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Integrated project delivery methods for energy renovation of social housing

Tadeo Baldiri Salcedo Rahola



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Glossary

Construction Management at-Risk (CM at-Risk) is a project delivery method in which the owner concludes contracts with separate entities at the same time for the design and the construction management. The entity in charge of the construction management acts as an advisor during the design phase and offers at the end of the design phase a guaranteed maximum price for the construction works (American Institute of Architects and Associated General Contractors of America, 2011).

Construction management is the use of varying combinations of human, technical, and conceptual skills to plan, direct, organise and control people and resources (Fryer, 2004). **Design-Bid-Build (DBB)** is a project delivery method in which the owner concludes contracts sequentially with separate entities for the design and construction (American Institute of Architects and Associated General Contractors of America, 2011).

Design-Build (DB) is a project delivery method in which the owner concludes a contract with a single entity for the design and construction (American Institute of Architects and Associated General Contractors of America, 2011).

Design-Build-Maintain (DBM, representing its variants DBMO, DBFO, DBMFO, BOT) is a project delivery method in which the owner concludes a contract with a single entity for the design, construction and maintenance (Koppinen and Lahdenperä, 2007).

Effectiveness is the extent to which planned activities are realized and planned results achieved (ISO 2005).

Efficiency is the relationship between the result achieved and the resources used (ISO 2005).

Energy Performance Contract (EPC) is a contractual arrangement under which an energy service company designs and implements an energy retrofit with a guaranteed level of energy performance. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on meeting the other agreed performance criteria (Milin et al., 2011).

Energy renovation is a renovation project with higher energy savings targets than a regular renovation project.

Energy service company (ESCO) is a natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in doing so. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria (Bertoldi et al., 2007).

Integrated contract is a construction contract that includes at least design and construction works, but that can also include maintenance, operation and finance (Chao-Duivis and Wamelink, 2013).

Integrated Project Delivery is a project delivery method in which the owner concludes contracts with a single or separate entities at the same time for the design and construction. The owner and the contracted entities also sign a multi-party agreement for the share of risks and rewards (American Institute of Architects and Associated General Contractors of America, 2011).

Partnering is a long-term commitment between two or more organization for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant resources (Construction Industry Institute, 1991).

Performance-based specifications is a procurement tool whereby the final output of the facility is the basis on what the facility is procured rather than using the traditional, prescriptive method which specifies the inputs (Ansell, 2005).

Project delivery method defines the sequence of events, contractual obligations, participant relationships, and specific mechanisms for overseeing time, cost and quality (Dorsey, 1997).

Process performance is the evaluation of the efficiency and effectiveness of a process (Sundqvist et al., 2014).

Project is a unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements, including the constraints of time, cost and resources (ISO 2005).

Public procurement is the process whereby public sector organisations acquire goods, services and works from third parties (Office of Government Commerce, 2008).

Social Housing Organisation is an organization that rents, maintains and in some cases sells affordable dwellings mainly for targeted groups because of their social vulnerability (Pittini and Laino, 2011).

Step-By-Step (SBS) is a project delivery method for renovation projects in which the owner subdivides the work in multiple functional parts (e.g. kitchen, roof, wall insulation, bath). Each part can be procured separately in a different period in time and contracted to a different entity.

Supply Chain Integration implies a redefinition of connections between firms in the building supply chain towards higher levels of repetitiveness and integration of products, business processes and inter-firm relations among the different firm types from clients to suppliers, and the supply chain evolving towards an extended enterprise or quasi-firm as it were a single firm persisting to exist, beyond the scope of separate projects (Vrijhoef, 2011).

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Summary

Optimised project delivery methods for social housing energy renovations

European Social Housing Organisations (SHOs) are currently facing challenging times. The ageing of their housing stock and the economic crisis, which has affected both their finances and the finances of their tenants, are testing their capacity to stick to their aim of providing decent and affordable housing. Housing renovation projects offer the possibility of upgrading the health and comfort levels of their old housing stock to current standards and improve energy efficiency, and this solution also addresses the fuel poverty problems suffered by some tenants. Unfortunately, the limited financial capacity of SHOs is hampering the scale of housing renovation projects and the energy savings achieved.

At the same time, the renovation of the existing housing stock is seen as one of the most promising alternative routes to achieving the ambitious CO₂ emissions reduction targets set by European authorities – namely, to reduce EU CO₂ emissions to 20% below their 1990 levels by 2020. The synergy between European targets and the aims of SHOs has been addressed by the energy policies of the member states, which focus on the potential energy savings achievable by renovating social housing. In fact, the European initiatives have prioritised energy savings in social housing renovations to such an extent that these are referred to as 'energy renovations'. Energy renovation is therefore a renovation project with higher energy savings target than a regular renovation project.

In total, European SHOs own 21.5 million dwellings representing around 9.4% of the total housing stock. Each SHO owns a large number of dwellings, which means there are fewer people to convince of the need to make energy savings through building renovations, maximising the potentially high impact of decisions. Moreover, SHOs are responsible for maintaining and upgrading their properties in order to continue renting them. As such, SHOs are used to dealing with renovations on a professional basis.

The limited financial capacity of SHOs to realise energy renovations magnifies the importance of improving process performance in order to get the best possible outcomes. In the last 30 years numerous authors have addressed the need to improve the performance of traditional construction processes via alternative project delivery

methods. However, very little is known about the specifics of renovations processes for social housing, the feasibility of applying innovative construction management methods and the consequences for the process, for the role of all the actors involved and for the results of the projects.

The aim of this study is to provide an insight into the project delivery methods available for SHOs when they are undertaking energy renovation projects and to evaluate how these methods could facilitate the achievement of a higher process performance.

The main research question is:

How can Social Housing Organisations improve the performance of energy renovation processes using more integrated project delivery methods?

The idea of a PhD thesis about social housing renovation processes originated from the participation of TU Delft as research partner in the Intelligent Energy Europe project SHELTER¹ which was carried out between 2010 and 2013. The aim of the SHELTER project was to promote and facilitate the use of new models of cooperation, inspired by integrated design, for the energy renovation of social housing. The SHELTER project was a joint effort between six social housing organisations (Arte Genova, Italy; Black Country Housing Group, United Kingdom; Bulgarian Housing Association, Bulgaria; Dynacité, France; Logirep, France and Société Wallonne du Logement, Belgium), three European professional federations based in Brussels (Architects Council of Europe, Cecodhas Housing Europe and European Builders Confederation) and one research partner (Delft University of Technology).

Research methods

This thesis is composed of five studies. The first study is based on a literature review. The second study is based on five case studies from four countries (Belgium, Italy, France and United Kingdom), a questionnaire completed by 36 SHOs from eight countries and 14 interviews with experts from ten countries. The third is based on two French case studies and the fourth and fifth are based on 8 and 13 Dutch case studies respectively.

Construction projects in housing involve a high number of professionals and take place over a long period of time. External factors, such as the economic and political situation or changes in construction or procurement regulations, can have a considerable influence on the construction process. Moreover, the specific characteristics of the

1 SHELTER, www.shelterproject-iee.eu.

construction sector of every country can also shape the process. In consequence, there are many interrelated variables that can have an influence on the dynamics of the process and on the outputs achieved. Research that seeks to understand the causes of changes in this process need to dig deeper into the internal and external characteristics of the process, which makes case study research the most appropriate research method for this type of study.

The cases in each of the studies have been selected because innovative project management methods aiming for better collaboration between the participating actors were applied and because it was possible to gather high-quality data concerning these projects. The data were gathered mainly through interviews but other methods were also used: a questionnaire, observations and an analysis of tender documents. A protocol based on the recommendations of case study research literature was applied to assure the scientific validity of the data collected through the interviews.

The case studies were complemented with a wide-ranging literature review covering scientific publications on project management in construction, mainly from the UK, the US, Australia, the Netherlands, Hong Kong and Finland. Reports from Intelligent Energy Europe projects were also reviewed, as well as legal texts relating to the tender options open to European social housing organisations.

Construction management methods

How to improve the performance of construction processes has long been and is still one of the key issues of the construction industry sector, social housing included. The performance of construction processes has been addressed from a range of perspectives in the construction management literature and diverse project management methods have been proposed. These methods are interrelated and in constant evolution. Moreover, different terminology is used to describe similar methods, which makes it difficult to obtain a clear picture. To simplify, three main perspectives or methods to improve the process integration and actors collaboration can be identified:

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

Supply chain integration looks at the performance of the construction process from a multi-project perspective, relating the construction process to an industrial process. The project delivery method takes a single-project perspective into account because it is based on the premise that the complexity and singularity of any construction project will make it unique. Finally, partnering is focused on the characteristics of collaboration between the actors involved in the construction process.

The singularity of renovation projects and the limitations of public procurement make the single project perspective the most feasible strategy for improving the process performance of social housing renovation projects. As such, the analysis of the project delivery methods is the most suitable method for improving the performance of renovation processes. The literature review shows that the more integrated project delivery methods are particularly indicated for construction projects with a high commitment to sustainability in general and for energy performance in particular. The literature review also reveals that the key factor in the process efficiency of all project delivery methods is collaboration between the actors involved in the project. Partnering methods can have a substantial positive influence on process performance.

The study of the legal limitations imposed by the currently applicable public procurement Directive 2004/18/EC shows that even though a limited amount of tender options are available, it is possible to tender projects that apply integrated project delivery methods using the competitive dialogue procedure. Moreover, the recently approved but not yet enacted public procurement Directive 2014/24/EU facilitates even further the use of competitive dialogue tenders for social housing energy renovations.

Project delivery methods in European social housing energy renovations

This study is based on five case studies, 36 questionnaires and 14 expert interviews, and identified four main project delivery methods for the energy renovation of social housing, namely:

- Step-by-Step (SBS)
- Design-Bid-Build (DBB)
- Design-Build (DB)
- Design-Build-Maintain (DBM).

SBS can be considered a major renovation when the replacement of a series of building components eventually produces the same final result as a renovation project. In order to optimise the service lives of building components, an SHO might choose to split a major renovation project into a series of minor renovations. Cost-efficiency is achieved by procuring a large number of replacements only when a particular component has reached the end of its service life. This project delivery method will not usually include a design phase because these interventions usually involve replacing building products and systems.

DBB, DB and DBM take place all at once and involve design companies, construction companies and maintenance companies. The difference between the three methods is the time frame for the involvement of the different actors and the contractual relationship with the SHO. In DBB, the various contracted parties are involved in the project one after the other, while in DB design companies and construction companies

are involved during the same time period, and in DBM all three parties are involved during the same time period. Under DB, the SHO tenders the design and construction work in a single contract and under DBM it tenders the design, construction and maintenance work in a single contract. The contracted entity may be a single company, with or without subcontractors, or a consortium.

SBS and DBB are the most commonly used project delivery methods for social housing renovation projects, although DB and DBM are also used for a small number of projects. The vast majority of SHOs use more than one project delivery method simultaneously, mainly a combination of SBS and DBB. For new-build projects, DBB has traditionally been considered the most commonly used project delivery method; however, our survey revealed that it is in fact the second most commonly used project delivery method after SBS.

The DBM approach has the maximum potential for delivering energy savings, because it facilitates collaboration between the different actors and promotes their commitment to achieving project goals. Furthermore, DBM offers greater price certainty and less risk of design failure compared to other project delivery methods. However, the project delivery method cannot guarantee the achievement of targeted energy savings by itself. Numerous factors need to be taken into account when considering a change in the project delivery method.

The property asset management of the dwelling stock that is renovated using SBS, which focuses on building elements and systems, is completely different from the property asset management of the dwelling stock renovated by DBB, DB or DBM, which focuses on entire properties. It is therefore unlikely that SHOs that are already applying SBS will switch to another project delivery method. Switching between DBB to DBM, or to DB, is feasible since they are similar in terms of property asset management.

A change of project delivery method could be motivated by the use of energy performance guarantees offered by energy performance contracting, which is possible in cases where DBM is used. However, this choice is not suitable for all SHOs. For example, if an SHO has an in-house design team and changes to DBM (or DB), its design team will not be involved in the project as the contractor will have its own design staff. If an SHO has a corporate responsibility towards SMEs and changes to DBM (or DB), it will be more difficult to keep SMEs directly involved since they will need to organise themselves into consortia. And finally, if an SHO already has a contract with a maintenance company to manage their entire housing stock, changing to DBM will create a conflict in their maintenance management, since for every property where DBM has been used, a different maintenance company will take charge of maintenance.

Energy efficiency in French social housing renovations via Design-Build-Maintain

The study is based on the analysis of two social housing renovation projects, implemented by two French SHOs:

- the renovation of 14 dwellings in a three-storey apartment block in Nurieux-Volognat (in south-eastern France) by the Dynacité SHO; and
- the renovation of 231 dwellings in four apartment blocks (ranging from 6 to 10 storeys) in Vitry-sur-Seine (in the southern suburbs of Paris) by the Logirep SHO.

The data on the case studies were obtained from: the tender documents (call for offers, specifications and preliminary designs); observation during the negotiation phase in the case of Dynacité; interviews, carried out after the construction work was finished, with the social housing renovations manager, the social housing project manager, the construction company, the architect's office and the maintenance company involved in both cases; and the evaluation reports produced by project managers at the SHOs.

The results demonstrate that it is possible to engage design companies, construction companies and maintenance companies to achieve energy savings that exceed those stipulated by the SHO and to obtain a guarantee of results. This approach also makes it possible to shorten the duration of a project, while limiting the costs involved to approximately the equivalent of those incurred in DBB renovation projects. The collaborative set-up of the DBM process also results in improved relations between the actors involved. However, an analysis of these relationships indicated that there is still room for improvement, particularly with regard to the maintenance company.

In order to guarantee the benefits of implementing a DBM process, it is necessary for the SHO to put in place the following: realistic but ambitious minimum requirements; clear and measurable award criteria that stress the importance of achieving high energy savings; and a guarantee mechanism that is fair and robust. Moreover, the SHO needs to ensure that the scale of the contract is large enough to guarantee that any compensation paid to non-selected candidates does not adversely affect the total cost of the project and that the SHO's maintenance strategy must be flexible enough to handle maintenance contracts that are project-related as well as maintenance stock-related contracts.

Competitive tenders for integrated contracts for social housing renovation projects

The study, which is based on an analysis of eight renovation projects undertaken by SHOs in the Netherlands, shows that Dutch SHOs apply a range of mechanisms in order to influence the ambition, collaboration and long-term view of the consortia that participate in competitive tenders for integrated renovation projects. Their aim is to improve the quality of the construction process and thereby enhance the quality of the output.

The scale of the ambition is raised, in first place, through the competitive character of the selection procedure. Several candidates are invited to the tender but only the best will be selected. Secondly, the minimum performance level is defined above common standards by setting high but achievable minimum requirements. Thirdly, the candidates are encouraged to perform at their best by being rated by award criteria that evaluate their performance. The findings show that SHOs are not all singing from the same song sheet when it comes to determining the level of ambition they require from their candidates in relation to the key issue of energy saving.

Collaboration is encouraged mainly by setting a very tight deadline for the design proposals, a period of just 11 weeks on average. The consortium members are thus required to work closely together in order to get the proposals out on time and make a convincing pitch in a presentation. The findings show that the procedures with higher numbers of meetings between the SHO and the consortium during the design proposal period appeared to increase collaboration with the SHO. Other mechanisms, such as setting conditions for the nature of the candidates or proposing team coaches, were implemented to a lesser extent and not regarded as appropriate by all SHOs.

A longer-term view is promoted by including an optional long-term maintenance contract for the renovated dwellings. The results of this strategy were not as good as expected, however, because the majority of the candidates did not integrate maintenance into their proposal, preferring to make an additional and separate maintenance offer. The SHOs did not include maintenance as an integral part of the renovation project because they were afraid of the possible implications of a long-term maintenance contract on a project basis for their general building stock maintenance strategy and their in-house maintenance teams.

The role of the architect using integrated contracts for social housing renovation projects

The focus of previous studies is on analysing the implementation of integrated project delivery methods from the demand side, the social housing organisation. However, it has been also identified that the use of integrated project delivery methods have consequences for the supply side actors. Especially for the architect because his central role in the design process could be affected. This study, which is based on the analysis of the role of the architect in thirteen renovation projects that used integrated contracts, concludes that the main role of the architect, as having principal responsibility for the design choices made, does not change when integrated contracts are used. However, the decision-making power of the architect does decrease. With the use of integrated contracts, the main contractor and some specialised contractors can also influence the design choices – an influence that they would not otherwise have. In cases where the main contractor plays an active leading role in the consortium,

the reduction of the decision-making power of the architect may become even more evident, and in the opinion of some architects, turn the role of architect into a role more akin to that of technical and aesthetic advisor. The changes in how design decisions are taken do not have a negative impact on the quality of the relationship between the architect and the SHO, and has a positive influence on the quality of the relationship between the architect and the construction companies involved in the project.

Some changes were reported relating to the workload for each project compared to Design-Bid-Build projects. In some cases, architects were no longer involved in project management tasks, while in other cases architects were assigned additional responsibilities, such as communicating with tenants. It is not possible, therefore, to establish a direct relationship between the use of integrated contracts and the size of the architect's workload.

Where there is an evident change is in the distribution of the workload and payment for the work done for the integrated contracts that have been tendered through a competitive procedure (seven of the thirteen projects analysed). In projects tendered using a competitive procedure, the work of the architect is condensed into a shorter timeframe (42% shorter than with a non-competitive procedure) and there is a higher risk that the working hours will not be paid in full if the consortium is not awarded the contract.

Conclusions

In order to improve the performance of energy renovation processes undertaken by social housing organisations, the Design-Build-Maintain project delivery method offers the best opportunity to facilitate the active involvement of all actors, obtain the best possible project performance and to guarantee the quality of the end results. However, given the characteristics of each SHO and the characteristics of the renovation projects, DBM is not always the project delivery method chosen. If DBM is not used, other simpler management mechanisms, such as the early involvement of contractors or the use of in-house maintenance companies as advisors, should be considered to contribute to better process performance.

In order to apply the DBM project delivery method successfully, it is necessary for the SHO to focus its efforts on designing a tender procedure that maximises the potential of the entire project delivery method.

- Choosing a competitive tender procedure that allows the dialogue with candidates.
- Defining performance-based specifications with realistic but ambitious minimum requirements and a set of clear and measurable award criteria that stress the importance of achieving energy savings.
- Defining a performance guarantee mechanism that is fair and robust.

- Setting up tender process conditions that facilitate communication between the candidates and the SHO and that promote team working among the candidate team (consortium).

The members of the candidate team, the consortium, also need to adapt to the new game rules. Specifically the architect needs to gain more managerial skills in order to keep his leading design decision position and become more of a team integrator. Future research should consider the changes in the roles of the other consortium members and the best consortium structures to ensure a good product quality and the fair treatment of all the parties involved.

Samenvatting

Geïntegreerde aanbestedingsvormen voor energierenovaties van sociale huurwoningen

Woningcorporaties in Europa staan momenteel voor grote uitdagingen. Het verouderde woningbestand en de economische crisis hebben niet alleen een gat geslagen in hun eigen financiën, maar ook in de financiën van hun huurders. Daarmee wordt hun doel, het beschikbaar stellen van goede en betaalbare woningen, steeds lastiger te realiseren. Renovatie biedt nog wel de mogelijkheid om de huidige woningen op een gezonder en comfortabeler niveau te brengen. Door hogere energieprestaties kan ook het energieverbruik worden beperkt of tot nul worden gereduceerd. Jammer genoeg staan de beperkte financiële middelen van vele woningcorporaties renovatieprojecten in de weg.

Tegelijkertijd is de renovatie van het bestaande woningbestand een van de meest veelbelovende alternatieven voor het halen van de door de Europese autoriteiten gestelde, ambitieuze emissiereductiedoelen voor CO₂ – namelijk de vermindering van de CO₂-uitstoot binnen de EU in 2020 met 20% ten opzichte van het niveau van 1990. Het energiebeleid van de lidstaten streeft onder meer naar een synergie tussen de Europese doelen en de doelstellingen van woningcorporaties. Daarbij wordt ingezet op de energiebesparing die kan worden behaald door het renoveren van sociale huurwoningen. De Europese initiatieven hebben het belang van energiebesparing bij de renovatie van sociale huisvesting inmiddels zo sterk op de voorgrond geplaatst, dat dergelijke verbouwingen inmiddels ‘energierenovaties’ worden genoemd.

In totaal hebben Europese woningcorporaties 21,5 miljoen woningen in bezit, ofwel ongeveer 9,4% van het totale aantal woningen. Iedere woningcorporatie bezit een groot aantal woningen, dus er hoeven maar weinig mensen te worden overtuigd van de noodzaak van energiebesparing door renovatie. De potentieel grote impact van beslissingen op dit terrein wordt daarmee gemaximaliseerd. Om hun woningbestand te kunnen blijven verhuren, is het aan de woningcorporaties om hun bezit te blijven onderhouden en verbeteren en mag professionaliteit hierin worden verwacht. Professionaliteit die zich onder meer uit in een duidelijke visie en strategie op prestaties, kosten, risico's en levensduur van woningen en een transparante besluitvorming.

De beperkte financiële capaciteit van woningcorporaties voor energierenovaties onderstreept het belang van de verbetering van bouwprocessen, om tot een rendabel mogelijk resultaat te komen. De afgelopen 30 jaar hebben tal van auteurs gewezen op het belang van verbetering van traditionele bouwprocessen door toepassing van alternatieve manieren van aanbesteden. Er is echter maar heel weinig bekend over de specifieke kenmerken van renovatieprocessen binnen de sociale huursector, de haalbaarheid van innovatieve bouwmanagementmethoden en de consequenties van deze methoden voor het bouwproces, voor de rol van alle betrokken actoren en voor het eindresultaat.

Het doel van dit onderzoek is om inzicht te geven in de constructiemanagementmethoden die woningcorporaties toepassen om energierenovatieprojecten uit te voeren. Tevens is het doel om te evalueren of en in hoeverre deze methoden kunnen leiden tot efficiëntere en effectievere processen. De belangrijkste onderzoeksvraag is:

Hoe kunnen woningcorporaties de prestaties van energierenovatieprocessen verbeteren door de inzet van geïntegreerde methoden voor het aanbesteden en uitvoeren van deze projecten?

Het idee voor een proefschrift over renovatieprocessen binnen de sociale huisvesting kwam voort uit de deelname van de TU Delft als onderzoekspartner aan het Intelligent Energy Europe-project SHELTER², dat plaatsvond van 2010 tot 2013. Het doel van het SHELTER-project was het stimuleren en faciliteren van nieuwe samenwerkingsmodellen voor energierenovatie van sociale huisvesting, geïnspireerd door geïntegreerd ontwerpen. Het SHELTER-project was een samenwerking van zes woningcorporaties op het gebied van sociale huisvesting (Arte Genova, Italië; Black Country Housing Group, Verenigd Koninkrijk; Bulgarian Housing Association, Bulgarije; Dynacité, Frankrijk; Logirep, Frankrijk en Société Wallonne du Logement, België), drie in Brussel gevestigde professionele Europese federaties (Architects Council of Europe, Cecodhas Housing Europe en European Builders Confederation) en een onderzoekspartner (TU Delft).

Onderzoeksmethoden

Dit proefschrift bestaat uit vijf onderzoeken die volgens vier methoden zijn uitgevoerd. Het eerste onderzoek is gebaseerd op literatuuronderzoek. Het tweede onderzoek is gebaseerd op vijf cases uitgevoerd in vier verschillende landen (België, Italië,

Frankrijk en het Verenigd Koninkrijk), op een enquête die door 36 woningcorporaties uit 8 landen is ingevuld en op 14 interviews met experts uit tien verschillende landen. Het derde onderzoek is gebaseerd op twee Franse casuonderzoeken en het vierde en vijfde onderzoek zijn gebaseerd op respectievelijk 8 en 13 Nederlandse casuonderzoeken.

Renovatieprojecten kennen een lange looptijd en er zijn veel professionals bij betrokken. Externe factoren, zoals de economische en politieke situatie of veranderingen in de bouw- of aanbestedingsvoorschriften, kunnen het bouwproces aanzienlijk beïnvloeden. Bovendien wordt het bouwproces ook vormgegeven door de specifieke kenmerken van de bouwsector in het betreffende land. Er is dan ook sprake van veel verschillende variabelen die onderling met elkaar verband houden en invloed kunnen hebben op de dynamiek van het proces zelf en op de behaalde resultaten. Bij een onderzoek naar de oorzaken van veranderingen in dit proces moeten de interne en externe kenmerken van het proces diepgaander worden onderzocht. Daarom is onderzoek aan de hand van verschillende casussen in dit geval de meest geschikte onderzoeksmethode.

De casussen zijn uitgekozen op grond van hun innovatieve constructiemanagementmethoden (waarin beter is samengewerkt tussen de verschillende spelers dan in traditionele aanbestedingsvormen) en op grond van kwalitatief hoogwaardige data die van deze projecten beschikbaar zijn. De gegevens zijn vooral verzameld aan de hand van interviews, maar er zijn ook waarnemingen gedaan en documenten geanalyseerd. De casuonderzoeken zijn aangevuld met een breed spectrum aan wetenschappelijke publicaties op het gebied van constructiemanagement bij bouwprojecten, voornamelijk afkomstig uit het Verenigd Koninkrijk, de Verenigde Staten, Australië, Nederland, Hong Kong en Finland. Er is ook gekeken naar de verslagen van IEE-projecten, evenals naar wetsteksten over aanbestedingsopties voor woningcorporatie in Europa.

Constructiemanagementmethoden

Meer efficiency tijdens bouwprocessen is al sinds lange tijd een van de belangrijkste aandachtspunten binnen de bouwsector, ook bij de bouw van sociale huurwoningen. De procesefficiency in de bouw wordt in de literatuur over constructiemanagement van verschillende kanten benaderd en er worden diverse methoden voor de uitvoering van projecten geopperd. Deze methoden hangen onderling samen en zijn constant in ontwikkeling. In de beschrijvingen van vergelijkbare methoden wordt geen uniforme terminologie gehanteerd, wat het lastig maakt om het beeld helder te krijgen. Ter verbetering van de vergelijkbaarheid kan er een onderscheid worden gemaakt tussen drie belangrijke benaderingen of methoden:

- integratie van de toeleveringsketen (meerdere projecten perspectief);
 - integratie van uitvoeringsfasen (enkel project perspectief);
 - partnerschapsbenadering (samenwerkingsperspectief).
- Bij integratie van de toeleveringsketen wordt gekeken naar de procesefficiency van het bouwproces vanuit het perspectief van meerdere projecten. Het bouwproces wordt daarbij benaderd als een industrieel proces. De integratie van uitvoeringsfasen door geïntegreerde aanbesteding gaat uit van een enkel project, omdat elk bouwproject uniek is door de complexiteit en eigenheid ervan. De partnerschapsbenadering richt zich op de kenmerken in de samenwerking van de actoren die bij het bouwproces betrokken zijn.

Het unieke karakter van elk renovatieproject en de beperkingen van openbare aanbestedingen maken het perspectief op basis van een enkel project de meest haalbare onderzoeksstrategie voor verbetering van de procesefficiency van renovatieprojecten in de sociale huursector. In die zin is de analyse van geïntegreerde aanbestedingsmethoden het meest geschikt voor de verbetering van de efficiency van renovatieprocessen. Uit het literatuuronderzoek blijkt bovendien dat de meer geïntegreerde methoden meer geschikt zijn voor bouwprojecten die sterk gericht zijn op duurzaamheid en in het bijzonder op energie-efficiëntie dan de andere methoden. Uit het literatuuronderzoek blijkt ook dat van alle constructiemanagementmethoden samenwerking is tussen de actoren die bij het project betrokken zijn de belangrijkste factor bij procesefficiency. Het aangaan van een partnerschap kan dus eveneens een substantiële positieve invloed hebben op de procesefficiency.

De huidige Europese Aanbestedingsrichtlijn 2004/18/EG biedt de mogelijkheid voor geïntegreerd aanbesteden van projecten door middel van concurrentiegerichte dialoog. De recent goedgekeurde, maar nog niet van kracht zijnde Europese Aanbestedingsrichtlijn 2014/24/EU biedt hiertoe meer mogelijkheden.

Toegepaste aanbestedingsmethoden bij energierenovaties in Europa

Er zijn vier hoofdmethoden vastgesteld voor de aanbesteding en uitvoering van energierenovatieprojecten:

- stap-voor-stap (Step-By-Step, verder te noemen SBS)
- ontwerp-aanbesteding-bouw (Design-Bid-Build, verder te noemen DBB)
- ontwerp-bouw (Design-Build, verder te noemen DB)
- ontwerp-bouw-onderhoud (Design-Build-Maintain, verder te noemen DBM).

Van de SBS-methode is sprake wanneer bij een grote renovatie de vervanging van een aantal bouwdelen uiteindelijk tot hetzelfde eindresultaat leidt als een complete renovatie. Om de levensduur van de bouwdelen te optimaliseren, kan een woningcorporatie een groot renovatieproject opsplitsen in een reeks kleinere renovaties

van afzonderlijke bouwdelen. De kostenefficiëntie ontstaat doordat aan het einde van de levensduur van deze bouwdelen een groot aantal vervangingen op één moment wordt aanbesteed. Deze werkwijze omvat meestal geen ontwerpfase, aangezien meestal alleen bouwcomponenten en –systemen worden vervangen.

DBB, DB en DBM vinden tegelijkertijd plaats en er zijn ontwerpbureaus, bouwbedrijven en onderhoudsbedrijven bij betrokken. De verschillen tussen deze drie methoden zijn het tijds kader waarbinnen de verschillende spelers bij het project betrokken worden en de contractuele relaties met de woningcorporatie. Bij DBB zijn de gecontracteerde partijen na elkaar bij het project betrokken, terwijl bij DB het ontwerp bureau en het bouwbedrijf gelijktijdig werken. Bij DBM werken de betrokken partijen alle drie samen binnen hetzelfde tijdsbestek. Bij DB besteedt de woningcorporatie het ontwerp en de bouw aan op basis van één contract. Bij DBM worden ontwerp, bouw en onderhoud op basis van één contract aanbesteed. De werkzaamheden kunnen worden gegund aan één aannemer, met of zonder onderaannemers, of aan een consortium.

SBS is de meest toegepaste vorm van projectuitvoering bij renovatie in de sociale huursector, gevolgd door DBB. DB en DBM worden ook toegepast, maar slechts bij een beperkt aantal projecten. De overgrote meerderheid van de woningcorporaties gebruikt meerdere vormen van projectuitvoering simultaan, hoofdzakelijk combinaties van SBS en DBB. Voor nieuwbouwprojecten geldt DBB van oudsher als de meest toegepaste projectuitvoeringsmethode; uit ons onderzoek blijkt echter dat deze methode eigenlijk de tweede plaats inneemt, na SBS.

Hoewel weinig gebruikt, heeft de DBM-benadering maximaal potentieel voor de uitvoering van energiebesparende maatregelen, aangezien hiermee een samenwerking tot stand komt tussen de diverse partijen en hun betrokkenheid bij het behalen van de projectdoelen groter is dan bij de andere benaderingen. Bovendien biedt DBM betere prijsgaranties en minder risico's op ontwerpfouten, vergeleken met de andere methoden van aanbesteding en projectuitvoering. Geen enkele uitvoeringsmethode garandeert echter dat de energiebesparingsdoelstellingen ook daadwerkelijk worden gehaald.

Het strategisch voorraadbeleid van woningcorporaties dat ten grondslag ligt aan de SBS-benadering, gericht op bouwdelen, wijkt sterk af van het strategisch voorraadbeleid dat ten grondslag ligt aan het renoveren van het woningbestand volgens DBB, DB en DBM, waarbij meer wordt gefocust op een omvangrijker renovatie dan alleen bouwdelen. Het is dan ook niet waarschijnlijk dat woningcorporaties die reeds SBS toepassen overstappen naar een andere methode van projectuitvoering. Overstappen van DBB naar DBM of DB is minder onwaarschijnlijk, aangezien deze methoden vanuit het oogpunt van het strategisch voorraadbeleid vergelijkbaar zijn.

Tot een overstap naar een andere projectuitvoeringsmethode kan besloten worden vanwege het gebruik van energieprestatiegaranties bij aanbesteding op energieprestatiebasis, een mogelijkheid die bestaat bij DBM. Deze overstap is echter niet voor elke woningcorporatie zinvol. Als een woningcorporatie bijvoorbeeld beschikt over een eigen ontwerpteam en overstapt naar DBM (of DB), zal het ontwerpteam niet betrokken zijn bij het project, aangezien de aannemer eigen ontwerp personeel meebrengt. Als een woningcorporatie verantwoordelijkheden heeft ten opzichte van kleine en middelgrote bedrijven en overstapt naar DBM (of DB), zal het moeilijker zijn om kleine en middelgrote bedrijven te contracteren, aangezien zij zich zullen moeten organiseren in consortia, iets dat voor deze bedrijven vaak niet mogelijk is vanwege een te bescheiden omvang, omzet en/of ervaring. Ten slotte ontstaat er bij woningcorporaties die overstappen naar DBM en die reeds beschikken over een contract met een onderhoudsbedrijf voor het hele woningbestand een conflictsituatie. Voor alle vastgoed waarbij DBM is toegepast voert immers een ander onderhoudsbedrijf het onderhoud uit.

Energie-efficiëntie bij Franse sociale huisvesting via DBM

Het onderzoek in Frankrijk (het derde onderzoek) is gebaseerd op analyse van twee renovatieprojecten in de sociale huursector, geïmplementeerd door twee Franse woningcorporaties:

- de renovatie van 14 woningen in een appartementencomplex van drie verdiepingen in Nurieux-Volognat (in het zuidoosten van Frankrijk) door woningcorporatie Dynacité;
- de renovatie van 231 woningen in 4 appartementencomplexen (van 6 à 10 verdiepingen) in Vitry-sur-Seine (een buitenwijk ten zuiden van Parijs) door woningcorporatie Logirep.

De gegevens zijn afkomstig van de aanbestedingsdocumenten (aanbesteding, specificaties en voorlopige ontwerpen), waarnemingen gedurende de onderhandelingsfase (in het geval van de Dynacité-casus), interviews (na afronding van de bouwwerkzaamheden) met de betrokken renovatiemanagers van de woningcorporatie, de projectmanagers sociale huisvesting, de bouwbedrijven, de architectenbureaus en de onderhoudsbedrijven, en de evaluatierapporten van de projectmanager bij de woningcorporaties.

Uit de resultaten blijkt dat het mogelijk is om ontwerp bureaus, bouwbedrijven en onderhoudsbedrijven samen tot meer energiebesparende maatregelen te bewegen dan door de woningcorporaties wordt geëist en bovendien garanties te bedingen op de resultaten. Door deze aanpak kan ook de duur van een project worden bekort, terwijl de kosten kunnen worden teruggebracht tot ongeveer het niveau van de kosten van DBB-renovatieprojecten. Door het samenwerkingsprincipe dat DBM-processen eigen is, is er ook sprake van betere relaties tussen de betrokken actoren. Uit een analyse van

deze relaties blijkt echter dat er nog steeds ruimte is voor verbetering, vooral wat de betrokkenheid van onderhoudsbedrijven betreft.

Om de voordelen van implementatie van een DBM-proces te kunnen garanderen, moet een woningcorporatie de volgende maatregelen treffen: realistische, maar wel ambitieuze minimale eisen, heldere en meetbare gunningscriteria, waarin het belang van het behalen van grote energiebesparingen voorop staat, en een garantiemechanisme dat fair en robuust van opzet is. De woningcorporatie moet er bovendien voor zorgen dat de omvang van de aanbesteding zo groot is dat de eventuele compensatiebetalingen aan niet-geselecteerde kandidaten geen negatieve uitwerking hebben op de totale kosten van het project. Ook moet het onderhoudsbeleid van de woningcorporatie zodanig zijn dat zowel onderhoudscontracten op projectbasis als onderhoudscontracten voor het totale woningbestand hierin een plaats kunnen krijgen.

Openbare aanbestedingen op basis van geïntegreerde contracten voor energierenovatieprojecten op het gebied van sociale huisvesting

Het vierde onderzoek is gebaseerd op een analyse van acht renovatieprojecten die zijn uitgevoerd door Nederlandse woningcorporaties. Uit dit deelonderzoek blijkt dat Nederlandse woningcorporaties verschillende mechanismen toepassen om de ambitie, samenwerking en het langetermijndenken te beïnvloeden bij de consortia die deelnemen aan openbare aanbestedingen voor geïntegreerde renovatieprojecten. Het doel van de corporaties is om de kwaliteit van bouwprocessen te verbeteren en zo de kwaliteit van het resultaat te verhogen.

Het ambitieniveau wordt allereerst verhoogd door het competitieve karakter van de selectieprocedure. Er worden verschillende kandidaten uitgenodigd om een offerte in te dienen, maar daaruit worden alleen de beste kandidaten geselecteerd. Ten tweede wordt het minimale prestatiepeil hoger gelegd dan de gebruikelijke prestaties, door het vastleggen van hoge, maar wel haalbare minimale vereisten. Ten derde worden kandidaten aangemoedigd om hogere kwaliteit te leveren, door hun prestaties te beoordelen aan de hand van gunningscriteria. Uit de resultaten blijkt dat woningcorporaties niet allemaal uit hetzelfde vaatje tappen bij het bepalen van het ambitieniveau dat zij van hun kandidaten verwachten waar het gaat om het cruciale onderwerp energiebesparing.

Samenwerking tussen consortiumleden in de aanbestedingsfase wordt vooral door het stellen van een heel strikte deadline voor de ontwerpvoorstellen bevorderd. Dit is gemiddeld een periode van slechts elf weken. De leden van het consortium moeten daarom nauw samenwerken om de voorstellen tijdig de deur uit te krijgen en tijdens een presentatie een overtuigende indruk achterlaten. Uit de onderzoeksresultaten blijkt dat bij procedures met een groter aantal bijeenkomsten tussen de

woningcorporatie en het consortium tijdens de ontwerpfase, de samenwerking met de woningcorporatie toeneemt. Andere middelen, zoals het bepalen van voorwaarden voor het soort kandidaten of het aanstellen van teamcoaches, worden minder vaak toegepast en niet door alle woningcorporaties als geschikte methoden beschouwd.

