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# An Investigation Into Current Procurement Strategies That Promote Collaboration Through Early Contractor Involvement With Regards to Their Suitability for Irish Public Work Projects

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# An investigation into current procurement strategies that promote collaboration through early contractor involvement with regards to their suitability for Irish public work projects

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**Abstract – Previous research has established that multi-disciplinary collaboration will benefit a construction project throughout its lifecycle. While Lean Construction, Building Information Modelling (BIM), and Integrated Project Delivery (IPD) can all be viewed as separate processes which add independent value to a project, they are more effective when used in partnership with each other. In order to ensure the high levels of collaboration expected for these processes to work in unison, the early involvement of the Contractor is paramount. Early contractor involvement within the design process can ensure a more focused integrated project team, improvement of both constructability and cost certainty, as well as better risk management. This approach has only been used occasionally on Irish public works projects. Competitive tendering has resulted in creating a culture of claims and adversity, not conducive to collaboration and therefore raising the question, is the traditional procurement format representing value for money for the Irish State.**

**This paper will investigate current procurement strategies that promote early contractor involvement and their suitability for Irish public works projects. The research will primarily focus on contracts that are best aligned to the Capital Works Management Framework (CWMF) strategic objectives of ensuring greater cost certainty, better value for money and more efficient end-user delivery. To achieve this an initial literature review was undertaken exploring award criteria for early Contractor involvement both within the International and Irish public and private sectors. This research focused on establishing and examining the potential barriers for implementation. The analysed data from this process was interrogated through Stakeholders interviews that aimed to understand the current state of the public work project procurement process and if government agencies would endorse a move away from the "lowest bid win" criteria for contractor selection. A case study was also carried out showcasing a form of IPD used in Ireland. The findings from this paper suggest that early contractor involvement in partnership with IPD can provide a more advantageous solution for the Irish State while also promoting both BIM and Lean Construction processes.**

*Keywords* – Early Contractor Involvement (ECI), Building Information Modelling (BIM), Lean Construction, Integrated Project Delivery (IPD), Public Work Contracts, Procurement.

## I Introduction

Reports such as the National BIM Council Roadmap to Digital Transition for Ireland's Construction Industry 2018-2021 warns about the risk of the digital transition stalling if more collaborative ways of working together are not found [1]. Collaboration is fundamental to the BIM process and the fragmentation and adversarial nature of the industry must end if the potential of BIM is to be fully realised [2, 3]

Current procurement methods are seen as one of the barriers to collaborative working [1]. Calls for changes to the procurement process, as well as an increase in collaboration, have been ongoing for years [4]. Clients, both in the public and private sectors, unhappy with traditional procurement routes, are also demanding changes [5]. The Irish Government and the European Union recognise the benefits of BIM to the public sector to generate better value for money [1, 6]. They must provide leadership and remove legal, regulatory, procurement and policy barriers [6].

Although there is no one best procurement method for all projects, the selection of the appropriate one can shape the success of a project

[3] with some methods better than others at promoting collaboration [4]. Early Contractor Involvement (ECI) and more integrated procurement methods contribute to the better buildability of the design and reduce risks [3]. However, the traditional "Design-Bid-Build" procurement method is still predominantly used [4]. Contractors are being appointed on the lowest bid win basis. But this selection method rarely equates to value for money for the client [3]. The industry needs to move away from this "lowest price wins downward spiral" [1].

A fundamental change of attitude and organisational structure is required [3] but implementing ECI represents a significant challenge to public sector clients since public regulation imposes the use of competitive and transparent selection processes [7].

This paper will investigate current procurement strategies that promote early contractor involvement and their suitability for Irish public works projects. The research will primarily focus on contracts that are best aligned to the Capital Works Management Framework (CWMF) strategic objectives of ensuring greater cost certainty, better value for money and more efficient end-user delivery.

This research concentrates on projects where the design is by the employer and therefore, excludes Design & Build and Public Private Partnership.

## II Literature review

Collaboration will result in better project outcomes and is essential to the success of the BIM process [8, 9]. Eastman et al. [10] suggest that for BIM to reach its maximum potential, a collaborative, procurement route must be used and contractors should be selected based on best value as opposed to lowest cost [11]. Collaborative contracts aim to '*overcome the misalignment of commercial incentives associated with conventional fixed-price contracts'* [12].

The 1994 Latham report recommended the use of partnering to promote co-operation [13]. However, partnering is non-binding [12, 14], only expresses the intent to collaborate [15] and does not guarantee that each project stakeholder will benefit equally from the relationship [16]. Hayford [12] suggests the methods that best promote collaboration are Project Alliancing and Integrated Project Delivery (IPD). Early Contractor Involvement (ECI) is a feature of both these methods.

### *a) Early Contractor Involvement*

The traditional Design-Bid-Build procurement method generally excludes contractors from the design development process as their appointment can only happen when the design is well advanced [11, 17]. More buildable or sustainable solutions can be overlooked [17]. This method can be a barrier to innovative change [18] and is viewed by some as a hindrance to the proper implementation of Lean and BIM [19]. Early Contractor Involvement is seen as key to the successful use of BIM [20]. According to Wondimu et al. [7], the main advantages of ECI are to improve relationship and collaboration between parties. Other vital benefits from ECI include increased buildability, reduced risks, early completion of projects, savings on projects costs, reduced change orders and overall better value for money [3, 7].

