2 Construction management methods

§ 2.1 Introduction

For some time now, the construction industry has been accused of limited cooperation between actors, low levels of trust and ineffective communication. This, it is argued, results in low levels of process performance. In fact, how to improve the performance of construction processes remains one of the key issues in the construction sector, including projects for social housing. Reports by the Construction Industry Institute (1991) in the US, and Latham (1994) and Egan (1998) in the UK have been much publicised wake-up calls to the need for different working practices in the construction sector, and others, too, have made similar claims. For example, in Australia the 'Building for Growth' Report (Industry Science Resources 1999) identified the need for integration in the construction supply chain in order to achieve the technical and financial capacity that will lead to international levels of competitiveness. In Hong Kong the 'Construct for Excellence' Report (Construction Industry Review Committee, 2001) highlighted that fragmentation within the sector and the low levels of cooperation is preventing improvements in buildability, safety and life cycle costs. And in the Netherlands, the 'Van raad naar daad' (From Advice to Action) Report (Regieraad Bouw, 2004) describes similar fragmentation within the construction sector and proposes learning the lessons from best practice in other countries and renewing processes and systems to achieve higher levels of innovation, creativity and quality.

All reports address the need for a higher degree of integration between the different tasks carried out during the complete construction process and for a higher degree of collaboration between the participating actors in order to improve the construction process performance. Construction management literature offers a wide range of construction management methods that seek for improvement in project integration and actors collaboration. In short, three main methods can be identified, two of which focused on process integration: supply chain integration and integrated project delivery methods; and one focuses on the actors collaboration: partnering. The three methods are closely interrelated because if there is an increase in process integration it will also imply an increase in the actors collaboration and the other way around. We could say that the three methods look at improving process integration and actors collaboration from a different perspective (See Figure 2.1):

- the multi-project perspective: supply chain integration,
- the single-project perspective: integrated project delivery methods,
- and collaboration perspective: partnering.

Some authors, who view the construction process from a multi-project perspective, compare the construction process to an industrial process. They consider a construction project to be something akin to an industrial product, and therefore the management methods that have been put in place to improve the performance of industrial processes could also be applied to the construction sector: supply chain integration (Briscoe et al., 2004; Cagliano et al., 2006; Vrijhoef, 2011).

Other authors view the construction process as a single, one-of-a-kind project. Construction projects are complex and unique. The time-span involved is usually lengthy, they are highly dependent on external factors and numerous companies of a different nature are involved. It is therefore unlikely that there will be several construction projects with similar characteristics. Based on the premise that each construction project is different from all others, authors who take the single-project perspective have focused on categorising and analysing the suitability of different typologies of construction processes. The construction processes are classified and analysed taking into consideration their project delivery methods (Mahdi and Alreshaid, 2005; Sanvido and Konchar, 1998; Thomsen 2006).

The common claim of all the authors who have analysed the performance of the construction process is that collaboration between the actors involved is the key issue. For this reason, a third group of authors emphasise the characteristics of the collaboration between the actors involved in a construction project. Their claim is that a higher degree of collaboration will improve the performance of the construction process (Anvuur and Kumaraswamy, 2007; Chan et al., 2004). Achieving a 'partnering' type of collaboration is seen as the highest degree of collaboration between companies and organisations involved in the construction process.

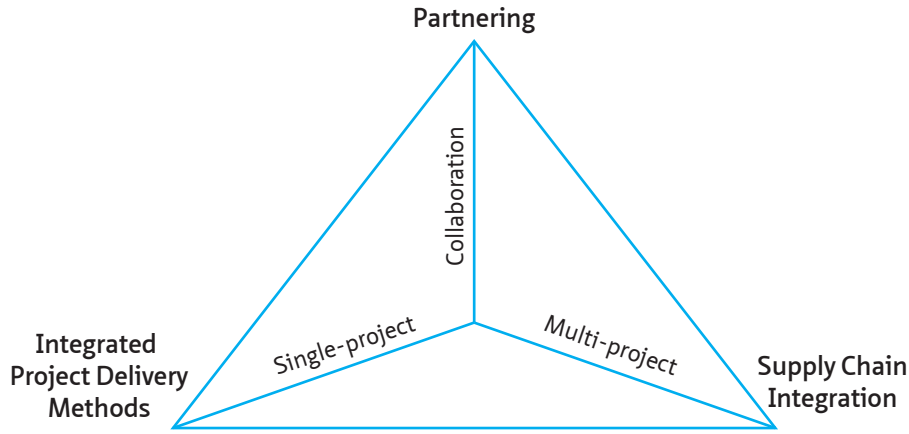

FIGURE 2.1 Overview of perspectives and methods for construction process performance improvement

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The aim of this literature review is to study the suitability of these management methods for analysing the process performance of social housing energy renovations. The performance of a construction process is evaluated by the process efficiency and the process effectiveness. The process efficiency is evaluated with the use of performance criteria like the time, the resources used or the amount of conflicts, and the process effectiveness is evaluated by the degree of fulfilment of the project goals. In the case of energy renovations especially by evaluating the degree of fulfilment of the energy savings targets. Many European Social Housing Organisations (SHOs) are currently involved in numerous building renovation projects due to their ageing building stock and pressure from the European authorities, which see great potential for reducing CO_2 emissions through these renovation projects. The analysis of the construction process in social housing energy renovations means taking into account the specifics of that process – namely, there is already an existing building with specific characteristics, energy savings is a key parameter for the evaluation of the success of the project, and SHOs are mainly organisations with a public nature. The main research question is therefore:

Which project management methods are relevant to improve the process performance of energy renovations in social housing?

The nature of social housing organisations is a very important aspect of whether they can and should make use of particular project management methods. For this reason, this literature study will also seek to answer the following secondary research question:

What are the legal limitations on the application of these methods by public organisations?