Met de toevoeging van een optioneel langdurig onderhoudscontract voor de gerenoveerde woningen aan de opdracht wordt een langetermijnvisie gestimuleerd. Deze aanpak leverde echter minder op dan verwacht, aangezien de meerderheid van de kandidaten er de voorkeur aan gaf om het onderhoud niet in hun offerte te integreren, maar hiervoor een afzonderlijke, offerte in te dienen. De woningcorporaties maakten het onderhoud niet tot een integraal onderdeel van het renovatieproject, omdat zij bang waren voor de mogelijke gevolgen die langdurige onderhoudscontracten op projectbasis zouden kunnen hebben voor het algemene onderhoudsbeleid van hun gehele woningbestand en voor hun eigen onderhoudsteams.

De rol van de architect bij geïntegreerde contracten voor energierenovatieprojecten op het gebied van sociale huisvesting

Het vijfde onderzoek, analyseert de rol van de architect bij dertien renovatieprojecten op basis van geïntegreerde contracten, is vast komen te staan dat de rol van de architect als hoofdverantwoordelijke voor de ontwerpbeslissingen niet verandert door het gebruik van geïntegreerde contracten. De besluitvormingskracht van de architect neemt echter wel af. Op basis van geïntegreerde contracten kunnen de hoofdaannemer en sommige gespecialiseerde aannemers ook invloed uitoefenen op de ontwerpbeslissingen – een invloed die zij normaliter niet zouden hebben. In die gevallen waarin de hoofdaannemer een leidinggevende rol speelt binnen het consortium, wordt de vermindering van de besluitvormingskracht van de architect nog duidelijker merkbaar. In de opinie van sommige architecten worden zij daarbij meer in de rol geduwd van technisch en esthetisch adviseur. De veranderingen in de wijze waarop ontwerpbeslissingen worden genomen, hebben geen negatieve invloed op de kwaliteit van de relatie tussen de architect en de woningcorporatie en hebben zelfs een positieve invloed op de kwaliteit van de relatie tussen de architect en de bouwbedrijven die bij het project betrokken zijn.

Er werden wel enkele veranderingen genoemd ten aanzien van de omvang van de werkzaamheden, vergeleken met projecten op basis van DBB. In sommige gevallen waren architecten niet langer betrokken bij projectmanagementtaken, terwijl architecten in andere gevallen juist extra verantwoordelijkheden kregen toegewezen, zoals de communicatie met de huurders. Het is dan ook niet mogelijk om een direct verband te leggen tussen het gebruik van geïntegreerde contracten en de omvang van de werkzaamheden van de architect. Er is wel sprake van een duidelijke verandering bij de verdeling van de werkzaamheden en de betaling daarvan bij geïntegreerde

contracten die zijn aanbesteed via een competitieve procedure (zeven van de dertien geanalyseerde projecten). Bij projecten die op deze wijze werden aanbesteed, hebben de architecten dat binnen een beduidend korter tijdsbestek gedaan (42% korter dan bij een niet-competitieve procedure) en was het risico groter dat de werkuren niet volledig werden uitbetaald als het consortium de opdracht niet gegund kreeg.

Conclusie

Om energierenovatieprocessen door organisaties op het gebied van sociale huisvesting te verbeteren, biedt de projectuitvoeringsmethode van ontwerp–bouw–onderhoud (Design–Build–Maintain, DBM) de beste kansen voor actieve betrokkenheid van alle actoren, voor een zo goed mogelijk projectresultaat en voor kwaliteitsgaranties ten aanzien van het eindresultaat. Gezien de uiteenlopende kenmerken van woningcorporaties en renovatieprojecten, is DBM echter niet voor alle projecten de meest geschikte methode van projectuitvoering. Als DBM niet kan worden toegepast, moet voor een beter verloop van het bouwproces het gebruik van andere, eenvoudiger manieren van managementmethoden worden overwogen, zoals het vroeg betrekken van aannemers bij het proces of het inzetten van eigen onderhoudsbedrijven als adviseurs.

Om de DBM-projectuitvoeringsmethode met succes te kunnen toepassen, moeten woningcorporaties zich richten op het opzetten van een aanbestedingsprocedure die het potentieel van deze methode maximaal benut:

- een competitieve aanbestedingsprocedure die een dialoog tussen de corporatie en de kandidaten mogelijk maakt.
- prestatiegerichte specificaties met realistische, maar ambitieuze minimale vereisten en een aantal duidelijke, meetbare gunningscriteria, waarbij de nadruk ligt op het belang van het behalen van energiebesparing.
- een eerlijke en solide methode voor prestatiegarantie.
- aanbestedingsvereisten die communicatie tussen de kandidaten en de woningcorporatie mogelijk maken en die teamwork binnen het team van kandidaten (het consortium) stimuleren.

De consortiumleden moeten zich ook aanpassen aan de nieuwe spelregels. De architect dient over meer managementvaardigheden te beschikken om zijn leidinggevende positie als besluitvormer op het gebied van het ontwerp te kunnen behouden en dient een grotere integrerende rol binnen het team te gaan spelen.

Bij toekomstig onderzoek moet worden gekeken naar de veranderingen in de rollen van de andere leden van het consortium en naar de beste manier voor het opzetten van een consortium voor een goede productkwaliteit en een eerlijke behandeling van alle betrokken partijen.

1 Introduction

European Social Housing Organisations (SHOs) are currently facing challenging times. The ageing of their housing stock and the economic crisis, which has affected both their finances and the finances of their tenants, are testing their capacity to stick to their aim of providing decent and affordable housing. Housing renovation projects offer the possibility of upgrading the health and comfort levels of their old housing stock to current standards and improve energy efficiency, and this solution also addresses the fuel poverty problems suffered by part of their tenants. Unfortunately, the limited financial capacity of SHOs is hampering the scale and of housing renovation projects and the energy savings achieved.

At the same time, the renovation of the existing housing stock is seen as one of the most promising alternative routes to achieving the ambitious CO₂ emissions reduction targets set by European authorities – namely, to reduce EU CO₂ emissions to 20% below their 1990 levels by 2020. The synergy between European targets and the aims of SHOs has been addressed by the energy policies of the member states bringing into the spotlight the potential energy savings achievable by renovating social housing. In fact, the European initiatives have prioritised energy savings in social housing renovations to such an extent that these are referred to as 'energy renovations'. Energy renovation is therefore a renovation project with a higher energy savings target than a regular renovation project.

In total, European SHOs own 21.5 million dwellings representing around 9.4% of the total housing stock. Each SHO owns a large number of dwellings, which means there are fewer people to convince of the need to make energy savings through building renovations, maximising the potentially high impact of decisions. Moreover, SHOs are responsible for maintaining and upgrading their properties in order to continue renting them. As such, SHOs are used to dealing with renovations on a professional basis.

The limited financial capacity of SHOs to realise energy renovations magnifies the importance of improving process performance in order to get the best possible outcomes. In the last 30 years numerous authors have addressed the need to improve the performance of traditional construction processes via alternative project delivery methods. However, very little is known about the specifics of social housing energy renovations processes, the feasibility of applying innovative construction management methods and the consequences for the process, for the role of all the actors involved and for the results of the projects.

The idea of a PhD thesis about social housing renovation processes originated from the participation of TU Delft as research partner in the Intelligent Energy Europe project SHELTER³, which was carried out between 2010 and 2013. The aim of the SHELTER project was to promote and facilitate the use of new models of cooperation, inspired by integrated design, for the energy renovation of social housing. The SHELTER project was a joint effort between six social housing organisations (Arte Genova, Italy; Black Country Housing Group, United Kingdom; Bulgarian Housing Association, Bulgaria; Dynacité, France; Logirep, France and Société Wallonne du Logement, Belgium), three European professional federations based in Brussels (Architects Council of Europe, Cecodhas Housing Europe and European Builders Confederation) and one research partner (Delft University of Technology).

The following two sections of the introduction give further insight into: (1) how European policies have focused on the energy savings potential of housing renovations and have identified SHOs as key actors to achieve the CO₂ reductions targets; and (2) the current characteristics of the European SHOs and their housing stock.

§ 1.1 Housing renovations, a European energy savings strategy

The ambitious targets defined by EU authorities in relation to climate change, reducing CO₂ emissions to 20% below their 1990 levels and increasing the share of renewable energy to 20% by 2020 (CEC, 2007), have brought the potential energy savings achievable in the EU building stock sharply into focus (Ekins and Lees, 2008). Buildings are the largest consumers of energy in Europe. In 2010, buildings consumed 39.8% of total final energy in the EU-27, compared to the 13.2% consumed by services and 26.6% consumed by households (European Union, 2012). It is expected that some older buildings will be replaced by new ones and the remainder renovated, to improve the average energy efficiency of the building stock (Economidou et al., 2011). The majority of new buildings are constructed in compliance with the prevailing standards. New buildings are, therefore, considerably more energy-efficient than older ones. For example, in the Netherlands the energy-efficiency of a building is expressed by the energy performance coefficient (EPC), a non-dimensional figure (Beerepoot and Beerepoot, 2007). The EPC required for new buildings has been reduced from 1.4 in 1994 to 0.6 today. The Dutch authorities plan to reduce the energy performance requirement to an EPC of 0.4 in 2015 and to an EPC of 0 in 2020, the equivalent to

3

SHELTER, www.shelterproject-iee.eu.

a Nearly Zero Energy Building (NZEB) (Maldonado et al., 2013). In fact, the energy-efficiency standards for new buildings in all EU Member States have been improved, particularly since the implementation of the Energy Performance of Building Directive (EPBD) which was issued in 2002, but was not implemented in all EU countries until 2009 (Andaloro, 2010). The EPBD includes the aims of achieving a Nearly Zero Energy Buildings (NZEB) standard for new buildings for 2020.

However, new construction is only a part of the solution, because the yearly building demolition ratio in the EU is estimated at only around 0.2% and the new building ratio at 0.5% (Economidou et al., 2011). The majority of the energy savings are expected to be achieved by renovating the current building stock. Several studies have addressed the savings potential in the residential sector. For example, Lechtenböhmer and Schüring (2011) conclude that there is huge potential for energy savings just through changes in the insulation levels of residential buildings: approximately 90 Mtoe by 2030 for the EU 27. The same study also indicates that the strategy for getting the best out of this energy savings potential is “a combination of higher quality energetic refurbishments which could be instrumented by a strengthening of building codes and better implementation of those into construction business and –probably most important- a significant ramp up of refurbishment rates”. Similar conclusions were found by Dall’O’ et al. (2012), who propose reducing uncertainty about the size of potential energy savings by setting up a municipal energy cadastre.

However, owners’ capacity to invest is a constraint on the degree of energy savings that can be achieved through the renovation of buildings. Specifically for the European social housing sector, it has been estimated that an additional investment of €180.6 billion will be needed in the period 2014-2020 in order to achieve the European energy savings targets (Bastiaanssen et al., 2014). In order to incentivise the renovation of existing buildings, with a clear focus on achieving substantial energy savings, several Member States of the European Union are designing policies of various kinds, such as subsidies, loans at advantageous rates, financial mechanisms, awareness campaigns and legislative changes. Member states reported their main national initiatives to the European authorities in their National Energy Efficiency Action Plans, which were published in 2007 and 2012 (European Commission, 2013). In 2013, the Intelligent Energy Europe project Energy Efficiency Watch published a report summarising best practices among European member states regarding energy policy for the residential building sector (Schüle et al., 2013). This report recommends an ideal policy package to create a balance between clear mandatory regulations, incentives, information and capacity building.

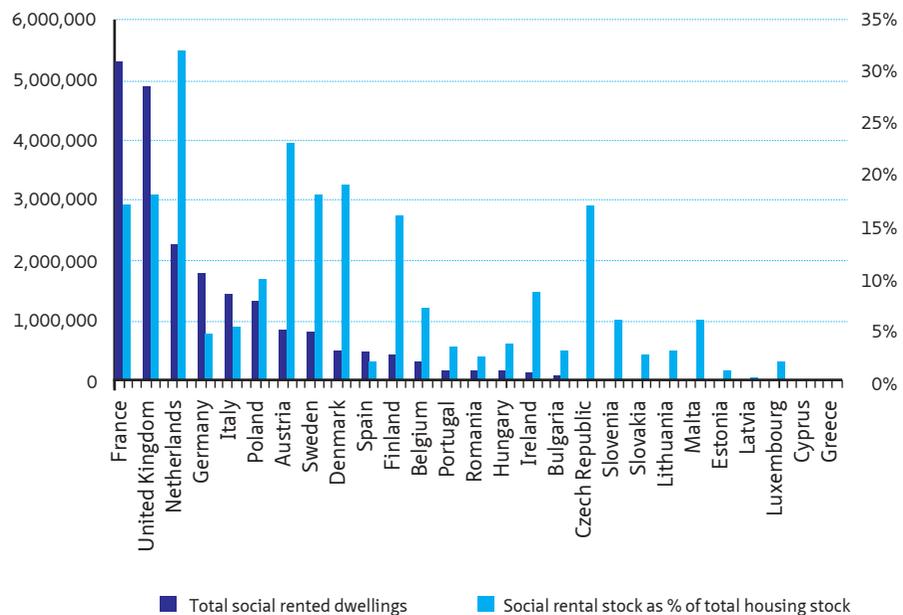
The opportunities and obstacles involved with these national policies were addressed in the study by Meijer et al. (2009), which highlights that current policies focus on the adoption of measures, but fail to address what happens after those measures have been put in place. A posterior study by Galvin and Sunnikka-Blank (2013) on thermal

retrofit policies based on the German KfW Energy-efficient renovation programme and comparing this to the UK's Green Deal renovation programme, addresses the miscalculations of the energy savings that can be made and the consequence for the economic viability of these measures. The difficulty of implementing a subsidy structure that will enable homeowners to renovate to high energy-efficiency standards at no extra cost is preventing energy renovations from becoming more widespread. In a similar study into the effectiveness of specific policy options in moving towards an energy-efficient residential stock, Uihlein and Eder (2010) arrive at similar conclusions to Galvin and Sunnika-Blank in regard to the economic viability of the energy measures. Uihlein and Eder conclude that the best strategy would be "to ensure that whenever a refurbishment takes place anyway, the best energy efficiency level possible is installed".

Today, many SHOs are already involved in renovation programmes because the majority of their building stock dates from before the 1980s and is in need of an upgrade to today's health, safety and comfort standards. This upgrade would therefore be the perfect moment to consider the inclusion of energy savings measures. Moreover, SHOs are professional owners, who are used to dealing with construction and maintenance issues. They are perfect candidates for implementing innovative construction management methods that could increase the performance of the energy renovation process. In fact, the suitability of SHOs as building owners for involvement in the national renovation strategies of European member states has been already addressed in some of the National Energy Efficiency Actions Plans at the national level. For example, in France as part of the building initiative of the Grenelle Acts, the objective was defined of renovating 800,000 of the most energy-inefficient social housing dwellings before 2020 (Plan bâtiment, 2013). In the Netherlands, the government together with the SHOs has signed an energy savings covenant for the rental sector (Ministry of the Interior and Kingdom Relations et al., 2012). This agreement defines the aim of upgrading the whole of the Netherlands' social housing building stock to an 'average' Energy Performance Certificate (EPC) rating of 'B'. In Finland, the government signed an energy-efficiency agreement for the building sector with the Finnish Association of Building Owners and Construction Clients (RAKLI); the agreement includes two operational programmes, one of which relates to residential lettings associations. Twenty-three residential lettings associations (representing 80% of the sector) joined the programme, which aims to reduce their total energy consumption by at least 7% by 2016, compared to energy consumption in 2010 (Ministry of the Environment et al., 2010).

§ 1.2 Social Housing Organisations as key partners to achieve the energy savings targets

Currently, SHOs own approximately 21.5 million dwellings in Europe representing around 9.4% of the total housing stock (Dol and Haffner, 2010). The percentage of social housing in different European countries varies considerably. Only in the Netherlands and Austria does it represent more than 20% of the total housing stock, while in Denmark, Sweden, United Kingdom, Czech Republic, France and Finland it represents between 15% and 20% of the total housing stock. In all the other countries, it is below 10%. However, for Germany, with 1.8 million rented social housing dwellings, and Italy, with 1.4 million rented social housing dwellings, the total numbers of rented social housing dwellings are still considerable (see Figure 1.1).



*Total dwelling stock (consisting of main residences + secondary residences + vacant dwellings) is not available for Austria and Italy. The total dwelling stock data used for these two countries correspond to the number of main residences.

FIGURE 1.1 Total social rented dwellings and percentage of social rental dwellings in relation to the total social housing stock in the EU-27 countries
(Data derived from Dol and Haffner, 2010.)

The beneficiaries of social housing are mainly groups that are targeted because of their social vulnerability, although in some countries social housing is open to all citizens (Pittini and Laino, 2011). Social housing is mostly rented, although dwelling sales and even intermediate forms of tenure are also possible. Because of the difficulty of

statistically identifying the stock of 'social' home ownership, the relative size of the sector is often illustrated by data on the social rental stock, as in Figure 1.1. In fact, the social rental stock is the dwelling stock that counts for the purpose of this research since these are the dwellings that are actually owned by the SHOs.

There is a great variety of SHO, including member state governments, local authorities, independent public bodies, co-operatives, private non-profit organisations and private for profit organisations. The origins of social housing at the beginning of the 20th century were mainly in the private sector, which responded to the emerging need for housing caused by industrialisation. After the Second World War, social housing became widespread in numerous European countries when organisations run by central government took on a significant role. From the 1990s until the present, social housing has tended to be transferred from government organisations to local and municipal organisations and to the private non-profit sector (Graëffly, 2006).

Currently, SHOs are going through challenging times because of the global economic crisis, which has considerably reduced the amount of subsidies available and transformed these organisations, which are required to maintain their public objectives but also to behave as market actors (Baldini and Poggio, 2013; Czischke, 2009; Driant and Li, 2012; Heijden van der et al., 2011). In fact, this dual character places SHOs in a complex legal situation with regard to the type of procurement there are entitled to engage in. SHOs are considered bodies governed by public law by EU authorities, and so they must comply with the requirements of the EU public procurement Directives – with the exception of Dutch SHOs, which have been considered autonomous, self-financing organisations since 1995 (Ronald and Dol, 2011) because they do not receive any direct subsidies from the national government (Priemus, 1996).

The public procurement directive is seen in the social housing sector as an impediment to fair and effective procurement. The opposition to the categorisation of SHOs as bodies governed by public law had led to legal discussions between the EU authorities and members states such as France and the UK. In the case of France, the discussion ended in the Court of Justice, which ruled against the French approach; in the case of the UK, the EU authorities' point of view was accepted without recourse to the court (European Commission - IP/05/44 - 14/01/2005). In a document that addressed the 2011 consultation for new EU public procurement directive, the European Social Housing federation CECODHAS stated that "the public procurement rules reduce, rather than increase competition for social housing production by effectively excluding many small and medium enterprises that are capable of undertaking the work" and that "the definition of 'bodies governed by public law' needs clarification". In fact, CECODHAS claims that "the receipt of public subsidies should lead to the application of the treaty principles of transparency but not of public procurement rules (which would add to their administrative costs)" (Cecodhas, 2011).

In summary, SHOs are professional property owners that aim to provide affordable, healthy and comfortable housing for their tenants. Despite the limitations on their financial and procurement activities, they are fully capable of adapting and implementing construction management methods to improve the performance of their construction processes (Priemus, 2012). Moreover, SHOs are committed to their tenants and, more generally to society, and sustainability has become an inherent goal for these organisations in recent years (Essa and Fortune, 2008; Smid and Nieboer; 2008). Energy renovations in social housing is therefore not only a matter of the European authorities, it is also a core issue for SHOs.

§ 1.3 Problem definition

The main aim of current social housing renovation projects is to upgrade health, safety, comfort and energy efficiency standards. SHOs also aim to maintain the renovated dwellings in a good state of repair until the next major renovation project is due to take place. Because of financial limitations and the inefficiency of the renovation process, the energy savings achieved through renovation are not currently achieving the same level as new-build construction. The potential energy savings of these projects are therefore not being fulfilled. Moreover, the misuse of building products and systems is causing design malfunctions in some cases, leading to cost overruns and headaches for maintenance teams.

Achieving the maximum potential for energy savings in renovation projects could be by improving the renovation process performance. Numerous authors argue that a higher degree of integration between project tasks could lead to higher process performance and in consequences deliver better project results (Pocock, 1996; Molenaar et al., 1999; Ibbs et al., 2003; Hale et al., 2009; El Asmar et al., 2013). This is particularly true when the aim is to achieve high sustainability and energy efficiency targets (Molenaar et al., 2010; Mollaoglu-Korkmaz, 2013; Ladhad and Parrish, 2013). However, the methods proposed in the existing literature have hardly been tested in actual renovation processes and almost never in residential building renovations. The specifics of renovation in social housing need to be taken into account when implementing the principles of project integration with the aim of improving the performance of energy renovation processes.

It is important to differentiate between process and project. A process is the “set of interrelated or interacting activities which transforms inputs into outputs” (ISO 9000:2005) while a project is a “unique process consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective

conforming to specific requirements, including the constraints of time, cost and resources” (ISO 9000:2005). The objective of this thesis is to analyse the processes used to deliver energy renovation projects.

The process performance is generally evaluated with the process efficiency, relationship between the result achieved and the resources used, and the process effectiveness, extent to which planned results are achieved (Sundqvist et al., 2014). In the case of an energy renovation project, where there is a higher energy savings target than in a regular renovation project, the process effectiveness becomes a crucial factor of the process performance.

The implementation of project integration principles will have consequences for the way of working of the demand-side, the SHO, and for the supply- side, the design, construction and maintenance companies. When project integration is applied more actors participate in the design phase, that is why it is of special interest to also analyse also the changes in the way of working of the architect, being the coordinator of the design phase: the architect.

§ 1.4 Aim of this study and research questions

As explained in the preceding sections, SHOs face a complex challenge. EU authorities have identified them as one of the key actors in their energy savings policies and, as such, SHOs have more ways of improving the quality of life of their tenants, upgrading health and comfort levels, lowering their energy costs and reducing fuel poverty through renovation projects. But this 'key actor' position also comes with the pressure of delivering the results expected by the EU authorities in terms of energy savings while maintaining financial integrity.

The aim of this study is to provide insight into the project delivery methods available to SHOs in energy renovation projects and identify how these methods could facilitate higher process performance. The main research question is:

How can Social Housing Organisations improve the performance of the energy renovation processes using more integrated project delivery methods?

The main research question is subdivided into five sub questions which will be addressed in Chapters 2 to 6 respectively. Chapter 2 is a literature review of the project management methods relevant to improve the performance of social housing renovations and the legal limitations on their application. Chapters 3 to 6 have been

written as individual studies and can be read independently. Chapters 3 and 4 have been published in international peer-reviewed journals and Chapter 5 and 6 have been submitted for publication.

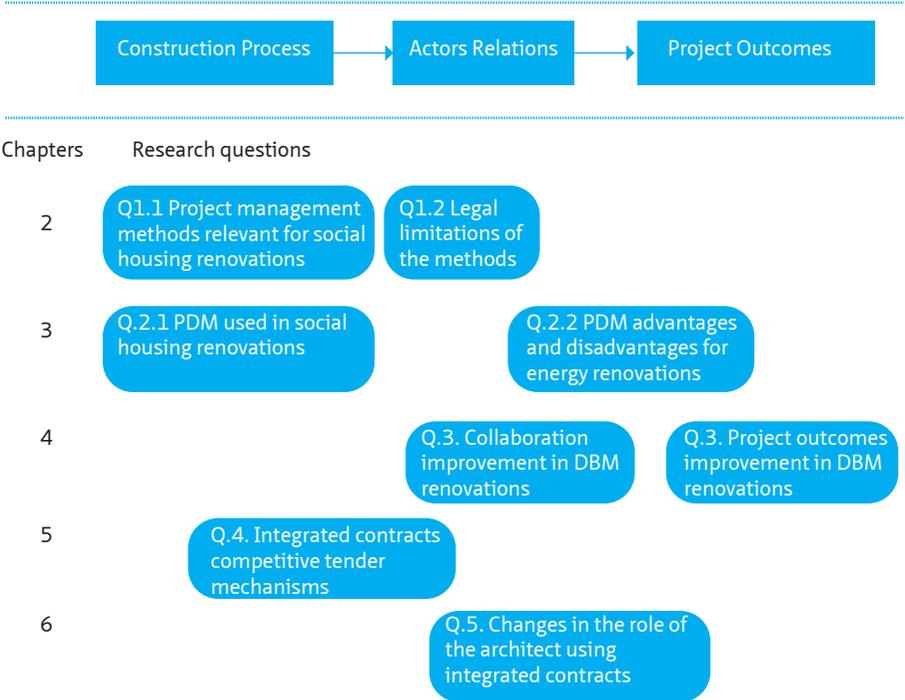


FIGURE 1.2 Relationship between research framework and research questions

The main topic of this research is the construction process in social housing renovation projects, focusing on how choices made in relation to the process affect the relationships between the participating actors and project outcomes, especially in terms of the effectiveness of delivering the aimed energy savings. Chapters 2 to 6 relate to the overall research framework topic. However, each of these chapters focuses on a restricted aspect of the topic, as outlined in Figure 1.2. The research sub questions addressed in each of the chapters are as follows.

Ch.2. Q1.1 Which project management methods are relevant to improve the process performance of energy renovations in social housing? Q1.2. What are the legal limitations on the application of these methods by public organisations?

The first research questions aim to establish an overview of the current project management methods in construction management literature that may be relevant to

improving process performance in social housing energy renovations, and to outline the legal limitations that need to be taken into account by public organisations that wish to apply these methods. The literature review reveals that renovation processes have not been the subject of much attention in construction management studies and that studies into the specifics of social housing are even harder to find. In fact, no information is available at all on the project delivery methods used by social housing organisations.

Ch.3. Q.2.1 What are the main characteristics of the project delivery methods used in European social housing renovations? Q2.2 What are the advantages and disadvantages of the various project delivery methods when applied to energy renovations?

The second research questions cover the knowledge gap identified previously: the project delivery methods used by social housing organisations in their renovation projects. The research question also aims to identify the advantages and disadvantages for each of the project delivery methods in relation to their energy savings potential. The study identifies four project delivery methods and ranked Design-Build-Maintain as the project delivery method that has the highest energy savings potential.

Ch.4. Q.3 How can the use of a Design-Build-Maintain contract improve collaborative working conditions for the actors involved while improving the project outcomes, particularly with regard to energy savings?

The third research question seeks deeper insight into the specifics of applying the Design-Build-Maintain project delivery method to social housing energy renovations. Particular attention is addressed to how the project delivery method influences the relationship between the actors involved and how it affects energy savings. The study concludes that Design-Build-Maintain has a positive effect on the degree of collaboration and the quality of the project outcomes. The study also identifies the crucial role of the tender procedure in achieving the goals of the social housing organisation.

Ch.5. Q.4 How do Dutch social housing organisations formulate optimal conditions for competitive tendering for integrated renovation projects?

The fourth research question aims to identify the key elements of the tender procedure for integrated contracts in social housing renovation projects, in order to enable social housing organisations to influence project outcomes.

Ch.6. Q.5 How do the role of architects in renovation projects of social housing organisations making use of integrated contracts differ from their role in previous comparable Design-Bid-Build projects?

Process changes imply role changes, previous questions focus mainly on the role of the SHO, the demand side. The aim of the fifth question is to identify the changes caused on the supply side from the perspective of the architect. Choosing the architect as the only supply-side actor analysed in depth is based on the results of the two

previous chapters. Process changes cause role changes for all actors, but because as a result of the process integration more parties are involved in the design phase, bringing the architect in an interesting new position as design coordinator. Moreover, as a result of the contractual forms used, there is a certain risk transfer and decision power transfer from the architect to the general contractor that could affect the architectural profession.

§ 1.5 Research methods

The two main research methods used in this thesis are literature review and case study research. Literature review is the main research method in Chapter 2 and a complementary research method in Chapters 3 to 6. The literature review covers a wide range of scientific publications about project management in construction mainly from the UK, US, Australia, the Netherlands, Hong Kong and Finland. Reports from Intelligent Energy Europe projects were also reviewed as well as legal texts in relation to the tender options available to European social housing organisations. Figure 1.3 describes the research methods used in each chapter and the origin of the data sources.

CHAPTERS	RESEARCH QUESTIONS	DATA SOURCES
2	Literature review (Scientific papers + IEE project reports + legal texts)	AU, NL, UK, US
3	5 case studies (case study = 10 interviews + maintenance strategy documents) 14 experts interviews 36 questionnaires	BE, IT, FR, UK SHELTER
4	2 case studies (case study = site visit + 5 interviews + tender documents + negotiation observation)	FR SHELTER
5	8 case studies (case study = 1 interviews + tender documents)	NL
6	13 case studies (case study = 1 interviews + project documents)	

FIGURE 1.3 Research methods used in each chapter

Chapters 3 to 6 also use case studies as their main research method. Construction projects in housing involve a high number of professionals and occur over a long period of time. External factors such as the economic and political situation or changes in construction or procurement regulations can have a considerable influence on the construction process. The specific situation of the construction sector in every country can also influence the process. In consequence, there are many interrelated variables that can have an influence on the dynamics of the process, and thus on outputs too. Research aiming to understand the reasons behind process changes need to dig deeper into the internal and external characteristics of the process, which makes case study research the most appropriate research method for this type of study. As Yin (1984) defined, a case study is “an empirical inquiry that: (1) investigates a contemporary phenomenon within its real life context, especially when (2) the boundaries between the phenomenon and context are not clearly evident”. Other researchers, such as Merriam (1988) and Stake (1995), also indicate in their definitions of case study research that it is suited to complex cases with a contemporary character that need to be investigated in their natural context.

Case study research has its origins in social sciences but it has also been extensively used in other more practice-oriented fields such as architecture, business management or construction management. Yin (1984) attempted to create a universal definition for case study research but several authors have also proposed field-specific definition and methodologies, such as Johansson (2007) for architecture, Eisenhardt and Graebner (2007) for business management and Taylor et al. (2011) for construction management. All the authors argue that case study research has a special importance in their field of knowledge and that it is a powerful tool with which to develop theory, provided the implications of working with a few cases and qualitative data are taken into account. Johansson (2007) presents the main challenges of case study research in his paper: (1) How to select the cases?; (2) How to validate the findings?; and (3) How to make generalisations?

The selection of the cases in case study research is based on a conscious choice – the cases are not representative of a particular population; they are selected because they are special in some way and offer the opportunity to capture a significant phenomenon under particular circumstances (Eisenhardt and Graebner, 2007). The validation of the findings is achieved by triangulation, which involves analysing the research question from multiple perspectives (Johansson, 2007). A generalisation is made by building up theory from the cases studied. The methodology for developing a theory from cases is outlined in the papers of Eisenhardt and Graebner (2007) and Taylor et al. (2011).

The recommendations made by Johansson (2007), Eisenhardt and Graebner (2007) and Taylor et al. (2011) have been taken into account in all the studies based on case study research included in Chapters 3 to 6. The main methodological principles in the four studies are the same. However, because of the difference in the number of cases analysed in each study, different choices were made with regard to certain details in the research method. The following paragraphs describe the overall method, and then the choices for each study will be explained.

The cases in each of the studies were selected because innovative project management methods were applied with the aim of better collaboration between the participating actors and because it was possible to collect high-quality information from these actors. The case, as an entity, differs between the first study, Chapter 3, and the other studies, Chapter 4 to 6. The case in the first study relates to the renovation strategy of a social housing organisation, while the cases in the other studies refer to a specific renovation project.

The data was gathered mainly through interviews but other methods were also used. There is a questionnaire in Chapter 3, observations in Chapter 4 and an analysis of tender documents in Chapters 4 and 5. Numerous pitfalls were identified that could have compromised the scientific validity of the data gathered through interviews for the case study research. In order to avoid the potential pitfalls while gathering, processing

and evaluating interview data, a protocol based on the recommendations of Eisenhardt and Graebner (2007) and Taylor et al. (2011) was defined. The protocol is summarised in Table 1.1 and was applied in all the chapters where case study research is used.

CASE STUDY RESEARCH PHASE	RECOMMENDATIONS
Case selection	Theoretical sampling of cases
Data collection and validation	Define data collection method and protocol
	Include longitudinal data collection
	Interviews that limit informant bias
	Replicate by multiple cases of subunits of analysis
	Involve multiple researchers or raters
	Triangulate across data types, across cases, and/or across subunits of analysis
Generalisation	Formulate new or refined propositional statements
	Rich presentation of evidence in tables and appendixes

TABLE 1.1 Case study protocol based on Eisenhardt and Graebner (2007) and Taylor et al. (2011)

For each of the case studies, the set of questions used in the interviews was validated in advance by external experts. The questions were written to avoid including any opinion that might influence the answer of the interviewee. In the invitation email and the telephone conversations to arrange the interviews, the opinion of the researcher about the research topic was not expressed. In the interviews, where possible, a closed question was asked first, followed by an open question on the same topic, for example:

- Question: How was the relationship with the client during this project compared to previous similar projects?
- Answers: (1) Better, (2) Similar, (3) Worse
- Question: Why?

The strategy of alternating closed and open questions facilitates comparison between cases. During the interviews, which lasted between one and two hours, the opinion of the researcher was not expressed at any point.

In the studies with a few case studies (Chapters 3 and 4), people with different perspectives were interviewed about the same topics. For example, in Chapter 4, the social housing project manager, the general contractor manager, the architect and the maintenance company manager were all asked about their perceptions of collaboration on a specific project. In the other two studies (Chapters 5 and 6), all the people interviewed looked at the case from the same perspective. To increase the validity of the results in these two studies, a larger number of cases was analysed.

In all the studies, the information gathered in the interviews was processed and compiled in comparison tables to facilitate analysis. In the first two studies (Chapters 3 and 4), there are only a few cases in each study. The results of the analysis are presented with comparison tables and a complete description of the context for each case. In the last two studies (Chapters 5 and 6), the results are also presented with comparison tables but without a complete description of the context for each case. Instead of the context description, there are numerous citations and examples from the cases presented to illustrate the arguments presented. “Presenting a relatively complete and unbroken narrative of each case is infeasible for multiple-case research, particularly as the number of cases increases. If the researcher relates the narrative of each case, then the theory is lost and the text balloons. So the challenge in multiple-case research is to stay within spatial constraints while also conveying both the emergent theory that is the research objective and the rich empirical evidence that supports the theory” (Eisenhardt and Graebner, 2007).

Chapter 3 gives an overview of the current renovation processes being implemented by SHOs and their advantages and disadvantages in terms of the potential for energy savings. To begin with, the renovation strategies of five SHOs from four European countries were analysed during a three-day visit to each of them. The SHOs were chosen because of their participation in the SHELTER project. Their involvement in the project ensured that they were organisations involved with alternative project management approaches and it also facilitated the numerous interviews with their employees and the companies working with them in the renovation projects. During every visit, an average of 12 interviews were carried out with the employees of the SHO and the companies involved in the renovation projects. A range of reports on the property management strategies of the five SHOs were also analysed. The results of the case studies were used to develop a questionnaire that was distributed to SHOs in eight EU countries, which was completed by 36 of them. To complement the advantages and disadvantages analysis of the identified process alternatives interviews were carried out with 14 experts from ten EU countries. The experts to be interviewed were proposed by the three European professional federations that participated in the SHELTER project: Architects Council of Europe, Cecodhas Housing Europe and the European Builders Confederation.

Chapter 4 provides an insight into the application of Design-Build-Maintain process in social housing renovation projects on the basis of two renovation projects carried out by French SHOs. The two projects were selected because they were some of the first social housing renovation projects in France to make use of Design-Build-Maintain contracts. Moreover, the two SHOs were partners in the SHELTER project, which facilitated the process of interviewing all the involved actors. The analysis is based on written tender documents, technical evaluation reports, observations made during the negotiation phase (in one of the cases) and interviews with the main actors involved at the end of the renovation work: SHO project manager, architect, technical consultant, construction company manager and maintenance manager.

Chapter 5 analyses the key elements of the competitive tender procedure for integrated contracts in social housing renovation projects. Eight Dutch renovation projects that made use of this procedure are analysed on the basis of written tender documents and interviews with property managers at the SHOs. The number of projects is limited to eight because this was the total number of social housing renovation projects that made use of competitive tendering identified after a broad national search.

Chapter 6 analyses the changes caused by the use of integrated contracts for social housing renovation projects on the supply side from the architect's perspective as a result of the previously identified interesting role changes in his profession. A broad search for social housing renovation projects that make use of integrated contracts resulted in a list of 21 projects. All architects participating in these projects were invited to participate in the research but only 13 accepted. The analysis is based on the interviews extended to those architects and the available public documents about the project developed by the SHOs and the other companies involved in the renovation.

§ 1.6 Scientific and societal relevance

This thesis will likely be of interest to researchers working in the field of construction and property management, for SHOs, to professionals involved in renovation projects and to the national and European authorities responsible for energy savings strategies. The research carried out in this thesis is consistent with the Research Program Housing in a Changing Society (OTB, 2014) of the Faculty of Architecture of Delft University of Technology. Specifically, it relates to the work of Vrijhoef (2011) focused on the use of supply chain integration methods for the construction sector and the work of Roders (2015) analysing the use of partnering methods by Dutch social housing organisations for the implementation of climate change adaptations. It also relates to the work of Mossel (2008) about the purchasing of maintenance services by Dutch social housing organisations and the work of Mlecnik (2013) about innovation-adoption strategies for reducing energy use in residential buildings.