However, implementing ECI is difficult [12]. The selection method "defies established standards" [7] and is a challenge for public procurement authorities regulated by EU Procurement Laws [20]. It requires a "fundamental change of attitude and organizational culture" [3] and the implementation of new procurement methods such as two-stage tendering [21] with a selection focused on qualitative criteria and not the lowest bid [7, 22]. The main drawback of two-stage tendering is the absence of competition during the second stage, where the contractor may view it as an opportunity to increase his price [11].

ECI is deemed more suited to complex projects and different models need to be developed depending on the need of the project [7]. Compensation also needs to be put in place for the contractor's input [21] and it could lead to the perception it will increase costs [22]. However, Lahdenpera [23] argues that minor additional investment in design costs will not increase total project cost significantly and may result in improved efficiency and reduced construction costs.

Roberts et al. [24] report that contractors believe their contribution to a project would be more effective if they were involved earlier, a point also made by the Construction Industry Federation (CIF) in Ireland in their Medium-Term Strategy for the Amendment of the Public Works Contracts [25]. Roberts et al. suggest the publication of new collaborative contracts in the UK is evidence of the importance of ECI [20].

### *b) Public Work Procurement in Ireland*

The department of public expenditure and reform provides through the CWMF the necessary policies and contracts for the procurement of general work in Ireland [5]. The objectives for the CWMF are to ensure greater cost certainty at the award stage, better value for money at all stages and more efficient end-user delivery [26]. McAuley et al. [2, 27] argue that they do not provide value for money and that due to incomplete design at tender stage, they also do not provide cost certainty. The guidance notes highlight that value for money should be considered in the context of whole life cycle cost, not just capital cost [28].

The procurement procedures must adhere to Irish and EU procurement regulations. They should

be "open, objective and transparent" and allow the best value for money being assessed through competitive tendering [28].

Before starting a project, the contracting authority should select the right contract type according to figure 1 and match it to the correct procurement strategy [28].

| Nature of Works | Contract Type | Code | Form of Contract |
|---|---|---|---|
| Building Works | Traditional | PW-CF1 | Public Works Contract for Building Works designed by the Employer |
| | Design and Build | PW-CF2 | Public Works Contract for Building Works designed by the Contractor |
| Civil Engineering Works | Traditional | PW-CF3 | Public Works Contract for Civil Engineering Works designed by the Employer |
| | Design and Build | PW-CF4 | Public Works Contract for Civil Engineering Works designed by the Contractor |
| Minor Works, Building and Civil Engineering | Traditional | PW-CF5 | Public Works Contract for Minor Building and Civil Engineering works designed by the Employer |
| Short Form, Building and Civil Engineering | Traditional | PW-CF6 | Public Works Short Form of Contract for Public Building and Civil Engineering Works |
| Investigation, Building and Civil Engineering | Traditional | PW-CF7 | Public Works Investigation Contract |
| | Traditional | PW-CF8 | Public Works Investigation Short Form of Contract |
| Framework Agreement | | PW-CF9 | Public Works Framework Agreement |
| Large projects (e.g. over €100 million), or technically complex projects on which Contractor input is required at an early stage PW-CF10 Public Works Contract for EARLY COLLABORATION | | PW-CF10 | Public Works Contract for EARLY COLLABORATION |
| Urgent maintenance requirements or where certain types of planned maintenance and refurbishment are envisaged | | PW-CF11 | Public Works Term Maintenance and Refurbishment Works Contract |

*Figure 1: Forms of Contract for Public Works [28]*

Under EU and national procurement rules, procurement procedures may be one of the following [28]:

• Open procedure (open to any individual or company who wishes to participate. Evaluation first based on suitability assessment than under tender evaluation criteria)

• Restricted procedure (Two stages: Pre-Qualification Questionnaire then Tender issued to a short list of qualified candidates)

• Innovation partnership (to be used when 'there is a need for the development of an innovative product or service or innovative works and the subsequent purchase of the resulting supplies, services or works cannot be met by solutions already available on the market'[29]).

• Competitive procedure with negotiation (used when 'prior negotiations are necessary due to nature, complexity or risk profile and when open or restricted procedures are unlikely to lead to a satisfactory outcome'[30])

• Competitive dialogue (used in exceptional circumstances, such as very complex projects that demand more flexibility in the procurement process than in either the restricted or open procedure – for example, those that involve public-private partnerships.)

• Negotiated procedure (may only be used in exceptional circumstances set out in Article 32 of 2014/24/EU, which must be documented comprehensively).

EU and national procurement rules state that winning tenders should be chosen as Most Economically Advantageous Tender (MEAT) or best price-quality ratio, and awarded based on objective criteria to ensure transparency, non-discrimination and equal treatment [31]. MEAT combines price and quality for the assessment of the tender [7]. MEAT is required on all project exceeding €2m in value [17]. It is assessed through technical, management and commercial criteria [28]. It is argued that tenderers often achieve similar scores on the quality assessment resulting in the price being the deciding factor [32]. The CIF [25] questions whether MEAT award is even a "real exercise" and warns that if the criteria are not objective and consistent, the award decision could be challenged [25].

The guidance notes acknowledge the limits of the current procedure by stating that the experts involved in a project are not part of a single integrated team with design and construction working independently of each other [28]. The public forms of contract have been criticised for not encouraging collaboration [2, 33]. The separation between design and construction operations cultivates an 'us and them' attitude [17].