This study provides a deeper insight into the general characteristics of the renovation process as well as an overview of the construction management methods that are most relevant to making the renovation process more effective and efficient.

§ 2.2 Methodology

In the literature on construction management, the construction process is subdivided into multiple steps and can cover a longer or a shorter period of time. The most common approach is to look at the period between the inception of the project and the end of the construction work, leaving the operation and maintenance phase out of the construction process. Under this approach, the construction process does not include the complete cycle of a building, preventing any evaluation of project performance

parameters during operation phase. Taking into account the operation/maintenance phase is particularly relevant when energy-efficiency is a key evaluation parameter for the performance of the project, as has been demonstrated in recent studies in which theoretical calculations of energy consumption differed considerably from actual energy consumption in those dwellings (Cayre et al., 2011; Hens et al., 2010; Guerra Satin and Itard , 2012; Majcen et al., 2013; Tigchelaar et al., 2011). As such, if we choose a wider definition of the construction process, it can be subdivided into at least three phases (see Figure 2.2).

FIGURE 2.2 Phases of a construction process

The phases of a new-build construction process and a renovation construction process are the same, although the characteristics of each will differ considerably because they are subsequent processes. This means that in a renovation process, there is a clearly defined departure point: the existing building with its specific characteristics (see Figure 2.3).

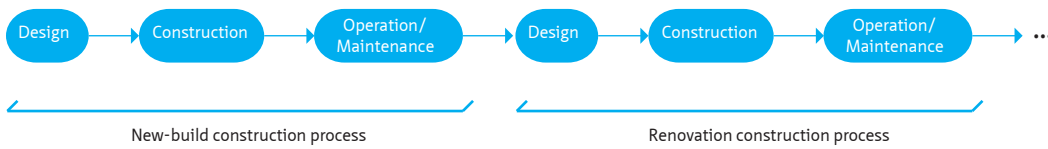

FIGURE 2.3 Phases of new build and renovation construction processes

The characteristics of the existing building are determined by the prevailing construction standards at the time of construction and by any subsequent modifications that have been made during the lifetime of the building. But even though the housing stock that is being renovated by SHOs dates from the same period and was constructed according to similar standards, it is unlikely that SHOs will have several renovation projects with the same characteristics. The variety of departure points in the processes of renovation, as opposed to new construction, makes it more difficult to apply a multi-project approach in order to improve process performance.

Some SHOs have in any case begun to apply supply chain integration methods for the renovation of their housing stock in the Netherlands (Vrijhoef, 2011; Roders et al., 2013). However, these examples cannot be taken as representative of SHOs in Europe because Dutch SHOs are the only SHOs in Europe that are not subject to public law.

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This means that Dutch SHOs do not have to comply with the requirements of the EU public procurement Directives (Ronald and Dol, 2011). Public procurement legislation imposes numerous limitations on the tendering options of European SHOs and, more especially, forces SHOs to publicly tender every renovation project making it particularly difficult to implement supply chain methods.

The specific nature of renovation projects involving European social housing, because of the type of projects and the procurement options, means that the single-project perspective is the most suitable way to look at their process performance. For this reason, this literature review covers studies on project delivery methods and partnering but has not included studies on supply chain integration. The limitations on the tendering procedures also affect the implementation of integrated project delivery methods, and so the last section of this literature review looks at the tender procedures that are available to SHOs.

The literature review covers a wide range of scientific articles published in international journals and reports from European research projects. The studies analysed are based mainly on new-build projects and were carried out in Australia, Hong Kong, France, Finland, the Netherlands, the United States and the United Kingdom. The few studies that relate specifically to social housing renovations are the subject of particular attention in the literature review.

The legal framework for public procurement, within which the large majority of Social Housing Organisations must operate when contracting renovation services, is based on the European Directives 2004/18 and 2014/24/EU.

§ 2.3 Project delivery methods

The project delivery method, also referred in the literature as project delivery system or procurement route, defines the process by which a construction project is delivered. Several authors have considered the definition of the project delivery method, such as Sanvido and Konchar (1998), Thomsen (2006) and Molenaar et al. (2010). One of the most widely accepted definitions of a project delivery method is the definition used by Dorsey (1997): "A project delivery method defines the sequence of events, contractual obligations, participant relationships, and specific mechanisms for overseeing time, cost and quality." Project delivery method cannot be taken as synonym for construction (project) management. The American Institute of Architects and the Associated General Contractors of America (2011) clarify the difference between delivery and management in their joint definition of project delivery methods: "'Delivery' refers to

the method for assigning responsibility to an organization or an individual for providing design and construction services. 'Management' refers to the means for coordinating the process of design and construction (planning, staffing, organizing, budgeting, scheduling, and monitoring)."
Several authors and organisations have proposed multiple categorisations that have evolved over time. An overview of the classifications used in the US literature and in the European literature are presented in this section. In the US literature there is a widely accepted project delivery methods categorisation but it is not the case in the European literature.

The US Construction Industry Institute explains one of the most widely used categorisations in construction management in their 1998 report "Project Delivery Systems: CM at Risk, Design-Build, Design-Bid-Build" (Sanvido and Konchar, 1998). The report presents three main project delivery methods: Design-Bid-Build (DBB), construction manager at risk (CM at risk) and Design-Build (DB). In its report entitled "Primer on project delivery" (2011), the American Institute of Architects together with the Associated General Contractors of America added an extra project delivery method to the list: Integrated Project Delivery (IPD). The inclusion of Integrated Project Delivery among the main project delivery methods has also been defended in a scientific article by Lahdenperä (2012).

An overview of the four project delivery methods is shown in Figure 2.4.