This study provides researchers in the field of construction and property management with a broad overview of what a renovation project implies. Renovation projects differ to a certain extent from new-build projects, and the differences between the two types of procedures are highlighted. Moreover, construction and property management literature on the use of integrated approaches is based mainly on large and complex construction projects. This thesis offers researchers proof of the benefits and limitations of this approach in smaller and less complex projects. As such, it adds to the few previous studies covering similar types of projects, such as the Intelligent

Energy Europe project FRESH, which focuses on the use of Energy Performance Contracts in social housing renovations (Milin et al., 2011), or the study of Amaral Fernandes et al. (2014), which analyses the use of Project Alliancing in apartment renovations in Finland.

The use of an integrated approach to social housing renovation with the goal of high energy savings provides another dimension to the recent work on the use of integrated approaches which aim for highly energy-efficient and sustainable buildings. Specific attention is addressed to the mechanisms available for clients that wish to improve the process effectiveness and the degree of innovation achieved. This builds on the recent literature presented in Chapter 2, such as the studies by Molenaar et al. (2010), which look at best-value procurement practices for sustainable Design-Build projects in the public sector, the study of Mollaoglu-Korkmaz (2013) which examines the relationship between the choice of project delivery method and the degree of integration in delivering sustainable high-performance buildings, and the study of Straub et al. (2012) about innovative solutions in Dutch DBFMO projects.

This thesis also offers deeper insight into the changes in the role of the main actors caused by using integrated approaches and their perceptions of the improvement in collaboration and trust between these actors. This represents a contribution to the scarce literature that takes a multi actor perspective, such as the work of Blois et al. (2011) that analyses the relationship between the formal structures of the project team and the formal and informal mechanisms of coordination. And specifically, this thesis offers an extensive overview of the changes in the role of the architects, building on the work of Renier and Volker (2009) and Wamelink et al. (2012), which proposes the architect as a system integrator.

In this thesis, SHOs can find a classification of the renovation methods that are currently in use and the range of management tools that can be implemented in order to improve the quality of their renovation projects, especially with regard to energy savings. Even though the suitability of the different options presented in this thesis will depend on the specific characteristics of a given SHO, the two basic typologies of procurement (public or private) are examined in this thesis. The aim of the research is to provide enough insight into the analysed case studies to allow SHOs to easily identify the similarities and differences with their own situation and facilitate their decision on whether it would be appropriate for them to apply similar tools. The recommendations addressed to SHOs in this thesis go one step further when integrated contracts are used.

This thesis also provides the professionals involved in SHO renovation projects with information about the main implications for their profession of the wider use of the proposed tools by SHOs, and in particular the implications of using integrated contracts. Since the focus was mainly on the design phase of the renovation projects, a specific analysis of the changes in the role of the architect is given in Chapter 4.

Finally, national and European authorities can identify the way in which SHOs are limited or enabled by current national and European policies and legislation when it comes to renovating their building stock with high energy-efficiency targets. The procurement procedures available for the different types of SHOs are analysed in this thesis in order to offer recommendations on how to avoid some of the limitations and maximise the opportunities.

§ 1.7 Limitations

As explained in the research methods section, the conclusions drawn in this thesis are based on case studies. A specific protocol has been used to ensure the validity of the results, but the results still need to be viewed with some measure of caution. For almost all the actors involved in each of the projects that we examined, this was the first experience with this type of project delivery method. Wider-ranging research, conducted after the project delivery methods presented in this thesis have become common practice, could produce different results because the actors involved will have more experience with this type of process.

In terms of its content, this thesis focuses mainly on the management of renovation projects from the perspective of the SHO. The implications for supply-side actors have only been partially covered. Special attention has been addressed to the role of the architect because he has a central role in helping to integrate the knowledge of all actors in the design decisions and because his own project tasks could change depending on the level of project integration. The role of other professionals involved, the main contractor and specialised contractors, is analysed to a lesser degree of detail.

§ 1.8 Thesis structure

This thesis contains five studies that are presented in five chapters. The first study, Chapter 2, is a literature review that covers the main project management methods relevant to this thesis as well as the legal framework for tendering social housing construction projects. The other four studies are presented as individual journal articles. Two of these, Chapters 3 and 4, have already been published in international peer-reviewed journals, while the other two have been submitted for publication. Each

of the chapters follows the usual structure for journal articles and each is related to the research questions presented earlier in this chapter. The titles of the five chapters are:

- Construction management methods
- Project delivery methods in European social housing energy renovations
- Energy efficiency in French social housing renovations via Design-Build-Maintain
- Competitive tenders for integrated contracts for social housing renovation projects
- The role of the architect using integrated contracts for social housing renovation projects.

Chapter 7 summarises the main findings of these studies, brings together some of their conclusions and considers some questions for further research.

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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.

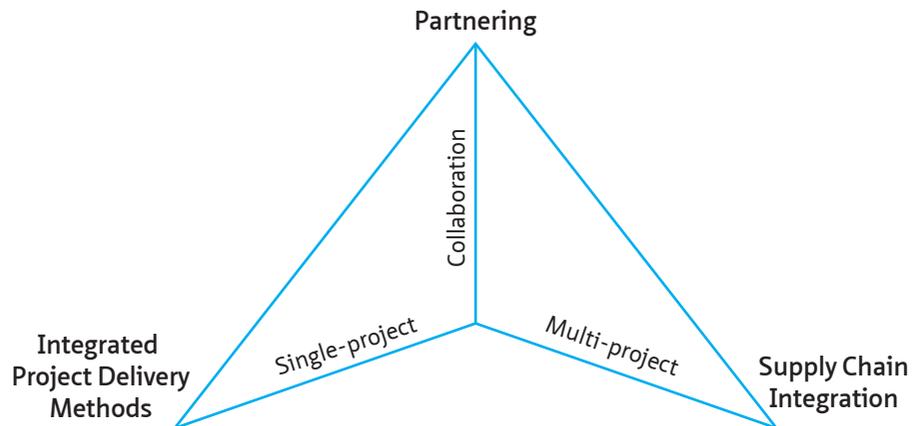


FIGURE 2.1 Overview of perspectives and methods for construction process performance improvement

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 CO₂ 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).

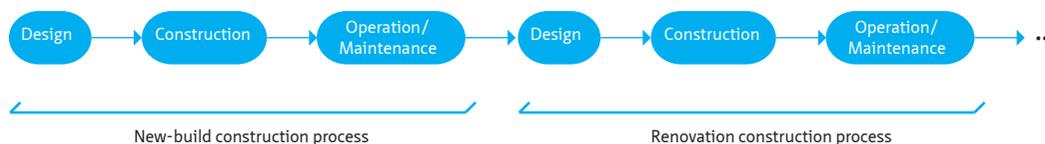


FIGURE 2.3 Phases of new build and renovation construction processes

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.

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.

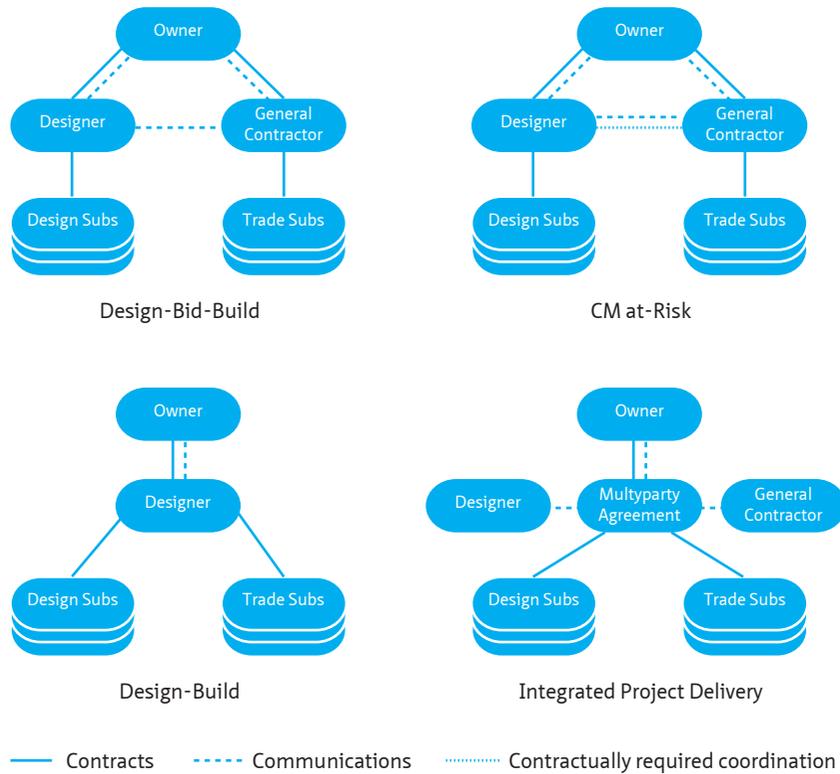


FIGURE 2.4 Project Delivery Methods: Contracts and communications

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.

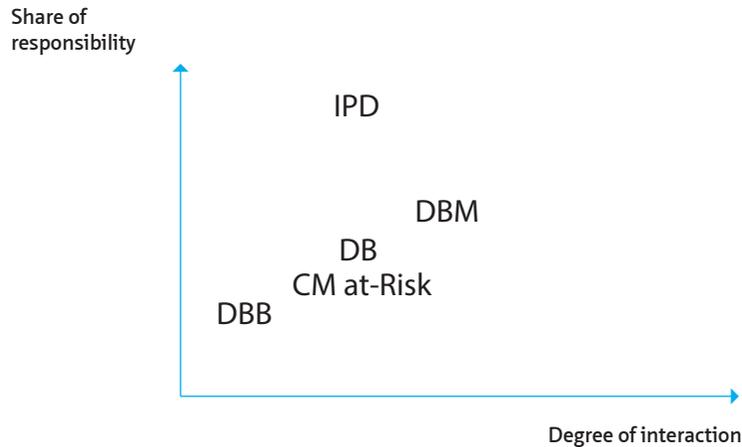
§ 2.3.1 Integrated project delivery methods

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.

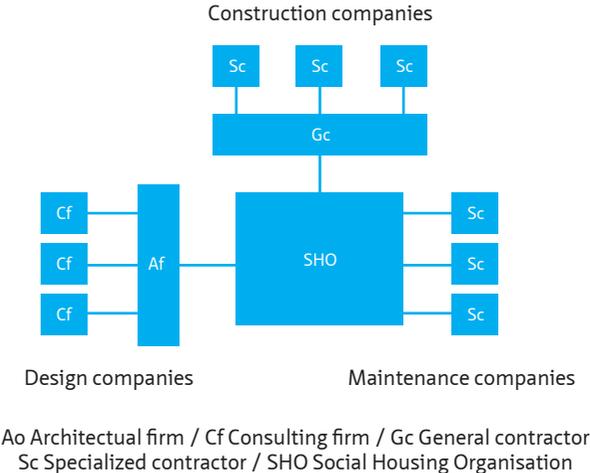


FIGURE 2.6 Possible relational structure of the organisations involved in a social housing renovation project

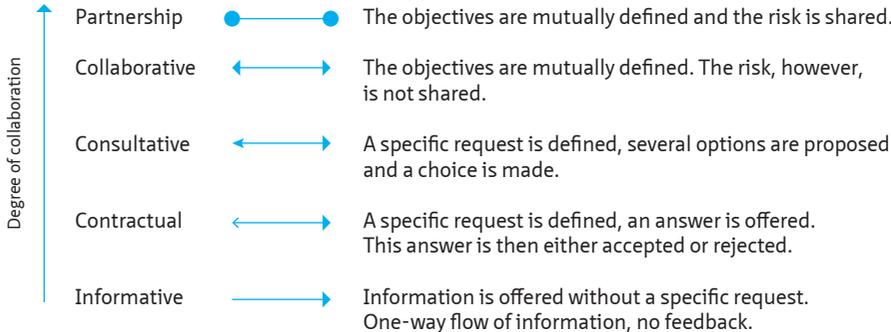


FIGURE 2.7 Relationship types between organisations in construction projects according to the degree of collaboration

§ 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).

Partnership	Duration	Project Strategic Both
	Actors	Dyad Multi-actor
	Development	Formal Informal Both

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

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 Anvuur and Kumaraswamy "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).

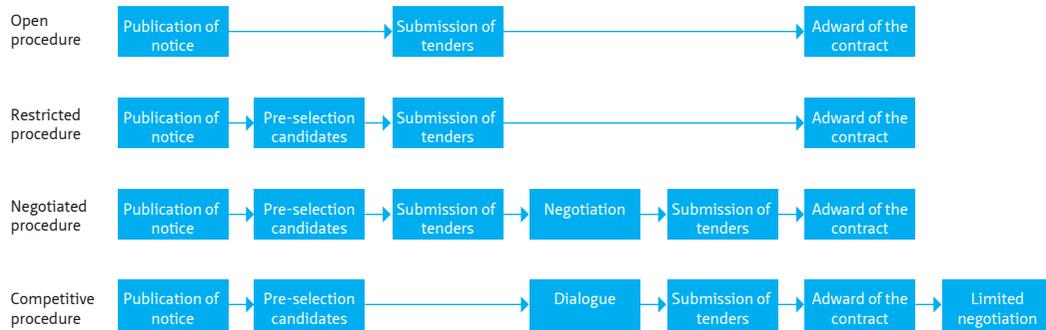


FIGURE 2.9 Public procurement tender procedures

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

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, it is 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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3 Project delivery methods in European social housing energy renovations

Explanatory note

Given the fact that there was no previous available information about the renovation processes carried out by European social housing organisations the first research paper presented in this thesis aims to identify the different types of renovation processes in use and to classify them by their project delivery method. With the aim of having a classification that includes all identified renovation processes next to the well-known project delivery methods, as been reviewed in Chapter 2, Step-By-Step is added as a specific project delivery method for renovation projects. Renovation of housing by Social Housing Organisations (SHOs) often is not an one-off process, but done step-by-step. In practice for performing each of these steps a project delivery method will be chosen, however focusing on the output of all these processes, step-by-step is treated as a project delivery method itself. The literature review and the survey have shown that construction management at risk is not used by SHOs for renovation projects or not seen as a project delivery method.

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Abstract

Purpose: The aim of the present study was to characterize the main project delivery methods that are used for the renovation of social housing, and to analyse the advantages and disadvantages of their application for energy renovations in order to assist social housing organisations making an informed decision on the choice of a project delivery method that suit their organizational context.

Design/methodologies/approach: The study is based on a literature review, five case studies of renovation processes by five social housing organizations in four EU countries, a questionnaire completed by 36 social housing organizations from eight EU countries, and a series of 14 interviews with energy renovation experts from 10 EU countries.

Findings: Four main project delivery methods were identified: Step-by-Step, Design-Bid-Build, Design-Build and Design-Build-Maintain. Design-Build-Maintain has the maximum potential to deliver energy savings because it facilitates collaboration between the various actors and promotes their commitment to achieving project goals.

Research limitations: The presented data is not meant to be representative for a country or the sector as a whole, but aims to indicate the main characteristics of the current energy renovations carried out by European social housing organizations.

Practical implications: Social housing organizations are provided with useful information about the advantages and disadvantages of different project delivery methods for energy renovation projects assisting them to choose for the option that suit their organizational context.

Originality/value: This study fills a knowledge gap about the project delivery methods currently used in social housing energy renovations and their potential for energy renovations.

Keywords: project delivery method, energy savings, renovation, social housing

§ 3.1 Introduction

In recent years, energy efficiency in the built environment has become one of the main objectives of European policies (Uihlein and Eder, 2009). The initial focus of these policies was on new-build construction, but as the amount of new building delivered each year represents only about 1% of the existing stock (Economidou et al., 2011), renovation of the existing building stock is gaining attention (Murphy et al., 2012).

In order to realize large energy savings through housing renovations, social housing organizations (SHOs) have a privileged position because they are the owners of large housing stocks (Pittini and Laino, 2012). European SHOs are involved in large national renovation programmes because a considerable part of their housing stock needs renovating, as the majority of their properties date from the 1960s and 1970s (UNECE, 2006). National renovation programmes have been focused mainly on improving the health and safety aspects of buildings; a good example is the UK Decent Homes Programme (House of Commons, 2010). Yet, as part of the declared energy-saving aims of EU authorities, SHOs are requested in new national energy savings policies to play a key role. Examples of this trend are the 'Plan Grenelle' in France (Plan Bâtiment Grenelle, 2010), the 'Plan of action energy savings in the built environment' in the Netherlands (Ministry of the Interior and Kingdom Relations, 2011) and the future 'Green Deal' in the UK (James, 2012).

There is no common definition of 'social housing' at the European level because it is characterized by a wide diversity of tenures, providers and beneficiaries. However, it is possible to identify a common aim, namely to provide decent and affordable housing (Czischke, 2009). Social housing is mostly rented out, although dwelling sales and even intermediate tenures are also possible. The providers (SHOs) can be public, non-profit, limited-profit organizations or, in some cases, even private for-profit

developers. The beneficiaries are mainly groups that are targeted because of their social vulnerability, although in some countries social housing is open to all citizens (Pittini and Laino, 2012).

The typical SHO is a public or semi-public organization that provides affordable rental housing. Because SHOs offer a public service, the majority must comply with public procurement regulations. Within the boundaries of public procurement regulations, energy performance regulations, their financial position and market circumstances, SHOs are making attempts to implement new renovation processes that promise lower costs and better performance, and take less time. The implementation of more effective project delivery methods for the renovation of social housing could be seen as a strategy to achieve the desired energy savings.

Little is known about the project delivery methods used by SHOs for the renovation of social housing, or about their suitability for achieving successful energy renovations. The literature on project delivery methods is based only on new-build processes and does not take into account the specificities of renovation processes. Therefore, the aim of the present research was to analyse the project delivery methods that are used for energy renovations in European social housing, and to establish their advantages and disadvantages.

The research method is described in the following section. This is followed in Section 3.3 by the literature review that was carried out to identify the renovation project delivery methods. The findings are presented in Section 3.4. The four main project delivery methods applied to the renovation of social housing are listed and their characteristics are described. Section 3.5 presents the conclusions and proposes further research questions.

§ 3.2 Research methodology

The underlying research questions were:

- What are the main characteristics of the project delivery methods used in European social housing renovations?
- What are the advantages and disadvantages of the various project delivery methods when applied to energy renovations?

Energy renovation in this research was considered a major renovation, resulting in an extension of the service life of the building and a significant improvement of its energy performance. We considered maintenance of the building – and especially that

of the building services – an integral part of the renovation process (particularly in the first years after completion), otherwise the actual energy savings cannot be measured (Haas and Biermayr, 2000; Hong et al., 2006). The initial status of the building defines the departure line. In order to evaluate the achievement of the renovation objectives, it is necessary to evaluate them during operation time. It is also necessary to include the modifications that were made during the maintenance phase in order to achieve the planned objectives. This is especially important to obtain the desired energy savings, which is the main objective of energy renovations.

Thus, energy renovations carried out by SHOs have several important characteristics that differentiate them from new-build processes:

- There is an existing building with existing energy-use related characteristics, such as insulation, glazing and building services.
- Each dwelling in a building has its own characteristics, and in many cases people are living in the dwellings and continue to do so during the renovation works.
- All the phases until the next renovation (i.e. design, construction and maintenance) are taken into account.
- Four main actors are usually involved: the SHO (the owner), the design companies, the construction companies and the maintenance companies.

Energy renovation projects are thus more complex than new-build projects. First, there are existing buildings and existing dwellings. Therefore, standard solutions cannot always be applied; specific solutions often need to be tailored. Second, the process includes the maintenance phase of the first years after completion. Third, because the maintenance phase is taken into account as part of the renovation process, maintenance companies may play a main role together with the SHO, the design companies and the construction companies.

The research consisted of a literature review, five case studies of renovation processes by five SHOs in four EU countries, a questionnaire completed by 36 SHOs from eight EU countries, and a series of 14 interviews with energy renovation experts from 10 EU countries.

The first phase comprised a broad literature review on construction processes, new build and renovations, and energy renovations in housing. A systematic approach was chosen by selecting all articles from the Scopus database (www.scopus.com) containing the keywords 'project delivery method' and 'procurement route'. In total, 74 papers were reviewed. The majority of the articles addressed the situation in the United Kingdom and the United States, but a few also referred to the situation in other countries, for example Finland, Hong Kong, Norway, South Korea, Sweden and Taiwan.

The second phase entailed an analysis⁴ of the current energy renovation processes of five SHOs in four European countries, namely Belgium, France, Italy and the United Kingdom. Members of the SHO and the actors involved in their housing renovations (such as architects, consultants, contractors and maintenance professionals) were interviewed during a three-day visit to each of the five SHOs. This qualitative analysis allowed the identification of six problem areas, namely strategy, work organization, design decisions, tendering and contracting, knowledge and influence on tenants' behaviour.

Based on the results obtained in the second phase, an in-depth electronic questionnaire on the renovation processes carried out by SHOs was elaborated and distributed among national contacts of the European Federation of Public Cooperative and Social-Housing (CECODHAS). The countries represented are Belgium, Denmark, England, France, Germany, Italy, Spain and Sweden. The national contacts were asked to distribute the questionnaire to SHOs that are known to have a strong interest in energy renovations. In total, 36 responses were obtained from different types of SHOs. Therefore, the analysis of the data is not representative of the country or the sector as a whole, but only indicates the main characteristics of the current energy renovations carried out by European SHOs.

The research was complemented by telephone interviews with 14 professionals in 10 European countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, Spain, Sweden and United Kingdom. The interviewees were asked for their opinion on how to improve collaboration amongst the actors involved in social housing energy renovations. All the professionals (3 architects, 2 technical advisors, 2 real estate advisors, 1 juridical advisor, 1 policy advisor, 2 politicians and 3 builders) have a direct relation with the renovation of social housing and are considered to have a good overview of the current situation. They were proposed by the three partner federations of the SHELTER project, that is, the Architects' Council of Europe (ACE), the European Builders Confederation (EBC) and CECODHAS.

4

In the framework of the SHELTER project of the EU Intelligent Energy Europe programme (www.shelterproject-iee.eu).

§ 3.3 Literature review

§ 3.3.1 New-build construction processes

Construction projects, like other complex projects, involve a large number of actors that interact in different phases of the process. The contractual relations, roles and responsibilities of the actors involved in this process are jointly referred to as the 'project delivery method' in the US literature and as 'procurement routes' in the UK literature. There are a multitude of project delivery methods in use. They are categorized by the US Construction Industry Institute (CII) into three main types: Design-Bid-Build (DBB), which is commonly referred to as the 'traditional' delivery method, construction management at risk (CM at-Risk) and Design-Build (DB) (CII, 1997). DBB and DB are the types most commonly used in Europe (RICS, 2007).

Numerous comparative analyses between project delivery methods have been carried out in the last 20 years (e.g. Ndekugri and Turner, 1994; Anumba and Evbuomwan, 1997; Akintoye, 2000; Pietroforte and Miller, 2002; Hale et al., 2009). In general, it is agreed that DB offers shorter lead times, the involvement of the construction companies in the design decisions, higher price certainty, better communication between the actors involved and reduced construction time compared to DBB. Moreover, clients perceive that DB delivers better value for money and causes fewer disputes.

Despite all the advantages presented in the various studies, there is a general perception that DB is not the best choice for all types of construction projects. Therefore, in addition to the comparative studies, the literature offers several methodologies to help in the selection of project delivery methods (Miller and Evje, 1999; Mahdi and Alreshaid, 2005; Chao and Hsiao, 2012). These methodologies are based on the analysis of such key factors as speed, price certainty, flexibility, quality standards, complexity, risk allocation, price competition and responsibility. But it is hard to evaluate their effectiveness, as the weighting of the different variables is highly dependent on the client's will (Chang and Ive, 2002).

The choice of a project delivery method seems to be related to the way the different construction sectors work. DB was first applied in US infrastructure projects as a result of the government's desire to transfer risk to private parties (Retherford, 1998). This trend evolved in recent years with the emergence of the Design-Build-Maintain-Finance-Operate (DBMFO) project delivery method (Witt and Liias, 2011). However, the transfer of risk from owner to contractor is accompanied by the transfer of control

in the project decisions. This dichotomy has been extensively covered by such authors as Friedlander and Roberts (1997), Ghavamifar and Touran (2010), and Osipova and Eriksson (2011).

Apart from the risk allocation, the relationships between the actors involved in the construction process also change in DB processes. Bibby et al. (2006) and Chang et al. (2010) analysed the actors' relationships and concluded that DB offers a better framework for establishing a strong collaboration than DBB. Yet to make it happen, there is a need for a proactive attitude towards collaboration among all the actors involved (Moore and Dainty, 2001; Plane and Green, 2012).

Collaboration in the construction industry is a key topic in the sector. Special interest was first shown in the 1990s when the US Construction Industry Institute (CII) published its report 'In search of partnering excellence' (CII, 1991); interest spread to other countries through the proposals for implementation formulated by Latham (1994) and Egan (1998) in the UK. Even though Latham and Egan did not indicate particular project delivery methods, they did clearly state the aim of achieving a better collaborative environment.

In the last decade, new project delivery methods that fit in the DB category have been developed with the aim of defining an improved collaborative framework; for example, project alliancing in Australia (Australian Department of Treasury and Finance, 2006; Hauck, 2004) and integrated project delivery in the USA (American Institute of Architecture, 2007; Kent and Becerik-Gerber, 2010). The spread of these new collaborative project delivery methods indicates the need for an integrative approach in order to obtain the best possible value project. Moreover, these new approaches are especially well suited to utilize performance-based specifications that facilitate the production of more sustainable and more efficient projects (Hamza and Greenwood, 2009; Molenaar et al., 2010).

§ 3.3.2 Renovation processes

The literature referred in this section relates to project delivery methods in new build because of the lack of literature on project delivery methods in renovation. Moreover, there is little literature related to energy renovations processes in housing. This is quite surprising, as EU authorities have targeted energy savings in the housing sector as one of the crucial elements of their CO₂ reduction policy (Council of the European Union, 2012). The literature that does refer to energy renovations is mainly based on evaluating the energy effectiveness of different building products and systems and their payback time (Papadopoulos et al., 2002; Verbeeck and Hens, 2005;

Harvey, 2009), and especially in Europe on the policies to be applied to promote the widespread use of this type of renovation (Mirasgedis et al., 2004; Tommerup and Svendsen, 2006; Amstalden et al., 2007; Zundel and Stieß, 2011). Nevertheless, an increasing interest in project delivery methods for energy renovations is foreseen due to the spread of energy performance contracting (EPC), which is currently mainly applied to the operation and maintenance of commercial buildings, but has potential in other sectors (Marino et al., 2011; Kellett and Pullen, 2012). In fact, EPC is currently being implemented in some pilot projects for the renovation of social housing, as reported by the Energy Europe project FRESH (Milin et al., 2011).

§ 3.4 Findings: energy renovation and project delivery methods

§ 3.4.1 Project delivery methods identified

From the five case studies, four main project delivery methods for the renovation of social housing were identified:

- Step-by-Step (SBS)
- Design-Bid-Build (DBB)
- Design-Build (DB)
- Design-Build-Maintain (DBM)

Figure 3.1 shows the four project delivery methods, the main actors, the building process phases and the contractual relations between the actors. In practice, the SBS project delivery method is a series of Bid-and-Build contracts. However, in the context of energy renovation, SBS is seen as a project delivery method itself. xz

Project Delivery Methods	Actors	Phases			Contractual relations
		Design	Build	Maintain	
SBS	SHO DC CC MC		—————		
DBB	SHO DC CC MC	—————	—————	—————	
DB	SHO DC CC MC	—————	—————	—————	
DBM	SHO DC CC MC	—————	—————	—————	

SHO: Social Housing Organisation / DC: Design Companies / CC: Construction Companies / MC: Maintenance Companies
SBS: Step-By-Step / DBB: Design-Bid-Build / DB: Design-Build / DBM: Design-Build-Maintain

FIGURE 3.1 Actors' phase involvement and contractual relations in energy renovations for social housing

Step-by-Step

Step-by-Step renovations can be considered a major renovation when the replacement of a series of building components results in the same condition of those components as after a renovation. In order to optimize the service lives of building components, an SHO might choose to split a major renovation into a series of minor renovations, for example roof insulation, insulation of façades, window replacement, heating system replacement, kitchen renovation, bathroom renovation, electrical installations and decoration. In that case, renovation activities will be carried out by different construction companies and at different times. Cost efficiency is achieved by procuring a large number of replacements only when a particular component has reached the end of its service life. This project delivery method will usually not contain a design phase because the interventions are mainly replacements of building products and systems. A designer would be required only if the appearance of a building is to be altered, structural alterations are to take place or complex building services are involved.

Step-by-Step renovations differ from planned maintenance in that the final status of the dwelling performs better than the initial one. Figure 3.2, which is based on the definition of planned maintenance given by Jones (2002) and that of renovation given by Pereira Roders (2007: 246), shows the difference between planned maintenance, SBS and major renovations.

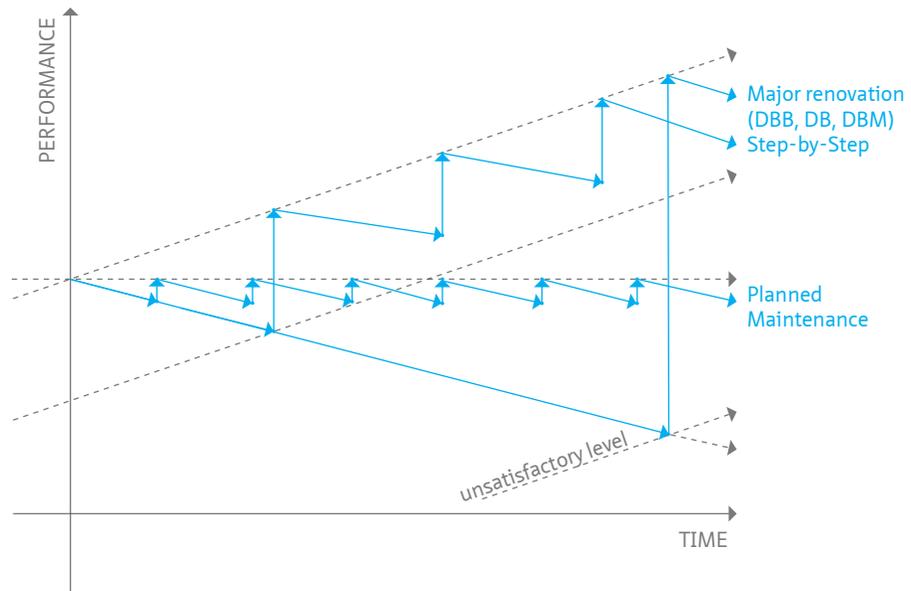


FIGURE 3.2 Step-by-Step renovation versus planned maintenance and major renovation

Design-Bid-Build

In DBB, the various contracted parties (design companies, construction companies and maintenance companies) are involved in the project one after the other. First, the SHO tenders the design work. The appointed design companies develop the technical specifications that will be used to tender construction works, and the successful contractor will deliver the specified works, albeit under the supervision of the designer. Once the works are finished, the responsibility for maintaining the building is transferred to the SHO's maintenance team, which arranges maintenance works, usually by contracting various specialist maintenance companies. To maintain building services, maintenance companies often have a contract with the SHO for a fixed duration (Millross, 2010). Tendering procedures for maintenance are unlikely to have any impact on or connection with tenders for renovation projects.

Design-Build

In DB, the SHO tenders the design and construction works in a single contract. The contracted entity could be a single company, with or without subcontractors, or a consortium that includes design and construction companies. Once the works are finished, the responsibility for maintaining the building is transferred to the SHO's maintenance team and the process continues as for DBB.

Design-Build-Maintain

In DBM, the SHO tenders the design, construction works and maintenance works in a single contract. Again, the contracted entity could be a single company, with or without subcontractors, or a consortium that includes design, construction and maintenance companies. In any case, the people in charge of the design, construction and maintenance are involved in the project from the design phase onwards.

§ 3.4.2 Results of the questionnaire

The results of the questionnaire confirm the common use of these four project delivery methods.

- SBS is the most commonly used project delivery method for social housing energy renovations: it is used by 32 of the 36 SHOs and is applied in 55% of their renovation projects (see Table 3.1).
 - DBB is the second most commonly used method: it is used by 34 of the SHOs and applied in 41.5% of their renovation projects. In new build, DBB is considered the traditional project delivery method, but in this survey it did not appear as the most used project delivery method, even though it is still used by the vast majority (96%) of the SHOs in some of their projects.
 - DB in renovations is implemented by some of the SHOs, but it is not a common practice: only four SHOs (from the UK and Denmark) use it in some renovation projects.
 - DBM is also not a common practice. However, it is used in four of the surveyed countries, namely Belgium, France, Denmark and Italy.
- SBS is the preferred option, used for more than 80% of the renovation projects, for SHOs that have a low proportion of tall buildings in their building stock (less than 10% of apartment blocks of more than 5 storeys).

	SBS	DBB	DB	DBM
Number of SHOs using	32	34	5	4
Percentage of projects using	55%	41.5%	1.5%	2%

TABLE 3.1 Number of SHOs implementing each project delivery method and total percentage of projects by project delivery method (n=36)

Of the SHOs, 85% use more than one project delivery method. Implementing SBS and DBB at the same time in different projects is the most common combination: it is used by 67% of the SHOs.

Most (63%) renovation projects are awarded using the most economically advantageous tender (MEAT) principles; the remainder (37%) are awarded according to the lowest price criterion. The majority (47%) of SHOs use MEAT to tender all their renovation projects, 38% make use of both awarding procedures and 15% award only to the lowest price.

A surprising result is that two of the analysed countries use only one awarding procedure: Belgian SHOs use only the lowest price criterion, while Spanish SHOs use only the MEAT criterion. In those cases where MEAT is used the award criteria relate to the experience of the contractor (82%), financial criteria (76%) and the availability of accredited specialists (65%). Other criteria – such as health and safety aspects, environmental impact or energy use – are also taken into account by some SHOs.

Descriptive specifications were made for 69% of the renovation projects. For the other projects, the SHOs made use of performance-based specifications. In three of the countries (Belgium, Italy and Spain), descriptive specifications are used in the vast majority of renovations projects.

In the opinion of the SHOs, the quality of their collaboration with other actors and of the collaboration among the different actors involved in the renovations is good or very good in most of the projects. However, maintenance companies seem to have less good collaborations, especially with design companies and construction companies (see Figure 3.3).

Because of the small sample and the fact that the vast majority of SHOs simultaneously use more than one project delivery method, it was not possible to relate the project delivery methods to the use of specifications and awarding criteria, or to the quality of the collaboration among the actors.

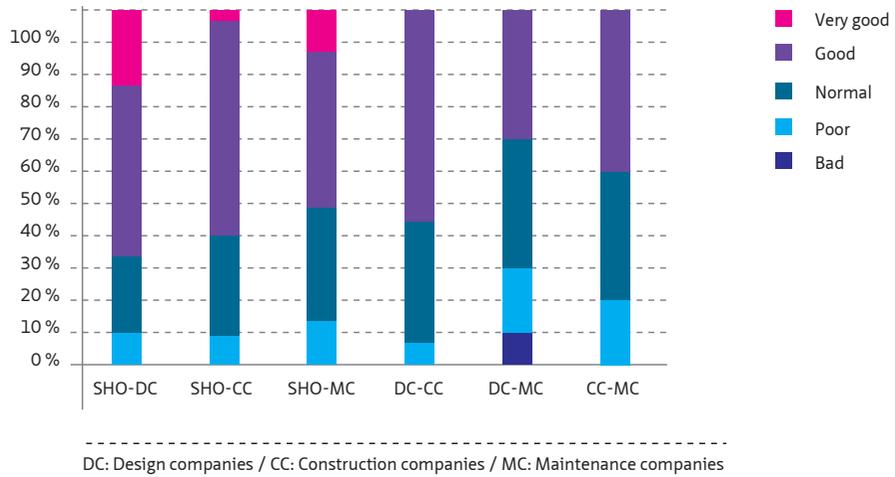


FIGURE 3.3 Quality of the collaboration among actors

§ 3.4.3 Advantages and disadvantages of the project delivery methods when applied to energy renovations

The advantages and disadvantages of the project delivery methods were identified through a literature review, case studies and expert interviews. Table 3.2 summarizes the advantages and disadvantages and relates the findings to the information sources.

