



## **Early Main Contractor Appointment at Design Stage: Opportunity to Enhance Quality in Irish Construction Projects**

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The benefit of selecting a main contractor at the design stage has attracted industry interest; however, studies, particularly from an Irish context when focusing on quality, are lacking. This paper examines the benefits, if any, of early contractor involvement (ECI) at the design stage with a specific focus towards quality. The aim is to ascertain the impact of early contractor involvement at design stage in the context of quality improvement, if any. In achieving this, 18 semi-structured industry professionals are interviewed. The results are thematically coded, to identify themes and underlying factors which impact project benefits measured against quality in the appointment of a main contractor at design stage. By carrying out this research, a link between ECI and attaining quality improvements can be established. The result will show clients, design teams and contractors, that selecting a main contractor at the design stage can prove beneficial in increasing the overall quality of the project. This paper stems from the lack of academic research on this subject, while highlighting to various stakeholders, the value of early contractor involvement from a quality perspective.

**Keywords:** Design Coordination, Early Contractor Engagement, ECE, Early Contractor Involvement, ECI, Quality Management System.

### **Introduction**

In the construction project management profession, there is a delicate balance between the quality of the design and resultant output. Thing Leo (2021) highlights that time and cost parameters are widely addressed, but studies around quality continue to raise contradiction and lack consensus. Quality, argues Memon, et al. (2011), can be greatly enhanced in the design and construction phase, through careful planning, communication, all founded on an appropriate quality management system (QMS). However, such quality management systems are often not put in place until project post design; thereby negating the positive impact of such systems, particularly at design stage. Design changes are not an uncommon occurrence in construction projects, which result in implications including impact on time, cost, and quality. With design changes occurring in the construction stage, this can have a negative consequence, not just on time and cost, but also on quality. Qi (2020) states that inadequate building data, such as incomplete drawings, inaccurate information and inconsistencies in documentation are critical factors, resulting in quality failure. When measuring benefits against

quality, which is critical factor to project success, Kebriyaii et al. (2021) highlights that quality is one of the three significant factors. Clients in a construction project will want critical information, such as expenditure, programme, and quality standards, from project inception through to the certificate of completion. Time, cost, and quality are values associated with clients' needs and standards, but very often, quality is only considered towards the latter end of the project, which is often too late to enact positive change. Having the contractor involved in the early stages of design has the potential to negate much of these issues, resulting in improvements in terms of constructability, risk management, and innovation (Antonsson et al. 2021), which in turn results in higher quality documentation and drawings produced by having the contractor involved earlier. This process of having a contractor involved early in the construction phase is known in the industry as ECI (Early Contractor Involvement). Antonson (2021) has found that there are various benefits to including the contractor in Phase 1 of a project's stages. The expected benefit from having less variations is allowing more time to be spent on completing the task correctly, which in turn will result in a higher quality finish. Critical quality failures occur from having to work under high time and cost pressure (Qi et al. 2020). Subsequently, the subject of early contractor engagement has been voiced by Eadie and Graham (2014) as a potential solution to improving project programming, support risk management, mitigate cost creep, among others. Rahman and Alhassan (2012) further this by investigating the contractor's perspective, but not specifically focusing on quality, rather indicating that 'Contractors' inputs to design have a direct impact on their own construction performance, in terms of cost, time, quality and safety...'. Rahman and Alhassan (2012) do note, in passing that ECI can '...lead to improvement in quality...', but do not delve into how this is achieved. The importance of appointing a main contractor at the design stage is widely acknowledged in that it enables early sharing of information among stakeholders, which benefits project outcomes. Sharing such information among parties at design stage of a project has the potential to result in higher quality design and better interconnection among stakeholders. Yet, early contractor involvement in construction projects is not the norm and this, in succession, has led to cost and time control to be adversely affected, resulting in schedule delays and cost overruns (Gómez-Cabrera et al. 2023), in addition to poor quality (Lappalainen et al. 2022). Therefore, this paper aims to investigate the appointment of a main contractor at design stage and its impact on project benefits measured against quality. Given the dearth of research in the Irish construction sector, while also a need to further the sector in terms of quality improvement, professionals within this region are targeted. Prior to doing so, literature of existing academic papers is reviewed and critiqued, to increase the knowledge base of the research team, to substantiate the gap in knowledge, but also to provide a basis for interview. This then supports an industry-based semi-structured interview process with professionals in the Irish construction sector. In total, 18 interviews are undertaken, and the results coded thematically, with both themes and underlying factors identified for further discussion. It is envisaged that the results of this study will support both clients and contractors, in addition to other stakeholders, in the early appointment at design stage, of construction contractors, with a view to improving the resultant quality of construction projects.