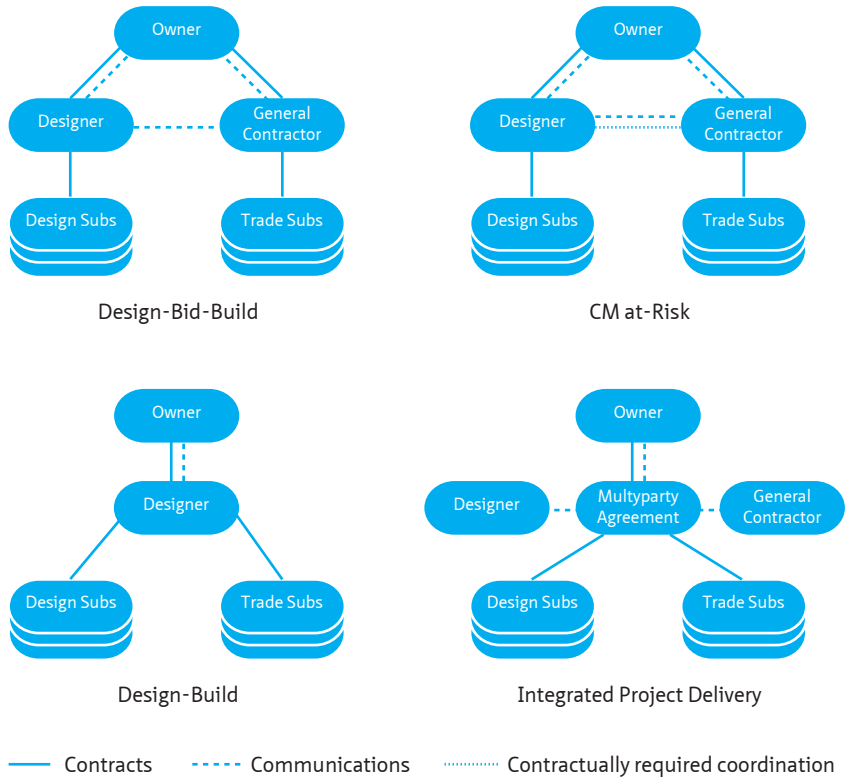


FIGURE 2.4 Project Delivery Methods: Contracts and communications

Several authors have researched the advantages and disadvantages of the four project delivery methods that we have outlined. Pocock (1996) compares the performance of traditional project approaches to alternative project approaches: partnered projects, Design-Build and combination projects. His findings, based on an analysis of 38 completed military construction projects, highlight the direct relationship between the degree of interaction and the performance of the project. The degree of interaction is defined by Pocock as an approximation of project integration. Meanwhile, Molenaar et al. (1999) analyse 104 completed public-sector Design-Build projects and conclude that the owners were satisfied with the overall performance. They forecast a growth in the use of this approach in the public sector. Ibbs et al. (2003) compare Design-Bid-Build, Design-Build and build-operate-transfer based on their analysis of 67 construction projects. Ibbs concludes that Design-Build offers time savings but his analysis shows no positive effects on costs or productivity. In his opinion, project management expertise and the experience of the contractor can have a greater impact on the results of the project than the choice of a particular project delivery method. The effectiveness of IPD compared to other project delivery methods was tested by El Asmar et al. (2013). El Asmar et al. analyse 35 completed projects (DBB, CM at-Risk, DBB and IPD), comparing 14 metrics across six performance areas: quality, schedule,

project changes, communication among stakeholders, environmental and financial performance. The findings reveal that IPD delivers higher quality facilities faster and at no significant cost premium.

Design-Bid-Build is often referred to in the literature as the 'traditional' project delivery method. In this type of project, the contracted parties, the designer (the architect) and the general contractor become involved sequentially, one after the other. First the owner contracts a designer, who develops the project specifications; these project specifications are then used to contract the general contractor. In Construction Management at-Risk, the owner has one contract with the designer and a separate agreement with the construction manager (sometimes referred to as general contractor), but the construction manager becomes involved earlier, during the design phase, acting first as the design advisor and later as the construction manager. The construction manager offers at the end of design phase a guaranteed maximum price for the construction works. In Design-Build, the owner has a single contract with one entity, a single company or consortium which provides both the design and construction services that are required. In this method, the designer and the general contractor become involved in the project at the same time. In Integrated Project Delivery, the owner also has a single contract. However, this contract is not with just one company, but is a multiparty agreement which defines the mechanism(s) for distributing responsibility between the parties involved. As in Design-Build, the designer and the general contractor become involved at the same time in the project.

In the European literature, there is no general classification of the main project delivery methods proposed by any sector organisation. This means that a larger number of main project delivery methods are covered in the literature, such as Design-Bid-Build (DBB), construction management (CM), Design-Build (DB), Design-Build-Maintain (DBM), Design-Build-Maintain-Operate (DBMO), Design-Build-Finance-Maintain-Operate (DBFMO), Build-Operate-Transfer (BOT), private finance initiative (PFI) or public-private partnership (PPP). The public sector plays a more prominent role in the European construction literature, which is why the financing element is relatively more important in these project delivery methods, as is the case of DBFMO, BOT, PFI and PPP (Dewulf et al., 2012). If we disregard the finance element, because alternative finance mechanisms are not the subject of study in this research, we could place DBM, DBMO, DBFMO, BOT, PFI and PPP in the same category: Design-Build-Maintain project delivery method. In Design-Build-Maintain the owner has a single contract with one entity, a single company or consortium which provides the design, construction and maintenance/operation services that are required. The use of DBM as the project delivery label for all these similar types of project delivery methods has been previously used in the comparative study of Koppinen and Lahdenperä (2007) about project delivery methods in Finland. In consequence, the project delivery methods of the European literature can be categorised in four main methods: DBB, CM, DB and DBM.