		LITERATURE REVIEW	CASE STUDIES	INTERVIEWS
SBS	+	Split renovation into small interventions	Jones, 2002	UK, BE
	+	Components' whole-life costing approach	Straub, 2009	UK, BE
	+	Easier to secure specific subsidies		UK, BE
	+	Facilitates intervention over pepper-potted stock		UK
	-	Prevents interactions between components and leads to sub-optimal renovations	Nieboert et al., 2012; Tofield and Ingham, 2012	UK, BE
	-	Favours components with a short pay-back time		UK
		No cooperation between construction teams		UK, BE

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		LITERATURE REVIEW	CASE STUDIES	INTERVIEWS	
DBB		Benefit from potential interactions		UK, BE	
	+	All actors know their role well	Pietroforte and Miller, 2002; Hale et al., 2009	All	
		Well suited to tendering for the lowest price	Constantino et al., 2012	IT	Federation SHOs, BE Construction company, BE
	-	Lack of collaboration between actors	Pietroforte and Miller, 2002; Hale et al., 2009	All	
		Harder to manage liability	Pietroforte and Miller, 2002; Hale et al., 2009	All	
DB	+	Improves certainty of price for renovation works	Pietroforte and Miller, 2002; Hale et al., 2009		Consultancy company, DK Federation SHOs, SE
		Completed in shorter time than DBB	Pietroforte and Miller, 2002; Hale et al., 2009		Consultancy company, DK Federation SHOs, SE
		Performance-based specifications can be implemented	Hamza and Greenwood, 2009; Molenaar, Sobin and Antillón, 2010		Consultancy company, DK Federation SHOs, SE
	-	Direct involvement of SMEs more complicated	Morand, 2003; Peck and Cabras, 2011		Federation SHOs, AT Construction company, BE Construction company, FR
		Precludes referee role of design companies	American Institute of Architects, 2002		Construction company, FR Federation SHO, BE
		Presupposes a change in the role of the actors	Chang, Shen and Ibbs, 2010		Consultancy company, DK Federation SHOs, SE
DBM	+	Improves substantially the certainty of price	Witt and Liias, 2011	2 FR	Consultancy company, DK Federation SHOs, SE
		Transfer the majority of the risk of design failure	Friedlander and Roberts, 1997; Osipova and Eriksson, 2011	2 FR	Consultancy company, DK Federation SHOs, SE
		Easier to use performance-based specifications	Hamza and Greenwood, 2009; Molenaar, Sobin and Antillón, 2010	2 FR	Consultancy company, DK Federation SHOs, SE
		Improves cooperation between design companies, construction companies and maintenance companies	Osipova and Eriksson, 2011	2 FR	Consultancy company, DK Federation SHOs, SE
	-	Direct involvement of SMEs more complicated	Morand, 2003; Peck and Cabras, 2011	2 FR	Federation SHOs, AT Construction company, BE
		Precludes referee role of design companies	American Institute of Architects, 2002	2 FR	Construction company, FR Federation SHOs, BE
		Presupposes a change in the role of the actors	Chang, Shen and Ibbs, 2010	2 FR	Consultancy company, DK Federation SHOs, SE
		Presupposes change in management strategy		2 FR	

TABLE 3.2 Project delivery method advantages and disadvantages and sources of information

Advantages

SBS is per definition undertaken on an elemental basis; for example, all kitchens are replaced at the same time in order to maximize cost efficiency within a limited budget. When SHOs have limited resources, splitting the major renovation into small interventions allows them to reduce costs by delaying component replacements until the end of the components' service life (Straub, 2009). It can also be easier to secure subsidies for specific building products and systems than for a more complex set of interventions, because some funders might think their money was subsidizing other types of work in which they have no interest. The current building stock of numerous European SHOs is widely distributed over a large area (heterogeneously distributed stock – or in the UK, 'pepper-potted stock'; Tiesdell, 2004), because of social policies that intentionally spread lower income people across neighbourhoods to create more mixed communities and, especially in the UK, because of the sale of dwellings to tenants (Tunstall, 2003; Pittini and Laino, 2012). When individual dwellings are heterogeneously distributed, there is no geographically based economy of scale. SBS facilitates a degree of cost effectiveness where there is no geographical concentration.

Disadvantages

The lack of a design phase prevents interactions between different building components or systems. For example, if the roof and the heating system are changed at the same time, it would be easier to install solar thermal panels. In SBS, it is more likely that building products and systems with a relatively short pay-back time will be chosen, missing the opportunity to make bigger life-time savings. It is expected that over the long term, 'sub-optimal renovations' make it harder to achieve high energy-reduction targets and that a combination of energy investments with other investments reduces capital loss and saves money (Nieboer et al., 2012; Tofield and Ingham, 2012). If design companies are not involved, it is more difficult to identify the potential to add value to the property by building extensions or making beneficial structural modifications, such as widening doorways to facilitate wheelchair access. As well as the lack of a design element, the fact that the different interventions are done by different teams and at different times, prevents cooperation between teams that might also have been able to add value through innovation.

Design-Bid-Build

Advantages

In comparison with SBS, DBB offers the possibility to benefit from the potential interactions between different building components and systems, and is more likely to identify the potential for structural modifications that can add value to the property. It enables a comprehensive solution that can take into account the specific attributes of the property.

In comparison with DBM, DBB is the traditional project delivery method for major renovation projects; consequently, all actors know their roles and what to expect from the process, and the majority of contract documents are well established (Pietroforte and Miller, 2002; Hale et al., 2009). DBB is well suited to tender for the lowest price, which is still seen as the most objective contract award criterion in some EU countries, where it is often the mechanism used to prevent the misuse of public funds. Even in countries that promote the most economically advantageous tendering procedure, not all SHOs make this choice, as tendering for the lowest price is still allowed. This is mainly because tendering for the lowest price entails less administrative burden, in terms of time and responsibility for demonstrating that the selection process is transparent and objective (Constantino et al., 2012).

Disadvantages

The main disadvantage of DBB is the lack of collaboration between the design, construction and maintenance companies. For example, the design company may choose a particular heating system, whilst the construction or maintenance company knows that it does not perform as it should. If the design excludes collaboration, maintenance might be required that could otherwise have been avoided. It is also harder for the SHO to manage liability where any one of the three actors could be responsible for the inappropriate functioning of a heating system but cannot identify who is responsible.

Design-Build

Advantages

DB improves the price certainty for the renovation works, and the majority of the risk of design failure is transferred to the contractor, as a single entity is responsible for design and construction. Moreover, the majority of DB projects are completed within a shorter time frame than is the case with DBB projects, as there is a single tendering procedure and it is not necessary to have a definitive design before starting the works (Pietroforte

and Miller, 2002; Hale et al., 2009). The use of performance-based specifications can be implemented, because the single entity responsible for design and construction can offer its own solutions that fit with the specifications (Pless et al., 2011).

Disadvantages

Works and design can be tendered in DB only as a single contract, making the direct involvement of SMEs more complicated. It also precludes design companies from acting as referees between SHOs and construction companies. DB also presupposes a change in the role of the actors; as a consequence, extra effort and time is needed to adapt to the new situation (Chang, 2010).

Design-Build-Maintain

Advantages

DBM substantially improves the price certainty for the renovation works and also offers certainty about maintenance costs during a fixed period. The majority of the risk of design failure is transferred to the consortium, being the single entity responsible for the complete process of design, construction and maintenance (Witt and Lias, 2011). Social housing providers own and maintain their properties during a long period. After a renovation the dwellings enter a new functional service that will last for at least 20-30 years. This makes DBM very attractive for energy renovations. The use of performance-based specifications can be fully implemented, because the contractor is still contracted to the SHO for the evaluation of the performance parameters that is to be undertaken during the maintenance phase (Milin et al., 2011). Moreover, a better collaboration among design companies, construction companies and maintenance companies is achieved due the share of responsibility on obtaining the project outcomes, as reported in the two French case studies and supported by Osipova and Eriksson, (2011).

Disadvantages

DBM can be tendered only in a single contract, making the direct involvement of SMEs more complicated. It also precludes design companies from acting as referees between SHOs and construction companies. DBM also presupposes a change in the role of the actors; as a consequence, extra effort and time is needed to adapt to the new situation (Chang, 2010), and a change in the management strategy for the SHO. SHOs normally appoint maintenance companies to be in charge of specific building components and/or building services for either a part or all of their dwelling stock. When a DBM contract is awarded for a project, the maintenance of all property within that project will be carried out by the chosen company, which is unlikely to be the company

already contracted by the SHO to maintain its other properties. After awarding several projects using this project delivery method – which are independent events that are due to public procurement legislation – the SHO could end up having problems managing a large number of project-related DBM contracts and non-project-related maintenance contracts.

§ 3.5 Conclusions

The present research provides new insights into the currently used project delivery methods for the energy renovation of social housing, namely Step-by-Step (SBS), Design-Bid-Build (DBB), Design-Build (DB) and Design-Build-Maintain (DBM). SBS and DBB are the most commonly used project delivery methods, while DB and DBM are still used in a small number of projects. The vast majority of SHOs simultaneously use more than one project delivery method, mainly the combination SBS and DBB. In new build, DBB is considered the traditional project delivery method; however, the survey revealed that it is the second most commonly used project delivery method after SBS.

The DBM approach has the maximum potential to deliver energy savings, because it facilitates the collaboration between the different actors and promotes their commitment to achieving project goals. Furthermore, DBM offers a higher certainty of price and less risk of design failure compared to the other project delivery methods. However, the project delivery method by itself will not guarantee the achievement of targeted energy savings. Therefore, numerous factors need to be taken into account when considering changing the project delivery method.

The property asset management of the dwelling stock being renovated by SBS, which is focused on building elements and systems, is completely different from the property asset management of the dwelling stock renovated by DBB, DB or DBM, which is focused on complete properties. It is therefore unlikely that SHOs that are already applying SBS will switch to another project delivery method. Switching from DBB to DBM, or to DB, is feasible as they have a similar property asset management.

The change of project delivery method could be motivated by the use of energy performance guarantees offered by energy performance contracting, which is possible in the case of applying DBM. However, this choice is not suitable for all SHOs. For example, if an SHO has an in-house design team and is changing to DBM (or DB), its design team will not be involved in the project as the contractor will have its own design staff; if an SHO has corporate social responsibility towards SMEs and is changing

to DBM (or DB), it will be more difficult to keep SMEs directly involved as they will need to organize themselves into consortia; and if an SHO already has maintenance companies contracted to be in charge of all their housing stock, changing to DBM will create a conflict in their maintenance management, as for every property applying DBM there will be another maintenance company in charge of the maintenance.

The findings of this research are based on a literature review, five case studies, 36 questionnaires and 14 interviews. Therefore, a larger study covering all key EU countries is recommended. Additionally, in order to maximize the performance of social housing energy renovation processes, further research on the optimization of the four project delivery methods described needs to be carried out. Moreover, research should identify possible ways to overcome the current obstacles to the implementation of DBM.

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4 Energy efficiency in French social housing renovations via Design-Build-Maintain

Explanatory note

The findings in the previous paper indicate that the project delivery method used by European social housing organisations for their energy renovations with the higher potential to deliver energy savings and to deliver higher process performance is Design-Build-Maintain. The following research paper seeks for evidence of the expected potential by analysing two social housing energy renovation projects carried out by two Shelter partners. The projects are among of the first Design-Build-Maintain experiences carried out by French social housing organisations.

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Abstract

The renovation of existing building stock is seen as one the most practical ways to achieve the high energy savings targets for the built environment defined by European authorities. In France, the Grenelle environmental legislation addresses the need to renovate the building stock and specifically stresses the key role of social housing organisations. In recent years, French procurement rules have been modified in order to allow social housing organisations to make use of integrated contracts such as Design-Build-Maintain. These contracts have a greater potential to deliver energy savings in renovation projects than do traditional project delivery methods, like Design-Bid-Build. This is because they facilitate collaboration between the various actors and boost their commitment to the achievement of project goals. In order to evaluate the estimated potential of such contracts to achieve energy savings, two renovation projects (carried out by two French social housing organisations) were analysed from their inception until the end of construction work. The analysis is based on written tender documents, technical evaluation reports, observations of the negotiation phase (in one of the cases) and interviews with the main actors involved. Findings show that Design-Build-Maintain contracts do indeed offer substantial energy savings. Both projects achieved higher energy targets than those initially required. Furthermore, the energy results are guaranteed by the contractor, through a system of bonuses and penalties. Other

results demonstrate that, compared to previous Design-bid-Build renovation projects, these projects were completed in less time (from project inception to completion of the work) and at virtually the same cost. There has also been a substantial improvement in cooperation between the actors involved.

Keywords: building renovation, Design-Build-Maintain, energy savings, integrated contracts, social housing.

§ 4.1 Introduction

The authorities in Europe consider the reduction of CO₂ emissions to be a top priority. Ambitious goals have been set at European level. These involve cutting CO₂ emissions by 20% (relative to the 1990 levels) by 2020, and by 50% by 2050 (CEC, 2007). There has been a particular focus on the potential for saving energy in the EU's building stock, as this is considered to be responsible for 40% of EU energy demand (Ekins and Lees, 2008).

In France the 2007 political debate, known as Grenelle de l'environnement, led to legislation in the form of the Grenelle I Act and the Grenelle II Act (Whiteside et al., 2010), which set out a more specific course of action to reduce CO₂ emissions. The Grenelle legislation covers a wide range of activities (e.g. agriculture, transport, education), the construction sector being one of the most important. Several of its proposals address the need to speed up the rate of renovation in the residential sector and to boost the energy savings achieved. Additionally, social housing organisations (SHOs) are identified as key players in the process of achieving the set targets. The following objectives, presented in the plan bâtiment (buildings initiative of the Grenelle Acts), give an impression of the French government's ambitions in terms of renovating existing building stock (Plan bâtiment, 2013):

- Energy renovation of 400,000 dwellings annually, starting 2013.
- Energy renovation of 800,000 of the most energy-inefficient social housing dwellings until 2020.
- Start of energy renovation of all public buildings before 2013.
- Encourage energy renovation in the public and private service sectors between 2012 and 2020.

Social housing in France represents 17% of the total housing stock, accounting for over 3.1 million dwellings. A large proportion of social housing is provided by publicly and privately owned companies acting on a non-profit basis, which are known as HLM, Habitation à Loyer Modéré. Access to social housing in France is

limited by income ceilings that vary between regions and according to household size. The level of these income ceilings ensures that a large proportion of the population is eligible. However, 35% of social housing tenants currently live below the poverty line (Pittini and Laino, 2012).

The energy saving ambitions of the French government have led to the use of integrated building contracts, which include design and construction work for the renovation of the social housing stock. The procurement rules for construction projects developed by public entities in France are based on legislation governing public contracting authorities, known as the MOP Act 85-704 (French Republic, 1985), and the public procurement code, or code des marchés publics (French Republic, 2006a). As far back as 1985, the MOP enabled the use of integrated contracts (known as conception-realisation in France). However, its use was restricted to particularly complex projects (Act 85-704; A.18). In the subsequent years, specific legislation in other sectors allowed the Ministries of Internal Affairs, Justice and Defence, as well as health institutions, to use integrated building contracts. The 2009-323 Act (French Republic, 2009) enabled the use of integrated contracts for the renovation of social housing (2009-323 Act; A.110). Modifications made to the public procurement code in 2008 allowed the use of competitive dialogue as a tendering procedure for integrated building contracts in the field of building renovations (Code des marchés publics; A.36, A.37 and A.67).

If maintaining the building in question is also included in the integrated contract (Design-Build-Maintain (DBM)), it is possible to guarantee a building's energy performance after the renovation work has been carried out (Chalançon et al., 2010). This is especially useful for SHOs that aim to optimise energy savings in their renovation projects. In research undertaken by Salcedo Rahola and Straub (2013), DBM was identified as the project delivery method with the greatest potential to deliver energy savings in social housing renovations. The reasons given were that it facilitates cooperation between the various actors and boosts their commitment to achieving the project's goals.

In this study, the use of Design-Build-Maintain contracts for the renovation of social housing is evaluated using two case studies of renovation projects procured by SHOs. Our research question was: how can the use of a Design-Build-Maintain contract improve collaborative working conditions for the actors involved while improving the project outcomes, particularly with regard to energy savings?

Section 4.2 gives details of our research methodology, while Section 4.3 describes the individual case studies. Our findings are set out in Section 4.4. Section 4.5 presents our conclusions and indicates this study's limitations. It also contains various managerial recommendations and suggestions for further research.

§ 4.2 Research methodology

For the purposes of this study, we conducted a literature review and two case studies. The literature review covers papers (published in international journals) dealing with integrated building contracts and with the renovation of residential buildings. More specific information about social housing and energy renovation in France, French national legislation, and French public procurement rules was obtained from reports produced by various French organisations and European research projects.

Our case studies were two social housing renovation projects, implemented by two French SHOs:

- the renovation of 14 dwellings in a three-storey apartment block in Nurieux-Volognat (in south-eastern France) by the Dynacité SHO; and
- the renovation of 231 dwellings in four apartment blocks (ranging from 6 to 10 storeys) in Vitry-sur-Seine (in the southern suburbs of Paris) by the Logirep SHO.

Dynacité is a public social housing organisation that operates in four administrative divisions in eastern France (Ain, Isère, Rhône and Saône et Loire). It owns 23,395 dwellings that are occupied by approximately 59,000 tenants. Logirep is a private social housing organisation operating in two regions in the north of France (Île-de-France and Haute-Normandie). It owns 36,000 dwellings that are occupied by approximately 108,000 tenants.

Both case studies were pilot projects within the Shelter project, funded by the Intelligent Energy Europe programme. The Shelter project aims to facilitate the use of new models of cooperation in the renovation of social housing. Data on the case studies was obtained from:

- the tender documents: call for offers, specifications and preliminary designs;
- observation of the negotiation phase, in the case of Dynacité;
- interviews, carried out after the construction work was finished, with the social housing renovations manager, the social housing project manager, the construction company, the architect office and the maintenance company involved in both cases;
- the evaluation reports produced by the SHOs' project managers.

A social network approach, as defined by Kenis and Oerlemans (2008), was used to gain insight into the actors' cooperation structure. This approach focuses on the characteristics of the relationships rather than the characteristics of the actors themselves. The relationship types defined for the purposes of this study are based on the citizen participation ladder defined by Arnstein (1969), including the alternatives proposed by Biggs (1989). They were adapted to comply with the specific circumstances of the construction sector. The five categories give an indication of the information flows between SHOs, designers, construction companies and maintenance companies:

- Informative: Information is offered without a specific request. One-way flow of information, no feedback.
- Contractual: A specific request is defined, an answer is offered. This answer is then either accepted or rejected.
- Consultative: A specific request is defined, several options are proposed and a choice is made.
- Collaborative: The objectives are mutually defined. The risk, however, is not shared.
- Partnership: The objectives are mutually defined and the risk is shared.

§ 4.3 Case studies

§ 4.3.1 Initial status of the buildings

Both the construction and the finishing materials of Dynacité’s apartment block at Nurieux-Volognat were of good quality. All of the components and equipment used dated from the year of construction (1972). No major renovation had previously been carried out, except for the insulation of two of the building’s façades (using 40mm polystyrene panels) during the 1980s. The windows had wooden frames and were single-glazed, while heating and hot water were supplied by a collective heating system running on fuel oil. The building made use of natural ventilation.

Logirep’s four apartment blocks at Vitry-sur-Seine were constructed in 1966. The quality of the construction and that of the finishing materials was still good and no major refurbishments had been carried out previously. The building had prefabricated, non-insulated walls and single-glazed windows with wooden frames. The heating and hot water were supplied by a district heating system and the building made use of natural ventilation. A summary of the characteristics of the buildings prior to renovation is presented in Table 4.1.

	NURIEUX-VOLOGNAT, DYNACITÉ	VITRY-SUR-SEINE, LOGIREP
Year of construction	1972	1966
Type of building	Apartment block, 3 storeys	Apartment blocks, 6-10 storeys
Number of dwellings	14	231
Windows	Wooden frame, single-glazed	Wooden frame, single-glazed
HVAC	Collective fuel oil heater, natural ventilation	District heating, natural ventilation
Theoretical energy use	266 kWh/m ² /year	168 kWh/m ² /year
Actual energy use	256 kWh/m ² /year	242 kWh/m ² /year

TABLE 4.1 Initial characteristics of the buildings in question

At Nurieux-Volognat, actual energy use (energy consumption as measured by the meter) was close to the theoretical energy use (calculated using methods proposed by the Energy Performance Building Directive). At Vitry-sur-Seine, however, actual use exceeded theoretical use by a considerable margin. Accordingly, both cases conflicted with recent studies in which actual energy use in poorly insulated dwellings was shown to be considerably lower than the theoretical predictions (Majcen et al., 2013). Majcen's hypothesis is that people in poorly insulated buildings are well aware of their dwelling's energy performance and that they act accordingly, by not heating every room or by turning down the thermostat. The SHO managers interviewed expressed the view that neither of these hypotheses (which could be valid in dwellings with individual heating systems) apply in buildings with a collective heating system.

§ 4.3.2 Characteristics of the tenders

In both cases, the renovation projects were tendered as Design-Build-Maintain contracts. Dynacité tendered the contract using a reduced competitive dialogue, consisting of a single round of negotiations. Only three candidates responded to the call for tenders. This is the legal minimum for this type of procedure, as defined in Article 67 of the 2006-975 Decree (French Republic, 2006b). The three candidates were all consortia, two of which were led by national construction companies. The other consisted of local SMEs. The three candidates were invited to participate in the negotiation phase.

During the negotiation phase, the three candidates presented their renovation proposals to Dynacité individually, in separate meetings. They had the opportunity to ask questions and were given feedback. The consortia led by national construction companies proposed a preliminary design that largely reflected the requirements set by Dynacité. The consortium consisting of local SMEs failed to comply with all the requirements. During the course of the meeting, it became clear that this particular consortium had misunderstood some of the requirements involved.

After the negotiations had been completed, the candidates had two months to modify their proposals and submit their final offers. The best offer was selected on the basis of a set of award criteria, within which energy performance represented 20% of the total score (see Table 4.2). The SMEs' consortium achieved the highest score and was awarded with the contract.

The non-selected candidates were awarded a sum of €12,000. Dynacité set the minimum requirements to be met in relation to energy performance: a minimum of French Energy Performance Certificate level B, below a theoretical 90 kWh/m²/year, and a minimum reduction of 40% in real energy consumption for heating and hot water.

In the case of Logirep, the contract was tendered using the restricted procedure. Five candidates from a total of eight, the legal minimum for this type of procedure (as stipulated in Article 61 of the 2001-210 Decree; French Republic, 2001), were pre-selected and invited to submit their proposals. The five candidates were all consortia, each of which was headed by a national construction company. The selection was based on a set of award criteria in which energy performance represented 30% of the total score (see Table 4.2). Candidates who had submitted a proposal but who had not been selected were awarded a sum of €15,000. Logirep defined the following minimum requirements to be achieved in relation to the energy performance: a minimum of French Energy Performance Certificate label BBC "low consumption building label" (equivalent to less than a theoretical 104 kWh/m²/year) and a minimum reduction of 30% in the actual energy consumption for heating and hot water.

NURIEUX-VOLOGNAT, DYNACITÉ		VITRY-SUR-SEINE, LOGIREP	
Price	45%	Price	30%
Energy performance objective	20%	Energy savings proposed	10%
Works methodology	14%	Energy saving measures proposed	15%
Quality of the maintenance	14%	Obtaining BBC certificate	5%
Tenant's guidance	7%	Technical report	25%
		Architectural quality of the project	15%

TABLE 4.2 Award criteria and distribution used

§ 4.3.3 Nature of the construction work

The renovation project in Nurieux-Volognat, with a budget of €39,000 per apartment, included the renovation of kitchens, bathrooms, floors and electric systems in the apartments and repainting work, the renewal of garbage facilities and floors in the common spaces. Moreover, a set of energy-saving measures representing 45% of the total budget was implemented:

- wall insulation (14 cm polystyrene panels);
- roof insulation (30 cm glass wool);
- replacement of windows (PVC frame, double glazing 4/16/4 low emissive argon, $U_w < 1.4 \text{ Wm}^2\text{K}$);
- installation of hygro-sensitive mechanical ventilation;
- replacement of heating boiler and hot water supply (high efficiency gas boiler).

In Vitry-sur-Seine, the renovation project had a budget of €40,174 per apartment. This project involved the renewal of kitchens, bathrooms, floors and electric systems in the apartment, repainting work, the restructuring of green areas and renewal of garbage facilities in the communal spaces. In this project, the energy-saving measures represented 48% of the total budget and included:

- wall insulation (12 cm polystyrene panels $R=3.75 \text{ m}^2\text{K/W}$);
- roof insulation (13 cm polyurethane panels);
- replacement of windows (PVC frame, double glazing 4/16/4 low emissive argon, $U_w < 1.4 \text{ Wm}^2\text{K}$);
- installation of hygro-sensitive mechanical ventilation;
- replacement of the district heating system heat exchanger;
- installation of energy monitoring system in each dwelling.



Nurieux-Volognat project after renovation



Vitry-sur-Seine project after renovation

§ 4.3.4 Energy performance

In both cases, an energy performance certificate was issued based on the official theoretical calculation method. Both projects also involved maintenance contracts that included a guarantee of performance, in terms of actual energy consumption. It was the consortia themselves that proposed the figure for guaranteed actual energy consumption (see Table 4.3).

The energy consumption guarantee has the same period of validity as the respective maintenance contracts (8 years for Nurieux-Volognat and 4 years in the case of Vitry-sur-Seine). According to the terms of the contracts, no penalties may be imposed during the first year in the event of under-performance. From the second year onwards, if the reduction in energy consumption is higher than the level specified in the contract, the gains are to be shared equally between the consortium and the tenants. In the event of underperformance, however, 100% of the amount involved is to be covered by the consortium. The difference between theoretical energy use and guaranteed energy use results from the uncertainties involved in predicting user behaviour. Indeed, the consortium members interviewed indicated that this is particularly applicable to buildings with a collective heating system.

	NURIEUX-VOLOGNAT, DYNACITÉ	VITRY-SUR-SEINE, LOGIREP
Theoretical energy consumption	89 kWh/m ² /year	65 kWh/m ² /year
Guaranteed energy consumption	166 kWh/m ² /year	145 kWh/m ² /year

TABLE 4.3 Energy use after renovation

§ 4.3.5 Characteristics of the relationships

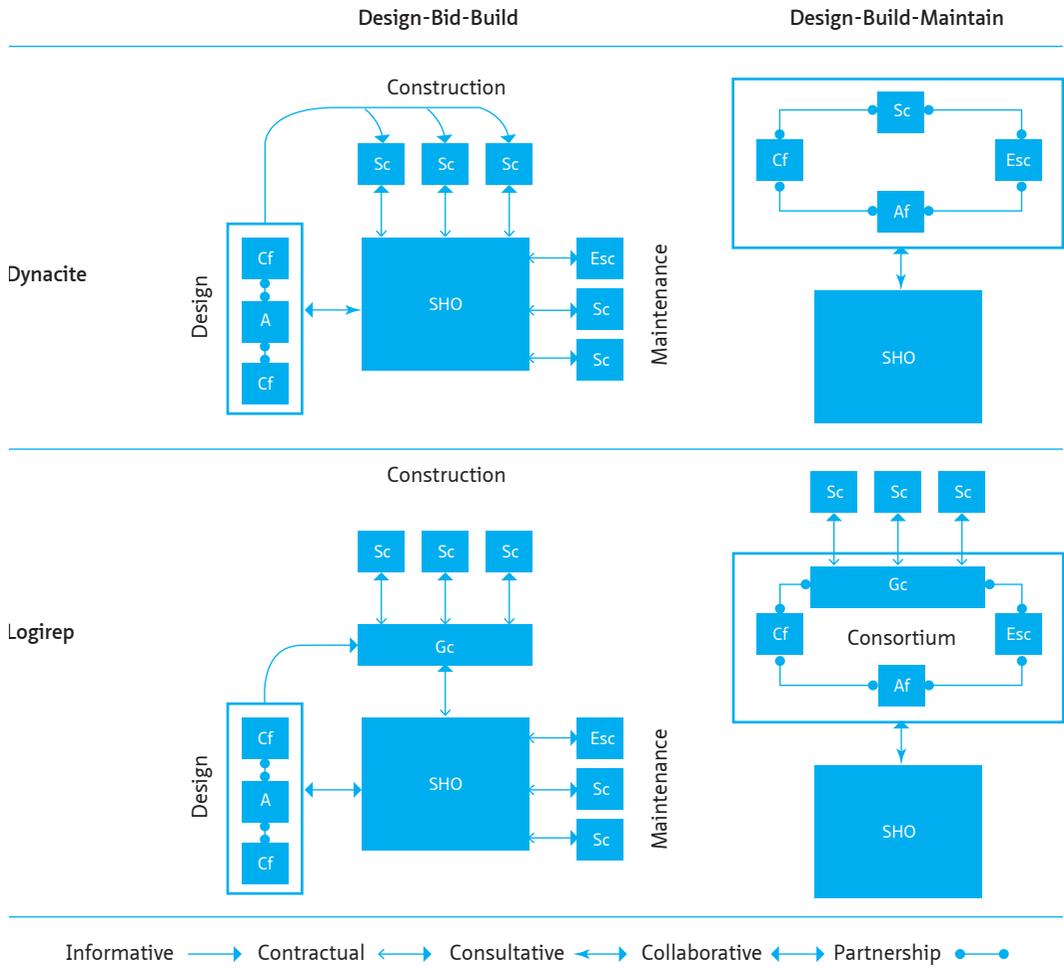
The common project delivery system used by Dynacité for major renovations is the traditional Design-Bid-Build (DbB) model. The design services are tendered in a single contract, which in France is called maître d'œuvre (project manager). The maître d'œuvre is usually a group of design companies led by an architectural firm. Using the technical documents produced by the design companies, the construction work is tendered by Dynacité in the form of multiple contracts. Dynacité usually divides the work into lots to facilitate the involvement of local small and medium-sized enterprises (SMEs). The maintenance services are contracted, per service, for a part of the entire building portfolio. Of the various maintenance services contracted, the energy services contract is the largest. The energy services company is responsible for maintaining

the energy systems as well as for the supply of energy. The design companies have a consultative role. During the design process, they propose a range of design options in response to requests from the SHO. The relationships between the SHO and the other contracted parties are purely contractual in nature, as the SHO is free to accept or reject the answer to its specific request. The relationship between the design companies and the specialised contractors is purely informative in nature, being restricted to a one-way flow of information (see Figure 4.3).

While common project delivery system used by Logirep is also based on the traditional DBB model, there are two major differences in terms of the renovation processes used. Since Logirep is a private SHO, if the total price of a bid is below a certain threshold, it does not need to comply with French public procurement rules. However, it must comply with its own procurement code, which requires a minimum number of offers rather than a public call. The amounts involved when contracting out design services often fall below this threshold. As a result, candidates are chosen from among a restricted number of design companies that the SHO has worked with in the past. This is why their relationship is considered 'collaborative' rather than 'consultative' (see Figure 4.1). The second difference is that Logirep usually tenders the construction work in a single contract, so the successful companies tend to be general contractors.

In both Design-Build-Maintain projects, the various companies contracted directly by the SHO were all consortia. The relationship between the various companies in a consortium can be seen as a partnership, as the consortium's objectives are mutually defined. For Logirep, the specialised contractors were not part of the consortium, since they were contracted by the general contractor.

The two cases studied involved quite different relationships between the SHO and the consortium. In the case of Logirep, the relationship is contractual. Logirep tendered the contract according to a restricted procedure. Accordingly, the pre-selected candidates immediately presented a preliminary design in response to a request from the SHO. In the case of Dynacité, this relationship can be considered consultative. Dynacité tendered the contract using a reduced competitive dialogue, consisting of a single round of negotiations. During these negotiations, the candidates participating in the competitive dialogue each presented a preliminary design to the SHO, together with a limited range of alternative options. Each candidate had an individual meeting with the SHO, which then provided feedback on the design proposal and its alternatives. In this course of this meeting, the SHO did not make a definitive choice from among the alternatives, however it was able to indicate its preferences. Following this meeting, the candidates each submitted a modified preliminary design.



Af Architectural firm / Cf Consulting firm / SHO Social Housing Organisation
 Gc General contractor / Sc Specialized contractor / Esc Energy services company

FIGURE 4.1 Common relations among actors in Design-Bid-Build and Design-Build-Maintain contracts of Dynacité and Logirep

§ 4.4 Findings

Both DBM projects achieved their energy savings targets and even surpassed the minimum requirements. These projects were completed in less time (from project inception to completion of construction) and at virtually the same cost (in terms of design and construction) as other, similar, DBB projects. Moreover, the general perception among the actors involved was that communication had been improved and mutual conflicts reduced. Previous studies on integrated contracts in other construction sectors delivered similar findings in terms of time-use, costs, and the relationships between individual actors (Hale et al., 2006; Koppinen and Lahdenperä, 2007; Molenaar et al., 2010; Palaneeswaran et al., 2003; Pietroforte and Miller, 2002).

At this stage it was not possible to verify the building's actual post-renovation energy consumption, given the limited amount of time that had elapsed since the work had been completed. The guarantee of energy consumption defined in the maintenance contract can be used as a performance indicator for energy efficiency. Dynacité required a 40% reduction in energy consumption, and the winning consortium provided a contractually guaranteed cut of 42.5%. Logirep required a 30% reduction in energy consumption, and the winning consortium provided a contractually guaranteed cut of 40%.

The total duration of the project was reduced in both cases. There were also changes to the length of individual project phases. In the case of Dynacité, the total duration of the project (from inception until the end of construction work) was cut by 3 months (relative to a conventional DBB renovation project with similar characteristics), which is equivalent to an 11% reduction in time. The corresponding figures for Logirep were 1 month, and 2.5%. In the case of Logirep, the project remained on stand-by for five months at the end of the design phase, as various internal financial agreements were not completed on time. Without this delay, the reduction involved would have been 15% (see Table 4.4). The SHOs believe that future projects involving DBM contracts could probably reduce this time by a further one or two months. This is because the design work on the new process is now complete, and the new contract documents have already been created, so no more time will need to be devoted to these aspects during the pre-tender phase.

The flow of information was reported to be higher during the initial stages of the project (the tender and design phases) and lower during the construction phase. It was also stated that the meetings were less formal.

DYNACITÉ	SHO		DC		CC		MC	LOGIREP	SHO		DC		CC		MC		
SHO	IF	M	-	-	-	=		SHO	IF	M	+	=	+	+	+	+	
	C	T	=	=	-	+			C	T	-	+	-	=	-	=	
Dc	=	-	IF	M	=	=		Dc	=	+	IF	M	+	=	=	=	
	=	+	C	T	-	+			-	+	C	T	-	=	=	=	
Cc	+	+	+	+	IF	M		Cc	+	+	=	=	IF	M	+	+	
	=	+	-	+	C	T			-	+	-	=	C	T	-	+	
Mc	+	+			+	+	IF	M	Mc	=	+	+	+	+	+	IF	M
	-	+			-	+	C	T		=	=	=	+	-	+	C	T

Dc: Design companies / Cc: Construction companies / Mc: maintenance companies
 If: Information flow / M: Meetings / C: Conflicts / T: Trust / +: more / -: equal / -: less

TABLE 4.5 Actor relationship evaluation compared to previous experiences of Design-Bid-Build

However, a deeper analysis of the relationship between the actors did yield some specific details. In the interviews, every actor was requested to evaluate their relationship with each of the other actors involved in the project. They had to indicate whether this was better, unchanged or worse, relative to their previous experiences of DBB, and to give reasons for this view. The evaluation of the relationship was based on four parameters: flow of information, meetings, conflicts and trust (see Table 4.5). In the case of Dynacité, there was reduced information flow and there were fewer meetings with contractors than in previous projects. This is because, in the past, a number of specialized contractors had to be commissioned directly. Using the present approach, the coordination role is transferred to the consortium. Dynacité found that reduced communication did not impact the trust that they had in their contractors.

In both cases the maintenance companies participated less in the process than the other actors. One unusual aspect of the Dynacité project was that the maintenance company contact person was switched during the process. This had the effect of reducing the company's presence at the regular team meetings. As a result, the relationship with the maintenance company was not evaluated. In the Logirep project, the maintenance company did participate in the regular meetings, but the other actors felt that it only played a minor part, and that its involvement was mainly limited to the design phase. On the other hand, in both cases, the maintenance companies believed that even making a minor contribution during the design phase represented a major step forward. They had gone from a situation in which they had no influence at all in the design to one in which they could be sure that the installations they would have to maintain, would meet all their requirements perfectly.

§ 4.5 Conclusions

We analysed two French social housing renovation projects (from inception to the end of construction work) that used the DBM project delivery method rather than the usual DBB method. We demonstrated that it is possible to engage the design companies, construction companies and maintenance companies to achieve energy savings that exceed those stipulated by the SHO and to obtain a guarantee of results. This approach also made it possible to reduce the duration of a project, while keeping the costs involved approximately equivalent to those incurred by DbB renovation projects. The collaborative set-up defined by the DBM process also resulted in improved relationships between the actors involved. However, our analysis of these relationships indicated that there is still room for improvement, particularly with regard to the maintenance company.

The case studies demonstrate that the use of Design-Build-Maintain project delivery in the renovation of social housing is a good strategy for improving energy savings. If such savings are to be achieved, it is necessary to define:

- realistic but ambitious minimum requirements;
- clear and measurable award criteria that stress the importance of achieving high energy savings; and
- a guarantee mechanism that is fair and robust.

However, in order to profit from these potential benefits, the following conditions need to be taken into consideration:

- the scale of the contract must be large enough to ensure that any compensation paid to non-selected candidates does not adversely affect the total cost of the project;
- the SHO's maintenance strategy needs to be flexible enough to handle maintenance contracts that are project-related as well as maintenance stock-related contracts.

The study involved two pilot projects in France. This sample size is too small to support any general conclusions. However, this study's conclusions could be of benefit to SHOs in France and other European states, given their common objective of achieving substantial energy savings in renovation projects. The scope for potential energy savings clearly depends on the initial consumption figures. Moreover, project results can vary considerably depending on whether the dwellings in question have individual or collective heating systems.

The social network approach used in this study has helped to identify the changes in relationships between the main actors involved. Further research is needed to extend the analysis to every one of the actors involved and to evaluate the changes in their relationships in greater detail.

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5 Competitive tenders for integrated contracts for social housing renovation projects

Explanatory note

The findings in the two previous research papers show that Design-Build-Maintain is the project delivery method that can offer the best process performance in the case of social housing energy renovations. The analysis of two Design-Build-Maintain energy renovation projects in the previous research paper highlighted the crucial importance of the tender procedure in order to profit from all the potential of integrated project delivery methods. The following research paper aims to gain insight in the characteristics of the tender procedure for integrated contracts, DB and DBM (the process tender for different types of integrated contracts is the same). The previous papers also identified the constraints imposed by public procurement regulations for the tender procedure of integrated contracts. The selected case studies for the following research paper are all from the Netherlands. In all selected cases there is a clear commitment for transparency during the complete tender procedure, but Dutch social housing organisations are not obliged to comply with public procurement regulations. The reason Dutch social housing renovation projects were selected is to analyse tender procedures with an aim for transparency but with less constraints to apply innovative mechanisms. This analysis could be of special interest to the Dutch and also to the European social housing organisations.

