mention of how to complain from the contractor in case the technical proposal or negotiation was not approved, or the responsibility in case there was an error in the technical proposal.

Table 4. Overview of ECI Methods in Each Country

<i>Nation</i>	Japan	UK	US	US	US
<i>Contract</i>	ECI	SBC+PCSA	AIA A133	CD 500	CD 500+CD 541
<i>Contract Type</i>	DBB + Preconstruction Service Agreement			Construction Management as Contractor	
<i>Selection Method</i>	Two Stage Tender			GMP Proposal	
<i>Payment Method</i>	Stipulated Sum			Guarantee Maximum Price	
<i>Period of Participation</i>	Pre construction Phase			Pre construction Phase	
<i>Partnership Agreement</i>	✓	-	-	-	✓

Table 5 shows the comparison between Japanese technical cooperation services and Pre construction Services in the USA and the UK specified in each contract. As for the technical cooperation work in the ECI method in Japan, the preparation of drawings for the proposed part might be included in the scope of works. On the other hand, the division of Design responsibilities for the drawings prepared by Contractor was not specified. According to the ECI Guideline of the MLIT, Contractor was responsible if there was a defect in the technical proposal, and the Architect was responsible if there was a defect in the reflection of the technical proposal into the design. However, since it was not specified in the partnership agreement, it is presumed that the parties decide who is responsible for any problems that actually arise through the technical proposal through discussions between the parties. Pre construction service in the UK and US included early procurement of subcontractor and long lead item, but these were not specified in the technical cooperation service in Japan.

Table 5. Contractor/Construction Manager’s Preconstruction Services in Each ECI Method

<i>Nation Contract</i>	Japan ECI	UK SBC+PCSA	US AIA C133	US CD 500	US CD 500+CD 541
<i>Preliminary Evaluation</i>	✓	✓	✓	✓	✓
<i>Consultation</i>	✓	✓	✓	✓	✓
<i>Reference drawings</i>	△	-	-	-	-
<i>Cost Estimation</i>	✓	✓	✓	✓	✓
<i>Value Engineering</i>	✓	✓	-	-	✓
<i>Scheduling</i>	✓	-	✓	✓	✓
<i>Phased Construction</i>	-	-	✓	-	-
<i>Constructability Review</i>	✓	-	✓	-	✓
<i>Long Lead Item</i>	-	-	-	✓	✓
<i>Early Procurement</i>	-	✓	✓	-	✓
<i>Prefabrication</i>	-	-	-	-	✓
<i>Solicitation of SCs</i>	-	✓	-	✓	✓
<i>SC’s Design Assist</i>	-	✓	-	-	✓
<i>Plan of temporary works</i>	✓	-	✓	✓	✓
<i>Building Permit</i>	✓	-	✓	✓	✓

4.4. Discussion

Based on the results of the survey and analysis, the verification report on the New National Stadium, which introduced the ECI method and failed before the start of construction, and the interviews with Owner and CMR of Project F shown in Table 1, the issues of the ECI method are discussed. The first problem is that Owner depends on Contractor for cost control. Owner's budget is presented to Contractor in the 1st stage tender and Owner and Contractor negotiate to keep within these budgets. However, the higher the construction value, the higher the profit for Contractor. Since Contractor has priority negotiation rights, it is not possible to expect cost reduction through free competition as in the case of general competitive bidding. The New National Stadium project required high material prices and the introduction of high-risk technologies, and the ECI method of retreating from the principle of competition and inadequate information provided by the Owner and Architect resulted in the contractor's estimate rising from 130 billion yen to 300 billion yen, which ultimately led to the project being redone. In the interview with Project F, the owner pointed out that it is important to obtain sufficient agreement from the contractor on the validity of the construction cost at the 1st tender. Another problem is the complicated division of roles and responsibilities among project members. According to the verification report, one of the problems in the New National Stadium project was the ambiguity in the division of roles and responsibilities between Zaha Hadid's office, local Japanese design JV, and the contractors. In order to solve this

problem, the client involved the CMR from the middle of the detail design phase, but it did not work well. In subsequent projects that introduced the ECI method, partnership agreement should be signed during the pre construction phase, and the CMR should be involved as a coordinator between the parties. According to Project F's interview, the CMR acted as an judge and coordinator to coordinate the opinions of all three parties and resolve conflicts of interest. The last problem is that the ECI method places a greater burden on Owner. The ECI method requires more work from Owner than the DBB method, such as coordination between the parties and order-related administration. This is very problematic for local governments that lack experience, capacity, and manpower, and is one of the reasons why few Owner have adopted the ECI method. The owner of Project F also used the ECI method for Project B, but since the ECI method was very time-consuming, they will use the DBB method instead of the ECI method in the future unless there is a major problem with the project.

Thus, it is possible that many of the benefits described in the MLIT guidelines described in section 4.2 (cost reduction, prevention of bidding failures, etc.) may not be working in practice. Further studies are needed to prove this point.

5. CONCLUSIONS AND FUTURE RESEARCH

In this study, the overview and cases of the ECI Method in Japan were introduced. It also compared the contract clauses of Japan, the U.K., and the U.S., and clarified the characteristics and problems of the ECI method in Japan. In the future, we will conduct more interviews on the ECI system in Japan and the UK to deepen our analysis and discussion.

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