DBB and DB are among the main project delivery methods in the US and European literature and they are described exactly in the same way. The US CM at-Risk and the European CM are quite similar. In both cases the owner has one contract with the designer and a separate agreement with the construction manager and also the construction manager acts first as the design advisor and later as construction manager. However, there is a substantial difference in risk taken by the owner. "In CM at-risk form (US), the responsibilities of administration, supervision and construction and the overall risk of price, quality and contract duration are placed on the construction manager. This is partly because the construction manager gives a guaranteed maximum price and fixed contract time as an option and acts like a general contractor at the construction phase. In CM form (UK), the management contractor bears the risk on cost and time but not on the works contractor's workmanship. Therefore the risk of cost and time lies with the management contractor and quality risk lies with the owner/works contractors" (Oyegoke 2001). In general terms US CM at-Risk and European CM could be considered the same type of project delivery method.

The real difference between US and European project delivery methods is that IPD is almost inexistent in Europe and DBM is not common in the US. DBM is a project delivery method in which the owner has a single contract with one entity, a single company or consortium which provides the design, construction and maintenance/operation services that are required. This is by definition a long-term contract, as the maintenance/operation phase is included in the contract. In this contract there is also a transfer of the majority of the risk from the owner to the supply side as the contracted party is held responsible for the building performance during the maintenance/operation phase. IPD usually only includes design and construction services but could also include maintenance. The difference between IPD and DB or DBM is that the risk is shared among all involved actors via a multiparty agreement.

Joining the two main classifications we obtain a list of five main project delivery methods that are present in US and European literature: DBB, CM at Risk, DB, IPD and DBM.

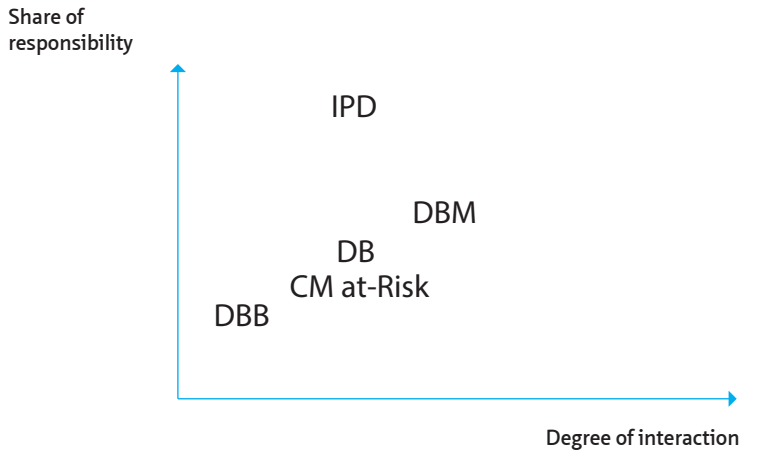
§ 2.3.1 Integrated project delivery methods

One point that the European and US literature have in common is that project delivery methods with a higher degree of integration are assumed to lead to lower costs, shorter construction times and higher overall quality in the end product. For example, the study of Hale et al. (2009) compares 39 DBB projects to 38 DB projects and concludes that DB projects perform better on almost every measure related to time and cost.

El Asmar et al. (2013) take a similar approach, comparing 35 projects (20% DBB, 37% CM at-Risk, 14% DB, and 29% IPD). The results of their research indicate that IPD achieves statistically significant improvements in six performance areas: quality, schedule, project changes, communication among stakeholders, environmental performance and financial performance.

One area where there is no clear consensus is what project integration means. Nam and Tatum (1992) use the term integration to mean "integration between design and construction" and the effects of this type of integration were analysed by Pocock (1996), who measure the degree of interaction in 38 construction projects. Project delivery methods based on multiparty agreements, such as Integrated Project Delivery, employ a broader definition of integration. This not only includes the interaction between the participating actors, but also the sharing of responsibilities. Therefore, one possible way of classifying the different project delivery methods according to their level of integration could be on the basis of these two dimensions: the degree of interaction and the degree of shared responsibility (see Figure 2.5).

The number of services included in a single contract phase could be taken as an approximate indicator of the degree of interaction, following the approach of Pocock (1996). With regard to the sharing of responsibility, it can be assumed that there should be more sharing of responsibility between actors in projects that include different services in a single contract, even though the contract may not include a well-defined mechanism for sharing this responsibility. That is why DBB, DB and DBM have a linear relation; each contract includes an extra service compared to the previous one so each project delivery method has a higher degree of interaction and in consequence also a higher share of responsibility. With CM at-Risk the design companies and the construction companies are present in the design phase, therefore the degree of interaction between the design companies and construction companies is the same as in DB. However, they do not have the same share of responsibility because in CM at-Risk the design companies and the construction companies have separate contracts with the owners. CM at-Risk has a higher degree of risk sharing than DBB because the construction companies act as advisors during the design phase; at the end of the design phase they offer guaranteed maximum prices for the construction works. In the case of IPD, it is obvious that the share of responsibility is the highest because this method includes a well-defined mechanism for sharing profits and losses.



DB = Design-Build; DBB = Design-Bid-Build;
IPD = Integrated Project Delivery; CM at-Risk = Construction Management at Risk

FIGURE 2.5 Level of integration of various project delivery methods

Other scientists have directed some criticism towards more integrated project delivery methods, claiming that they do not represent a panacea for all construction projects. In fact, several authors, such as Chang and Yve (2002), Mahdi and Alreshaid (2005), Miller and Evje (1999), have proposed different methods to facilitate the choice of the most appropriate project delivery method by considering the characteristics of the project or the goals of the owner. In the work of these authors, more integrated project delivery methods are seen as the most appropriate project delivery method for particularly complex construction projects.