Salcedo Rahola, T.B. and A. Straub (submitted for publication)

Abstract

In recent years European Social Housing Organisations and European authorities have devoted particular attention to the renovation of the European social housing stock. The reasons are twofold: first, the stock is aging, and secondly, it offers potential for energy savings. Recently, in the Netherlands, where social housing accounts for 32% of the total building stock, the national government and the social housing organisations signed an energy-saving covenant in which the social housing organisations agreed to upgrade the entire social housing stock to an average energy performance certificate rating of B. The terms of the covenant have forced social housing organisations to embrace integrated contracts and competitive tender procedures in an effort to find ways to improve the efficiency of renovation processes and increase the outputs.

These contracts focus particularly on energy savings. In this research project eight competitive tenders for integrated contracts for social housing renovation projects were studied via a tender document analysis and in-depth interviews with the social housing property managers. Tender procedures were analysed by comparing the schedule, the preconditions for the candidates, the minimum requirements, and the award criteria. Characterisation of the tender elements enabled the researchers to identify the mechanisms applied by the social housing organisations to influence the ambition, collaboration and long-term view of the companies concerned. The ambition was sharpened by the competitive nature of the tender but the potential for minimum requirements and award criteria in this regard was not fully exploited. The collaboration was clearly promoted by setting a short deadline for developing the design proposals. Other strategies, involving, for example, the number and type of meetings with the social housing organisation, and conditions for the nature and composition of the consortia were applied by only some social housing organisations. The long-term view was broached by the inclusion of an optional maintenance contract in some cases, but the elective character of the contract stood in the way of any influence it may have exerted.

Key words: competitive tender, Design-Build, energy efficiency, integrated contracts, social housing

§ 5.1 Introduction

In recent years European Social Housing Organisations and European authorities have devoted particular attention to the renovation of the European social housing stock. The reasons are twofold: first, the stock is aging, and secondly, it offers potential for energy savings. Most of the European social housing stock dates from before the 1980s and is in need of an upgrade in order to meet current health and comfort standards (UNECE, 2006). European authorities, who are under pressure to achieve their own ambitious CO₂ emissions targets by 2020 – a 20% reduction compared with 1990 (CEC, 2007) – have drawn attention to the potential energy savings that can be won from the social housing stock, which accounts for 9.4% of the total European housing stock (Dol and Haffner, 2010). At present, there is a wide gap between the actual renovation ratio of the European social housing stock and the ratio needed to meet the European targets. A recent study by Bastiaanssen et al. (2014) has estimated that, in order to achieve the targets, the annual investment in renovation should be increased almost fourfold.

The Netherlands is no different in this regard, where the majority of the social housing stock dates from before the 1980s (Majcen and Itard, 2011). The national government has highlighted the potential energy savings in the social housing stock by entering an agreement (Energy Saving Covenant, signed in 2008, upgraded in 2012) with the Social Housing Organisations (SHOs) on the realisation of energy efficiency improvements via maintenance and renovation projects (Nieboer et al., 2013). The concrete aim defined in the agreement is to upgrade the whole of the Dutch social housing stock to an 'average' Energy Performance Certificate (EPC) rating of 'B'. The involvement of SHOs in the energy saving strategy is crucially important in the Netherlands as they represent 32% of the national housing stock (Dol and Haffner, 2010). The need for greater and smarter investment in social housing renovation projects with a view to obtaining a more energy-efficient housing stock has also been covered in an analysis carried out by the Taskforce CO₂ Foundation (2013).

The need for greater efficiency in construction processes has been a burning issue for some time now. Construction processes are generally seen as adversarial, and there is an extensive body of literature on how to raise process efficiency by stepping up collaboration among the players. The reports by Latham (1994) and Egan (1998) have been described as wake-up calls for a pattern change in the construction sector. Several authors have since argued that integrated project delivery processes, such as Design-Build, offer the best potential for achieving quality improvements in projects (Bennett et al., 1996; El Asmar et al., 2013; Ibbs et al., 2003; Hale et al., 2009; Molenaar et al., 1999). Other authors have pointed out that integrated project deliveries are especially meant for construction projects that aim for innovation and high sustainability standards (Korkmaz et al., 2010; Molenaar et al., 2010; Straub et al., 2012). These authors further stress that the use of a specific project delivery method will not, in itself, suffice to raise the level of collaboration; a certain degree of commitment is also required from the players. Most of the current literature is based on experience of large new-build real estate and infrastructure projects. However, similar results have been reported by previous research based in two French social housing renovation projects which made use of Design-Build-Maintain contracts, namely: a shorter timespan for the project, guaranteed results, and almost the same costs (Salcedo Rahola et al., 2014).

The Dutch authorities have recently recognised the potential of integrated project deliveries for achieving higher sustainability levels in the housing stock. The suitability of such methods for housing renovation projects is outlined in the report "Cost-effective sustainable buildings renovation in the Netherlands" produced by the Netherlands Enterprise Agency, an offshoot of the Ministry of Economic Affairs (Tol and Balvers, 2012). The report pinpoints the complexity and the crucial role of the tender phase in Design-Build projects, since this is the phase in which all the important choices are made.

There are a few SHOs in the Netherlands which have already used integrated contracts in renovation projects in an effort to find a more effective construction process. A previous study on the role of architects in social housing renovation projects in the Netherlands identified two types of tender procedures that used integrated contracts: the competitive and the non-competitive procedure (Salcedo Rahola and Straub) (see Figure 5.1). It is customary in a tender for integrated contracts to select a group of companies to develop the project. This group may consist, for example, of a general contractor, specialised contractors, an architect's firm, and technical consultants, and is commonly referred to as a 'consortium'. There is no legal structure associated with consortia. Normally, in Dutch social housing renovation projects, the SHO has a contract with the general contractor, who has contracts with all the other consortium members. In some cases the group of companies create a joint company.

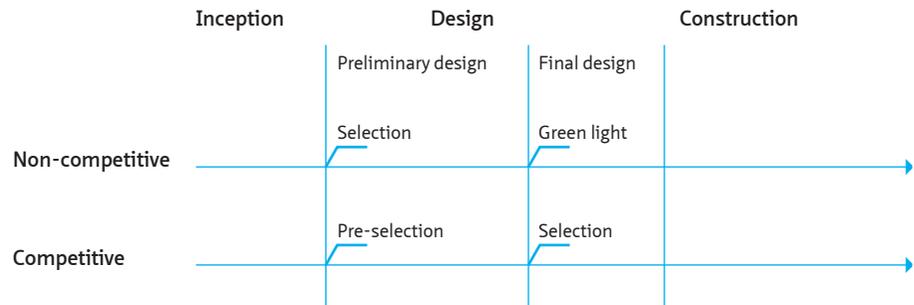


FIGURE 5.1 Phases of non-competitive and competitive procedures

In non-competitive procedures the consortium is usually selected on the basis of criteria unrelated to the project e.g., the capacity for team work, the sustainability vision, or the capacity to innovate and gain experience for similar work. The design work begins after the consortium has been selected. When the preliminary version is ready there is often a green light procedure – a moment when the SHO decides whether to proceed with the project, and when the budget is finalised. In competitive procedures there is a pre-selection and a selection phase. The pre-selection phase is again based on criteria unrelated to the project. The pre-selected candidates are then invited to participate in the selection process, which is based on an evaluation of the preliminary design proposals. Accordingly, most of the design work has been completed prior to the selection of the consortium. Once this phase is complete, some additional work needs to be done to turn the design into a definitive proposal.

It is assumed that a competitive tender will increase process efficiency by shortening the timeframe of the project. This is because construction companies are already involved in the early stages (the design phase) and there is a fixed time schedule

for selection (Salcedo Rahola and Straub). A competitive tender also boosts quality and innovation, thanks to the design competition character in the selection process (Hal et al., 2011; Savanović et al., 2012). The different elements of competitive tender processes have not been defined in previous studies. The main question in this research is: How do Dutch SHOs formulate optimal conditions for competitive tendering for integrated renovation projects?

An analysis of competitive tendering for integrated energy renovation projects that aim to improve process efficiency would be of interest not only to Dutch SHOs but also SHOs in other European countries, since they are all committed to raising the energy efficiency of their building stock with limited resources. Unlike Dutch SHOs, European SHOs are regarded as public bodies and must therefore comply with the EU Public Procurement Directive (2004/18/EC). Dutch SHOs are under no such obligation as they have not received direct government funding since 1995 (Priemus and Gruis, 2011). Accordingly, only a limited amount of tender procedures are available to European SHOs, but they can, however, make use of Competitive Dialogue for projects deemed to be 'complex'. Some European member states (including France and the United Kingdom) have indeed decided that projects which make use of integrated contracts can be categorised as 'complex' (Arrowsmith and Craven, 2012; Salcedo Rahola et al., 2014). As the competitive tender procedure used by Dutch SHOs strongly resembles the Competitive Dialogue procedure, the results of this study will also be of interest to European SHOs that make use of integrated contracts in their renovation processes.

The research method is described in the next section. This is followed by the presentation of the findings in Section 5.3, a discussion of some of the findings in Section 5.4, and conclusions and suggestions for further avenues of research in Section 5.5.

§ 5.2 Research method

Twenty-three Dutch social housing renovation projects which made use of integrated contracts that had either been completed or were in the construction phase were identified with a search of specialised websites and with assistance from experts in the field. The search included websites that list innovative construction projects: Agentschap NL (Agency of the Dutch Ministry of Economic Affairs), EnergieSprong (a programme for innovation in construction, initiated by the Dutch Ministry of the Interior and Kingdom Relations) and Passief Bouwen (Dutch passive house organisation). The experts belonged to SBRCURnet (a Dutch knowledge network in the construction sector), Vernieuwing Bouw (a Dutch renovation knowledge network in the construction sector) and Noorderberg (a firm of consultants specialising in integrating the construction supply chain).

Eight of the 23 projects were tendered by seven SHOs which applied the competitive procedure. All seven agreed to participate in this study. The tendering had taken place between 2005 and 2013. A summary of the main characteristics of the renovation projects is presented in Table 5.1.

PROJECT	SOCIAL HOUSING ORGANISATION	PROJECT LOCATION	NUMBER OF DWELLINGS	TYPE OF DWELLINGS	TENDER YEAR*	CONTRACT TYPE	INVESTMENT PER DWELLING IN EUROS
1	Delta Wonen	Zwolle	148	Terraced houses and apartment blocks	2010	DB+M	70,000
2	OFV	Biddinghuizen	80	Terraced houses	2005	DB	40,000
3	Openbaar Belang	Zwolle	24	Terraced houses	2011	DB+M	108,00
4	Qua Wonen	Krimpen aan den IJssel	240	Terraced houses	2012	DB+M	80,000
5	Stadlander	Bergen op Zoom	300	Terraced houses	2013	DB+M	45,000
6	Wonion	Uft	54	Terraced houses	2011	DB	80,000
7	Wonion	Uft	115	Terraced houses	2011	DB	82,000
8	Woon Friesland	Leeuwarden	290	Terraced houses and apartment blocks	2013	DB+M	20,000

* Year of publication of the tender specifications

TABLE 5.1 Summary of the main characteristics of the renovation projects

The study is based on an analysis of the tender documents of the eight projects and interviews with the SHO property managers or the project manager directly involved in the renovation project. These were structured interviews which sought validation for the data extracted from the tender documents and the choices regarding the type and number of pre-selected candidates, the preconditions for the nature of the candidates, the number and type of meetings with candidates during the selection process, the conditions for the collaboration methods of the candidates, the levels of compensation for non-selected candidates, the minimum project requirements, the award criteria, the evaluation of the award criteria, and whether to include maintenance in the contract. The interviewees were also asked if they would be likely to change these elements of the competitive tender procedure in future projects. In addition, some complementary information about the design proposals developed by the selected candidates was collected by interviewing the architects involved in seven of the eight projects. In all the interviews, with SHO managers and architects, a special emphasis was placed on the elements directly related to energy efficiency.

§ 5.3 Findings

The projects in this analysis were the first attempt by six social housing organisations to apply integrated contracts to their renovation projects. Only Wonion had previous experience of integrated contracts for new-building, and had applied it in two renovation projects. All the tender processes were in some way different, but they could be divided into two groups depending on whether they were based on the OFV model or the Wonion model. The OFV project, tendered in 2005, was taken as a reference by Delta Wonen and Openbaar Belang because all three organisations operated in the same region and were familiar with one another's projects. The Wonion projects, tendered by a process that became known in the Netherlands as the 'Soft Selection Method', inspired the tender processes of QuaWonen, Stadlander and WoonFriesland because the Slim & Snel (Fast & Smart) programme of the Dutch government which promotes the use of innovative construction processes in social housing renovations that aim to deliver high energy savings (Savanović et al., 2012) had used this method as an example.

§ 5.3.1 Pre-selection

The competitive tender procedure consisted of two selection rounds. The first, referred to in this study as pre-selection, was based on criteria unrelated to the project (e.g., the capacity for team work, the vision on sustainability, or the capacity to innovate) and previous experience. The main features of the pre-selection for the renovation projects in the analysis are presented in Table 5.2.

PROJECT	TENDER CALL	NUMBER OF PRE-SELECTED CANDIDATES	PRE-CONDITIONS NATURE OF CANDIDATES
1	Market search	4	Yes
2	Market search	3	Yes
3	Market search	3	No
4	Open call	3	No
5	Open call	3	No
6	Market search	3	Yes
7	Market search	3	Yes
8	Open call	3	Yes

TABLE 5.2 Main features of pre-selection of the tender candidates

As mentioned in the introduction, Dutch social housing organisations are not legally obliged to comply with the Public Procurement Directive, so they do not have to launch an open call for the first selection round. However, three of the projects, the ones participating in the Slim en Snel programme, did decide to launch an open call. The numerous candidates that responded were vetted on the basis of a short description of their organisation and its aims, which they had to present in the form of a video or 'live' for the SHO. The SHOs involved in these projects justified the use of an open call by pointing out that a new process would require a lot of changes in the working methods of their own organisation and of their contracted companies. An open call afforded opportunities for involving many people from their own organisation and allowed them to show numerous potential candidates their new way of working. For example, in one of the projects a large group of SHO employees participated in the selection of the candidates by voting for the best presentations. The three property managers said in the interviews that the open call had served its purpose and would probably not be used again as it requires substantial investments in time and energy. The five projects that did not launch an open call selected the candidates through a market search, which was limited in two projects to companies that often worked with the SHO and extended to other companies in the other three. In one project the SHO used the market search to draw up a short-list of candidates and then selected three on the basis of non-project-related criteria. The other four projects used the market search to select the three candidates directly.

The SHOs that made use of a market search to pre-select the candidates chose a general contractor first and asked him to set up a team that would participate in the competitive tender. The property managers said in the interviews that, in their opinion, the general contractor was the most suitable consortium member to take leadership and bear the risk. Conditions for the nature of the team were set in four projects: in two projects the team architect had to have experience of renovation projects; and in the other two, from the same SHO, the risks and benefits had to be distributed among the team. However, only one of these two projects required a specific formal arrangement for the distribution of risks and benefits. This condition prompted the consortium members to form a joint company. When the property manager was asked if they would again require the setting-up of a formal consortium, he replied: "It is not so much about the structure, it is about the mind-set." The same manager argued that there are several ways in which the level of collaboration among construction companies can be improved, but if the companies do not do this themselves they need to be pushed in that direction. Forcing the companies in the consortium to define new team structures is still an option, but other means could be applied in future projects.

Only one of the three projects that launched an open call set specific conditions for the nature of the candidates: a construction consortium formed by at least three companies, one of which could not be directly related to construction. In other words, it had to be, for example, a communication company, a social consultancy

or a design office. Moreover, it was specified that, after the selection procedure, the consortium members would be required to draw up a legal structure that would allow them to formally share the risks and benefits. The winning consortium did indeed form a joint company. The two other SHOs did not set conditions for the nature of the candidates, but they did express a preference for multiparty teams with shared risks and benefits.

In seven of the eight projects three candidates were pre-selected. The interviewees said that in future projects the SHOs would again pre-select three candidates, as a greater number would increase each candidate's risk of losing the tender, with all the associated costs. Fewer candidates, on the other hand, would hamper competition. Four candidates were pre-selected for one project. In this case the manager was of the opinion that the number of candidates should be determined by the size of the project; the risk of candidates losing out could be higher for larger projects.

§ 5.3.2 Selection process

Schedule

The winner was selected from the pre-selected candidates on the basis of a set of award criteria that were defined in the tender specifications. In this research the selection period was the time that elapsed between the release of the tender specifications by the SHO and the signing of the contract with the selected candidate. The selection period was further divided into four sub-phases: the design proposal (time between the release of the tender specifications and the submission of the design proposal report), the design proposal evaluation (time between the submission and the presentation of the design proposal), the evaluation of the design proposal presentation (time between the design proposal presentation and the selection of the winning consortium) and the preparation of the contract (time between the selection of the consortium and signing the contract) (see Table 5.3).

	1	2	3	4	5	6	7	8	AVERAGE
Design proposal (weeks)	11	9	7	16	11	11	10	12	10.875
Evaluation of the design proposal report (weeks)	1	1	1	3	1	0	1	2	1.25
Evaluation of the design proposal presentation (weeks)	2	3	0	0	1	0	0	0	0.75
Preparation of the contract (weeks)	2	1	4	27	16	12	12	24	12.25
Total	16	14	12	46	29	23	23	38	25.125

TABLE 5.3 Duration of the selection process (in weeks) from release of tender specifications to contract signing

On average, the selection process took 25 weeks, but with a wide variation between the projects. The shortest process took 12 weeks, the longest 46. The variation in the duration of the selection phase occurred primarily in the contract preparation. The duration of the projects based on the OFV model (projects 1 to 3) was considerably shorter than that of the projects based on the Wonion model (projects 4 to 8).

The significant difference in the time required for the preparation of the contract once the candidate had been selected can be explained by the fact that projects 1 to 3 clearly specified that the main contractors bore sole responsibility for the contract among the consortium members, whereas the other projects specified that the consortium as a whole was responsible for the contract. The distribution of responsibilities among the consortium members was decided in different ways in projects 4 to 8. Only two of the five projects required the consortium to adopt a formal, legal structure, but three consortia decided to create a joint company for this purpose. It took a long time to define the legal structure in two cases, as this was the first time for both the companies and the SHOs.

Another notable aspect of the selection schedule is the short deadline – an average of 11 weeks – set by all the SHOs for the development of the design proposals. The consortia participating in Design-Build social housing renovation projects, which did not use a competitive selection process, took an average of 39 weeks to elaborate on the design proposals, according to a study by Salcedo and Straub (2014).

Collaboration

Only in two projects had the client set a condition that was specifically designed to influence the collaboration among the consortium members (see Table 5.4). In both cases the SHO recruited and paid a team coach to assist the three consortia during the selection phase. Even though both SHOs described the experience as positive they could not say for certain whether they would repeat it in subsequent projects, as it is difficult to tell companies how to work and equally difficult to find the right person to assist as coach. The other SHOs saw no need to intervene in the working methods of the consortium. One of the interviewees said: “I think that collaboration between market parties should be a precondition. It is ridiculous to have to bring in a coach to ensure collaboration. I am not saying that this strategy won’t work but I don’t think it is the task of the client to facilitate the collaboration. The market parties have to do it by themselves.”

PROJECT	COLLABORATION CONDITIONS BETWEEN CONSORTIUM MEMBERS	NUMBER OF MEETINGS CONSORTIUM-SHO	TYPE OF MEETINGS
1	no	0	n.a.
2	no	1	Bilateral
3	no	1	Bilateral
4	no	4	Plenary
5	yes	6	Plenary
6	no	6	2 Plenary + 2 Bilateral + 1 with tenants + 1 with Building Aesthetics Committee
7	yes	6	2 Plenary + 2 Bilateral + 1 with tenants + 1 with Building Aesthetics Committee
8	no	7	Plenary

TABLE 5.4 Main characteristics of the pre-selection of tender candidates

A wide difference emerged between the projects based on the OFV model and those based on the Wonion model when it came to the number of meetings between the SHO and consortia during the selection procedure. The projects based on the OFV model held one bilateral meeting (two projects) or no meeting at all (one project). On the other hand, the projects based on the Wonion model held, on average, six meetings. In three projects the SHO met with all the consortia at the same time. In the remaining two the SHO had some bilateral and some plenary meetings. One SHO also organised meetings between the consortia and the tenants and between the consortia and the Building Aesthetics Committee (Welstandscommissie), which assists the municipality in planning permission processes by advising on whether the design of a building fits in with its surroundings.

Plenary meetings with all the pre-selected consortia during the competition phase were held in five of the projects. Plenary meetings are not allowed in public projects that make use of Competitive Dialogue. Surprisingly, the main reason the property managers gave for holding plenary meetings is also the main objective of public procurement: transparency. The property managers said that, in order to avoid giving different information to each candidate in a bilateral meeting, they had opted for plenary meetings. The plenary meetings were described by the property managers as collegial, but they also said that the candidates were cautious with their comments as they had no intention of sharing their best ideas with their competitors.

Minimum requirements and award criteria

The minimum requirements for the project and the award criteria were set out by the SHO in the tender documents. On the whole, the minimum requirements were not clearly specified because they were mixed with the project aims. In the same

description of requirements it was not unusual to find a general requirement, such as improving sustainability or improving the floor plan, alongside a specific minimum requirement such as the achievement of 45% in energy savings to obtain a police safety certificate or a certain energy performance certificate rating. In fact, the only topic with specific minimum requirements in all the tender documents was energy efficiency. The main parameter for evaluating energy efficiency was the energy performance certificate (EPC) rating. In five projects an energy performance certificate with an A rating was defined as the minimum requirement, one level higher than the level agreed with the national government in the Energy Saving Covenant. In the other three projects the minimum energy requirement was a B rating. The managers of these projects stated in the interviews that these requirements had been set a long time ago, and that the minimum energy requirement for all current projects would be an A rating (see Table 5.5). Other parameters were also used to evaluate the energy performance. A specific energy savings percentage or energy performance improvement target was set in two projects. The property manager for the project that set a minimum requirement of 45% for energy performance improvement commented in the interview that in future projects they would be more specific about the minimum requirement, as they wanted a 45% improvement in energy consumption and the consortia understood a 45% improvement in the reduction of CO₂ emissions. The other parameter – used in only one project – to evaluate the energy performance was the GPR rating, which is a Dutch sustainable building rating system that helps managers of new construction and renovation projects to evaluate solutions to sustainability issues during the design and construction phase. The system scores the performance in five different fields: energy, environment, health, user quality and future value. The energy evaluation is based on several indicators, such as the EPC value, energy savings, or the renewables that are used. The score is given on a scale of 0 to 10, with a score of five for a design satisfying all the minimum values of the current Dutch building regulations (Vreenegoor et al., 2008).

PROJECT	MINIMUM ENERGY REQUIREMENTS	TYPE OF AWARD CRITERIA	ENERGY AWARD CRITERIA
1	EPC rating B	Subjective + Objective (with weights)	Energy savings 7.5%
2	EPC rating B	Subjective (no weights)	Energy performance 1/6 *
3	EPC rating A Energy cost per tenant < €75 excl. electricity GPR average > 8, energy GPR > 8	Subjective + Objective (with weights)	Energy consumption 11% Quality of installations 7%
4	EPC rating A 45% energy savings	Subjective (no weights)	Energy 1/5
5	EPC rating A	Subjective (with weights)	Aim for energy neutral 4%
6	EPC rating B	Subjective (no weights)	Energy 1/16 *
7	EPC rating B	Subjective (no weights)	Energy 1/16 *
8	EPC rating A 45% Energy performance improvement	Subjective (no weights)	Energy Performance 1/5 *

* In this case there was no weighting system; it was assumed that all award criteria at the same level were weighted equally.

TABLE 5.5 Minimum requirements and award criteria characteristics

The SHOs used two types of award criteria, objective and subjective. The objective criteria were the ones in which the ratings were defined in a formula or a table. Hence, the score for a specific design proposal could be calculated beforehand. The subjective criteria were evaluated by a jury determined by the SHO. The tender documents included a description of what would be taken into account when a specific award criterion was evaluated, but it was not possible to know the score beforehand. Two projects made some use of objective criteria, the others used only subjective criteria. In five projects the importance of each criterion for the final decision was not specified. The property managers participating in these projects argued that they did not want the consortia to focus disproportionately on the elements that are rated higher; what they wanted was a balanced design proposal.

The importance of energy efficiency in the award criteria varied widely, with values ranging between 4% and 20%. Only one project requested a specific methodology from the consortia to check out the targeted energy performance aside from the EPC rating. Even in projects where a specific minimum value in energy savings or energy performance was requested the calculation method was chosen by the consortium.

Compensation for non-selected candidates

The amount of compensation offered to non-selected candidates differed considerably from one project to another, ranging from €5,000 to €50,000 (see Table 5.6). All property managers said that the offered compensation would not cover the costs incurred by the consortia for producing the offer, but the majority reckoned that they would offer similar compensation in future projects if a similar amount of effort was required from the consortia to produce their offers. In one project, however, the amount of compensation was not chosen by the SHO, but by consensus among the consortia participating in the selection process. The three consortia in this project were asked to agree on the level of compensation for the non-selected consortia, taking account of the fact that the money had to be extracted from the total project budget. The total agreed amount was €45,000.

PROJECT	1	2	3	4	5	6	7	8	AVERAGE
Compensation	€5,000	€5,000	€7,000	€50,000	€35,000	€20,000	€35,000	€45,000	€25,250

TABLE 5.6 Compensation for non-selected candidates

§ 5.3.3 Maintenance as part of the integrated contract

Maintenance was included in five of the eight projects, but only as an option to be taken up a posteriori. The consortia were asked to hand in a maintenance plan complete with the anticipated costs as part of the design proposal. Only one of the five project managers said that the selected consortium had taken the longer time horizon into account. The other four said in the interviews that it did not work out as expected. One said: "We thought that the consortia would look for a good balance between the construction and maintenance costs, that they would think about the total cost of ownership. What we have seen in practice is that no consortium has adopted an integral approach. They have not related the costs of the construction phase to the costs of the maintenance phase. And that is a pity." The managers could not say for sure if they would keep including maintenance as an option in similar projects in the future. The managers who had not included maintenance as an option also said that they were not certain whether maintenance could be included in the future. In both cases the property managers drew attention to the dilemma of including maintenance to promote a long-term view in the decision-making or excluding it to avoid a conflict with existing maintenance contracts. It is common practice among SHOs to enter maintenance contracts with different maintenance providers for the entire housing

stock. If they started contracting for maintenance contracts with different companies on a project basis, integrating the two approaches could get very complicated. Moreover, some SHOs have in-house maintenance teams for daily maintenance work. If maintenance were included in the contract these teams would have less to do.

§ 5.4 Discussion

It may be concluded from the findings that SHOs make use of different tender mechanisms to influence the working methods of consortia and thus raise the bar for a higher quality design proposal. More specifically, the analysis indicates that the SHOs looked for ways to influence the ambition, collaboration and long-term views of the consortia. The different mechanisms applied to influence consortia are highlighted and discussed in the next section.

§ 5.4.1 Ambition

In the first place the ambition of the consortia was sharpened by the competitive character of the tender. The fact that every consortium was competing with other consortia pushed each of them to offer something that the competitors did not. The findings show that the optimal number of consortia invited to the selection process was three. This outcome does not differ from the optimal number of candidates found by studies of other construction sectors that used similar competitive tender procedures (Nagelkerke et al., 2009; Thompson et al., 2001). In addition, the SHOs employed a few mechanisms to shape the competition. The entrance level was defined by the minimum requirements of the project and the selection mechanism was established through the award criteria.

It may be inferred from the analysis that the potential of the minimum requirements is not yet being used to the full. Some of the requirements were outlined as general aims, such as improving sustainability, so they were difficult to evaluate. All projects set a minimum energy performance certificate rating for the energy requirements. However, it is still possible to arrive at a much sharper evaluation of the energy performance, which would make for greater certainty in the anticipated results, such as a certain ratio of air infiltration or a certain insulation rate for the facades which can be confirmed via air infiltration tests and thermal photography respectively.

The use of subjective award criteria increased the workload for the SHO because it required evaluation by a selection committee. At the same time it gave the SHO more scope for making common sense decisions, especially when the award criteria were not weighted. However, the use of subjective award criteria did require a very transparent selection process in order to dissuade the non-selected candidates from contesting the selection.

There was a considerable difference between projects with regard to the relative importance of the energy criteria, which could indicate that even though energy efficiency is a key issue at national level, it was not accorded the same degree of importance by all SHOs. A more specific evaluation method for the award criteria for energy would increase the certainty of the results.

§ 5.4.2 Collaboration

It emerged from the analysis that the SHOs applied three main strategies to influence the collaboration level among the consortium members and between the consortium and the SHO:

1. They set conditions for the nature of the consortium.
2. They defined the duration of the selection phase.
3. They proposed meetings during the selection phase.

A few organisations set conditions for the nature of the consortia; for instance, they wanted the consortia to define a formal structure that would allow them to share responsibilities. Fulfilling this condition prolonged the period between the selection and the signing of the contract for these projects. The consortia needed extra time to decide on and implement the formal agreements. On the other hand, the creation of a formal structure, such as a joint company, opened up a whole array of possible services that could be offered to the SHO. For example, in one project the consortium offered energy services by selling the electricity generated by solar panels on the roofs of the renovated houses.

A short deadline for tenders appeared to be the most effective way to step up the collaboration between the companies in the consortium. The time pressure forced the team members to engage in intensive communication and to trust each other's expertise in the search for a fast and smart design decision that would give them a good chance of winning the tender. The short timescale that the consortia were given to produce a detailed design proposal did in fact promote team-building and reportedly generated benefits for the project as a whole. The interviewees said that the intensity of collaboration diminished after the contract was signed, but they added that there were fewer issues to

discuss during the construction phase because of the good collaboration in the design phase. If a specific matter needed to be discussed, the communication lines were very short. These experiences contradict reports from organisations involved in public projects that make use of integrated contracts. These organisations say that after the contract has been signed, the trust that has been built between the demand and the supply side is lost. This might be due to the fact that, in public projects – which are often large projects – the teams participating in the selection process on the demand side and the supply side are not the same teams that develop the project. Lenferink et al. (2011), who analysed four infrastructure projects in the Netherlands that made use of Competitive Dialogue, concluded: “Once the Competitive Dialogue process is completed and the phase of (preparation for) construction begins, substantial changes in personnel take place. This causes tacit knowledge, obtained during the informal moments in the competitive dialogue process, to be lost, as well as any personal trust-relations that were formed” (Lenferink et al., 2011, p. 256).

The aim of the meetings between the SHO and the consortia during the selection process was to prevent the consortia from misinterpreting the tender documents. It was generally assumed that more meetings would increase the probability that the consortium would offer the SHO what it wanted. What is not clear is if the use of plenary meetings instead of bilateral meetings increased or decreased the level of communication between the consortia and the SHO during the selection phase. The use of plenary meetings excluded the risk that one of the candidates would accuse the SHO of not giving them the same information as the competitors. In this scenario the SHO managers did not need to weigh up every single word and could express themselves more freely. Public organisations that use bilateral meetings in Competitive Dialogue procedures have reported that keeping track of all the communications in bilateral meetings in order to avoid the prospect of litigation in the future is one of the most complicated parts of the procedure (Nagelkerke et al., 2009). However, the use of plenary meetings hampers communication from the consortia side. The consortia at plenary meetings tend to be cautious about what they say, as they must, at all costs, avoid disclosing their ideas to the competitors.

§ 5.4.3 Long-term view

The long-term view was promoted in five projects by including an optional maintenance contract and by requesting, in some cases, a whole life costing report for the design proposal. But, as reported in the interviews, the response from the consortia was not as expected. There was only one project in which the consortium had really taken account of the long-term view in its design decisions, proposing building products and systems with higher investment costs but lower maintenance costs.

One possible strategy for exerting more influence on the long-term view of a consortium is to have maintenance included in the contract from the very start and not as an option a posteriori. Most probably, a consortium that is unsure of reaping benefits in the future will not invest more heavily than necessary in the construction phase. However, the SHOs were reluctant to embrace Design-Build-Maintain contracts because they would conflict with their current maintenance strategy, which was based on maintenance contracts for their entire building stock, and with the fact that some SHO have in-house maintenance teams. Moreover, they were hesitant to engage in long-term contracts. A similar situation has been reported from the initial experiences of Design-Build-Maintain contracts for social housing renovation in France, which were analysed in a study by Salcedo Rahola et al. (2014).

§ 5.5 Conclusions

Dutch SHOs that use competitive tender procedures for integrated contracts apply different mechanisms to influence (1) the ambition, (2) the collaboration and (3) the long-term view of the consortia participating in the selection procedure. The aim is to improve the quality of the construction process and the output. (1) The ambition is sharpened by the competitive character of the selection procedure, by setting high but achievable minimum requirements and by award criteria that value a higher performance. The findings show that the SHOs are not all singing from the same songsheet when determining the level of ambition they want from the market in the key issue of energy saving. (2) The collaboration is encouraged mainly by setting a very short deadline for the design proposals. This, in turn, forces the various consortium members to work intensively together in order to get the proposals out on time and to make a convincing pitch in a presentation. The number of meetings during the design proposal period also appeared to increase collaboration with the SHO. Other mechanisms such as setting conditions for the nature of the candidates or proposing team coaches were implemented to a lesser extent and were not regarded as appropriate by all SHOs. (3) The long-term view was promoted by the inclusion of a long-term maintenance contract for the renovated dwellings. However, the fact that the SHOs included maintenance services only as an option and not as an integral part of a single Design-Build-Maintain contract hampered its potential benefits. The SHOs were afraid of the possible implications of a long-term maintenance contract on a project basis for their general building stock maintenance strategy and their in-house maintenance teams.

These research findings are based on just eight renovation projects. In addition, most of the SHOs in the research were reporting their first experience of such contracts and tender procedures. The comments should be therefore approached with caution, but they are still highly valuable to Dutch and European SHOs. An analysis of the effect of these types of tender procedures from the perspective of the consortium members would be of great interest.

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6 The role of the architect using integrated contracts for social housing renovation projects

Explanatory note

Previous research papers focused on analysing the implementation of integrated project delivery methods for social housing renovation projects. The focus was mainly on the demand side, the social housing organisation. However, in the second research paper (Chapter 4) the implication for all actors involved in the renovation process has been analysed and it is concluded that the bigger process changes compared to traditional Design-Bid-Build approaches occur during the design phase. It has been also highlighted in the first research paper (Chapter 3) that the role of the professional in charge of the design phase, the architect, could considerably change when integrated project delivery methods are used instead of Design-Bid-Build. That is why the following research paper focusses on the role changes of the architect, as a way of looking at the process from the demand side. As indicated in the thesis conclusions, the analysis of the supply side as a whole and of its individual members when using integrated contracts, is a topic for further research.

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Abstract

The use of integrated contracts in the Dutch construction sector has increased in recent years. Integrated contracts presume facilitating a much more effective process than traditional delivery methods, saving money and time, as well as improving quality. Formally this type of contracts was only used for large and complex infrastructure projects and new buildings. In the last five years, however, they have been used also in the social housing sector for renovation projects, and have led to positive project outcomes. In this kind of projects, the supply-side actors work together in a team formed by an architect, consultants and construction companies; commonly referred to as a consortium. Currently, there is a lack of knowledge about the formal and informal links between the members of a consortium and their specific roles. This research helps to understand the tendering procedures and organisational typologies of consortia working with integrated contracts and especially the inherent changes in the role of the architect, e.g. type and amount of work, and relations with the client and consortium members. The study is based on a series of interviews with architects working with integrated contracts in social

housing renovation projects. The findings indicate that in the majority of these projects, the architect is contracted by the main contractor rather than by the social housing organisation. The new contractual relationship has no significant effect on the relationship of the architect with the social housing organisation and improves the relationship of the architect with the main contractor, consultants and advisors, and other specialist contractors involved. The architect switches from the role of designer to that of technical and aesthetic advisor, compared to traditional Design-Bid-Build projects.

Keywords: architect role; construction procurement; integrated contracts; renovation; social housing.

§ 6.1 Introduction

In the Dutch construction sector, the concept of ‘integrated contracts’ refers to contracts that include both design and construction work in a single contract, but they can also include maintenance, finance and/or operation (Chao-Duivis & Wamelink, 2013). This definition is based on the approach used by Name and Tatum (1992), who used the term integration to mean “integration between design and construction”. The same approach has been used by several other authors when researching the performance of Design-Build projects in relation to the degree of integration (e.g. Anumba and Ebuomwan, 1997; Cheng & Tsai, 2007; Elvin, 2010; Mollaoglu-Korkmaz et al., 2013; Pocock, 1996). In recent years, another dimension has been added to the concept of integration - namely the formal share of risk and rewards among the actors involved in the construction process. This is the case in Project Alliances and Integrated Project Delivery contracts that include a multiparty agreement to specify the share of risks and rewards between the actors involved (El Asmar et al., 2013; Lahdenperä, 2012). Such a multiparty agreement is not part of the definition of integrated contracts in this paper.

One of the main characteristics of integrated contracts is that the companies in charge of the construction process, and in some cases also maintenance and operation, are involved in the project from the beginning of the design phase. This allows them to participate in design decisions and to contribute their practical knowledge at this early stage. Integrated contracts are generally assumed to result in lower costs, better performance and lower risks as a result of a collaborative environment and output specifications (Akintoye et al., 2005; Blayse & Manley, 2004; Leiringer, 2006; Korkmaz et al., 2010; Molenaar et al., 1999). The use of integrated contracts in the Dutch construction sector has become more frequent in recent years, totalling 8.9% of all public construction contracts published on the main Dutch tender database in 2011 (www.aanbestedingskalender.nl) (Hardeman, 2012).