### **Quality and the Benefits of Early Contractor Involvement**

Evaluating quality is required in all facets of construction projects, so clients can choose quality-focused businesses that will deliver higher-quality goods and services, on time and within budget. Since an internationally recognized standard, that is, ISO 9001 was implemented in the construction sector, quality and construction have become intertwined. Oakland and Marosszeky (2017) states that since then, a quality standard has been applied to goods and services, requiring a higher level of building quality. Brooks et al. (2021) furthers this in outlining that a quality management system (QMS) can be used in construction, as a tool to improve the overall quality of construction and is the leading and most prolifically adopted tool used today in the world of construction. Auchterlounie (2009) counters this, whereby outlining that, as a result of main contractors not being certified in ISO

9001, unfortunately, this leads to a significant reduction in quality of construction projects, as evidenced in the Edenborough schools (2016), the Orchard estate, and the Grenfell fire (both 2017). Kebriyaa et al. (2021) found that quality in construction is one of three factors in the 'iron triangle' along with time and cost for decision making in the building design and execution. In construction, quality is not just about the finish of a building project, but the design and construction process efficiency. Wasim et al. (2022) has found that optimization and coordination of the design for manufacture at the design stage of a construction project can reduce delays, and improve safety; therefore enhancing the overall productivity. A project that meets all specifications in the scope and standards required is considered a high-quality build. Stepanova et al. (2021) found that having poor quality control on construction projects can lead to projects not being in compliance with the scope of work and requirements which can lead to further delays and costs. This therefore affirms that quality is a key factor requiring stringent monitor, not just during, but before project construction. Kebriyaa et al. (2021) found that one of the key elements of a successful project is quality, which is typically assessed by looking at the completed work, but often failing to address the early design stage, where the greatest impact on quality can be attributed (Rajendran et al. 2014). Despite having objective features, meaning has remained personal and has meant different things to different people. Quality has nevertheless remained a crucial component, albeit difficulties due to its subjective nature, but Ryd (2014) summarizes that quality encompasses meeting client needs in the context of specified budgets, satisfying demands and expectations, resulting in a project which is fit for purpose and as prescribed in the tender specifications.

In achieving this, much has been voiced about the opportunities provided by early contractor involvement/engagement, or ECI/ECA, as it is more frequently referred to, thereby unlocking and utilizing the contractor's expertise, experience, and knowledge, to produce better outcomes in turn of time, cost, and quality (Antonsson et al, 2021; Reardon, 2023). Marius et al. (2021) has proven that using early contractor involvement in the design phase can reduce risk and uncertainty, by providing more innovative and intelligent initiatives, resulting in cost-reducing solutions. Construction quality is not just about the finish of a building project but the design and construction process. ECI can have a positive effect on relations in a project. Malvik et al. (2021) found that ECI can lead to a more positive relationship between the client and contractor. ECI has been shown to have a positive effect on numerous projects. Nygard et al. (2019) found that by having ECI, you can then implement best value procurement, which has led to a better execution phase; thus, a better product for the client. Shan et al. (2020) has shown that ECI has been proven to be a success factor in green building projects, resulting in a more sustainable design and environmentally friendly construction process being implemented. Engebø et al. (2020) states that having contractors involved early, can lead to a more successful move to integrating new technology into builds and achieving a higher performance building. Liu et al. (2019) argues that contractor perfunctory and consummate behavior at the design stage has been proven to have a positive impact on engineering project value added. With quality being such a key factor of any project, early contractor involvement has proven to have many advantages over the other two factors in the iron triangle; cost and time. Rahmani (2021) has documented proven benefits to a client in terms of a better certainty to price and scope of work on a project, by implementing ECI, but focus on how ECI can benefit, if at all, quality in a construction project, is omitted. Establishing this link could prove to have numerous advantages to clients selecting to implement ECI on construction projects and further the knowledge of contractors to show how they can improve the quality of development at the early stages. Kanters (2020) found that one of the main drivers for implementing a new strategy is a well-informed client. So, by providing this link between quality and early contractor engagement, this has the potential to lead to further use of this approach.