§ 2.3.2 Sustainability via integrated project delivery methods

Recent literature has also stressed that higher levels of sustainability and innovation could be achieved by using more integrated processes. Molenaar et al. (2010) analyse the tender documents from 26 Design-Build projects and conclude that there are opportunities in the procurement process to put in place best-value award formulas that take into account sustainability, but that owners are missing opportunities to evaluate design-builders in terms of their sustainable building experience and the sustainability of the proposed design. In their opinion, modifying tender documents to include these elements could improve overall performance. Straub et al. (2012) compare two DBFMO office projects with five office projects delivered using traditional methods. Their study reports that the integrated projects used some innovations that

affected maintenance costs and energy use. These innovations are considered to be a successful method of transferring knowledge between the actors involved which could not have taken place using traditional delivery processes. On the other hand, some criticism has been directed at Korkmaz et al. (2010), who evaluate several metrics for sustainable high-performance buildings. Their findings show that certain delivery attributes, such as the timing of an actor's involvement or the type of owner, are more important than the type of project delivery method used. However, Korkmaz's findings may also indicate that the application of a certain project delivery method does not necessarily imply that better results will be achieved: what is needed is commitment on the part of the main actors. A posterior study by Mollaoglu-Korkmaz (2013) provides some extra insight into the relationship between the project delivery method, project integration and project outcomes, especially sustainability goals in building projects. In this study, which included 12 in-depth case studies, it is concluded that "although Design-Build and Construction Management at-Risk have better chances of facilitating integration, results show that DBB also has the potential to provide higher levels of integration if it informally involves the constructor in the earlier phases of the project".

§ 2.3.3 Limitations

The studies that relate to Project Delivery Methods that are presented in this section are mostly based on large new-build construction projects. Building renovation projects are very few and far between among the cases studies carried out in the current body of construction management literature, and case studies involving the renovations of residential buildings are even harder to find. One exception is the study of Amaral Fernandes et al. (2014) who analyse a renovation project at a university residence in Finland that uses Project Alliancing. The study concludes that the integrated approach contributed to higher levels of collaboration between participants and enabled very positive results to be achieved. The authors claim that the benefits of integrated approaches can also be obtained in small residential projects. However, the few studies that have looked at renovation projects have not taken into account the specific characteristics of renovation processes.

The renovation of residential buildings is addressed mainly in the literature on building technologies that relates to the energy savings associated with certain technologies (e.g. Harvey, 2009; Papadopoulos et al., 2002; Verbeeck and Hens, 2005) or in the energy policy literature, with reference to the potential energy savings that could be made in the existing building stock (Mirasgedis et al., 2004; Tommerup and Svendsen 2006, Zundel and Stieß 2011). Unfortunately, in this type of study, the management aspects of the renovation project are invariably omitted.

§ 2.4 Performance-based specifications

The use of performance-based specifications in construction projects instead of descriptive specifications encourages innovation, facilitates the transfer of risk from the owner to contractors and boosts the achievement of a higher degree of sustainability (Bröchner et al., 1999; Thompson et al., 2011). Performance-based specifications are intrinsically related to integrated processes because of the sequence in which the main actors become involved. In DBB, where design companies are involved first, it is common practice to develop descriptive specifications that are used in the contracts with the construction companies. In the case of integrated project delivery methods, the construction companies are also involved in the design phase and take part in design decisions. This makes it feasible to use performance-based specifications. Gard (2004), who argues in his paper that Design-Build is the best approach to delivering high-performance buildings, expresses it as follows: "To be effective, design-build requires a mastery of performance specifications rather than the commonly used design specifications. Thus, sustainable design and energy efficiency must be specified through a performance specification, rather than a detailed design specification".

While looking at how to optimise integrated project delivery methods in the public construction sector, some authors have considered the importance of the tender procedure and the definition of the performance criteria. For example, Molenaar and Johnson (2003) analyse tender practices in the US transport sector that include Design-Build and conclude: "It is contended that the best value through increased innovation in design/build will not be fully realised until the transportation sector develops better performance specifications."

In the social housing sector, performance-based specifications have already been used for tendering maintenance contracts. As in the case of construction projects, SHOs traditionally tender maintenance services using descriptive specifications. However, these days, with the aim of achieving budget certainty, improving building quality, simplifying maintenance and promoting innovation, some Dutch SHOs have begun to use performance-based specifications. In their study, Straub and Mossel (2007) comment that: "The performance based approach means that maintenance contractors no longer act as suppliers of maintenance capacity, but as active participants in the overall maintenance process. They give advice on maintenance strategies, maintenance scenarios, performance specifications and activities. In other words, they start to act as engineering consultants." A similar approach has been proposed by Sharp and Jones (2012) for the UK social housing sector. The concept of practitioners (construction companies or maintenance companies) acting as engineering consultants during the design decision process is highlighted as one of the key success factors in the integrated approach. Moreover, the construction sector's capacity for innovation is improved, it is argued, by the use of performance-based specifications (Straub, 2011).

From an economic point of view, the use of performance-based specifications offers the possibility of defining new finance mechanisms for energy renovations. The Intelligent Energy Europe project, FRESH (Financing energy refurbishment for social housing) has implemented Energy Performance Contracts (EPC) in a number of social housing renovation pilot projects (Milin et al., 2011). The main aim of Energy Performance Contracts is to create a finance mechanism to cover some of the renovation costs via the energy savings obtained after the renovation works. In order to set up such a mechanism, it is necessary to use a Design-Build-Maintain approach and to clearly define and evaluate energy-performance parameters.

§ 2.5 Partnering

Each of the relationships between the organisations participating in a construction project has specific characteristics. For example, a Social Housing Organisation involved in a construction project will have a different relationship with the architect's office than it does with the construction companies or maintenance companies. It is also possible that the architect's office, the construction companies and the maintenance companies also have dealings and that they have dealings with other companies. Figure 2.6 shows an example of a possible relational structure in a social housing renovation project.