Initially, this type of contract was only used in the Netherlands for large and complex projects (Boes & Dorée, 2008), but in the last five years they have also been used in the social housing sector for new construction and renovation (Hal et al., 2011; Savanović et al., 2012). In fact, the use of these contracts in renovation gained particular momentum in 2008, when the shared goal of the national government and social housing organisations (SHOs) to reduce the energy consumption of their housing stock led to the 'Covenant for energy savings'. This covenant specifies the goal of upgrading the whole of the Netherlands' social housing building stock to an 'average' Energy Performance Certificate (EPC) rating of 'B'. In the Netherlands, social housing accounted for 32% of the total national dwelling stock in 2008 (Pittini & Laino, 2011). Since 1995, social housing organisations in the Netherlands have been autonomous self-financing organisations (Ronald & Dol, 2011). As such, they are not required to comply with public procurement rules.

In projects that make use of integrated contracts, the supply-side actors work together in a team made up of the architect, the consultants and the construction companies – commonly referred to as a consortium in the Netherlands. Currently, little is known about the role of each of the consortium members and the formal and informal relationships between them. Present literature focuses mainly on the dyadic relationship between the client and the consortium or between the client and the main contractor (Bygballe et al., 2010). Some research has been carried out in recent years into the formal and informal relationships between the members of temporary multi-organisations (TMOs) in construction, and this can be applied to the consortium structure (Blois et al., 2011; Lizarralde et al., 2011). Studies into TMOs take account of all the members involved: client, main contractor and specialised contractors. However, in the projects analysed in these studies, the architect is always treated as simply one more specialised contractor and no specific attention is given to changes in his specific role.

The few studies into integrated contracts that refer to the role of the architect have flagged up changes in this role relative to the traditional Design-Bid-Build approach. Previous research into construction projects in the Netherlands that use integrated contracts have reported that the leading role in the consortium is taken by a construction company that acts as the main contractor (Volker & Klein, 2010). The client has a contract with the main contractor and the main contractor subcontracts all the other companies involved, including the architect. In the UK, where integrated contracts are used widely, a similar contractual structure has been reported (Greenwood et al., 2008). The same contractual arrangement is described by Raisbeck (2008) who, based on the analysis of a large Design-Build project in Australia, discusses the architect's liability for project outcomes when subcontracted by the main contractor. Design liability in Design-Build contracts is also the focus of the study carried out by Chan and Yu (2005) in Hong Kong based on a survey and interviews with construction professionals representing the owner, the designers and the main contractors.

In consortia where the architect and the main contractor sit on the same side of the table, the tasks and responsibilities of each one are not always clear for the client (Sebastian, 2011). If the architect is contracted by the main contractor, the main contractor becomes the client of the architect rather than of the building owner, and as such the role of the architect as advisor to the building owner could be compromised. On the other hand, numerous comparative studies concerning the use of integrated contracts in large construction projects have reported an improvement in the cooperation between consortium members (Akintoye et al., 2005; Konchar & Sanvido, 1998; Leiringer, 2006).

In projects that employ a Design-Bid-Build approach, the architect and the construction companies only begin communicating when the design has been completely finalised and they have clearly different responsibilities with regard to the building owner. Under this set-up, in which architects and construction companies need to focus primarily on their own responsibilities, communication between them tends to be formal. In projects that use integrated contracts, the architect and construction companies sit on the same side of the table and, from the point of view of the building owner, they share related responsibilities. Moreover, they are both involved in the design phase, meaning that there is intensive communication between them during this phase. This is expected to lead to less formality in their communication (Hoezen & Volker, 2012).

Because the construction companies participate in the design phase, architects can take faster decisions regarding the viability (price and technical feasibility) of various design alternatives. Moreover, compared to a Design-Bid-Build approach there is no need for a works tender after the design has been completed. The combined effect of these two factors is that the design phase can be shortened considerably, as reported in previous research into two French social housing renovation projects (Salcedo & Straub, 2014).

In short, the use of integrated contracts may have changed the characteristics of the work performed by the architect as well as his relationship with the building owner, and with the other companies involved. The research question addressed in this paper is:

How do the role of the architects in renovation projects of social housing organisations (SHOs) making use of integrated contracts differ from their role in previous comparable Design-Bid-Build projects?

A better understanding of the changes in the role of the architect will help to oversee the future prospects for architects working in the field of housing renovation. It therefore provides useful insight for educational reform to prepare students and practising architects to make the most of the new situation.

First we will describe the research methods used. This will be followed by a presentation and discussion of our findings. Finally, in the conclusion, the main findings will be highlighted and the limitations of this research and recommendations for further research will be outlined.

§ 6.2 Research methodology

Firstly, we searched a range of websites listing innovative construction projects in order to identify social housing renovation projects using integrated contracts that had either been completed or were in their construction phase. This search included: Agentschap NL (Agency of the Dutch Ministry of Economic Affairs), Energie Sprong (a programme for innovation in construction, initiated by the Dutch Ministry of the Interior and Kingdom Relations) and Passief Bouwen (Dutch passive house organisation). We also requested the assistance of experts at several organisations in order to identify this sort of projects. These organisations included SBRCURnet (a Dutch construction knowledge network organisation), Vernieuwing Bouw (a Dutch construction renovation knowledge network organisation), Noorderberg (a firm of consultants specialising in integrating the construction supply chain), and several other experts.

In total, 21 social housing renovation projects using an integrated contract with the involvement of an architect were identified in the period 2005-2013. All the projects were tendered as Design-Build contracts and some of them included the possibility of Maintenance a posteriori. In the Netherlands, it is not mandatory for an architect to participate in a renovation project. Nevertheless, it is common practice to involve an architect when the façade is modified, because an architect is the most competent professional to present the project to the local Welstandscommissie ('Building Aesthetics Committee'), which advises the municipality on whether the design of a building suits its surroundings, in order to obtain the construction permits.

The architects involved in the renovation projects were invited to participate in the research by e-mail and by telephone. Of the 21, 13 accepted. The participating architects were interviewed using a semi-structured questionnaire with open and closed questions; interviews lasted an average of 90 minutes. The 13 interviews were the main source of information for this study. This was supplemented with information published on the websites of the actors concerned: SHOs, firms of architects and construction companies.

The renovation projects were mainly carried out on terraced housing. The size of the projects varied between 24 dwellings and 290 dwellings and the investment per apartment ranged from approximately €20,000 to €120,000. A summary of the characteristics of the projects is presented in Table 6.1.

	PROJECT LOCATION	NUMBER OF DWELLINGS	TYPE OF DWELLINGS	TENDER	INVESTMENT PER DWELLING IN EUROS
1	Leiden	252	Terraced houses	Non-competitive	56,500
2	Leek	45	Terraced houses	Non-competitive	80,000
3	Hoek van Holland	52	Terraced houses	Non-competitive	120,000
4	Drunen	25	Terraced houses	Non-competitive	45,000
5	Haarsteeg	32	Terraced houses	Non-competitive	100,000
6	Almere	246	Apartment block	Non-competitive	23,000
7	Zwolle	148	Terraced houses and apartment blocks	Competitive	70,000
8	Biddinghuizen	80	Terraced houses	Competitive	40,000
9	Zwolle	24	Terraced houses	Competitive	108,333
10	Krimpen aan den IJssel	240	Terraced houses	Competitive	80,000
11	Uft	54	Terraced houses	Competitive	80,000
12	Uft	115	Terraced houses	Competitive	81,739
13	Leeuwarden	290	Terraced houses and apartment blocks	Competitive	19,931

TABLE 6.1 Overview of projects analysed

The contractual organisation that was put in place in the thirteen projects is analysed in this research to confirm the trend identified in previous studies and/or to find other possible models for contractual organisations. The architects' views of the changes in their role and in their relationship with the social housing organisation and construction companies compared to Design-Bid-Build projects were gathered using interviews. A summary of the data obtained from the interviews is presented in the next section, together with direct quotes to demonstrate the validity of our analysis.

In order to characterise the type of work, four parameters were taken into account in this research. The interviewed architects were asked to compare the analysed projects to similar previous projects developed using a Design-Bid-Build approach. They were asked to consider the following aspects specifically:

- Type of work
- Amount of work
- Time distribution of the work
- Payment for work.

To evaluate the changes in the relationships with the SHO and the construction companies, the architects were asked to make an overall comparison of the quality of these relationships compared to Design-Bid-Build projects. They were also asked to evaluate the parameters of their relationship, namely the confidence that the SHO had in them and the sharing of information with the construction companies.

§ 6.3 Findings

§ 6.3.1 Tendering procedures

Two types of tendering procedures were identified among the analysed projects - non-competitive (six projects) and competitive (seven projects) (see Figure 6.1 for details).

In the non-competitive procedure, the selection of the consortium is commonly based on criteria unrelated to the project (e.g. capacity for team work, sustainability vision or capacity to innovate) and their previous experiences. The common practice is that only invited candidates participate in the selection procedure. In two of the projects using the non-competitive procedure there was no selection procedure and the successful candidate was appointed directly. The design work begins after the consortium has been selected. When the preliminary design is finished there is often a green light procedure – a moment when the SHO decides if it will proceed with the project and when the budget is finalised.

Under the competitive procedure, there is a pre-selection and a selection phase. The pre-selection phase is based on criteria unrelated to the project; usually, a limited number of candidates are invited directly to participate in the pre-selection process by the SHO but in some cases the SHO issues an open call. The pre-selected candidates are then invited to participate in the selection process, which is based on the evaluation of the preliminary design proposals. This means that prior to the selection of the consortium, most of the design work has already been completed. In six of the seven projects using the competitive procedure, three candidates were invited to the selection phase, while in the seventh case four candidates were invited. After the consortium has been selected, there is still some design work to be done to refine the initial design proposal. The size of the sample, thirteen projects, did not allow us to make a statistical analysis. However, some differences can be identified between the competitive and non-competitive projects.

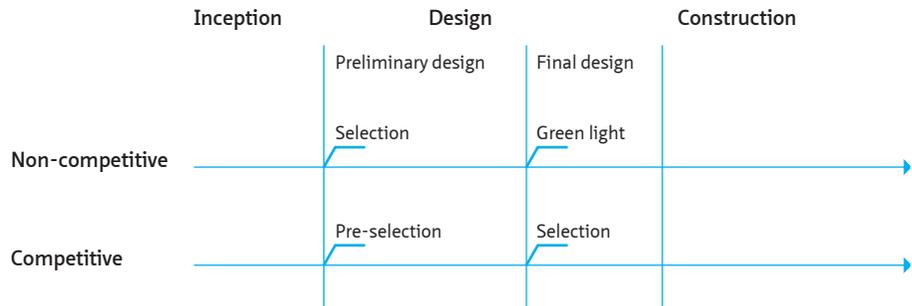


FIGURE 6.1 Phases of non-competitive and competitive procedures

§ 6.3.2 Contractual arrangements

In the Netherlands, there is no legal definition for a construction consortium and neither could a common definition be derived from the interviews. Different names were used by the interviewees to refer to the consortium; e.g. consortium, co-makers, co-creators or building team. In some cases, the consortium bore a resemblance to the TMO concept defined by Blois et al. (2011). The TMO is composed by all companies involved in the design and construction phases. In other cases, not all the companies involved in the design and construction were considered members of the consortium. For example, in some of the analysed projects, the actors that had a real influence on design decisions – the firm of architects, the main contractors, advisors and some specialist contractors (e.g. manufacturer of pre-fabricated façades, manufacturer of windows) were considered consortium members, while the other specialist contractors involved in the project were not considered members of the consortium.

Four different types of contractual arrangements with architects were identified – please refer to Table 6.2 for details. The most common arrangement was that the firm of architects was contracted by the main contractor. In these projects, the initiative for creating the consortium came from the main contractor. In only one of the ten projects where the architect was subcontracted by the main contractor did the initiative for the consortium come from the firm of architects.

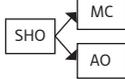
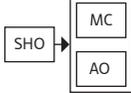
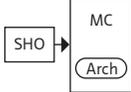
	CONTRACTUAL STRUCTURE	NUMBER OF PROJECTS
Architects office subcontracted by main contractor		10
Architects office contracted by the SHO		1
Architects office co-owner of a joint company		1
Architects employed by the main contractor		1

TABLE 6.2 Projects using each contractual arrangement

In none of the analysed projects did the firm of architects act as the main contractor and only one of the interviewed architects said that that would have been possible for his office. The financial risk involved in Design-Build projects was said to be too high to be taken on by architects alone. Limiting the scope for financial risk has already been cited by Wamelink et al. (2012) in his proposal for designer-led Design-Build projects, in which he advocates a leading role for architects.

Six out of thirteen architects declared that they shared some degree of risk with the main contractor. In two cases, this was because the architect and the main contractor belonged to the same company: in one case it was a joint company, with the architect owning 1.5% of the shared company; in the other case the architect was an employee of the main contractor. In the other four projects, an agreement on risk sharing had been reached: in three cases this was a limited percentage of the agreed architectural fees and in the fourth case the main contractor reserved a share of the budget to cover possible shortfalls – in the event that this money remained unused, it was to be shared among the consortium members as a bonus.

§ 6.3.3 Nature of work

The majority of the architects interviewed, nine out of thirteen, considered the working method to be different from comparable Design-Bid-Build projects, and eight of them explained this in similar terms. In Design-Bid-Build projects, the architect is in charge of proposing design solutions and giving a detailed description. With a consortium, on the other hand, the architect is in charge of collecting the proposals from all those

involved in the design, facilitating the design choices and taking care of the aesthetics of the project. One architect commented: "It is the same type of work but there is a different ratio between making drawings and giving advice. You act more like an advisor than a designer." However, the change in the nature of the work does not translate clearly into the amount of work done by the architect in each project. There was no significant difference between the competitive and non-competitive approaches in relation to the quantity of work. Please refer to Table 6.3 for further details.

Type of work		WORKLOAD		
		Less	Similar	More
Similar	Non-competitive	1	0	2
	Competitive	1	0	0
Different	Non-competitive	1	0	2
	Competitive	1	3	2

TABLE 6.3 Type of work and workload per project

In three of the four projects in which the architects reported a reduced workload, the claim was made that the constructor had taken on some of the duties that would previously have belonged to the architect. The fourth architect argued that because of the new set-up, the design process was more efficient and as a result there was a reduced workload.

No single reason emerged among the six architects that reported an increased workload compared to similar Design-Bid-Build projects. Three architects argued that the main contractor allocated them extra tasks that he believed the architect was the most competent to carry out. In two projects the extra tasks involved communication with tenants and in the other project they related to site supervision. The other three architects that reported a higher workload stated that this related to the specifics of the project: the fact that it was a pilot project, the fact that it was a renovation project (every house being slightly different) or the fact that BIM (building information modelling) was implemented.

In only one of the analysed projects BIM was implemented. It was not entirely successful because the firm of architects needed to use BIM and more traditional information tools in parallel because the small, specialised contractors involved in the project had no experience of working with BIM systems.

In reference to the time taken for the architects' work, one important difference was observed between projects with a non-competitive approach and projects with a competitive approach. The design phase in projects with a non-competitive approach was on average over twice as long as the projects with a competitive approach (see Figure 6.2 for details).

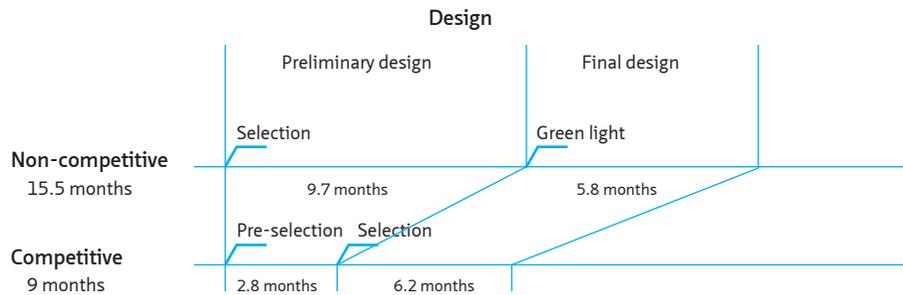


FIGURE 6.2 Average duration of design phase in months

Under the competitive approach, the selection of the consortium is based on the preliminary design presented by the candidates. The length of the selection procedure is defined by the SHO, which obliges the participating consortia to develop and submit their design proposals within a specific timeframe. The consortia participating in projects with a competitive approach needed an average of 2.8 months to develop their preliminary design.

Under a non-competitive process, the preliminary design is developed between the selection of the consortium and the green-light procedure. The average time for this phase among the analysed projects was 9.7 months, almost 3.5 times longer than for the competitive projects. One factor that needs to be taken into account is the tenants' approval of the renovation project. In the Netherlands at least 70% of the tenants need to approve such a project before it can proceed (Dutch civil code, BW 2 A.220.3). Under the non-competitive approach, the tenants' approval is given during the preliminary design phase while under the competitive approach it is given after the selection of the winning consortium. However, this does not result in a significant delay under the competitive approach in the final design phase: this is 6.2 months in comparison with 5.8 months under the non-competitive approach.

In relation to payment for the work done by the architects, no difference was reported in the hourly fee by any of the architects. Some of the architects that reported a lower workload per project indicated that they would need more projects per year in order to maintain a stable income.

It must be added, however, that the architects participating in competitive tenders ran a considerable risk of getting paid less for their work in the event that their consortium was not selected. Under the competitive approach, the majority of the architect's work is done before the tender and if the architect is not selected, they receive no payment for this work. In all the competitive tendered projects the SHO did pay some compensation to the non-selected candidates, ranging from €5,000 to €50,000.

However, this compensation does not cover the costs incurred by the consortium developing the offers, or even the cost of the firm of architects.

Of the seven projects with a competitive tender, three architects agreed with the construction company prior to the competition that they would receive full or almost full payment for their work. In three cases, they had agreed to be paid for 50% of their hours and in one case they had agreed to be paid for 33% of their hours.

§ 6.3.4 Relationship with the SHO

Compared to previous similar Design-Bid-Build projects the contractual relationship between the architect and the SHO changes in integrated projects because in the majority of the cases the SHO is no longer the client of the architect, but of the main contractor (please refer to Table 6.2 for details). However, the new contractual situation does not adversely affect the quality of the relationship in the opinion of the interviewed architects and in some cases it actually had a positive influence. Of the ten projects in which the architect was contracted by the main contractor, six rated the quality of their relationship with the SHO as similar to previous Design-Bid-Build projects, three as better and only one as worse. There was no significant difference between the competitive and non-competitive projects (please refer to Table 6.4 for details). In the other three projects, in which the architect was not contracted by the main contractor, the architects rated their relationship with the SHO as better than in previous Design-Bid-Build projects.

	WORSE	SIMILAR	BETTER
Non-competitive	0	4	2
Competitive	1	2	1

TABLE 6.4 Rating of the architect-SHO relationship in comparison to previous similar Design-Bid-Build projects for projects where the architect was contracted by the main contractor

In the interviews the architects were also asked if they thought the SHO's confidence in them was less than in previous similar Design-Bid-Build projects and the answer was a unanimous 'no'. However, five of the six architects who rated their relationship with the SHO as similar believed that their position as a professional had been compromised because they had been contracted by the main contractor and not by the SHO.

One architect said: "The distance is a bit bigger. You feel that who pays decides and that has an influence. We knew the SHO and all the others sitting around the table and we had close contact with them, but communication went through the filter of the main contractor. Before a proposal arrived at the SHO, it was checked for financial feasibility. It is a slightly different role for the SHO."

In the one case where the relationship was rated as worse than previous experiences, the architect was involved in the project when the SHO and the main contractor had already begun negotiating about the project; it was one of the projects with a non-competitive process. The main contractor was in charge of communicating with the tenants and in this case was not entirely successful because the approach taken was too technical. At a certain stage of the project, the SHO decided that it would feel more comfortable if it was in charge of the contract with the architect. After this contractual change was made, the project developed without major incidents.

In the three projects in which the architect was contracted by the main contractor and rated its relationship as better, it was argued that the SHO communicated very effectively with the consortium during the design phase. One of the architects said: "I think the relationship was better because together with the contractor you are in front, you are a strong team. It is not just you as an architect dealing with the housing corporation. You are supported by the contractor."

§ 6.3.5 Relationship with the construction companies

Nine out of the thirteen architects considered the relationship between the architect and the construction companies involved in the renovation project to be better than in comparable Design-Bid-Build projects (please refer to Table 6.5 for details). None of the architects interviewed rated their current relationship as worse and four rated it as similar. Three of the four architects that rated the relationship as similar stated in the interview that they had previously had a good relationship with the construction companies and the relationship had simply not changed.

	WORSE	SIMILAR	BETTER
Architects – Construction companies	0	4	9

TABLE 6.5 Architects' opinions about their relationship with the construction companies compared to previous similar Design-Bid-Build projects

All the architects stated during the interviews that they had direct feedback from the construction companies during the design phase meetings and also that the communication by electronic means was fast, which avoided delays in taking design decisions. One of the architects said: "The relationship is better because you get to know each other through the intensive collaboration. The attitude of the parties is important to promote a spirit of cooperation."

Three electronic communication methods were used by the architects during the realisation of the projects: e-mail (seven), a project webpage that allowed communication and the storage of large files (five), and BIM (one). The architects who made use of the simplest electronic communication method, e-mail, had a generally positive experience. One of the seven architects thought that communication could be improved by using a project webpage because it would facilitate keeping track of the design decisions. Four of the five architects who used a project webpage were not particularly positive about their experience, commenting that the project webpage was used mainly to store large files but communication had been still been conducted by e-mail. The architect that was involved in the project that used BIM commented in the interview that it was not practical in their project because not all the subcontractors had used it. Only one of the architects using the project webpage had had a positive experience of it and stated that in future projects they would probably use BIM.

A significant proportion of the communication between architects and construction companies in the form of drawings and technical specifications (Styhre and Gluch, 2009). In order to assess the formality of communication between architects and the construction companies, the architects were asked about the level of detail in the drawings they passed to the construction companies. Ten of the thirteen architects interviewed considered that the level of detail in communications with the construction companies was lower than in comparable Design-Bid-Build projects (please refer to Table 6.6 for details).

	LOWER	SIMILAR	HIGHER
Level of detail	10	2	1

TABLE 6.6 Level of detail in the communication between architect and construction companies compared to previous similar Design-Bid-Build projects

The interviewees commented that drawings for comparable Design-Bid-Build projects are developed to a high degree of detail while some of the drawings used in the projects were only elaborated up to a sketch level. For example, where prefabricated façades were used, the construction company in charge of that part of the project would work on the detailed drawing of the façade while the ensemble was supervised by the architect.

When asked whether the level of detail in communications with the constructor was the same, one of the architects commented: "I relied a bit on the expertise of the builder. We did not need to detail everything because they are just as capable of doing a proper job. We only interfered in the section of the roof, because the roof was completely renewed and the contour of the building was changed. There we did some detailing."

The two architects that stated that the level of detail in the drawings was the same, who were both participating in a competitive procedure, explained that the preliminary designs presented for the selection procedure were already at the level of detail of final designs. The only architect that declared a higher level of detail explained in the interview that the construction companies involved in his project had no previous experience with the passive house standards used for the project.

§ 6.4 Discussion

The findings show that in the new set-up the architect is in a different position in relation to the client and the construction companies compared to Design-Bid-Build projects. The new set-up brings with it new game rules and also defines some new roles: architects still have a central position in elaborating design proposals, but their duties and power to make decisions are reduced because they are no longer in the leading role.

§ 6.4.1 Initiative

Taking the initiative, and as such taking the leading role, is generally associated with the party that bears the financial risk. In the analysed projects the initiative among the consortium members was mainly taken by the main contractor. This is in line with what has been previously found in other studies (Greenwood et al., 2008; Raisbeck, 2008; Volker & Klein, 2010). In some of the interviews, a certain degree of resignation was expressed over the fact that the architects had lost some of their decision-making power. Three strategies were identified as possible alternatives for regaining some of that decision-making power by taking a higher level of initiative.

The first strategy is to place the architect's firm at a similar or even higher level of responsibility than the main contractor. To give the architect a higher level of responsibility means that the architect's office would assume the role of the main contractor, both in terms of organisation and financial risk. This option, mentioned by one of the interviewees, would only be feasible for large firms of architects and as such, would not be feasible for the majority of architecture firms in the Europe. Just 4% of architectural practices across Europe have more than five employees (ACE, 2012). The idea of the architecture office taking the leading role has already been covered in a previous study by Wamelink (2012).

The second strategy, for smaller architect's offices, is to place themselves at a similar level to the main contractor by creating a joint company. The only joint company created among the analysed consortia was the product of an initiative by the architect's office and in that joint company, the architect's office only participated with a small percentage, related to the risk it could bear. Companies other than the architect's office and the main contractor can also participate in the joint company. The idea of sharing the profits and the risks in order to obtain the same level of commitment from the main actors involved in construction projects is not new. Projects that use multiparty agreements such as Project Alliancing or Integrated Project Delivery have the same goal, but these approaches have not been applied to housing projects in the Netherlands as yet.

The third strategy is for the architect to play the role of 'team integrator'. Even though formally the initiative and the leading role are taken by the main contractor, the design choices are still made with the participation of the consortium members. In the consortium, the architect can act as a technical and aesthetical advisor – an idea that was expressed in some of the interviews – and leave the design choices for the main contractor; alternatively the architect can take on the role of team integrator. The team integrator ensures the involvement of all the actors in developing the design and making design choices and ensures that the joint knowledge of the consortium members is used to produce the best design proposal. Previous research by Renier and Volker (2009) in the Netherlands has already shown that architects are well prepared for the role of team integrator, but our research shows that more initiative is required from the architect to prevent another consortium member from taking this role. Moreover, new skills are needed to become a good team integrator.

§ 6.4.2 Skills

In order to apply the strategies proposed here, it is necessary for architects to acquire extra project management skills and team management skills. Architects need extra project management skills to evaluate their role as a leading or co-leading team member and the associated risks. For example, in the project in which the architect's office formed a joint company with the main contractor, the architect's office took only a very small share. But although the share was just 1.5%, the new position enabled the architect's office to assume the same level of responsibility as the main contractor.

Additional team management skills are needed to coordinate a design team that include parties that are used to participating in the design process (technical advisors) and parties that are much less used to participating in the design process (main contractor and specialised contractors). As some of our interviewees mentioned, the

traditional roles of the main contractors (making requests) and specialised contractors (delivering a service) are difficult to alter, but in order to arrive at the best design proposal from the shared knowledge of the Design-Build team, the architect will need to involve all parties actively in the creation of the design proposal.

§ 6.5 Conclusion

A total of 21 social housing renovation projects featuring an integrated contract that included both design and construction work in a single contract with the involvement of an architect were identified in the period 2005-2013. This research, which is based on an analysis of thirteen of the projects, helps us to understand the changes in the role of the architect compared to Design-Bid-Build projects.

Integrated contracts are tendered via a competitive or non-competitive tendering procedure. As far as the architects are concerned, the main two differences between the two procedures are:

- in the competitive procedure, the work of the architect is condensed into a shorter timeframe (42% shorter than with a non-competitive procedure);
- in the competitive procedure, there is a higher risk that the working hours will not be paid in full in the event that the consortium is not awarded the contract.

Four types of contractual arrangement have been identified. Under the most common contractual arrangement, the SHO has a contract with the main contractor and the main contractor has a contract with the architect. The new contractual position of the architect, compared to traditional Design-Bid-Build projects, does not have a negative effect and in some cases it actually had a positive effect on the relationship between the architect and the SHO. In fact, the architect does not perceive that the SHO has less confidence in his advice. The new set-up has a positive effect on the relationship between the architect and the construction companies; the relationship is rated as better and the communication between architects and construction companies is less formal than in Design-Bid-Build projects.

The use of integrated contracts is not directly related to the workload per project for the architect compared to Design-Bid-Build projects. In some cases architects were no longer involved in project management tasks, while in other cases architects were assigned additional responsibilities, such as communicating with tenants. It seems that architects working on integrated projects often made a switch from the role of designer to that of technical and aesthetic advisor.

If architects would like to retain their leading role in the design process in this new set-up, they need to gain more project management and team management skills so that they can take the initiative more easily. How to introduce these skills into existing educational programmes for architects is a possible subject for further research.

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7 Conclusions and recommendations

§ 7.1 Introduction

This research aims to gain insight into the social housing organisations application of integrated project delivery for their energy renovation projects in order to improve the performance of their renovation processes. A series of five studies has been carried out in order to achieve the following aims:

1. identify and evaluate the project management methods available to improve the performance of construction processes;
2. identify, characterise and evaluate the project delivery methods in use by European SHOs for social housing energy renovation work;
3. analyse and evaluate the implementation of the Design-Build-Maintain project delivery method for social housing energy renovation work;
4. identify the key elements of the tender of integrated contracts for the process performance improvement of social housing energy renovations;
5. identify changes in the role of architects working on social housing energy renovation projects that use integrated contracts.

The five studies represent a sequence of steps in gaining a comprehensive view of the implementation of integrated project delivery methods aiming to improve the process performance of social housing energy renovation projects. Figure 7.1 provides an overview of this.

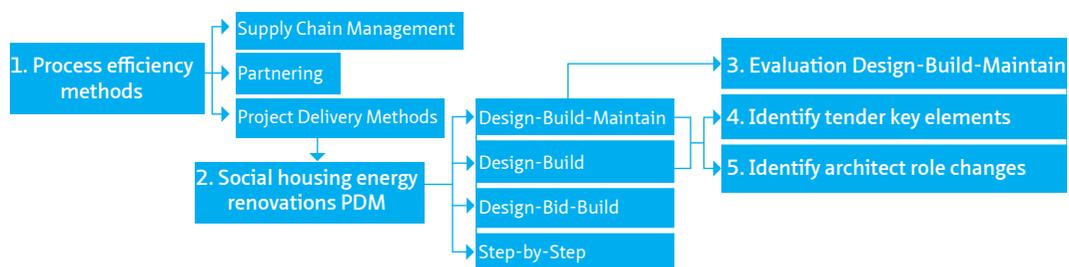


FIGURE 7.1 How the five studies relate to one another

The first study is based on a literature review. The second study is based on five case studies in four countries (Belgium, Italy, France and the United Kingdom), a questionnaire completed by 36 SHOs from eight countries and 14 interviews with experts from ten countries. The third study is based on two French case studies and the fourth and fifth studies are based on 8 and 13 case studies in the Netherlands, respectively. A specific protocol based on the recommendations of Eisenhardt and Graebner (2007) and Taylor et al. (2011) was used to implement the case study research methodology.

This chapter summarises the conclusions of each of the studies, and makes some recommendations for practice, for policy and for further research. The practice and policy recommendations presented are in line with the final documents produced for the European Intelligent Energy Europe project Shelter, a recommendation guide for European SHOs and a recommendation document for the EU authorities. The Shelter project, which was the origin of this research thesis, was carried out by six SHOs (Arte Genova, Italy; Black Country Housing Group, United Kingdom; Bulgarian Housing Association, Bulgaria; Dynacité, France; Logirep, France and Société Wallonne du Logement, Belgium), three European professional federations based in Brussels (Architects Council of Europe, Cecodhas Housing Europe and European Builders Confederation) and one research partner (Delft University of Technology).

§ 7.2 Construction management methods

Q1.1 Which project management methods are relevant to improve the process performance of energy renovations in social housing?

There is an extensive body of construction management literature on how to improve the performance of the construction process. The studies are the response to several national construction reports that highlight the urgent need for greater performance in the construction process and the fact that the potential for improvement is considerable. The studies reviewed propose a wide range of methods and tools that use similar concepts and names. These methods can be divided into three broad categories:

- supply chain integration;
- integrated project delivery method; and
- partnering.

Each of these methods provides a different perspective on the strategy to improve the construction process performance. Supply chain integration focuses on the performance of the construction process from a multi project perspective, approaching

the construction process like an industrial process. Integrated project delivery methods, meanwhile, take account of the uniqueness of each individual construction project, and the complexity and singularity of every construction project. Finally, partnering focuses on the characteristics of the relationship between the actors involved in the construction process. These three methods are complementary and closely interrelated.

Because of the characteristics of social housing renovation projects, integrated project delivery methods are the most suitable strategy to improve the performance of this type of construction process. Renovation projects are often one-off projects: they have a clearly defined departure point in the form of the existing building with its specific characteristics. Even though some renovation projects may have similar characteristics, it is unlikely that they would happen to be carried out by the same group of partners. The buildings may belong to different owners, the companies involved in each of the renovation projects may be different and the projects may take place at different times. In the case of social housing organisations, there is a single owner for numerous buildings that may have similar characteristics; however, public procurement regulations, which apply to the vast majority of European social housing organisations, force them to use independent tender procedures, making it highly unlikely that they would have the same team of companies working on similar projects. The single-project approach of integrated project delivery methods is therefore more suitable than the multi-project approach of supply chain integration methods.

Analysing the construction process from a project delivery method point of view allows to get a wider perspective of the process than using partnering methods. With project delivery methods the contractual arrangements, sequence of events and actors relationships are taken into account while with partnering the analysis is mainly focused on the actors relationships.

The project delivery methods that provide a higher degree of integration between the different construction phases are particularly suitable for construction projects with a high commitment to sustainability in general and for energy-efficiency in particular. In Design-Build and Design-Build-Maintain projects, the involvement of construction companies and in some cases maintenance companies in the design phase allows highly beneficial knowledge transfer that would otherwise not be possible. The need to make use of performance specifications to be able to tender a contract that includes design and construction force to define smart performance criteria. The performance criteria can be used to evaluate the performance of the construction process and this information can be used to upgrade the quality target to be achieved.

The implementation of integrated project delivery methods does not automatically lead to better process performance, however. The commitment of the main actors is also essential. In this respect, partnering methods can have a significant positive influence on process performance.

Q1.2 What are the legal limitations on the application of these methods by public organisations?

It is possible to tender integrated contracts for social housing renovation projects under the regulations of EU directive 2004/18/EC, as well as under the current directive 2014/24/EU. The more recent of the two directives, 2014/24/EU, has not been yet transposed into national law by the EU member states, which is why our analysis takes both directives into account. Of the main four tender procedures available under EU directive 2004/18/EC, two are feasible for tendering integrated contracts: the restricted procedure and the competitive dialogue; however, only the competitive dialogue is particularly suitable. The directive limits the use of the competitive dialogue to 'particularly complex' projects and allows member states to define 'particularly complex'. France and the Netherlands have defined social housing renovation projects that use integrated contracts as particularly complex projects in their national public procurement regulations.

The competitive dialogue procedure allows the pre-selection of candidates, reducing the number of offers needing to be studied to a minimum of three (the restricted procedure allows pre-selection down to a minimum of five). The competitive dialogue is the only procedure that allows a dialogue with the pre-selected candidates while they prepare their final offers. It is possible to give feedback to the candidates to make sure that the candidates have understood what exactly is required. The dialogue with each of the candidates must be carried out as three independent processes, which makes it a long and complex tender process. When the contract is awarded, it is also the only procedure that allows limited negotiation over the terms.

The new directive 2014/24/EU introduces a small number of changes to the tender procedures. In regard to the use of competitive dialogue, the new directive makes it clearer that this is the right method for the tender of integrated contracts.

§ 7.3 Project delivery methods in European social housing energy renovations

Q2.1 What are the main characteristics of the project delivery methods used in European social housing renovations?

The findings of the survey based on 36 questionnaires identify four project delivery methods used by European SHOs in their energy renovation projects:

- Step-by-Step (SBS)
- Design-Bid-Build (DBB)
- Design-Build (DB)
- Design-Build-Maintain (DBM).

SBS and DBM are the most commonly used project delivery methods, while DB and DBM are only used in a small number of projects. SHOs often use more than one project delivery method simultaneously. SBS has not been mentioned as a project delivery method in previous studies because current literature is based mainly on new-build projects. The differences between renovation processes and new-build processes have not previously been taken into account.

SBS can be considered as a major renovation when the replacement of a series of building components results in the same outcome as after a renovation (see Figure 3.2 for a representation of this). In order to optimise the service life of building components, an SHO may choose to split a major renovation into a series of minor renovations. Greater cost-efficiency is achieved by procuring a large number of replacements only when a particular component has reached the end of its service life. This project delivery method will usually not include a design phase because the interventions mainly involve replacing building products and systems.

DBB, DB and DBM take place alongside one another with the involvement of design companies, construction companies and maintenance companies. The difference between the three methods is the time frame for involvement by the different actors and the contractual relationship with the SHO (see Figure 3.1 for a representation of this). In DBB, the various contracted parties become involved in the project one after the other. In DB, meanwhile, the design companies and construction companies are involved over the same time period and in DBM all three of them are involved over the same time period. In DB, the SHO tenders the design and construction works in a single contract and in DBM, the SHO tenders the design, construction and maintenance work in a single contract. The contracted entity could be a single company, with or without subcontractors, or a consortium.

Q2.2 What are the advantages and disadvantages of the various project delivery methods when applied to energy renovations?

SBS allows SHOs to split major renovation projects into smaller interventions, reducing the cost by delaying the replacement of components until the end of the components' service life. What is more, SBS can improve cost-effectiveness when the properties are not geographically concentrated, the so-called 'pepper-potted stock'. On the other hand, the lack of a design phase prevents interaction between different building components or systems and hinders the identification of potential structural changes that would add value to the property.

DBB offers the opportunity to benefit from the synergy between different building components and systems, and it is more likely to lead to the identification of structural modifications that could add value to the property. In DBB, the majority of contract documents are well established and all actors know their roles and what to expect from the process. On the other hand, the main disadvantage of DBB is the lack of

collaboration between the design, construction and maintenance companies, which can lead to flawed design choices and problems in identifying the responsible party in the event of inappropriate functioning.

DB allows the use of performance-based specifications because a single entity is responsible for both design and construction. The contractor is allowed to choose its own solutions and thus bears the majority of the risk in the event of design failures. The responsibility of the contractor for the design choices increases certainty over the price and duration of the construction project. On the other hand, in DB the work and the design must be tendered a single contract, making the direct involvement of SMEs more complicated. It also precludes the involvement of design companies as referees between SHOs and construction companies. DB also assumes a change in the role of the actors; as a consequence, extra effort and time is needed to adapt to the new situation.