### **Research Design**

The review of the literature conducted above focused on quality and the benefits of early contractor involvement. To gain deeper understanding of the subject matter, a qualitative approach using semi-structured interviews is employed. Johnson et al. (2020) states that qualitative research must be conducted in a way that is credible, transparent and non-biased, drawing purely on the knowledge and experience of the interviewee. Reeves et al. (2008) states that using qualitative data is the best type of research data collection method, when trying to find an understanding of things that cannot be measured objectively. Subsequently, 18 interviewees are identified for inclusion in this study. Interviews are conducted with a range of construction professionals working in the Irish construction industry and include Project Managers, Quantity Surveyors, Architects, Senior Engineers, and Clients. Due to the limitations on space, further details of the particulars of the interviewees are not presented. Interviews are conducted online and align with Billups (2021) whereby when conducted accordingly this approach has the potential to be more efficient in time and data collection, for all parties (interviewer and participant) involved. Braun et al. (2021) found that people prefer and are more likely to participate in the more traditional methods of tracking data (interviews) when discussing a topic over newer methods of a link to register data (surveys). Flick (2018) shows that the purpose of the interview is to allow the collection of all the data, both exploratory and confirmatory (literature review data) from the selected group, the result of which, will be analyzed and findings developed. Adeoye-Olatunde et al. (2021) shows that a semi-structured interview gives the researcher the focused information required, while still allowing the interviewee the freedom to voice their thoughts regarding the topic, hence further the understanding of the topic. By adopting thematic coding from the semi-structured interviews, this provided the research team with the ability to document the interviewee's experience and thoughts on the topic, in a non-biased way, while minimizing conscious bias. Nassaji (2020) furthers this by identifying good qualitative research identifies patterns for development while also trying to understand and explore the findings. Grodal et al. (2021) states that analyzing the findings of a qualitative research method is best done by identifying categories or themes in the data gathered and portraying the findings, in conjunction with literature, as follows.

### Thematic Analysis of the Literature and Interviews

On conducting the review and critique of the literature, in addition to the 18 interviews, some 8 themes and 31 factors are identified.

Theme	Factor	Literature	Interviewee #
Quality Standards	A quality baseline being established.	Oakland and Marosszeczy (2017)	1,3,5,7,10,11,12,13,16,17,18
	Developing quality standards of ISO 9001.	Brooks et al. (2021)	2,5
	Lack of knowledge of quality standards.	Auchterlounie (2009)	1,7,10,11,13,14,16,17
	Quality standard identified leads to less variations and time on site.	-	1,3,5,8,9,10,11,12,14,15,16,17
	Quality management & inspections being used to stay within scope.	Stepanova et al (2021)	2,3,4,7,10,11,17,18
Decision Making	Quality based decision-making regarding time and cost.	Kebriyaii et al. (2021)	1,2,3,5,6,8,9,12,13,15,16
	Coordination and optimizing a quality design phase leading to a more efficient build.	Wasim et al. (2022)	1,2,4,6,7,10,11,14,16,18