As part of their submission to the report on the review of the Public Works Contracts, Ireland's professional bodies asked for the introduction of collaborative working. The report outlined how to implement co-operation measures, to improve existing contract forms. [32].

The PW-CF10 Public Works Contract for Early Collaboration (for large projects over €100m only) was introduced in 2011 and is effectively a two-stage tender process which facilitates ECI [17]. The contractors are paid an early service fee to take the design to a stage where they can offer a Guaranteed Maximum Price (GMP) for the work. The GMP should be lower than the Target Price tendered during the first stage, and this contract introduces the concept of Initial Saving Share (percentage of the difference between the agreed Guaranteed Price and the tendered Target Price for a Task) [28]. ECI was implemented on the National Children's Hospital project [34] and on the public sector Cashel to Mitchelstown motorway project which was successfully delivered ahead of a challenging schedule [25].

In March 2019, the Minister for Finance and Public Expenditure and Reform launched a review of procurement policy for public works projects [35]. However, some of the recommendations from the previous report on the review of public works contracts published in 2014 have yet to be implemented [25, 32, 33].

The Government Contracts Committee for Construction (GCCC) acknowledged that its suite of contracts was not suited to all construction projects and they were open to considering UK and international alternatives [32]. The Construction Industry Federation (CIF) supported this proposition

and added that because Ireland and UK were both subject to EU Procurement Directives, it would be rational to use recognised contracts in this jurisdiction [25].

*c) Public Work Procurement in the UK*

In its 2018 National Construction Contracts and Law Report [4], the NBS revealed that traditional procurement is still the most used in the UK (46% of projects). They also reported that more than a third of all projects started in 2017 didn't adopt any collaboration techniques. Respondents commented that single stage tendering is still prevalent but that two-stage tendering and negotiation are on the rise.

Two-Stage Open Book tendering is one of the UK Government's recommended procurement models and comprises of Cost-Led Procurement and Integrated Project Insurance [36]. The objectives of these three new models of procurement were to reduce cost, improve programme certainty, reduce risk, encourage innovation, improve the relationship and provide value for money even if it didn't deliver the cheapest construction project [37]. This process is compliant with EU Procurement rules and enables ECI. Bidders are being chosen based on their capacity, capability, stability, experience, and strength of their supply chain plus their profit/fees/overheads and their other costed proposals as appropriate [38]. The contractor selection process for these three methods is detailed in figure 2.

Mosey [38] claims up to 20% savings were achieved on trial projects using the Two-Stage Open Book method. Significant savings were made using a collaborative approach for the London 2012 Velodrome [39]. However, resistance to change from client and industry is seen as a barrier to more widespread adoption [40]. Farmer [40] argue that a levy for clients who procure in a 'short-term or irresponsible manner,' could be the solution to increase the use of collaborative contracts.

Three forms of collaborative contracts were endorsed as part of the UK Government Construction Strategy to support these new procurement methods, namely the ACA Partnering Contract PPC2000, the JCT Constructing Excellence Contract and the NEC3 contract [21]. The NEC has since published the NEC4 Alliance contract at the end of 2017 [8]. It includes multiparty collaboration at its core and is designed for use on major projects or where a number of smaller projects can be combined to create a programme of work [41]. Roberts et al. [24] claim Alliances are considered to be the 'ultimate form of collaborative project and programme delivery' in the UK and elsewhere.

| | Cost Led Procurement | Integrated Project Insurance | Two Stage Open Book |
|---|---|---|---|
| Early Contractor Involvement | Yes | Yes | Yes |
| Contractor Selection Process | 2 or 3 integrated framework supply teams (pre-selected by the client) bid for project. If no team can deliver the Target Cost, the project can either be offered to suppliers outside the framework or abandonned or the budget/specification can be revised. | Client holds a competition to appoint the members of an integrated project team. Scoring may include elements assessing competence, capability, proven track record, maturity of behaviours, proposals for removing waste and inefficiency, and fee declaration | Based on an outline brief and cost benchmark. Contractors compete for the contract in a first stage with bidders being chosen based on their capacity, capability, stability, experience, strength of their supply chain, and fee (profit plus company overhead). As a second stage, the successful contractor are appointed to work up a proposal on the basis of an open book cost. |
| Selection Criteria | selection on basis of tender price and design | selection on ability to deliver and open book accounting | selection on ability to deliver and open book accounting |
| Design Development | 2-3 designs worked up during mini competition | Single design worked up following 1st stage selection | Single design worked up following 1st stage selection |
| Allocation of Risks | Defined by contractual arrangements / "Joint Risk Pot" | "No blame" integrated project insurance product throughout with predetermined sharing of capped benefit and risk | "No blame" integrated project insurance product throughout with predetermined sharing of capped benefit and risk |
| Form of Contract | Collaborative Forms (JCT, NEC, PPC) | Alliancing Forms (Bespoke Multi Party, JCT/CE, Amended PPC) | Alliancing Forms (PPC, JCT/NEC with preconstruction agreement) |

*Figure 2: UK New Procurement Methods (By Author)*

*d) Project Alliance and Integrated Project Delivery*

The use of Project Alliancing is increasing with Australia one of the country's leading the way [42]. Alliance was introduced there in the 1990s on oil and gas projects [43], subsequently developed and in 2015, the Australian Government reported that $30bn worth of public sector projects had been completed or were planned using alliances [14]. Three collaborative procurement methods in use by the public sector allow for the early involvement of contractors namely the Early Contractor Involvement (ECI), Early Tender Involvement (ETI) and Managing Contractor [44].