'Partnering' describes a specific type of relationship, in which there is a high degree of collaboration between the organisations involved. The Construction Industry Institute (1991) describes partnering as follows:

"A long-term commitment by two or more organizations for the purpose of achieving specific business objectives by maximising the effectiveness of each participant's resources. This requires changing traditional relationships to a shared culture without regard to organization boundaries. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services." (CII, 1191, p.iv)

Many types of relationships between organisations involved in construction projects are possible. The types of relationships can be categorised into five main categories according to the degree of collaboration as shown in Figure 2.7.

This categorisation is based on the citizen participation ladder defined by Arnstein (1969), including the alternatives proposed by Biggs (1989). In this classification, partnership represents the highest achievable level of collaboration between two organisations.

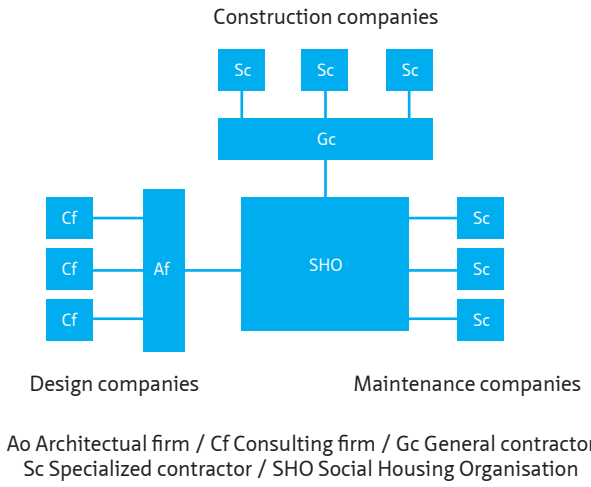


FIGURE 2.6 Possible relational structure of the organisations involved in a social housing renovation project

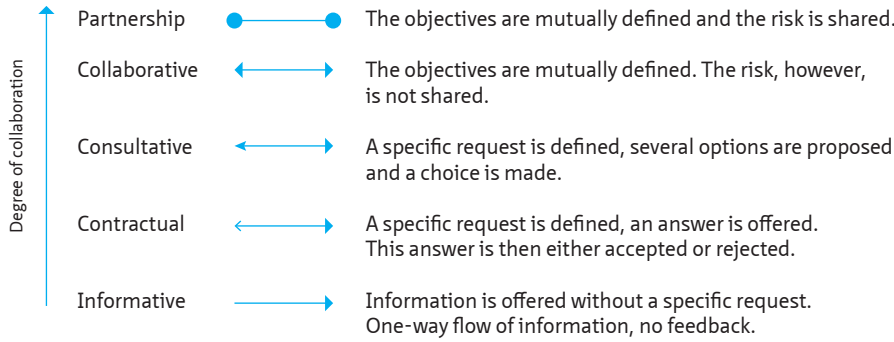


FIGURE 2.7 Relationship types between organisations in construction projects according to the degree of collaboration

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§ 2.5.1 Partnering study types

There is an extensive body of construction management literature that has looked at the implementation of partnering relationships in practice. These studies analyse the advantages and disadvantages of this type of relationship from different perspectives. In Bygballe et al.'s literature review on partnering in the construction sector (2010), the studies are classified according to three dimensions: duration, actors involved and development. The duration of the partnering relationship is classified as 'project partnering' when it is only intended for the duration of a specific project, or as 'strategic partnering' when it will continue over a series of different projects. The actors' relationship is classified as 'dyads' when the actors are only divided between demand-side and supply-side, and 'multi-actors' when the specific characteristics of the different actors are taken into account. The development, which refers to the way in which the relationship develops, is classified as 'engineering', when formal instruments such as legally binding agreements are employed, or as 'social' when informal tools such as social dynamics and cultural-structural aspects are at play. It is possible that for the categories of duration and development, some partnering concepts make use of both categories at the same time (see Figure 2.8 for an overview).

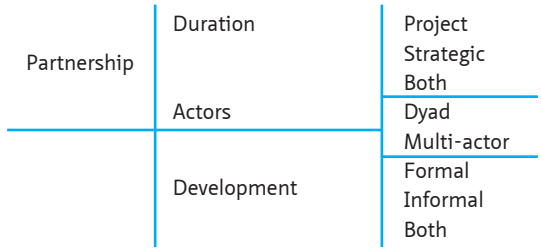

FIGURE 2.8 Partnering dimensions based on Bygballe et al.'s (2010) classificaiton

The majority of the studies that address the subject of partnership do this on a project basis analysing only one relationship link and studying only formal aspects of the relationship. Because of the nature of construction projects, each project is often carried out by a different team of organisations, so project partnership is the most common form of partnership analysed. In a construction project, many organisations are involved and there are multiple relationship links between them, each one with different characteristics. The studies tend to focus on one single relationship link: that between the demand-side (the client) and the supply-side (often the general contractor). Because of the difficulty of analysing the informal characteristics of the relationship between organisations, the majority of studies primarily consider the legal dealings between organisations; however, several studies also include some informal characteristics in their analysis.

§ 2.5.2 Partnering performance

Projects that use some type of partnering method are generally reported to have a higher project performance than those that do not. Larson (1995) analyses 280 construction projects in US and Canada by means of a questionnaire, and the findings indicate that projects with formal partnering arrangements obtain better results in terms of controlling costs, technical performance and customer satisfaction compared to projects that do not use partnering arrangements, and even compared to projects that only use informal partnering arrangements. Fortune and Setiawan (2005), survey the partnership practices of 43 SHOs in the UK. Their research concludes that partnering practices are widespread among SHOs and are assumed to deliver benefits in terms of project costs, delivery times and quality levels. The work focuses only on perceptions among the SHOs, and therefore the authors recommend further study of the involvement of contractors, sub-contractors and suppliers in the supply chain alliances.