Successful Project	Having everyone involved in design phase leading towards a single target (quality).	Cidik (2020)	1,2,5,6,7,11,13,14,16,18
	Quality as a key indicator of project success.	Kebriyaii et al. (2021)	1,2,3,4,5,8,9,10,11,12,15,16,17
	Meeting clients' demands can lead to successful project completion.	Kebriyaii et al. (2021)	1,2,3,4,5,8,9,10,15,16
	Managing quality expectations of the client.	Ryd (2014)	1,4,6,7,8,9,10,11,12,13,15,16,17
	Past work is a factor in getting future projects	Rahmani (2021)	1,3,5,6,8,9,10,11,12,13,15,16,18
	Client satisfaction proven to be increased with ECI	Antonsson et al (2021)	2,3,6,7,8,9,10,11,12,13,15,16,17
Knowledge Management	Making use of contractor's knowledge leads to a more practicable build.	Antonsson et al. (2021)	1,2,3,4,5,6,11,12,13,14,18
	Using a contractor's expertise early in the design phase can lead to better quality.	Reardon (2023)	1,2,3,4,5,7,10,11,15,16,17
	Contractors' knowledge used to produce smarter building solutions.	Marius et al. (2021)	1,2,4,7,10,11,12,13,14,15,17
	Over design leads to quality compromised	-	1,2,5,6,7,10,11,12,14,15,16
	Lack of practical building knowledge leads to over design of building.	-	1,2,3,5,7,8,9,10,12,13,14,15,16,17
	Lack of knowledge by design team leads to poor quality.	-	1,3,5,7,11,14,16,17
	Lack of knowledge in material by design team leading to delays.	-	1,3,5,8,9,10,12,13,15,17
	Understanding the client's level of knowledge.	Kanters (2020)	3,7,8,9,10,11,12,13,14,15,16,17,18
Communication	A contractor's positive attitude can have a beneficial outcome on designer's attitude.	Liu et al. (2019)	1,7,10,11,14,18
	ECI leads to positive communication channels being established early.	Malvik et al. (2021)	2,5,7,10,11,12,13,14,15,16,17,18
Design Coordination	Drawings partially completed due to lack of practical knowledge	-	1,3,5,7,8,9,13,14,16,17,18
	Earlier design issues can be solved, improving quality	-	1,2,3,5,6,7,10,11,12,13,14,15,16,17
	Different design solutions to meet spec.	-	2,3,5,6,7,10,11,12,13,14,15,16,17,18
	Technical coordination results in higher quality material procured.	-	1,2,5,6,10,15,17
Client Expectations	Design team schedule inaccurate, compromising quality	-	2,7,8,9,10,11,12,13,15,16,17,18
	Early contractor engagement beneficial in design quality improvements	-	1,2,3,5,7,8,9,10,15,16
Environmental	Early contractor engagement lead integration of technology	Engebø et al. (2020)	2,5,7,10,13,14,15,16,17,18
	Contractors' early engagement lead to more efficient building method	Shan et al. (2020)	1,2,4,6,7,8,9,10,11,12,13,14,15,16,18

## Discussion

The choice to designate the main contractor early in a construction project has a significant impact on a project, including its quality. This highlights the value of early cooperation and integrated project delivery in attaining sustained levels of quality required. In total, 8 themes are identified and form the basis for the subsequent discussion, all of which are presented in no order, as follows.

### *Quality Standards*

Data presented from the interviews regarding quality standards shows that ‘a quality baseline being established in construction’ as identified by Oakland (2017), is one of the key elements echoed by interviewees, showing that a baseline standard of quality being established from the start, can greatly enhance the overall quality standards. An aspect that is referenced by over a third of the people interviewed is high quality standards being set from the start, can lead to less variations, resulting in less time spent on site. This is a key aspect referenced, but little research can be found into the cause-and-effect relationship of this. This would suggest that higher quality leads to less rework, snags, and remedial corrections. Statements from both interviewees 8 and 11 stated that ‘Profit margins can be totally destroyed by poor quality standards’ whereby interviewees argue that ‘...you have to spend more time and money fixing up mistakes that are costing you money and damaging your reputation’. Interview number 3 furthers this in stating that ‘you spend years developing high quality standards and reputation, but one project can destroy this’.

### *Decision Making*

Having less time and money spent correcting defective work at the end of the project can be greatly influenced by early quality-based decision making. The interviews correlate with this theory, similar to those discussed by both Kebriyahi et al. (2021) and Wasim et al. (2022), where quality-based decision making towards time and cost, while optimizing coordination to achieve a quality design phase, can lead to more efficient builds. Over 94% of the interviewees agreed with this premise, outlining the key linkage between quality and decision making. A key facet of interview 1 is that ‘poor quality design at the beginning for finishing elements of a project, can lead to more work being done to compensate for this at the end of the project’. This therefore has the potential to lead to money and time being lost, along with quality standards being compromised, due to the frustration of having to undertake these works, all of which are easily avoidable.

### *Knowledge Management*

The term ‘successful project’ is subjective, given the context of the stakeholder. This aspect was referenced in 77% of the interviews, where they illustrated that managing the client's expectations in terms of quality is a factor in the success of a project (Ryd 2014). Pairing this with 72% of interviews and the work of Rahmani (2021), this argues that client satisfaction has been proven to increase where early contractor involvement is adopted. This is a significant theme, with the underlying factors, as identified in Table 1, repeatedly referenced. In furthering this, ‘past work and its quality is a major factor on securing future work’ is highlighted by 61% of the interviewees.