DBM makes it possible to fully implement performance-based specifications because the performance parameters can be evaluated during the maintenance phase, which allows the implementation of energy-performance guarantees. The risk of design failure is transferred to the contracted party, providing a high degree of price certainty. Additionally, the involvement of design companies, construction companies and maintenance companies from the design phase onwards facilitates good collaboration and the use of all the available knowledge in order to choose the best available solution. On the other hand, as with DB, DBM can only be tendered in a single contract, making the direct involvement of SMEs more complicated and precluding the involvement of design companies as referees between SHOs and construction companies. DBM also assumes a change in the role of the actors and a change in the management strategy for the SHO, because instead of specific building components and/or building services maintenance contracts for part or all of their dwelling stock, the SHO will start to use project-related maintenance contracts.

The DBM approach has the greatest potential to deliver energy savings because it facilitates collaboration between the different actors and promotes their commitment to achieving the goals of the project. However, DBM may not be first choice for every SHO. It is SHOs that are already applying SBS to switch to another project delivery method because this would imply a difficult change from a form of property asset management that focuses on building elements and systems to one that focuses on entire properties. Switching from DBB to DBM, is easier since these are based on a similar approach to property asset management. The possibility of obtaining an energy-performance guarantee when DBM is implemented may trigger a shift towards this method. However, the change may be difficult for SHOs with an in-house design team or for organisations with corporate social responsibility towards SMEs. The change can also be the cause of conflicts over maintenance management because for every property that uses DBM, another maintenance company will be responsible for maintenance.

§ 7.4 Energy efficiency in French social housing renovations via Design-Build-Maintain

Q3 How can the use of a Design-Build-Maintain contract improve collaborative working conditions for the actors involved while improving the project outcomes, particularly with regard to energy savings?

It is possible to engage the design companies, construction companies and maintenance companies to achieve energy savings that exceed those stipulated by the SHO and obtain a guarantee of results by using smart performance-based specifications. The specifications should have realistic but ambitious minimum requirements, clear and measurable award criteria that stress the importance of achieving high energy savings and a guarantee mechanism that is fair and robust.

However, in order to profit from these potential benefits without increasing project costs, it is necessary to ensure that the scale of the contract is large enough to ensure that any compensation paid to the candidates that are not selected does not adversely affect the total cost of the project and that the SHO's maintenance strategy needs to be flexible enough to handle maintenance contracts that are project-related as well as contracts related to maintenance stock. It must also be remembered that the definition of successful performance-based specifications will require a considerable investment of time by the SHO the first time that they tender for a project in this way.

The collaborative set-up defined by the DBM process also results in improved relationships between the actors involved because they are all involved from the design phase onwards and they are jointly responsible for the design decisions taken. However, the analysis of these relationships indicates that there is still room for improvement, particularly with regard to the maintenance company. Even though contractually the maintenance company is involved from the start of the project, it is also necessary for them to change their attitude from being responsive to one of active involvement.

§ 7.5 Competitive tenders of social housing renovation projects by integrated contracts

Q4 How do Dutch social housing organisations formulate optimal conditions for competitive tendering for integrated renovation projects?

Dutch SHOs apply a range of mechanisms to influence the ambition, collaboration and long-term view of the consortia that participate in competitive tenders for integrated renovation projects. The aim of their actions is to improve the quality of the construction process and thereby improve output quality.

The ambitions are set higher firstly by the competitive character of the selection procedure: several candidates are invited to the tender but only the best will be selected. A second factor is that the minimum performance level is set above common standards through high but achievable minimum requirements. Thirdly, the candidates are incentivised to offer their very best by being rated in terms of award criteria that evaluate performance. The findings show that the SHOs are not all singing from the same song sheet when setting the level of ambition they require from their candidates on the key issue of energy saving.

Collaboration is encouraged mainly by setting a very short deadline for the design proposals, a period of time of just 11 weeks on average. This obliges the consortium members to work closely together in order to get the proposals out on time and make a convincing pitch in a presentation. The findings show that the procedures with a higher number of meetings between the SHO and the consortium during the design proposal period appear to increase collaboration with the SHO. Other mechanisms, such as setting requirements for the nature of the candidates or proposing team coaches, were implemented to a lesser extent and were not regarded as appropriate by all SHOs. The candidates are encouraged to take a long-term view by including an optional long-term maintenance contract for the renovated dwellings. This strategy was less successful than expected because the majority of the candidates did not include integrated maintenance in their proposal but made an additional maintenance offer. The SHOs did not include maintenance as an integral part of the renovation work because they were concerned about the possible implications of a long-term maintenance contract on a project basis for their general building stock maintenance strategy and their in-house maintenance teams.

§ 7.6 The role of the architect using integrated contracts for social housing renovation projects

Q5 How does the role of architects in renovation projects of social housing organisations (SHOs) making use of integrated contracts differ from their role in previous comparable Design-Bid-Build projects?

The main role of the architect – assuming primary responsibility for design choices – does not change through the use of integrated contracts, but the decision-making power of the architect is diminished. With the use of integrated contracts, the main contractor and some specialist contractors gain influence over the design choices that they would otherwise not have had. If the main contractor plays an active and leading role in the consortium, the reduction of the decision power of the architect may be even more evident and, in the opinion of some architects, reduce the role of the architect to something akin to a technical or aesthetic advisor. The changes in the way that design

decisions are taken does not have a negative impact on the quality of the relationship of the architect with the SHO and positively influence the quality of the relationship between the architect and the construction companies involved in the project.

Some changes have been reported concerning the workload for each project compared to Design-Bid-Build projects. In some cases, architects were no longer involved in project management tasks, while in other cases they were assigned additional responsibilities, such as communicating with tenants. It is not possible, therefore, to establish a direct relationship between the use of integrated contracts and the size of the workload. Where there is an evident change in the distribution of the workload and payment for the work done for the integrated contracts that have been tendered via a competitive procedure. This was the case in seven of the thirteen projects analysed. In projects tendered via a competitive procedure, the work of the architect is condensed into a shorter timeframe and there is a higher risk that working hours will not be paid in full in the event that the consortium is not awarded the contract.

§ 7.7 Optimised project delivery methods for social housing energy renovations

Main Research Question: How can Social Housing Organisations optimise energy renovation processes?

SHOs can optimise the energy renovation process by using all available knowledge from the stakeholders involved when choosing the best design solutions and by ensuring the commitment of all the parties involved to the aims of the project during the entire renovation process. The use of Design-Build-Maintain as project delivery method allows SHOs to achieve this all at once.

DBM has a long time span that allows the implementation of a 'whole-life costing' approach. It is possible to get all the companies involved in the project from the first day, gathering and benefiting from all their knowledge. Using performance-based specifications, it is possible to make use of this knowledge to choose the optimal design solutions. DBM also allows the establishment of a mechanism to share successes and failures between all the actors involved, including the SHO, helping to ensure that they are all committed and responsible for achieving the goals of the project.

The conditions for the process are defined by the SHO during the tendering procedure. The benefit of a competitive procedure with demanding but realistic minimum requirements and award criteria that specifically value performance is that it encourages the proposal of optimised solutions. A short selection procedure, including meetings with the candidates, facilitates the formation of a team and ensures that the design

proposals meet the SHO's expectations. The inclusion of a performance guarantee in the maintenance contract ensures commitment to obtaining the performance target. The application of a Design-Build-Maintain project delivery method requires the investment of considerable time and effort in the first stages of the project both on the part of the SHO and all the candidates. It also requires professionals to be motivated to change their way of working to make it successful.

§ 7.8 Contribution to science

This thesis offers a wide overview of the characteristics of renovation processes and highlights the differences between new-build process and the renovation process. In particular, it has highlighted the benefits and limitations of using integrated approaches in housing projects. It also builds on previous work by Milin et al. (2011) concerning the use of energy performance contracts for social housing renovations and the work of Amaral Fernandes et al. (2014) analysing the use of project alliancing in apartment renovations.

This thesis proves that by using an integrated project delivery method, there is much involvement by all actors in design decisions and high commitment over the entire duration of the project. The result is much better performance in energy renovation projects with an integrated method than with other project delivery methods. By this the thesis provides proof of the performance of integrated renovation processes, building on the work of Molenaar (2010), Straub et al. (2012) and Mollaoglu-Korkmaz (2013), who have already highlighted the suitability of integrated approaches for construction projects that aim to achieve highly energy-efficient and sustainable buildings.

This thesis also gives us more insight into the multi actor analysis of construction projects relating to the formal structures of the project team and the formal and informal mechanisms for coordination, building on the work of Blois et al. (2011). Specifically, this thesis has addressed the changes in the role of architects in integrated renovation processes, adding to the work of Renier and Volker (2009) and Wamelink et al. (2012). Working with integrated contracts, the main contractor and specific specialist contractors gain influence over the design choices that they would otherwise not have had. In integrated contracts the relationship between the architect and the construction companies is better and the communication between architects and construction companies is less formal than in Design-Bid-Build projects.

§ 7.9 Recommendations

The work done in this thesis has mainly been based on the analysis of recent renovation projects that were the first experiences of SHOs in applying integrated project delivery methods. The results of these analyses should be viewed with care from a research point of view, but they are valuable in a consultative sense. The majority of the analysed projects were carried out in France and the Netherlands, but the results are of interest for all sorts of SHOs across Europe. This section provides recommendations, in the first place, to the actors currently using integrated contracts or intending to do so, the SHOs, the architects, the construction companies and the maintenance companies; in the second place, there are recommendations for the authorities setting up the 'rules of the game' at the European and national levels; and thirdly there is advice for researchers for developing further research in this field.

§ 7.9.1 Recommendations for practice

The implementation of integrated project delivery methods has been covered mainly from the perspective of the SHO in this research. The recommendations of this section are therefore addressed specifically at them. Firstly, some recommendations are given about how to choose the most suitable project delivery method, and this is followed by some recommendations about how to implement an integrated project delivery method successfully. Some recommendations are also given for architects and SMEs (construction and maintenance companies) about how to adapt to these changes and make the best of the new opportunities offered.

How to choose the appropriate project delivery method

The findings of this research identify Design-Build-Maintain as the project delivery method with the maximum potential for delivering energy savings in renovation projects. But because of the specificities of each SHO, it is possible that Design-Build-Maintain may not necessarily be the project delivery method that is the most appropriate in every case. The decision tree below (Figure 7.2) could help SHOs to choose the most appropriate project delivery method for them.

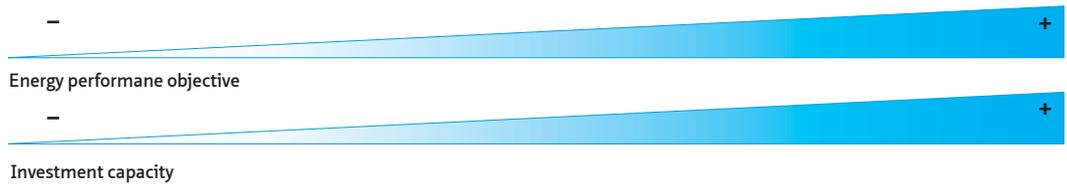
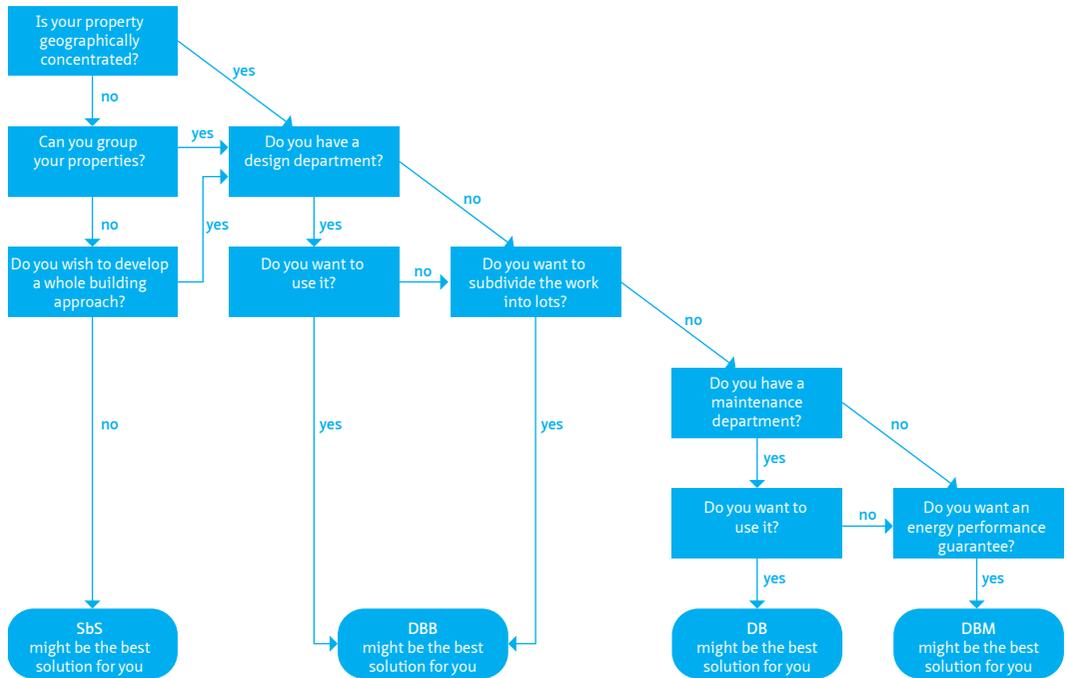


FIGURE 7.2 SHOs project delivery method decision tree for energy renovations

Several factors can influence the decisions of SHOs; the main factors are summarised in Table 7.1.

FACTOR	INFLUENCE
Building stock characteristics	SHOs with properties with a wider geographical distribution, or SHOs that own only some residential units in a building could have difficulties grouping properties into a single renovation project.
Working force characteristics	SHOs with an in-house design capacity or an in-house maintenance capacity may decide not to choose a project delivery method that could compromise the work of some of their employees.
Policy about local SMEs	SHOs with a policy on the involvement of local SMEs may decide to divide the works contracts in separate lots.
Investment capacity	Step-by-Step renovations require less investment capacity since the work is split into a series of minor renovations at different times and can therefore normally be funded from day-to-day revenues rather than necessitating borrowing. Conversely, using Design-Build-Maintain implies developing an ambitious project that requires a high capacity for investment.
Energy performance objective	The DBM has the maximum potential to deliver energy savings, because it facilitates collaboration between the different actors and promotes their commitment to achieving project goals. Less integrated project delivery methods have a lower potential to deliver energy savings.

TABLE 7.1 Factors influencing the Project Delivery Method choice for SHOs

If a SHO chooses a project delivery method other than Design-Build-Maintain, this does not mean that it is not possible to achieve an efficient renovation process or to obtain an energy-efficient building. It simply means that it will have fewer opportunities to achieve these goals. In Appendix V, a series of recommendations is presented on how to achieve better collaboration and commitment from the actors involved using every project delivery method.

How to implement an efficient Design-Build-Maintain renovation project

First, in order to implement an efficient Design-Build-Maintain renovation project, the SHO must choose a tender procedure. Since the large majority of European SHOs are subject to public law, the available tender procedures are limited. The tender procedure that offers the best options for SHOs to influence the quality of the output is competitive dialogue. The competitive dialogue facilitates the use of performance-based specifications and it is the only tender method that allows meetings between the candidates and the contracting authority before the selection takes place. In cases where an SHO is not subject to public law, the SHO can make use of a competitive tender procedure similar to the competitive dialogue but without the limitations defined by the European public procurement directive.

Second, the SHOs will need to define the performance-based specifications. The social housing organisation should aim to develop project specifications that allow the candidates to propose innovative solutions but at the same time it should be demanding in terms of the level of ambition that it requires. This can be done by defining realistic but ambitious minimum requirements and a set of clear and measurable award criteria that stress the importance of achieving high energy savings. Moreover, the SHO should define a performance guarantee mechanism that is fair and robust. It is advisable to choose performance parameters that are easy to evaluate and reliable and that clearly state the aims of the SHO. Specifically for the evaluation of energy performance, it is advisable always to use the same performance parameter (for the minimum requirements, for the award criteria and for the guarantee mechanism): actual energy use.

Third, the SHO can influence the degree of collaboration between the companies participating in the consortium, and between the consortium and the SHO, through the conditions of the selection procedure. The SHO can define the duration of the selection phase: defining a short selection phase forces the participating consortia to work together closely, promoting team work and cooperation. The SHO can also define the number of meetings that will take place during the selection phase: more meetings will mean more effort by all sides but will also create more opportunity for the SHO to verify that the consortia have understood what is requested from them. This is especially important when performance-based specifications are used because this type of specification offers scope for the candidates to choose their own solutions and these solutions may be far removed from what the SHO was expecting. In cases where the SHO is not subject to public law, the SHO can impose conditions on the composition of the consortia – such as conditions on the minimum number of companies that may form part of the consortium or the legal structure of the consortium. These conditions could offer extra guarantees that the consortium will act as a team.

The implementation of a successful Design-Build-Maintain renovation project requires significant effort and time from all the actors involved – the SHO and the consortia – during the first stages of the project. However, the investment made in reaching the right decisions before the start of the construction work will pay dividends during the construction and maintenance phases.

How architects can adapt to their new role

Architects working with integrated project delivery methods need to develop extra managerial skills in order to retain a central position in the design decision-making process. With the use of integrated project delivery methods, the main design decisions are taken by the whole consortium and the position of the architect within the consortium will determine his or her degree of influence over these decisions.

The decision-making power in consortia is related to the management of the consortium and currently the consortium is managed mainly by the party that bears the highest financial risk, the general contractor.

With extra managerial skills, architects' offices could evaluate the risk of formally taking on a higher level of involvement in the project by leading the consortium themselves, taking on the general contractor role or creating a joint company with other members of the consortium. In addition to the more formal managerial skills concerning financial risks, architects may also gain team leadership skills, which could help them to become the most suitable professional within the consortium to play the role of 'team integrator'.

How SMEs can adapt to their new role

No chapter in this thesis has been dedicated to the consequences of the use of integrated project delivery methods for SMEs. Further research in this area is needed to gain a better picture. However, the subject was covered to some extent in Chapters 3 and 4 and it has been a topic for discussion at numerous meetings of the SHELTER project. From the experience of the projects analysed, we can conclude that there is room within the consortium structure to allow SMEs to take an active role in decision making. However, to benefit from this opportunity, a change of attitude among SMEs is necessary, moving from a reactive attitude (there is a request and we do what is requested) to a more proactive attitude (there is a request and we make proposals in order to improve this request).

SMEs perceive that the use of integrated contracts for the renovation of social housing means that they become just another subcontracted party, while previously they were in some cases directly contracted, and that, as such, their involvement in the project is reduced. However, integrated contracts give them the opportunity to give their input on the decisions taken during the design phase, increasing their involvement in the success of the project. In fact, if they do not make the most of this opportunity, a significant part of the potential for improvement under an integrated approach is lost.

§ 7.9.2 Recommendations for policy

The use of integrated project delivery methods aims to change the dynamic in the relations between the actors involved in the construction process, moving from an adversarial relationship to a much more collaborative relationship. In order to help obtain the best results from integrated project delivery methods, it will be necessary for European, national, regional and municipal authorities to facilitate its full implementation.

The first obstacle to its full implementation, from a policy point of view, is the public procurement process. Recently, a new European directive on Public Procurement (2014/24/EU) has entered into force, introducing a few changes to the previous directive, 2004/18/EC. For example, it states clearly that it is possible to make use of the competitive dialogue to tender for renovation projects with integrated contracts. However, the new directive does not provide for a mechanism to motivate the contracting authorities to make use of these possibilities. In fact, the new directive does not even force contracting authorities to make use only of the most economically advantageous bid and still allows the use of price as a single selection criteria.

The opportunity lost with the new European Public Directive could be corrected at the national level, however. Over the next months and years, EU member states will transpose the new directive into national law. This will give them the opportunity to make it clear that there is preference for tendering to the most economically advantageous offer and for the use of competitive dialogue and integrated contracts for construction projects.

In addition to national public procurement regulations that favour a certain type of tender procedure, public bodies must also be encouraged to use integrated contracts including maintenance for all their new construction and renovation projects because with this type of contract it is possible to include a performance guarantee. With energy savings in mind, it is specifically recommended that major renovation contracts incorporate energy performance targets.

In addition to the promotion of certain procurement methods, it is also important that national authorities facilitate the creation of different types of consortia as a legal entity. More and more simplified mechanisms by which to define a consortium as a legal entity will help SMEs to participate in tender procedures that use integrated contracts, as a member of the core team rather than as a subcontracted party.

Regional and local authorities and also bodies subject to public law that contract a large amount of construction work may also have the duty to inform the market about the changes in their procurement policy and the different options for creating consortia.

§ 7.9.3 Recommendations for further research

One clear finding of this thesis is that there are plenty of possibilities for further research into optimising energy renovation processes, since there are multiple types of processes and multiple factors that influence the final result. Focusing on the use of integrated project delivery methods, the following research should focus on optimising

construction consortia. Analysing the best formal and informal structures to get the best from each of the partners and to assure that each of them is rewarded fairly for the work done. The analysis of the consortium structure and its working mechanisms should also be done from a legal and a management perspective because both aspects are completely interdependent. Our experience in this research has revealed a considerable difference between construction consortia working in large-scale building and infrastructure projects and construction consortia working in smaller-scale projects such as energy renovations.

An analysis of the types of consortium structures and the management mechanisms used should be followed by a study into the consequences for each of the actors involved in these consortia. This thesis presents some results about the consequences for architects, but the architect is only one of actors involved in a consortium. The role of the others has not yet been considered. The consequences for specialised contractors, mostly SMEs, is of special interest because European authorities are also promoting an open market and the involvement of local SMEs, which could be incompatible aims when construction companies are organised into consortia.

§ 7.10 Closing remarks

Analysing a complete process in order to find the optimum approach is a complex task. In order to ensure that it is done systematically, some key parameters that may influence the final result were identified and subsequently analysed, which was probably a good strategy. Nevertheless, it is often forgotten that even the most relevant parameters can only explain a part of the story. In the case of this thesis, the conclusion is that when an integrated project delivery method is used, there is greater involvement by all actors in design decisions and greater commitment over the entire duration of the project, and the result is much better performance in energy renovation projects with an integrated method than results achieved using other project delivery methods. However, there are some factors that can significantly limit the benefits of the method or even lead to failure. Examples of such factors include the regulations limiting communication between parties during the tendering procedure, the reluctance of some parties to change their working methods or unfairness in the way that profits and losses are shared out. There is no magic formula to define the perfect project delivery method, but the integrated project delivery method is currently the best recipe to follow when combining all the ingredients.

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Appendix A Materials used for Chapter 3

Materials used for the elaboration of Chapter 3, Project delivery methods in European social housing energy renovations:

- I Questionnaire Shelter SHOs basic information
- II Graphs actors relations for analysed SHOs renovation projects
- III Questionnaire project delivery methods by European SHOs
- IV Reference questions for European experts interviews

A.1 Questionnaire: Basic information about housing associations participating in Shelter project and their proposed case studies

This questionnaire aims to gather some general information about:

- your housing association
- the common renovation processes in your country/company
- past experiences you propose as case studies

This information will help us to get a general picture of the current situation and design a strategy for the next steps. We kindly request you to complete it as much as possible. Nevertheless, a skype meeting with you will be arranged later to clarify all possible doubts in the answers given.

We have pre-filled in some fields, please check if the information is correct. Moreover, some fields have specific instructions about which kind of information is required, and a few require looking into the annexes before to fill in. In any case, if you have any extra information related to these questions we invite you to add it.

If you have any doubt or further questions you can contact Baldiri Salcedo at the email address t.b.salcedorahola@tudelft.nl or at the phone number +31 (0)15 27 81055.

Thank you for your collaboration.

1 General information about your housing association

- 1.1 Name
- 1.2 Website
- 1.3 Phone contact number
- 1.4 Country and Area of Action
- 1.5 Number of dwellings
- 1.6 Average rent
- 1.7 Types of contracts
Which are the main types of contracts you offer to your clients, which are the characteristics of these contracts (Rent, Service Charges, Lease length, Responsibilities for maintenance and repairs, Common break of contract causes)?
- 1.8 General characteristics of your clients
Income (Average, graph with distribution of income), Age (Average, graph with distribution of ages), Nationality (percentage of foreigners), Unemployment rate, People with specific needs (percentage of elderly people, percentage of handicapped people, etc.).
- 1.9 Building types.
Number of dwellings from your stock from every type.

		BEFORE 1920	1921-1945	1946-1965	1966-1990	AFTER 1990
Multi-family dwelling	Multi-family house					
	5 or less storey apartment block					
	More than 5 storey apartment block					
Single-family dwelling	Terraced house					
	Semi-detached house					
	Detached house					

2 General information about renovation processes in your country

- 2.1 Which are the regulations that are applied to renovation processes in your country?
- 2.2 Which are the common obstacles that these regulations cause?
- 2.3 Which are the possible help programs you can apply for?
As help programs we refer to: subsidies, tax reduction, low rate loan, etc.
- 2.4 Which are the main institutions in your country related to renovation processes?
As: Ministries, Regional entities, Regulatory councils, etc.

3 General information about your renovation processes

- 3.1 Which is the number of dwellings renovated in 2009?
- 3.2 Which is the expected number of dwellings to be renovated in 2010?
- 3.3 Which is the expected number of dwellings to be renovated in 2011?
- 3.4 Which kinds of renovation are applied?
It is referred to the main aim of the renovation. As it could be ...
- Solve housing quality problems (old kitchen, sanitary, ...)
 - Solve problems with old installations (electricity, hvac, ...)
 - Solve structural problems (roof, windows, ...)
 - Comply with legislations / building regulations
 - Take profit of subsidize program for renovation
 - Improve energy efficiency
 - Others (specify please)
 - ... and to which extend this renovation are applied
 - Investment per dwelling
 - Energy performance certificate before and after renovation
 - Real energy use before and after renovation
- 3.5 Which kinds of technologies are applied?
Use the elements in Annex 1 to fill this question.
- 3.6 Which are the common steps in one of your renovation process of your organization?
We propose a general list of steps in a renovation process. You can add, delete or change their order.
- 1 Initiative
 - 2 Program of requirements
 - 3 Feasibility study
 - 4 Finance
 - 5 Tendering of the design
 - 6 Design
 - 7 Tendering of the building construction
 - 8 Tendering of the building services
 - 9 Execution of construction
 - 10 Execution of building services
 - 11 Completion
 - 12 Tendering of the maintenance services
 - 13 Maintenance
- 3.7 Are these steps representative of the common practices in your region and in your country, if not; can you define the common steps in the renovation practices at regional and national level?
- 3.8 Which are the common stakeholders involved in every step of your renovation processes?
You can modify the table: add, remove or change the order of the steps and add or delete stakeholders.

	1. INITIATIVE	2. PROGRAM OF REQUIREMENTS	3. FEASIBILITY STUDY	4. FINANCE	5. TENDERING OF THE DESIGN	6. DESIGN	7. TENDERING OF THE BUILDING CONSTRUCTION	9. TENDERING OF THE BUILDING SERVICES	8. EXECUTION OF CONSTRUCTION	10. EXECUTION OF BUILDING SERVICES	11. COMPLETION	12. TENDERING OF THE MAINTENANCE SERVICES	13. MAINTENANCE
Housing association													
Bank/Finances													
Insurance company													
Architect													
Construction advisors													
Construction company													
Specialized construction company													
Building services company													
Municipality													
Regional government													
National government													
Residents (Tenants)													

- 3.9 Which are the common subcontractors involved in your renovation processes?
Common subcontractors could be: specialized companies or building services companies.
- 3.10 Who is in charge of the selection process of the subcontractors? Is the level of subcontractors limited?
- 3.11 Which are the common problems during the process (technical/ management/financial/social)?
- 3.12 Which are the possible solutions to these problems?
In case there are some general possible solutions that you already have thought about, please write them here.

4 Specific information about the case studies proposed

In this section we would like to collect some information about the three or four case studies that you have already proposed. We will use the same schema as the Power House project from CECODHAS. You can check some examples at their webpage: http://www.powerhouseeurope.eu/nc/cases_resources/case_studies/search_form/

- 4.1 General information
 - 4.1.1 Name of organization:
 - 4.1.2 Year of finalization:
 - 4.1.3 Type of Area:
 - 4.1.4 Scale: (building level, neighborhood level)
 - 4.1.5 Type of building:
 - 4.1.6 Number of units/dwellings:
 - 4.1.7 Tenure:
 - 4.1.8 Street:
 - 4.1.9 Postcode:
 - 4.1.10 City:
 - 4.1.11 Region/County:
 - 4.1.12 Country:
- 4.2 Short Description:
- 4.3 Key elements: (use the elements in Annex 1 to fill this question)
- 4.4 Main results:
- 4.5 Lessons Learned:
- 4.6 Stakeholders involved:
- 4.7 Additional information:

Annex 1. List of Key Elements

FINANCING AND MANAGEMENT



Funding = Raising capitals to finance energy efficiency and renewable energies systems.



Incentives = Use of public and private incentive schemes to achieve energy efficiency and adopt renewable energies systems.



Project Management = Procedures to optimize the management of one project.



Asset Management = Procedures to optimize the management of part or the entire building stock of an organization.

KNOWLEDGE AND SUPPORT



Partnership Working = Involving in the project different expertise in order to enhance energy efficiency and renewable energies.



Work with Residents = Raising awareness of tenants on energy efficiency, renewable energies and environmental issues through campaigns, posters, etc., training programs for residents, involving residents in the design process.



Capacity Building = Training staff - architects/organizations and management staff/technicians/energy experts/social workers/caretakers.

ARCHITECTURE



Thermal Insulation = Thermal insulation systems and type of materials used elimination of thermal bridges.



Windows and Shading = Window glazing (double or triple paned, low-emissivity coating, gas filled), window frames (type and material), shading systems.



Air Tightness = Air tight construction systems and materials, air sealing improvements (windows, ducts etc.), draught stripping



Asset Management = Procedures to optimize the management of part or the entire building stock of an organization.

RENEWABLE ENERGIES



Solar Thermal = Solar thermal systems, for production of domestic hot water and space heating, solar air collectors.



Solar Photovoltaic = Photovoltaic systems..



Other Renewable=Geothermal, biomass, wood-fuelled boilers and stoves, wind turbines, water turbines, fuel cells.

BUILDING SERVICES



Heating and Hot Water = Micro combined and power units, district heating supply systems, heat pumps, energy efficient boilers, central heating and hot water systems, control systems, hydraulic balancing, measurement of energy and water consumed in each dwelling.



Cooling = Energy efficient active cooling systems.



Ventilation = Mechanical ventilation, mechanical ventilation with heat recovery, ventilation control systems.



Electricity Saving Products = Energy efficient lighting systems, energy efficient appliances (fridges, dishwashers etc.).



Water Saving = Water-efficient appliances and fittings, rainwater harvesting and storage systems, waste water recycling, greywater and blackwater/ecological sewage systems.

MONITORING AND CERTIFICATION



Certification = Procedures to assess the energy efficiency of a building or a building component.



Monitoring = Measuring the performance of a building in terms of consumption of energy and water and comfort parameters.

A.2 Renovation project phases and actors relations of the SHOs analysed

The renovation project phases and actors relations of 5 SHOs were analysed as part of the study on project delivery methods. The following figures are the summary of the analysis carried out. The complete description of the analysis is available at the website of the Shelter project (www.shelterproject-iee.eu). The analysed SHOs were: Arte Genova, Italy; Black Country Housing Group, United Kingdom; Dynacité, France; Logirep, France and Société Wallonne du Logement, Belgium.

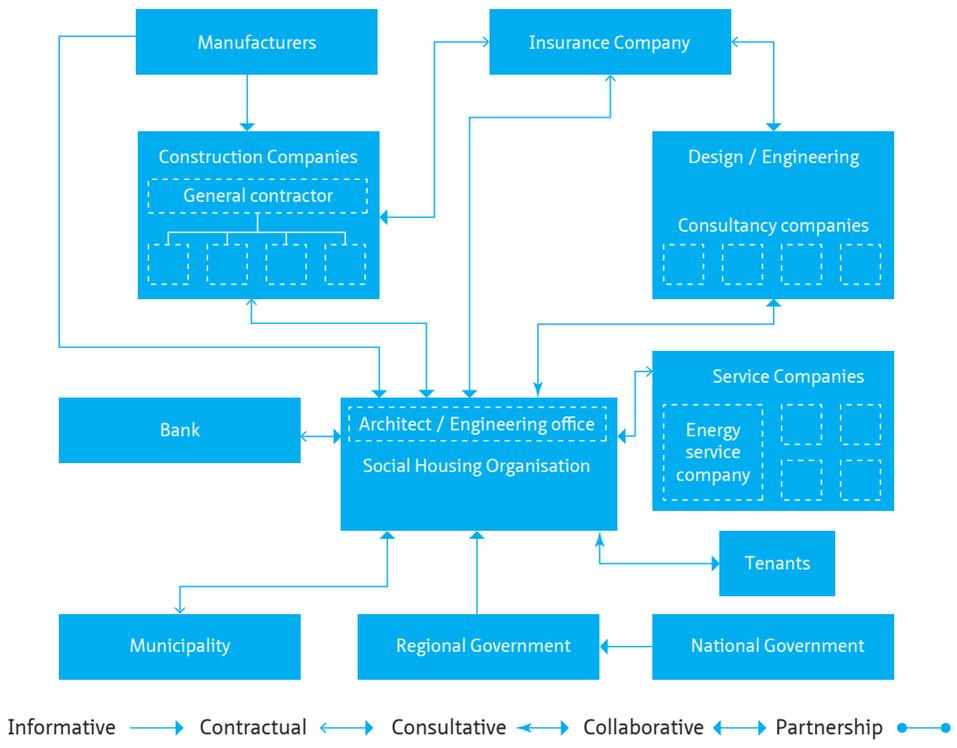


FIGURE APP.A.3 Renovation project actors relations Arte Genova, Model 2

Black Country Housing Group, United Kingdom

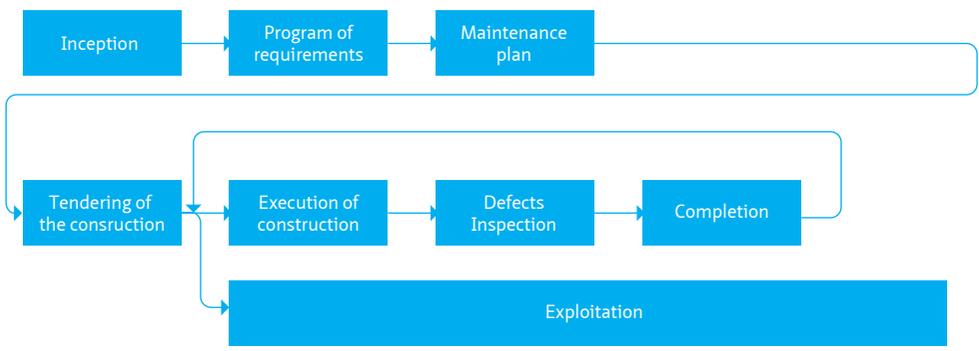


FIGURE APP.A.4 Renovation project phases of Black Country Housing Group, Model 1



FIGURE APP.A.5 Renovation project phases of Black Country Housing Group, Model 2A



FIGURE APP.A.6 Renovation project phases of Black Country Housing Group, Model 2B

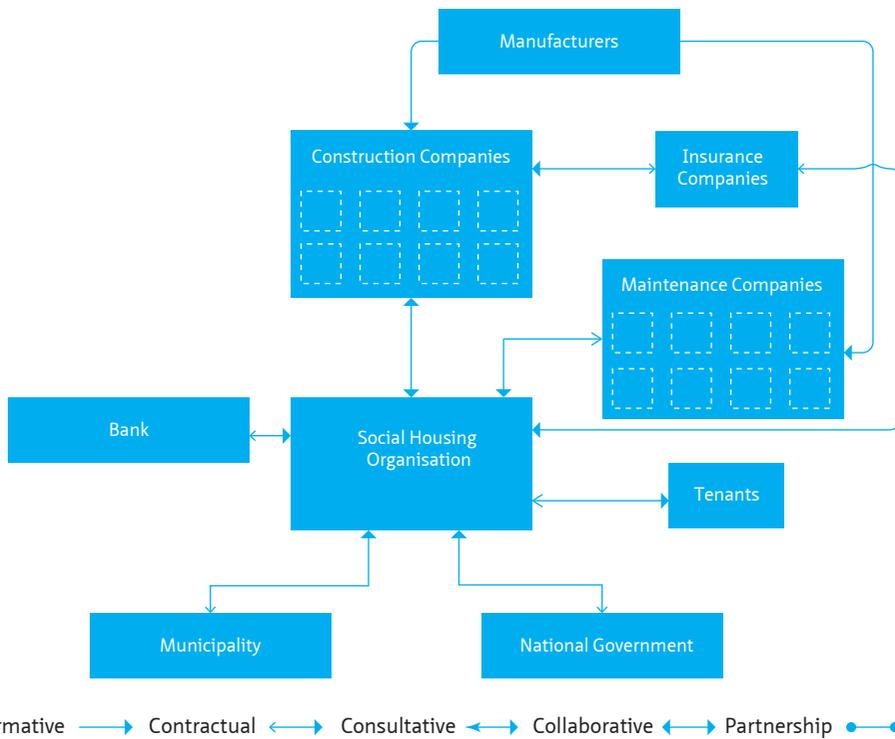


FIGURE APP.A.7 Renovation project actors relations Black Country Housing Group, Model 1