The guide to Alliance Contracting [14] explains that the selection of the Non-Owner Participants (NOPs) is based on non-price and price elements. As detailed in figure 3, non-price criteria include capability, experience or financial capacities. The price elements will include reimbursable costs, corporate overhead and profit margin. By having a fixed margin (as opposed to a percentage), the contractor has no commercial motive to oppose cost-saving design solutions [23].

| Model feature | ECI | ETI | Managing Contractor* |
|---|---|---|---|
| Project phase by model | EOI, RFP and ECI Phase | EOI, RFP and ETI Phase | EOI, RFP and D&C Phase |
| Project characteristics suited to the model | • Complex<br>• High Risk<br>• Project risks or design elements best understood by Client<br>• Some design unknowns<br>• Benefit from Client's 'insider' knowledge<br>• Price certainty is paramount<br>• Time is restricted<br>• Scarcity of available resources<br>• Opportunity for innovation<br>• Risk of not obtaining competitive tenders using other procurement models | • Complex<br>• Client has mature design<br>• Benefit from value engineering / innovation | • Complex program of works over years<br>• Can be broken into work packages such as site and forward works<br>• Project risks or design elements can be best understood and managed during delivery<br>• Scarcity of Client project management resources<br>• Client cannot provide tender documentation with clarity on scope, risks and other constraints |
| Design maturity pre-tender | Mature / Limited | Mature | Mature |
| Project elements requiring collaboration | • Design<br>• Construction Method<br>• Program<br>• Risk Allocation | • No Design<br>• Construction Method<br>• Program<br>• Risk Allocation | • Design<br>• Construction Method<br>• Program<br>• Risk Allocation |
| Procurement resource impacts | Senior Client resources required to collaborate | Senior Client resources required to collaborate | Senior Client resources required to collaborate |
| Selection criteria[1] | EOI and ECI Phase<br>• Capability<br>• Experience<br>• Perceived<br>• Systems<br>• Direct Cost Rates<br>• Indirect Cost Rates<br>• Program<br>• Company Financials<br>• Fixed fee | EOI and ETI Phase<br>• Capability<br>• Experience<br>• Perceived<br>• Systems<br>• Direct Cost Rates<br>• Indirect Cost Rates<br>• Program<br>• Company Financials<br>• Fixed fee | EOI and RFP Phase<br>• Capability<br>• Experience<br>• Perceived<br>• Systems<br>• Direct Cost Rates<br>• Indirect Cost Rates<br>D&C Phase<br>• Above plus Programme; Lump Sum Management Fee; Risk Allocation; Scope Changes |
| Payment for Collaboration Phase | Fixed fee (suggested 50% of estimated costs) | Fixed fee (suggested 50% of estimated costs) | Fixed fee (suggested 50% of estimated costs) or Schedule of Rates |
| Form of Construction Phase contract | • Risk allocated, lump sum | • Risk allocated, lump sum<br>• | • Lump sum with Management Fee<br>• Actual reimbursable costs to sub-contractors<br>• Generally a Guaranteed Maximum Price (GMP) |
| Risk allocation for Construction Phase | N/A | N/A | Supplier generally takes some delivery risk surrounding quality and completion date |

*Figure 3: Key differences between ECI, ETI & Managing Contractor[44]*

Depending on the maturity of the design and urgency to appoint or start a project, NOPs can be selected based on a full price, partial price, or non-price basis. Non-price selection is carried out through written submissions or interviews, but the guide states it is rare that some form of price competition isn't used during the process [14]. Compliance with EU Procurement Laws would be difficult with a non-price selection process as legislation dictates that price should be part of the criteria [45]. Figure 4 compares these three selection methods with the traditional design & construct (D&C) method.

The success of an Alliance project is based on teams integrating, working together and not 'reverting to their old mentality' when things go wrong [42]. It requires strong client leadership as collaboration will not happen just because it is written in the contract [18, 20, 44].

The project alliance model has been successfully implemented in the American construction industry, where it is called Integrated Project Delivery (IPD) [12]. The AIA defines IPD as "a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction" [46].

One of the challenges to implementing IPD is how to select a project team that will collaborate effectively as it deviates from standard methods [7, 9]. The participants are selected based on qualitative non-price criteria [12] as opposed to the traditional lowest priced or most economically advantageous tender. This is necessary as the team is formed at the earliest possible time in the project timeline before the design is even started [46]. With the need for transparency and fairness in the procurement process, the difficulty of choosing contractors on a non-price basis, such as interviews is challenging for public organisations [47]. Proving value for money is difficult when there is no price competition and this could lead to a lack of public support for the method [45].