Chan et al. (2004) explore the critical success factors for project partnering in Hong Kong. The success factors are identified by means of extended expert interviews and subsequently rated using a questionnaire (78 responses, 30% response rate) distributed among professionals involved in partnering projects. "The results indicated that certain requirements must be met for partnering to succeed. In particular, the establishment and communication of a conflict resolution strategy, a willingness to share resources among project participants, a clear definition of responsibilities, a commitment to a win-win attitude, and regular monitoring of partnering process were believed to be the significant underlying factors for partnering success." Anvuur and Kumaraswamy (2007) outline a conceptual model of project partnering based on the results of previous scientific research. Their study identifies two main success factors and one outcome for project partnering. These success factors are the early involvement of the partners and the contractual incentives, which need to be monitored well and combined with mechanisms for sanctions and rewards. The outcome is trust, which for Anvurr and Kumuraswamy "is more a consequence of, than a means for, achieving cooperation".

The formal structure of the participating organisations defined by contracts and agreements in projects that implement some kind of partnering method also plays a role in the success of the project (Chan et al., 2008; Eriksson and Laan, 2007; Jacobson and Choi, 2008). A clear example was given in the previous section on project delivery methods. However, these structures do not guarantee the quality of the relationships and do not guarantee benefits for all the participating organisations. Blois et al. (2011) analyse the relationship between the formal structures of the project team (named 'temporary multi-organisations') and formal and informal mechanisms of coordination. On the basis of three case studies, they conclude that the formal

structure of the team does not reflect the real relationships between the project participants. The work of Packham et al. (2003) focuses on the effects of the partnering practice for small construction enterprises. Their findings are based on a single case study, meaning that their conclusions cannot be generalised, but they address the question of whether the expected benefits of partnering practices are really tangible for small construction companies.

Although partnering may not be beneficial for all the actors involved, it is generally considered beneficial for overall performance of the project and some authors conclude that these benefits could be extended if a longer-term perspective was taken. Cheng et al. 2004 address the need to create a 'learning culture' (learning from experience, continuous improvement and a learning climate) in order to help achieve strategic partnering in the construction sector. Kaluarachchi and Jones (2007) study a specific strategic partnering agreement over a four-year period between a group of 15 SHOs and a contractor for the construction of new-build social housing. This study is based on a single case study, which means that the conclusions cannot be taken as generally applicable, but they are similar to those described in relation to project partnering. Partnering requires a change of mind-set at all levels, a high degree of commitment from all actors involved, and effective communication and coordination; all these factors are needed to deliver a product that meets the requirements. The only substantial difference with project partnering is that strategic partnering develops over a longer period of time, making it a dynamic activity that needs to adapt to changes. Indeed, in the search for better collaboration, some authors see a strategic partnership as the logical next step after project partnership (Cheng et al., 2000; Thompson and Sanders, 1998).

§ 2.6 Public procurement

In Europe, SHOs come in a wide range of different types (e.g. those run by central government, those run by local government, independent public bodies, co-operatives, private non-profit organisations and private for-profit organisations), but all of them are considered by EU authorities as bodies subject to public law, meaning that they must comply with the requirements of the EU public procurement Directives (with the exception of SHOs in the Netherlands). The EU's public procurement Directive 2004/18/EC is the legal text that has been transposed into the national law of the member states, and as such it is the central legal text analysed in this section. However, a new EU public procurement Directive, entitled 2014/24/EU, was approved in February 2014 and April 2016 has been set as the deadline for the member states to

transpose this into national law. In this section we will also consider the most relevant changes in the new Directive in regard to tendering procedures.
The public procurement directive is central to this thesis because it limits tendering procedures for social housing organisations when they are tendering for renovation projects. These limitations are even greater when a social housing organisation plans to tender a renovation project using an integrated contract, design and work contracts together. This section offers an overview of the tender procedures open to SHOs and analyses the feasibility of applying these when tendering for integrated contracts for renovation projects.

§ 2.6.1 Directive 2004/18/EC

The aim of the European public procurement directive is to ensure open, transparent and fair procedures for all contract tenders organised by bodies subject to public law. The directive is applicable to all contracts over a certain threshold value. For the year 2014, the threshold for work contracts was set at €5,186,000 and that for architectural or engineering services contracts at €134,000. Each European member state is responsible for transposing the directive into its own national public procurement code. Below the threshold specified, the member states can apply their own rules but these must correspond with the main goals of the European directive.

Currently, public contracts in Europe can be tendered using an open procedure, a restricted procedure, a negotiated procedure or a competitive dialogue. The open procedure has one single round of bidding and is open to all candidates. The restricted procedure has two rounds of bidding, the first of which is open to all candidates and the second only to selected bidders. In the open and restricted procedures, no further negotiation with the contracting authority is allowed. The negotiated and the competitive dialogue procedures can include two or more bidding rounds and negotiation is allowed after the first selection round (see Figure 2.9).