### *Design Coordination*

A key aspect noted is that involving a contractor early, can significantly improve coordination (Song et al. 2009). The sequential order of project phases has traditionally resulted in a lack of coordination and communication between the design and construction teams. In contrast, the results found that

77% show that the earlier in a project the contractor is involved, the better the quality results achieved are. The findings indicate that 34% of participants acknowledge that early involvement of the contractor promotes a collaborative atmosphere that allows contractors, engineers, and architects to effectively work together. Additionally, results shown after the contractor is appointed, there is insufficient time to refine the building design and specifications before works commence. Interviewee 6 specifically references that 'the contractor can break the design down and show more efficient building methods and more realistic goals'.

#### *Client Expectations*

Fulfilling client expectations is essential to the success of any project, and research indicates that out of the eighteen interviewees, 56% argue that choosing a principal or main contractor early in the design process increases client satisfaction. This early engagement makes it possible to fully comprehend the needs of the client and the goals of the project. From the outset, the principal or main contractor can match their skills with the client's vision, resulting in a more customized and satisfactory project completion. However, the results also show that the design team forecasts an unrealistic timeframe to achieve the build; a aspect reiterated by 77% of interviewees, resulting in the predicted project completion date not being met. This is essential for the accomplishment of a project, to bringing the client's vision to life, and to establish enduring connections with clients. In furthering this, resultant coding identifies that 72% of the interviewees state that client satisfaction is greater when early contractor involvement is embraced. 56% followed up by stating that client expectations being managed early by the contractor, leads to a happier client at the end of the project.

#### *Environmental*

In the era of sustainable construction practices, this study reveals a positive correlation between early main contractor involvement and enhanced environmental considerations. With environmental regulations becoming increasingly stringent, the findings illustrate that 16 out of 18 people note that 'appointing a main contractor during the design stage facilitates the incorporation of sustainable practices making the project a more efficient building method'; a sentiment echoed by Shan et al. (2020). The contractor's input in material selection, waste management, and energy-efficient construction methods contributes to a greener and more environmentally responsible project. This is consistent with results with 56% of interviewees referencing that early contractor involvement can lead to a smoother integration of new technology, as well as the work of Engebo et al. (2020).

#### *Communication*

The most important factor of a successful project management strategy is effective communication. The study emphasizes how better communication between project stakeholders is facilitated by the major contractor's early involvement, as identified by 12 out of 18 interviewees and Malvik et al. (2021). The possibility of miscommunication and delay are decreased by encouraging teamwork between the contractor and design team, resulting in a better-quality project, as iterated by a third of the interviewees and mirrored in the work of Liu et al. (2019). Maintaining open lines of communication throughout the project lifecycle reduces risks and improves overall project efficiency by ensuring that all parties are informed. Following on, 34% of the interviewees argue that the earlier the contractor is involved the more open and productive the communication channels for the design team are; hence the opportunity to enhance quality. This in turn results in the fact that a higher and more efficient design phase takes place achieving a more fit for purpose and constructible building being designed. A more efficient design which the contractor is involved in has the potential to contribute to higher quality; a sentiment echoed by 77% of the people interviewed.

## Conclusion

The appointment of a main contractor earlier on construction projects is not a new phenomenon, with research on the positive impact on time and cost well documented. However, the impact on quality is lacking, particularly from an Irish context. As a result, the aim of this paper is to ascertain the opportunity that early contractor engagement brings to enhance quality on the respective projects. To address this aim, 18 interviewees participated in the data collection, accompanied by a critique of the literature. In total, 8 themes emerge: Quality Standards, Decision Making, Successful Project, Knowledge Management, Communication, Design Coordination, Client Expectations, and Environmental. The benefits identified indicate that the construction industry should not only embrace early contractor engagement from a cost and scheduling perspective, but also from the viewpoint of improving quality. From more efficient designs, to increased productive, better communication channels, and better coordination from the outset, this paper argues that there are multiple benefits in the context of quality to be attained. Fundamentally, early contractor engagement is key to achieving quality, particularly in the aspect of finishes the client requires, as these can be identified earlier, methods employed, and results achieved. Subsequently, this paper presents clear indication that early contractor engagement has the potential to impact positively on a project, specifically relating to improvements around quality in construction. However, and more importantly, to note, the hindrance to early contractor involvement is that the Irish construction industry is still focused a traditional procurement route, whereby the design team is appointed, design completed, works progress to tender, contractor prices accordingly, and only then, is appointed to construct the building. The design phase happens largely void of contractor involvement and negates much of the benefits identified. However, given the benefits outlined and the benefits clearly documented, it is anticipated, at least, that clients would consider the findings, particularly where quality is paramount.

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