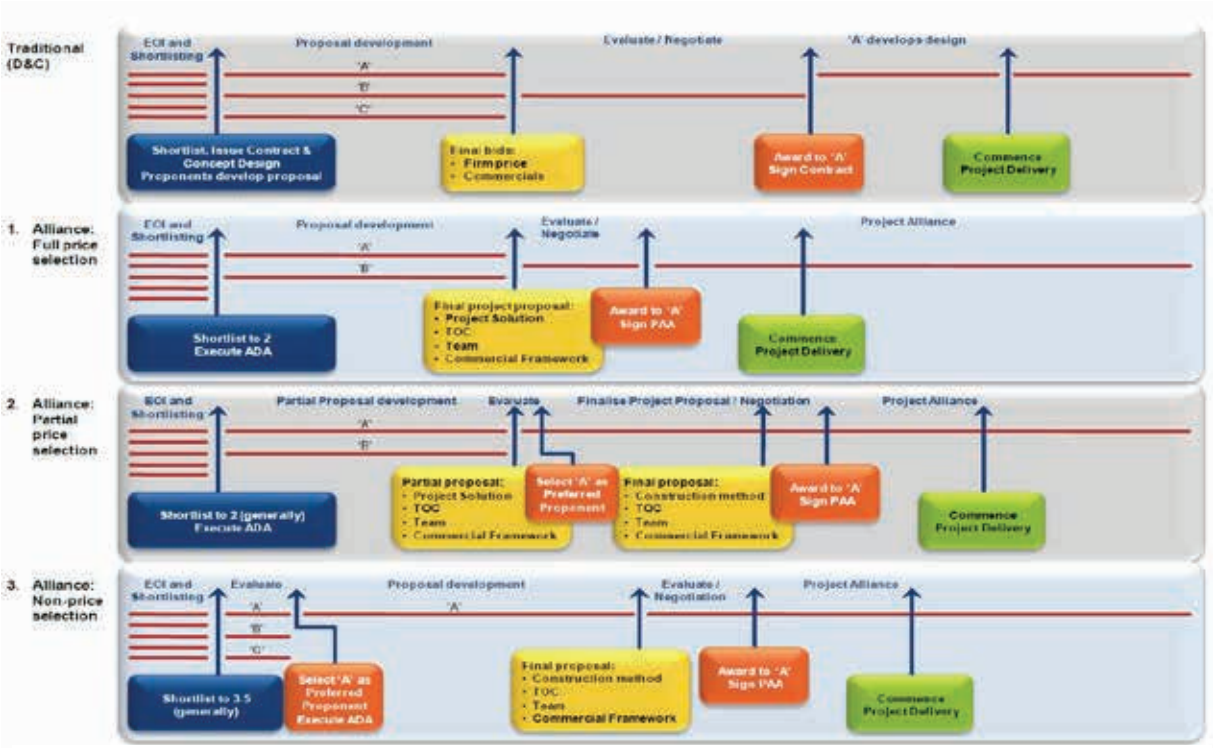


*Figure 4: Comparison of procurement activities andmilestones in selection processes [14]*

Unlike traditionally procured projects, redesign and value engineering are replaced by a target value design process where the budget is continuously monitored [46]. This budget or target price is set collectively by the project team, and potential conflict of interests are dealt with by open book estimating and use of independent consultants [46].

One of the IPD team selection process is described by Townes et al. [9] in figure 5. "Self-selected teams" (similar to a Joint Venture) composed of the architect, construction manager, engineers, commissioning agent, and potentially the mechanical, electrical and plumbing (MEP) trade contractors developed a proposal. The owner's screening committee established a "long list" of qualified teams. These teams were then invited to a site visit and to submit a technical proposal. A short list was then established and the remaining teams we invited to workshops. Design concept proposals were developed, and a final interview took place to select the winning team.

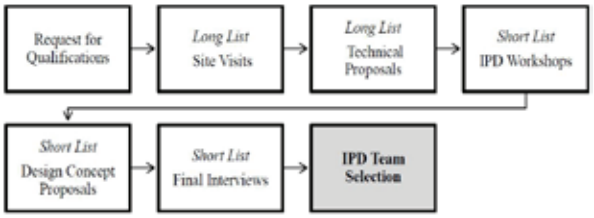


*Figure 5: Sequential representation of the case study team selection process [9]*

## III Methodology

This paper used a qualitative research methodology. It started with an extensive literature review of academic papers, industry and government guidelines and reports from Ireland and abroad. The main objectives were to:

- critically evaluate the current public work procurement processes in Ireland
- critically evaluate collaborative procurement processes in use in both private and public sector abroad.
- critically assess which method (if any) could be implemented in the public sector in Ireland to promote early contractor involvement and improve collaboration.

Semi-structured interviews were then carried out to get an up to date assessment of the public work procurement process in Ireland and test some of the recommendations established during the literature review. The participants selected were all working in a senior position in their organisation with experience and expertise in public work procurement and/or collaborative procurement methods. They were also chosen for their involvement in professional bodies in Ireland and knowledge of the BIM process and the importance of procurement for its successful implementation.

| Name | Company | Role |
|---|---|---|
| Participant A | Public Procurement Agency | Senior Architect - BIM Champion |
| Participant B | Public Procurement Agency | Senior Engineer Estate Management |
| Participant C | Sollicitor | Procurement & Construction Law, Public Work Contracts |
| Participant D | Tier 1 Contractor | CEO |
| Participant E | Tier 1 Contractor | Director |

Finally, a case study was carried out on the implementation of IPD on a project for a confidential client in Ireland. One of the key people responsible for procurement was interviewed. The objective of this study was to understand the contractor selection process, ascertain the barriers to implementation, review the lesson learned and tie in with the results of the literature review and interviews.