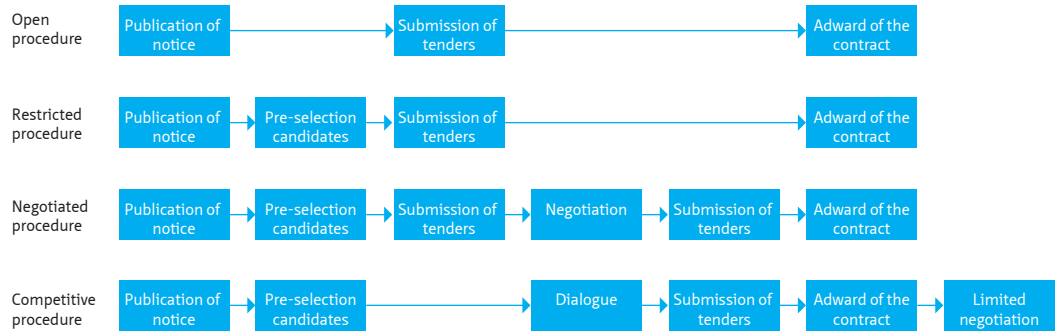

FIGURE 2.9 Public procurement tender procedures

Because of the nature of integrated contracts, the open procedure is not the most obvious choice for awarding such contracts. Offers are based on certain requirements and the criteria that will be used to evaluate them. An offer must include a preliminary design and a plan for implementation. The candidates need to do a great deal of work to draw up their offer with the prospect of no compensation if they fail to win the contract. The commissioning party, meanwhile, would be forced to evaluate a large number of offers that include documents that may be difficult to compare.

Under a restricted procedure, the selection of candidates is based on selection criteria defined by the contracting authority, such as the candidate's level of experience, manpower or ability to fulfil the contract. A minimum of five candidates must be invited to submit a tender. The contract can be awarded to the party offering the lowest price or to the 'most economically advantageous tender' ('MEAT'). To determine the MEAT, the contracting authority defines a set of award criteria (e.g. quality, price, technical merit, aesthetic and functional characteristics, environmental characteristics, service and technical assistance or date of delivery). Compensation is not mandatory for those candidates who are not selected.

The negotiated procedure can only be applied in exceptional cases, such as when there has been a previous open, irregular restricted or competitive dialogue tender, when the nature of work does not allow for pricing in advance, or when the work is to be performed solely for research purposes. Under a negotiated procedure, as in the case of the restricted procedure, the selection of candidates is based on selection criteria. The submission of the tender is followed by a negotiation phase, and negotiations with each candidate are conducted separately. At the end of the negotiation phase, modified tenders are resubmitted.

The competitive dialogue is a procedure reserved for particularly complex projects. The European directive leaves the definition of 'particularly complex' open for interpretation by the individual member states. For example, in the Netherlands

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projects that are based on DBM(FO) contracts are included in the group of 'particularly complex' projects that can use the competitive dialogue procedure (Nagelkerke et al., 2009), and in France a modification made to the public procurement code in 2008 allows the use of competitive dialogue for integrated building contracts in the field of building renovations.

In a competitive dialogue procedure, the selection of candidates is based on a set of selection criteria. The minimum number of candidates invited to participate in the dialogue phase is 3. The dialogue phase consists of several rounds of negotiations. In every round, each candidate presents a proposal for discussion at one or more meetings, with each candidate presenting a final offer after the round of negotiations. Negotiations with each candidate are carried out separately. As in the case of the restricted procedure, it is not mandatory to offer compensation to unsuccessful candidates, but it is common practice (Nagelkerke et al., 2009).

The main difference between the negotiated procedure and the competitive dialogue is that the former negotiations are based on the offer presented and in the latter there is a dialogue to help define the offer. The competitive dialogue also allows certain negotiations with the preferred bidder after the final offer has been presented, provided the negotiations do not modify any essential aspects of the tender.

§ 2.6.2 Directive 2014/24/EU

The new public procurement directive 2014/24/EU introduces three main changes to tendering procedures compared to 2004/18/EC:

1. it provides for an extra tendering procedure: innovation partnership;
2. it replaces the negotiated procedure with a competitive procedure with negotiation; and
3. it defines new conditions for the application of the competitive procedure with negotiation and the competitive dialogue.

The new procedure, innovation partnership, can only be applied when the contracting authority aims to develop an innovative product or service, making it a procedure that can only be used in exceptional cases. On the other hand, the competitive procedure with negotiation can now be applied under the same circumstances as the competitive dialogue. Both procedures can be applied when any of the following conditions apply:

"i) the needs of the contracting authority cannot be met without adaptation of readily available solutions;

ii) they include design or innovative solutions;

iii) the contract cannot be awarded without prior negotiations because of specific circumstances related to the nature, the complexity or the legal and financial make-up or because of the risks attaching to them;
iv) the technical specifications cannot be established with sufficient precision by the contracting authority with reference to a standard" (Directive 2014/24/EU).

These conditions are broad and they make it easy for the contracting authorities to justify their choice if they use the competitive procedure with negotiation or the competitive dialogue for tenders for integrated contracts relating to renovation projects.

§ 2.7 Conclusions

The literature review has covered a wide range of construction management studies, based mainly on new-build projects. We have focused particular attention on the few studies that relate to the renovation of social housing. From the literature review, we can see that the specific characteristics of renovation projects and the limitations of public procurement make the single project perspective the most feasible approach to address the improvement of process performance of social housing renovations. Therefore, the implementation of integrated project delivery methods is identified as the best strategy to improve social housing renovation process performance. In consequence, supply chain integration methods are not taken in consideration in this study.

The literature review shows that the more integrated project delivery methods are particularly suited to construction projects with a high commitment to sustainability in general and to energy-efficiency in particular. The literature review also reveals that the key factor for process performance in all project delivery methods is collaboration between the actors involved in the project. That is why partnering methods are to be taken into account as additional source of information to deepen the analysis of the characteristics of integrated project delivery methods.

Our study of the legal limitations defined by the public procurement Directive 2004/18/EC, which currently remains applicable, shows that although limited tender options are available, is it possible to tender projects that apply integrated project delivery methods by means of competitive dialogue. Moreover, public procurement Directive 2014/24/EU, which has recently been approved but has not yet entered into force, further facilitates the use of competitive dialogue tenders for social housing energy renovation projects.

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