## IV Results

### *a) Evaluation of collaboration and public works contracts in Ireland*

The adversarial nature of the construction industry and the need for more collaboration is frequently discussed in industry reports and research papers. All participants in this study confirmed this but there was no consensus on whether the increased use of BIM tools in the last few years had improved collaboration: none felt it got worse and only one felt it got better with the caveat that *"BIM shouldn't be sold as the answer to all the industry's issues"*. One contributor commented that if all professional bodies were invested in promoting BIM, there was a lack of joined up thinking, contradicting the idea of collaboration, an issue also raised in the UK context [40].

The participants were asked for their assessment of the public work procurement process and if they felt it promoted collaboration. All but one answered that current contracts failed to encourage collaboration. It was remarked that the word collaboration is not mentioned once in the contracts or guidance notes and that when the word co-operation was mentioned, it was merely aspirational. One contributor stated the 2007 PWC reform had set the industry back many years, failing to follow the international trend for more collaboration. Recurring issues with overspending on public projects proved that it hadn't delivered on its objectives of better cost certainty and value for taxpayer money and that the sometimes-unfair allocation of risks to the contractors had seen many building firms refuse to tender for public works. The interviewee did,

however, comment that many public sector procurers understood the benefit of collaboration and were *"going out of their way to make it work"*.

Most participants mentioned the lack of resources or expertise in the public sector leading to a reliance on external private consultants. They commented that when *'things went wrong'* on a project, the public authority and contractors were generally taking the blame and that they should be held accountable. However, the consultants, who were hired by the public sector to provide this expertise, seemed to escape any blame and contractual liability when they were given poor advice on procurement, BIM, design, M&E services or budget.

*b) MEAT & Selection Criteria*

The CWMF strategic objectives are to ensure greater cost certainty, better value for money and more efficient end-user delivery [26]. The participants were asked if they felt this was or could be achieved when the selection of the contractor was based on the lowest bid or Most Economically Advantageous Tender basis (MEAT). All participants mentioned the difficulty of implementing a fair, transparent and robust assessment of pre-qualification and MEAT criteria. They all recognised that if the scoring system was open to any interpretation, the award of a tender could be challenged by losing bidders. In this context, awarding the project to the lowest bidder was the easiest and less risky approach despite most participants confirming the evidence gathered in the literature review that the lowest bid didn't necessarily represent the best value for money for the client. Three of them felt that the pre-qualification process should eliminate poor quality contractors, so the only remaining selection criteria left was price.

EU Procurement Laws allow public clients to prohibit or restrict the use of price only when assessing MEAT, but tender cannot be awarded on non-cost criteria only. However, award can be based using a Life Cycle Costing (LCC) approach [31]. Four out of five participants felt more emphasis should be placed on LCC because as one interview stated: *"it makes absolute sense."* Unlike many private projects, where the goal is a quick commercial return or the urgency to place a product on the market, national and local public authorities will be responsible for their assets for the long term. One interviewee stated *"the government should drive this as they will always be around*" while another felt there was growing awareness about the importance of LCC in the public sector and both procurement authority representatives confirmed this. However, many barriers or issues were cited. The assessment of Life Cycle in the context of the contractor selection was difficult due to a lack of expertise in this area, the sometimes *"speculative"* nature of LCC due to fast-evolving technologies and the fact that clients were driving the design, limiting what contractor could propose.

LCC is essential in the context of sustainability by selecting energy-efficient equipment, for example and in the context of cost savings for the client [48]. Another approach encompassing these goals is Lean Construction which promotes the elimination or reduction of waste. Four out of five interviewees felt Lean, but also offsite construction should be a consideration whether at pre-qualification stage or for qualitative tender assessment. One contributor argued that *"ultimately, waste is paid by the client"* and therefore Lean Construction should be implemented. However, they again stated that it would be a challenge to score it: *"how do you measure commitment to reduction of waste?"* The remaining participant argued that smaller contractors working on tight margins across the country were doing Lean without maybe realising it as a matter of survival for their business. He also indicated that if the reduction of waste was so critical for the public sector, reforming the *"broken apprenticeship system"* and teaching new entrants in the industry how to work leaner and how to use modern technologies would yield more results in the long term.

*c) Early Contractor Involvement and Collaborative Procurement Methods*

Except for the PW-CF10 form of contract (which only applies to projects over €100m), the standard types of contract for employer designed projects in the public sector in Ireland do not allow for Early Contractor Involvement. Therefore, unsurprisingly, the representants of the public procurement authorities, confirmed they didn't have experience of ECI on previous projects. On the other hand, the three private sector interviewees, who had ECI experience, would like to see it extended in the public sector and confirmed many of the benefits previously discussed in the literature review including better value for client and contractor, improved buildability or better teamwork. One contributor commented that offsite fabrication was difficult, if not impossible, without ECI. Industry research shows that client fears a loss of competition and potential cost increase when the contractors are involved before the project is fully designed. One of the contractors confirmed that some contractors might see ECI as a way of *"making more money"* and that trust and honesty were required from both clients and contractors to make it work. However, it was noted that if the client has the necessary expertise to implement two-stage tendering, the risks of increased cost are minimal. Another interviewee estimated that on traditional projects, variations and arbitration/adjudication could cost between 5 or 10 percent of the final expenses. He argued that setting aside 2 or 3 percent of the budget for ECI could

eliminate most variations and disputes and therefore save the client money.

A two-stage tender process was adopted for the procurement of the National Children's Hospital project. Some contributors commented that this process was being used very successfully in the UK. They feared that the well-publicised failure of its implementation on the NCH would see procuring authorities revert back to single stage tendering and set back the move towards more collaborative procurement methods and forms of contract.

The UK, Australia or the US have all developed collaborative procurement methods and contracts such as project alliance and IPD. All these approaches have multi-party contract, early contractor involvement and a form of shared risk and reward scheme in common. In the case of the AIA IPD, the contractor selection is often based on qualitative criteria only. The five participants are all senior members of public organisations or professional bodies and they all stated that, to their knowledge, there was no such method being currently developed in the public sector in Ireland. They cited many barriers to their implementation. Unlike the private sector, the public sector has an obligation of transparent, fair and unchallengeable competition which makes qualitative selection difficult. The lack of resources and expertise in public agencies and the lack of support from top decision maker was also mentioned. One interviewee commented on the *"glacial speed"* of the reform of the PWC and that there was a tendency to re-write contracts and guidance documents instead of re-using what had been done elsewhere confirming some of the comments made by the CIF and RIAI previously [25, 33]. Another barrier mentioned was the general lack of trust between stakeholders and that it would require a "change of mindset" to implement new procurement methods.

Synergies between Lean, BIM and IPD are indisputable, but there is currently no contract that facilitates an IPD relationship in Ireland [5]. Nonetheless, the Office of Public Works (OPW) introduced a two-stage procurement system and IPD framework for their lift replacement programme in 2017 [49]. This initiative followed the Lean principles of reducing wastes and repetition from processes and proved to be a success for all the parties involved. One participant commented that the lift industry has few actors in Ireland and this type of framework would be difficult to implement and administer on public construction projects due to the number of contractors bidding for public works. However, this case study did show a willingness to innovate in the public sector and that a *"version of IPD"* can be implemented and improve outcomes.

*d) Analysis*

The interviews revealed several key concerns:

1. More collaboration is needed to improve project outcomes, but it is not reflected in the current suite of public work contracts.
2. There is a knowledge, experience and expertise gap in the industry and public sector about ECI and other collaborative procurement methods.
3. Assessing qualitative criteria in a fair, transparent and consistent manner is challenging a move away from the price as being the main selection criteria.
4. The need to comply with local and EU procurement rules and getting value for money by price competition will challenge the creation and implementation of an IPD public form of contract.

To further investigates the findings of the literature review and the results of the interviews, a case study of a private IPD project in Ireland was carried out. Although the contractor selection process for a private client doesn't have the same constraint as the one used in the public sector, this project involved many actors who are routinely engaged in public work projects in Ireland (Design team, consultants and contractors). Therefore, it is deemed relevant to the potential application of this particular form of collaborative procurement in public works projects.

## V CASE STUDY

This case study examines the procurement process and implementation of IPD on a large size project located in Ireland. The client appointed a construction management firm to oversee the construction of a new plant. The findings of this case study are based on the interview of the commercial and procurement manager of this firm.

Based on the brief and an outline design (approximatively 30 percent complete), an approximate bill of quantities was produced and sent out to eight contractors for pricing. Due to the size of the project and the completion deadline, the scope was divided into site geographical areas and it was decided to appoint multiple contractors to work alongside each other on a framework.

The selection of the preferred bidders was made on capability and price. Only two contractors had the capacity (workforce and financial) to carry out some of the most extensive packages and were appointed on the framework. To ensure competitive pricing, three other contractors were also appointed for some of the smaller packages.

Prior to appointment, they had to agree to work in an IPD framework agreement. The contract management firm and all the contractors would all work together to achieve the target cost of the project. This target cost was set lower than the total of all the tendered packages and all parties agreed it was achievable if they worked together. Savings would be shared, but so would over-runs.

Contractors had to declare their profit margin and would be reimbursed their costs.

Some of the critical attributes of IPD were applied to this project: Collaboration, efficient co-location or project dashboards [50]. The IPDA [50] states that for the client to reap the reward of collaboration, it must also be collaborative. Daily meetings were organised, including the client, contract management firm and the contractors, where decision were made in common. Each stakeholder had one vote. Decisions were made quicker than on a traditional project.

Contractors had an incentive to work together and provide savings. Some of these were achieved through Lean processes. Waste were identified, and measures were taken to reduce or eliminate them. Off-site fabrication was a feature of the project, but several other ideas were implemented. For example, it was found that the site canteen was 15minutes away from the job site resulting in loss of productive time. The decision was made to move the canteen closer to the job site and savings amounted to approximatively four times the cost of the relocation. It was also found that there was no need for each contractor to have their own safety officer on site, so a decision was made to pool resources together and appoint a safety team for the whole project.

Although the client didn't report any savings on the original target cost, variations were virtually eliminated (other than changes to the original client brief). As profit was declared from the onset of the project, there was no incentive for contractors to claim for some of the minor changes due to co-ordination or delays. The cost of raising and administrating these change orders would be more than the profits they would generate and would eat into the shared profit pool. Traditionally, if a contractor is late finishing an area, the contractor who is delayed would claim against the client or contractor. Here, any delay was discussed at the daily meetings, the other parties would ask how they could help resolve the issue and put the project back on track. This could mean a contractor "loaning" some of his resources to another contractor.

The main difficulty was to get people on board with the concept of IPD and collaboration at the start of the project. It was a change of culture for contractors who would have been used to a particular way of working for many years. There is traditionally a lack of trust between parties and this framework would involve companies usually competing against each other. For this reason, the client appointed an IPD and collaboration specialist to explain and guide the contractors. After some initial teething problem, the collaboration process was deemed a success by the contract management company.

This case study tackles a number of the issues raised in the literature review and interviews. It offers practical solutions to these issues that could be implemented on public works projects without updating the current suite of contracts. The contractors were selected on qualitative and price criteria, not dissimilar to the two-stage process used on the National Children's Hospital project. The IPD framework was implemented after the contractors were selected, allowing them to contribute to bringing the design to 100% and implement Lean solutions. During the interviews, one of participants mentioned that the Office of Public Works (OPW) owned and maintain a wide range of building including offices and car parks. In the case of city centre projects for example, the use of these facilities could provide the space for collocation and reduce some of the contractor's costs associated with site offices and parking. In the case study, the early involvement of contractors allowed the use of off-site fabrication, reducing on-site waste and helping achieve tight deadlines.

The shared risk and reward scheme is a feature of the PW-CF10 form of contract. If contractors were to declare their margin at the end of the second stage of tender (GMP) in a similar manner as this project, it would create an incentive to provide savings as their project margin would be secure regardless of their reimbursable costs. Any cost savings solution such a pulling resources together for health and safety would benefit all parties by increasing their share of the saving pool.

Neither consultants nor contractors had experience of IPD before this project. The knowledge and experience gap was plugged by the appointment of a collaboration specialist. The cost of this appointment was negligible compared to the benefits better collaboration brought to the project. Public projects are plagued with claims and disputes and many of these issues can be tackled by collaborative working as proven in this case study.

## VI Recommendations

### *a) Education & Training*

E.D. Love et al. [22] talked about a "fear of the unknown and desire to avoid criticism" to explain the public sector's reluctance to adopt new procurement methods. The lack of awareness and understanding has also been mentioned [51]. Early Contractor Involvement has been proven to work in the UK and other markets. However, it is relatively new in Ireland and both public and private sector actors would need to understand its benefits and how to successfully implement it to rid procurers of this fear of the unknown. Education and Training is one of the four recommendations made by the National BIM Council in its Roadmap to Digital Transition for Ireland's Construction Industry 2018-2021 [1]. Collaborative procurement methods and contracts should be considered an integral part of any reform or improvement of college construction courses. Quantity Surveyors, under the umbrella of the Society of Chartered Surveyors Ireland (SCSI),

regularly provide procurement advice to public procuring authorities, and would be best placed to lead the upskilling of the current workforce through CPDs.

*b) Contractor Prequalification/Tender Evaluation*

The results from this research paper support some of the recommendations made by the CIF and RIAI [25, 33]. BIM, Lean or Life Cycle Costing are integral features of construction and their assessment should form part of the tender evaluation process, whether as part of the prequalification process or the MEAT process. To ensure a fair, transparent and consistent assessment, new selection criteria assessment guidance documents should be developed to help the procuring authorities and bidders.

The cost and burden of carrying out this assessment for the client and of prequalifying for consultancy and construction firms cannot be ignored. Standardising prequalification between public procurement authorities and introducing a framework, in which firms would pre-qualify for public works as opposed to a single public project, would go a long way to alleviate this burden.

Part of this assessment should include previous performance on public construction project. This would require the development of Key Performance Indicators (KPIs) for all the parties involved in the project.

*c) Develop collaborative working for public works*

As demonstrated in the case study, collaboration can be improved even when using a traditional procurement method. It is argued that collaboration will fail if it's not clearly described in the contracts [4]. However, despite the traditional adversarial nature of the construction industry, the research has shown that most stakeholders in the industry want change. Re-writing existing contracts or developing new contracts takes time but in the interim, collaborative charters or protocols could be developed alongside collaboration guidance documents (Code of good conduct, colocation, KPIs, lessons learnt, etc…).

*d) Develop Early Contractor Involvement*

The PW-CF10 form of contract has a threshold of €100 million and requires advance permission of the GCCC. This limits its use to occasional large-scale projects. However, ECI could also be implemented on intricate projects (in Healthcare or Infrastructure for example) by lowering this threshold.

## VII Conclusions

Previous research has established that for BIM and Lean to reach their full potential, multidisciplinary collaboration is required, and Early Contractor Involvement is essential to achieve it. The aim is of this paper was to establish the barriers to implementing collaborative procurement methods on public works projects in Ireland by assessing the current processes in Ireland and review best practice abroad.

This research has shown that if the US model of Integrated Project Delivery provides one of the best collaborative platforms to enable BIM and Lean to thrive, its implementation would be challenging in the current public works context. However, the case study has shown that other forms of IPD are possible using traditional procurement methods. The current forms of contract suite enable two-stage tendering which is a prerequisite for ECI. The current threshold restricts its use to large scale projects but could be lowered to extend its adoption.

Concerns have been raised that two-stage tendering allowing Early Contractor Involvement could be abandoned in the light of the much-publicised budget issues of the National Children's Hospital[34]. While lessons must be learned from this project to ensure the same errors are not made again, reverting to traditional procurement must be resisted as it would go against the international trend of the development of more collaborative procurement methods and contracts.

## VIII Limitations

While every effort was made to include representation of all stakeholders involved in the procurement of public projects, time constraints and scheduling issues meant that the author couldn't get the input from all the national and local procurement agencies and a Cost Consultant.

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