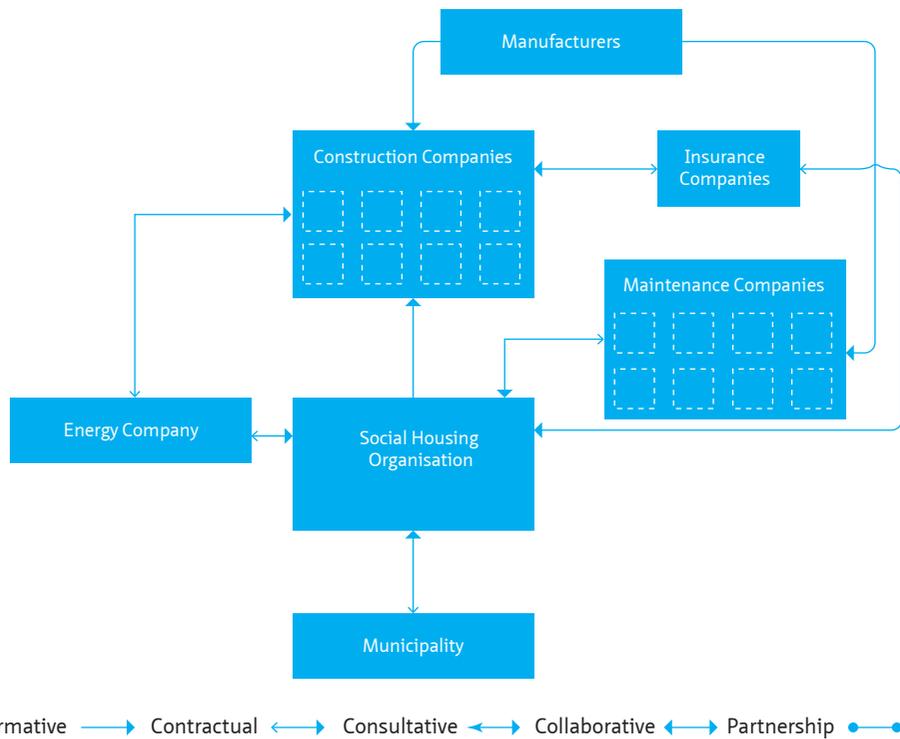


FIGURE APP.A.8 Renovation project actors relations Black Country Housing Group, Model 2A

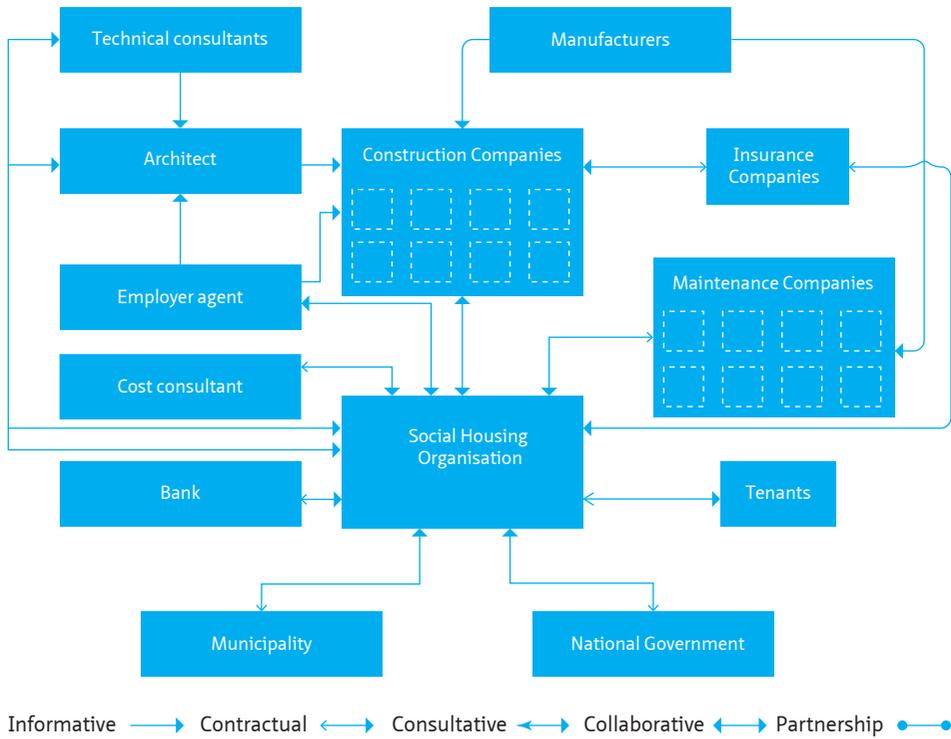


FIGURE APP.A.9 Renovation project actors relations Black Country Housing Group, Model 2B



FIGURE APP.A.10 Renovation project phases of Dynacité

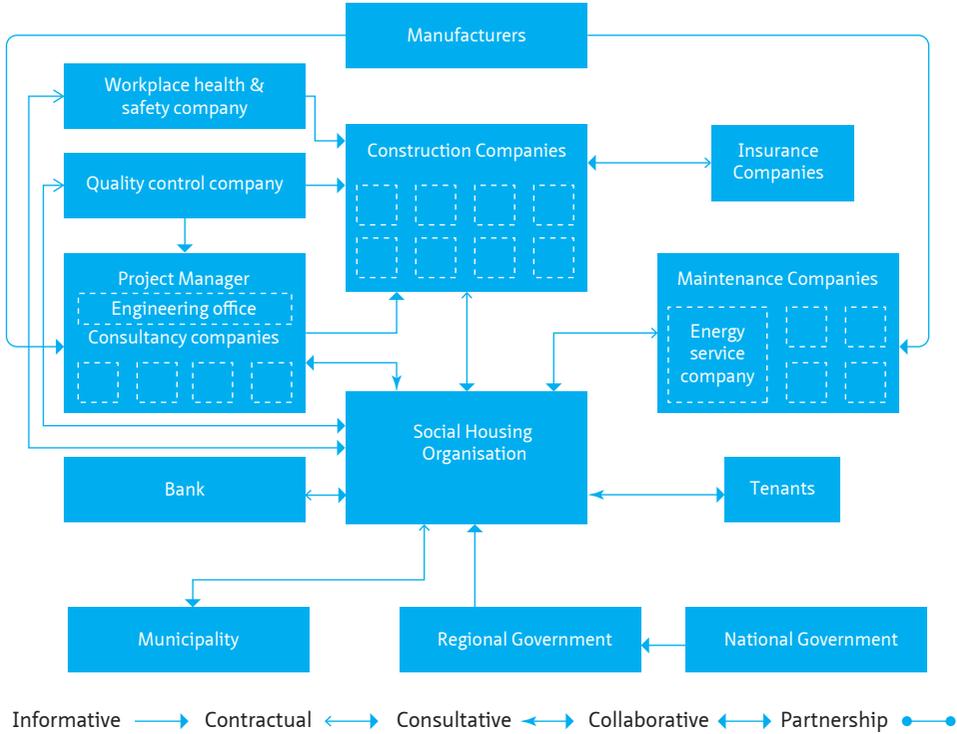


FIGURE APP.A.11 Renovation project actors relations Dynacité

Logirep, France



FIGURE APP.A.12 Renovation project phases of Logirep

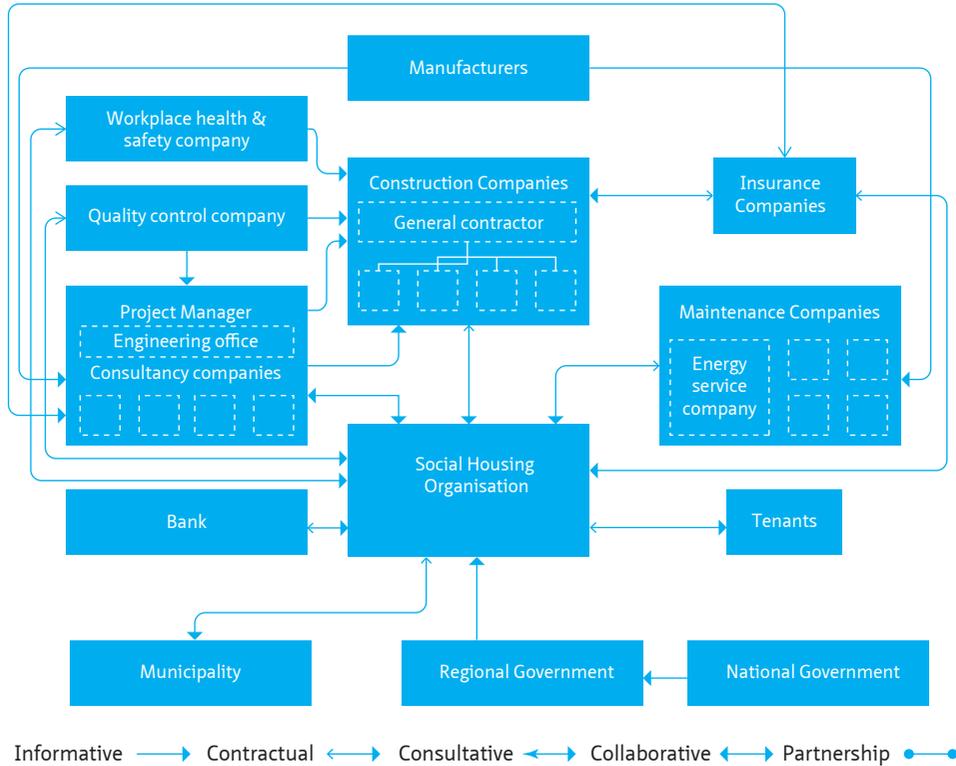


FIGURE APP.A.13 Renovation project actors relations Logirep

Société Wallonne du Logement, Belgium



FIGURE APP.A.14 Renovation project phases of Société Wallonne du Logement

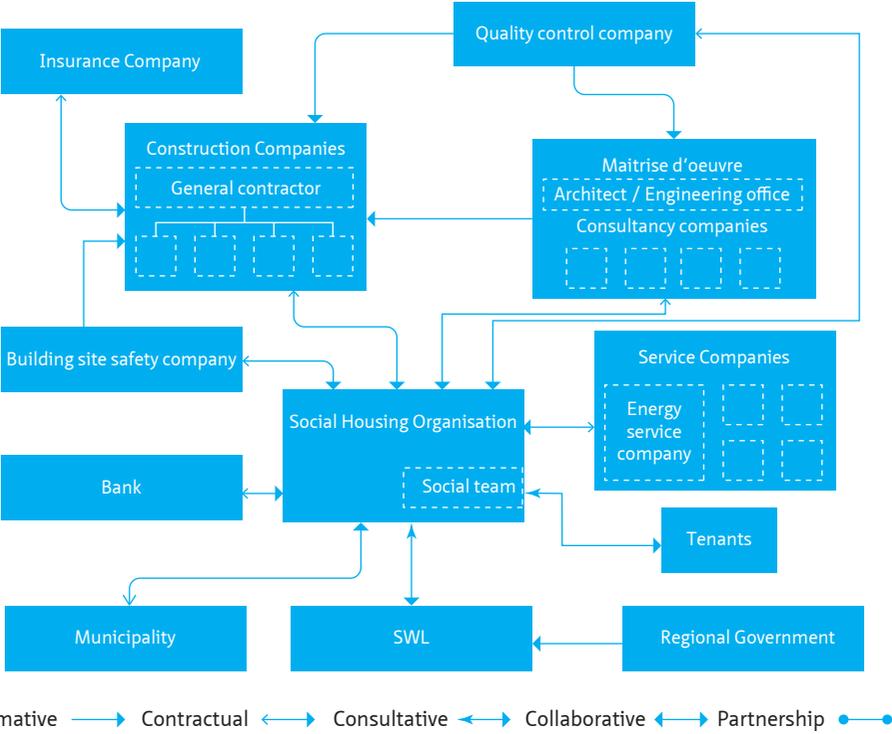


FIGURE APP.A.15 Renovation project actors relations Société Wallonne du Logement

A.3 Questionnaire project delivery methods by European SHOs

The electronic questionnaire about the renovation processes carried out by SHOs was distributed among national contacts of the European Federation of Public Cooperative and Social-Housing (CECODHAS). The national contacts were asked to distribute the questionnaire to SHOs that are known to have a strong interest in energy renovations. In total, 36 responses from eight countries (Belgium, Denmark, England, France, Germany, Italy, Spain and Sweden) were obtained from different types of SHOs.

General Information

- 1 Name of the organisation:
- 2 Website:
- 3 Country:
- 4 Area of action:
- 5 Number of dwellings:
- 6 Building types:
Percentage of dwellings from your stock from every type

		BEFORE 1920	1921-1945	1946-1965	1966-1990	AFTER 1990
Multi-family dwelling	Multi-family house					
	5 or less storey apartment block					
	More than 5 storey apartment block					
Single-family dwelling	Terraced house					
	Semi-detached house					
	Detached house					

- 7 Contact person:
- 8 Email contact person:
- 9 Phone number contact person:

Strategy

- 10 What are the main elements of your dwelling renovation strategy?
- a Housing quality
 - b Living quality
 - c Energy Savings
 - d Others
-
- 11 Which percentage of your building stock has an energy certificate?
_____ 100% for all, 0% for any
- 12 Do you have an energy efficiency evaluation of your building stock in your property register?
- a No
 - b Yes. Which type of energy evaluation do you have in place?
-
- 13 Which percentage of the funds applied to renovation is specifically for energy saving measures? (e.g. insulation, double glazing, ventilation, etc.)
_____ 100% for all, 0% for any

Work organization

- 14 Which kind of strategy do you use for the renewal of your building stock?
- a Planned maintenance _____ %
 - b Minor and major renovations _____ %
- 15 In case you apply planned maintenance as renewal strategy, is there an architect involved in the planning of the maintenance plan?
- a No
 - b Yes, which are his duties?
-

Tendering and contracting

- 16 In case you apply major renovation as part of your renovation strategy, which types of delivery method do you use and in which percentage?
- a Contracted Design + Contracted Works (single contract with general contractor)
 - b Contracted Design + Contracted Works (Separate lots)
 - c In house Design + Contracted Works (single contract with general contractor)
 - d In house Design + Contracted Works (Separate lots)
 - e Contracted Design and Works (single contract with a consortium coordinated by a general contractor)
 - f Contracted Design and Works (single contract with a consortium without a general contractor)
 - g Contracted Design, Works and Maintenance (single contract with a single company)
 - h Contracted Design, Works and Maintenance (single contract with a consortium coordinated by a general contractor)
 - i Contracted Design, Works and Maintenance (single contract with a consortium without a general contractor)
- 17 Which type of awarding procedure do you use in your renovation contracts?
- a Lowest price _____ %
 - b Most economically advantageous offer _____ %
- 18 Do you make use of performance criteria in your tendering procedures for renovation contracts?
- a No _____ %
 - b Yes _____ %

Design decisions

- 19 How is the quality of your collaboration with design companies (architects, engineers, etc.), construction companies and maintenance companies working with you?

	BAD	POOR	REGULAR	GOOD	VERY GOOD
Design companies					
Construction companies					
Maintenance companies					

- 20 Do you promote the collaboration between design companies, construction companies and/or maintenance companies working in the same project?
- a No
 - b Yes. How?
- _____

Knowledge

- 21 Are you satisfied with the technical knowledge of the companies involved in your energy renovations?
- a Yes
 - b No. Why?
-
- 22 Do you verify which is knowledge level of the companies working for you?
- a No.
 - b Yes. How?
-

Influence on tenants behaviour

- 23 Have the tenants an accompaniment service during the renovation works?
- a No
 - b Yes. Which type?
-
- 24 Do the tenants get user instructions after renovation works?
- a No
 - b Yes. Which type?
-
- 25 Do you monitor the energy consumption of your tenants?
- a No
 - b Yes. How?
-

A.4 Questions for European experts interviews

The following questions were used in telephone interviews with 14 professionals from 10 European countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, Spain, Sweden and United Kingdom. The interviewees were asked for their opinion on how to improve collaboration amongst the actors involved in social housing energy renovations. All the professionals (3 architects, 2 technical advisors, 2 real estate advisors, 1 juridical advisor, 1 policy advisor, 2 politicians and 3 builders) have a direct relation with the renovation of social housing and are considered to have a good overview of the current situation. They were proposed by the three partner federations of the SHELTER project, that is, the Architects' Council of Europe (ACE), the European Builders Confederation (EBC) and CECODHAS.

Mechanisms to improve cooperation among actors involved in energy renovations for social housing

Social housing organisations have a privileged position to implement changes on the quality of the housing stock, as they are the owners of a large stock of dwellings. In recent years energy efficiency has become one of the main focuses of their renovation processes. However, the financial capacity of these entities is rather small and limits considerably their opportunities to improve the quality of their housing stock. Moreover, as they offer a public or semi-public service, commonly they have to work with strict regulations.

The current energy renovation processes of social housing organizations from five European countries have been analysed in the framework of the Shelter project: Belgium (Walloon region), Bulgaria, France, Italy and United Kingdom. From this qualitative analysis several problem areas have been identified: strategy, work organization, design decisions, tendering and contracting, knowledge and influence on tenant behaviour.

Moreover, possible alternatives have been proposed aiming to increase the energy performance by improving the coordination and cooperation of the different actors involved in the process. The most important recommendations are:

- Involve construction and maintenance companies during the design phase in energy renovation projects.
- Define lists of recommended award criteria for contractors selected for energy renovation projects.
- Make use of performance-based specifications.

More detailed information about the results of the analysis can be found in the report 'Coordination of professional' published on the Shelter website.

Reference questions about your organization and yourself

- 1 What your company/organization does?
- 2 What is your role in your company/organization?
- 3 What is your geographical area of action?

Reference questions about energy renovations in social housing

- 4 How do you think how the use of award criteria for tendering procedures related to energy efficiency can be promoted?
- 5 How do you think how the use of performance-based specifications can be promoted?
- 6 How do you think how contractors and maintenance companies can be involved in the design phase of renovation projects?
- 7 What do you think about the role of the architect in new energy renovation processes?
- 8 What do you think about the role of SME's in new energy renovation processes?

Appendix B Materials used for Chapter 4

Reference questions for the interviews

The following questions aim for getting a general impression of the project with its positive and negative points and some more detailed information about:

- Duration of the project and the different phases
- Conflicts and resolution of conflicts
- Energy savings, expected and real
- Relations between actors
- Awarding procedure
- Cost/Benefit.

And the opinion of the different actors involved about if it is an experience to repeat and in what cases.

There are five sets of questions, one for each of the professionals interviewed:

- 1 SHOs manager of renovation projects
- 2 SHO project manager
- 3 Construction company project manager
- 4 Architect (design companies project manager)
- 5 Maintenance company project manager.

1 SHOs Manager of renovation projects

- What do you think about the project?
- What are the positive points compared to previous projects?
- What are the negative points compared to previous projects?
- What is the energy performance achieved in previous renovation projects?
- Does the theoretical energy performance differ from the real one in previous energy renovations?
- Do you think this experience can be applied to other renovations projects of your SHO?
- To which percentage of renovations do you think it can be applied?
- Why it is not applicable to all renovation projects?
- The maintenance contract associated to the renovation project is of XX years, do you think it is enough?
- Does the coexistence of projects DBM, with a maintenance contract, with the maintenance contract of the rest of your building stock creates conflicts?
- What do you think about the awarding procedure used?
- Why have you chosen for this awarding procedure?
- In terms to energy savings, what have changed compared to previous projects?
- Do you think these changes can be achieved with other types of contracts too?
- Have you found differences in terms of cost/benefits between this project and previous projects?

2 SHO project manager

General questions

- What do you think about the project?
- What are the positive points compared to previous projects?
- What are the negative points compared to previous projects?

Tendering

- What do you think about the awarding procedure used?
- Why have you chosen for this awarding procedure?
- Does the award criteria performed well?
- Is the market mature for this type of procedure?
- The maintenance contract associated to the renovation project is of XX years, do you think it is enough?

Relations

- How is your relation with the consortium? How it has changed compared to previous projects?
- How is your relation with the design companies? How it has changed compared to previous projects?
- How is your relation with the construction companies? How it has changed compared to previous projects?
- How is your relation with the maintenance companies? How it has changed compared to previous projects?

	SHO	CONSTRUCTION COMPANIES	DESIGN COMPANIES	MAINTENANCE COMPANIES
Trust				
Flow of information				
Meetings				
Conflicts				
Resolution of conflicts				

- Compared to previous projects, what is your opinion about the: trust, flow of information, meetings, conflicts, resolution of conflicts?
- Better/Similar/Worse or More/Equal/Less and why?
- Do you have made use of integrated information systems?
- In case of conflicts, did you notice any difference in the way of dealing with them compared to previous projects?
- Did you have a conflict resolution protocol?

Performance

- Did the duration of the project differed with previous projects? In which phases it has been different?
- In terms of energy savings, what have changed compared to previous projects?
- Do you think these changes can be achieved with other types of contracts too?
- Do you think this experience can be repeated other renovations projects of Logier?
- To which percentage of renovations do you think it can be applied?
- Why it is not applicable to all renovation projects?
- Did you have found differences in terms of cost/benefits between this project and previous projects?

3 Construction company project manager

- What do you think about the project?
- What are the positive points compared to previous projects?
- What are the negative points compared to previous projects?
- How is your relation with the SHO? How it has changed compared to previous projects?
- How is your relation with the design companies?
- How is your relation with the maintenance companies?

	SHO	CONSTRUCTION COMPANIES	DESIGN COMPANIES	MAINTENANCE COMPANIES
Trust				
Flow of information				
Meetings				
Conflicts				
Resolution of conflicts				

- Compared to previous projects, what is your opinion about the: trust, flow of information, meetings, conflicts, resolution of conflicts with the other actors?
- Better/Similar/Worse or More/Equal/Less and why?
- In case of conflicts, have you notice any difference in the way of dealing with them compared to previous projects?
- Have had you more or less delay than in previous projects? In case of differences in delay: What has caused in your opinion this change?
- In terms to energy savings, what have changed compared to previous projects?
- Do you think these changes can be achieved with other types of contracts too?
- Do you think this experience can be applied to other renovations projects of SHOs?
- To what type of projects do you think it can be applied?
- What do you think about the awarding procedure used?
- Do you think the awarding procedure could be done in another way?
- Have you found differences in terms of cost/benefits between this project and previous projects?

4 Architect (design companies project manager)

- What do you think about the project?
- What are the positive points compared to previous projects?
- What are the negative points compared to previous projects?
- How is your relation with the SHO? How it has changed compared to previous projects?
- How is your relation with the construction companies?
- How is your relation with the maintenance companies?

	SHO	CONSTRUCTION COMPANIES	DESIGN COMPANIES	MAINTENANCE COMPANIES
Trust				
Flow of information				
Meetings				
Conflicts				
Resolution of conflicts				

- Compared to previous projects, what is your opinion about the: trust, flow of information, meetings, conflicts, resolution of conflicts with the other actors?
- Better/Similar/Worse or More/Equal/Less and why?
- In case of conflicts, have you notice any difference in the way of dealing with them compared to previous projects?
- Have had you more or less delay than in previous projects? In case of differences in delay: What has caused in your opinion this change?
- In terms to energy savings, what have changed compared to previous projects?
- Do you think these changes can be achieved with other types of contracts too?
- Do you think this experience can be applied to other renovations projects of SHOs?
- To what type of projects do you think it can be applied?
- What do you think about the awarding procedure used?
- Do you think the awarding procedure could be done in another way?
- Have you found differences in terms of cost/benefits between this project and previous projects?

5 Maintenance company project manager

- What do you think about the project?
- What are the positive points compared to previous projects?
- What are the negative points compared to previous projects?
- How is your relation with the SHO? How it has changed compared to previous projects?
- How is your relation with the design companies?
- How is your relation with the construction companies?

	SHO	CONSTRUCTION COMPANIES	DESIGN COMPANIES	MAINTENANCE COMPANIES
Trust				
Flow of information				
Meetings				
Conflicts				
Resolution of conflicts				

- Compared to previous projects, what is your opinion about the: trust, flow of information, meetings, conflicts, resolution of conflicts with the other actors? Better/Similar/Worse or More/Equal/Less and why?
- In case of conflicts, have you notice any difference in the way of dealing with them compared to previous projects?
- Have had you more or less delay than in previous projects? In case of differences in delay: What has caused in your opinion this change?
- In terms to energy savings, what have changed compared to previous projects?
- Do you think these changes can be achieved with other types of contracts too?
- Do you think this experience can be applied to other renovations projects of SHOs?
- To what type of projects do you think it can be applied?
- What do you think about the awarding procedure used?
- Do you think the awarding procedure could be done in another way?
- Have you found differences in terms of cost/benefits between this project and previous projects?

Appendix C Materials used for Chapter 5

Reference questions for the interviews

General description of the project

Project:
SHO:
Contract type:
Number of dwellings:
Types of dwellings:
Contract value:
Architect interviewed:

Questions

- 1 How was the selection of the candidates?
In the next project would you do it in the same way? Why?
- 2 How many candidates were selected?
In the next project would you do it in the same way? Why?
- 3 What was the compensation for non-selected candidates?
In the next project would you do it in the same way? Why?
- 4 What were the conditions about the nature/composition of the candidates?
In case of consortia a specific shared responsibility agreement was requested?
In the next project would you do it in the same way? Why?
- 5 What were the conditions about how the consortium members work together?
In the next project would you do it in the same way? Why?
- 6 What was the duration of the selection phase?
In the next project would you do it in the same way? Why?

PERIOD	WEEKS
Sending award specifications – Getting the offers	
Getting the offers – Presentations of the offers	
Presentation of the offers – Deciding the winner	
Deciding the winner – Signing the contract	
Total	

- 7 How many meetings and from which type were organized during the selection procedure with the candidates?
In the next project would you do it in the same way? Why?
- 8 What were the main requirements?
In the next project would you do it in the same way? Why?
- 9 What were the award criteria?
In the next project would you do it in the same way? Why?
- 10 What were the requested quality guarantees?
- 11 Was the plan associated to a maintenance contract?
In the next project would you do it in the same way? Why?
- 12 Would you use this selection procedure again?
- 13 What are in your regard the key elements in this type of procedure?
- 14 What are the positive/negative points of this type of procedure?

Appendix D Materials used for Chapter 6

Reference questions for the interviews: the role of the architect in construction consortia for renovation of social housing

General description of the project

Project:
SHO:
Contract type:
Number of dwellings: 2
Types of dwellings:
Contract value: € (€ per dwelling)

Organization matters

- What is your experience with integrated contracts in Social Housing?
- What was the organizational structure of the “consortium”?
- What type of contract/agreement was established between the companies?
- Did you work before with the other companies of the “consortium”?
- Did you work before for this housing association?

Comparison with previous experiences

- What have been the changes for you compared to a traditional DBB type of project?
 - Fees
_____ Lower _____ Similar _____ Higher
 - Amount of work
_____ Less _____ Similar _____ More
 - Type of work
_____ Similar _____ Different
 - Time spent
_____ Less _____ Similar _____ More

- Months from inception to award of the project

- Months from award of the project to the start of the construction works

- Relation with the client
_____ Worst _____ Similar _____ Better
- How have you got feedback about the design from your client?
- How have you dealt with client trust?
 - Relation with the other companies
_____ Worse _____ Similar _____ Better
- How did you get feedback about the design from the other companies?
- What was the commitment of the other companies with the project goals?
- How was the information shared?
- What was the detail level of the communication with the other companies?
- How have you dealt with collaboration issues?
- How have you dealt with risk share?
- Who was in charge of the project management?

Energy issues

- What were the energy minimum requirements defined by the client?
- What were the energy award criteria defined by the client?
- What were the energy guarantees of results (if they existed)?
- What was the proposal you made for the energy issues?
- Did you implement innovative technical solutions related to energy?
- Is this type of contract facilitating the achievement of higher energy savings in your regard?

Conclusion

- What are in your regard the advantages and disadvantages compared to traditional DBB type of project?
- Do you think all renovation projects could be developed in this way? Which types yes and which not?

Appendix E Recommendations for SHOs

The end product of the Shelter project was a guide for social housing organisations. In this appendix we present the set of recommendations for SHO proposed in this guide.

Implementing effective energy renovation projects

When a SHO decides to improve the energy performance of a building, it must choose a project delivery method. Results of the SHELTER project show that the DBM approach offers the maximum potential to deliver energy savings. This project delivery method facilitates the collaboration between the different people involved as well as their commitment to achieve common project goals. It is possible, however, to use other project delivery methods and still obtain substantial energy savings, by following the recommendations within this guide.

In Table E.1 options that SHOs could take when implementing an effective energy renovation project are listed per project delivery method.

STRATEGY				
Introduce energy efficiency as one of the key parameters	Sbs	DBB	DB	DBM
Group properties by typology and geography	Sbs			
TENDERING AND CONTRACTING				
Use award criteria	Sbs	DBB	DB	DBM
Use framework agreements	Sbs	DBB	DB	DBM
Use performance-based specifications			DB	DBM
Use competitive dialogue			DB	DBM
Use Energy Performance Contracting				DBM
DESIGN				
Design models by typology of dwellings	Sbs			
Invite maintenance companies to participate in design phase		DBB	DB	
Strengthen the design team's role	Sbs	DBB	DB	DBM
CONSTRUCTION				
Organise meetings with all the project team members		DBB		
MAINTENANCE				
Agree transfer process from construction to maintenances	Sbs	DBB	DB	

TABLE APP.E.1 Table APP.E1 Key actions per phase and project delivery method

STRATEGY					
Introduce energy efficiency as one of the key parameters		Sbs	DBB	DB	DBM
Why	To ensure the integration of energy efficiency improvements as part of wider renovation objectives. To prioritise the renovation projects with larger potential energy savings. To guarantee lower costs for the energy efficiency measures, in comparison with doing the work in isolation.				
How	Add energy performance information to the housing stock asset management data, for example by recording certified energy performance of dwellings (which is already mandatory in several European countries). Take into account energy efficiency information when defining housing stock strategies and renovation plans				
Example	The French SHO, Dynacité, has integrated energy performance as an indicator in its housing renovation strategy. Energy performance is analysed with other indicators, like external architectural quality, social impacts and commercial capability. These indicators allow Dynacité to prioritise buildings on which to concentrate its renovation capacities. Dynacité has labelled 100% of its housing stock during the year 2011 for their “energy note”. In addition to Energy Performance Certificates, Dynamite also includes the dilapidation of the heating system and, the type of fuel used (gas, electricity, wood, etc.) in its “energy note”. They now plan to prioritise the renovation of dwellings rated as class E or worse.				
Know more	Managing the assets: a guide for housing associations, National Housing Federation. Link Concerted action EPBC, EU. Link				
Linked to recommendation 1 of the document “Recommendations for Public Authorities”.					
Group properties by typology and geography		Sbs			
Why	To facilitate the implementation of measures in a larger amount of properties reducing its price per unit. This can be enhanced if additional, neighbouring properties owned by other people/organisations can be included with the landlord’s own properties.				
How	Add housing typology information to the housing stock asset management data. Group properties by typology and geography. Take into account the typology and geographical information when defining the renovation plans.				
Example	By focussing its attention strategically; by typology and by geography, the UK SHO, Black Country Housing Group, generated savings of £80,000 on a £1.0M programme, i.e. 8% before competitive pricing effects. It was also possible to concentrate solid-wall insulation on an estate where BCHG owns a significant number in a pepper-potted estate.				
Know more	Typology Approach for Building Stock Energy Assessment, TABULA. Link				

TENDERING AND CONTRACTING

Use award criteria	Sbs	DBB	DB	DBM
Why	To encourage competition on quality rather than price.			
How	Define award criteria related to the main goals to be achieved by the renovation project. Choose award criteria that are easy to evaluate. Define evaluation procedures for the award criteria. Explain clearly, to the organisations who are tendering, the criteria and evaluation procedures; at the beginning of the selection process.			
Example	<p>The French SHO Dynacité has used the following award criteria in its DBM energy renovation project in Nurieux:</p> <ol style="list-style-type: none"> 1. Technical criteria - 55%; 1.1. Works methodology (14%); 1.2. Energy performance objective (20%); 1.3. Quality of the maintenance (14%); 1.4. Tenant's guidance (7%) 2. Price 45% <p>To evaluate the technical criteria, Dynacité had created a reference offer, which included all of the technical aspects Dynacité wanted to implement in its project. The tender submissions were compared to this reference offer. The tender that was the closest to the reference offer was chosen.</p> <p>The French SHO Logirep has used the following award criteria for its DBM energy renovation project in Vitry-sur-Seine (Paris region):</p> <ol style="list-style-type: none"> 1. Price (30%) 2. Energy savings proposed (10%) 3. Energy saving measures proposed (15%) 4. Obtaining the French BBC certificate (high energy performing building corresponding to a theoretical consumption of 104 kWh/m²/year) (5%) 5. Technical report (25%) 6. Architectural quality of the project (15%) <p>The Italian SHO ARTE Genoa has used the following criteria for its DBB deep renovation project Via Sertoli n.9 in Genoa:</p> <ol style="list-style-type: none"> 1. Economic bid (30%) 2. Technical bid (20%) (particular attention is reserved to the works program) 3. Technical bid for energy saving (50%) <p>The technical bid for energy savings was divided in sub-criteria</p> <ol style="list-style-type: none"> 1. Efficiency of the heating and hot-water system (6%) 2. Efficiency of the photovoltaic system (3%) points 3. Efficiency of the solar thermal system (3%) 4. Most valuable energy saving in terms of thermal inertia of the insulating shell of the building (8%) 5. Energy saving/recovering lifts (3%) 6. Efficiency of the data communication system connected to the terminals of the technical offices of ARTE (3%) 7. Term for system maintenance (9%) 8. Energy saving from thermal performance of windows, French windows and landing doors; including frames. (5%) 9. Increase in the global energy performance of the building (10%) <p>Dynacité project information in Power House Europe Link Logirep project information in Power House Europe Link Arte project information in Power House Europ</p>			
Know more	Construction Green Public procurement (GPP) Product Sheet, European Commission. Link. Linked to the recommendation 2 of the document "Recommendations for Public Authorities"			

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TENDERING AND CONTRACTING

Use framework agreements

Sbs

DBB

DB

DBM

Why	When a SHO has an on-going demand for works and services and the exact quantities are unknown, they can simplify the tender using framework agreements.
How	Tender a framework agreement for specific types of work or services. Select a single provider or pre-select multiple providers for that specific type of work or service for a set period e.g. four years.
Example	In the UK it has been shown to be advantageous to tender a large programme of works on multiple sites in a partnering arrangement known as a Framework Agreement. This approach enables a proper economic test to be undertaken through a formal procurement but without knowing the specifics of design, specification or even, perhaps, specific addresses. Once the successful partners are appointed they collaborate to “design” the most efficient programme for the client. Through Framework agreements, lessons learned on early interventions can be transferred to later interventions. Improvements can be in performance and/or cost. Cost savings can be shared, in order to incentivise all parties to seek them. Collaborative working practices, within Frameworks, have also been shown to improve the relationships between partners. Black Country Housing Group employed Framework agreements for trial projects in their SHELTER pilot; for all of these reasons. They employed a specialist consultant to develop the framework agreement such that the contracts between the various parties were written “back-to-back”. This was essential to ensure that no one contract made it impossible to execute one of the other contracts.
Know more	Framework agreement guide, SIGMA Support for Improvement in Governance and Management. Link

Use performance-based specifications

DB

DBM

Why	To allow the candidates to propose several alternatives for the required functionality. To define clear actions and responsibilities if the required performance is not being achieved.
How	Choose which performance parameters are to be used in the specifications and define minimum or maximum values (e.g. dwelling temperature 20-22oC, heating consumption 50kWh/m ²). Define the methods to evaluate the parameters chosen. Define the penalties and bonuses (where applicable) in relation to the performance achieved.
Example	The French SHO Logirep has used performance-based specifications in its energy renovation project of Vitry-sur-Seine. One of the performance-parameters defined in specifications was actual energy consumption. The contractor was engaged to reduce actual energy consumption by 40%, in comparison with a “0 level” that had been assessed by an independent engineering firm. This target had been included in the tendering procedure. The invitation to tender asked for 30% of energy reduction (also defined by an external engineering firm). We speak here of actual energy consumption for heating and hot water, not estimated consumption. Therefore, the behaviour of the tenants has an influence on the contracted performance. This risk was owned by the successful consortium. The consortium included a social worker, responsible for working with the tenants in order to promote more energy efficient behaviour. No penalties are applied for under-performance during the first year after the end of the works, which is a “test year”. During this first year, the guaranteed solar performance is agreed. After the “test year”, if the reduction in energy consumption is greater than contracted, the gains are shared 50/50 between the consortium and the tenants. In case of underperformance, 100% of the extra cost is paid by the consortium. Project information in Power House Europe. Link
Know more	Performance specification guide, U.S. Department of Defence Link

Linked to the recommendation 2 and 3 of the document Recommendations for Public Authorities.

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TENDERING AND CONTRACTING

Use competitive dialogue

DB

DBM

Why	To improve the quality of the offers. To make sure that pre-selected organisations, invited to tender, understand the functional specifications in the same way as the SHO before they make their offers.
How	Announce that the tender will make use of competitive dialogue as a tendering procedure. It is advisable that the pre-selection reduces the number of candidates to three. Define a schedule of meetings with the candidates, organised in rounds. Make sure that all candidates always have the same information from you, so that none gets a competitive advantage but do not share proposals from one candidate with his/her competitors. Take into consideration that compensation for the unsuccessful candidates is reasonable practice.
Example	The French SHO Dynacité has made use of a competitive dialogue in one round in its energy renovation project in Nurieux. The tendering procedure, from publishing the offer until awarding the contract took about 9 months. The competitive dialogue offered Dynacité the possibility to better understand and evaluate the offers made by the different candidates. It also allowed improving the initial program of works of the project, thanks to the solutions presented and explained by the candidates. The competitive dialogue gave Dynacité the possibility to evaluate the professionalism and the motivation of candidates, demonstrated by the presentations and discussions.
Know more	The competitive dialogue. Government of the Netherlands. Link Linked to the recommendation 5 of the document "Recommendations for Public Authorities".

Use Energy Performance Contracting

DBM

Why	To stress the importance of energy efficiency as a performance criterion. To guarantee the successful achievement of the contracted energy performance. To access third party finance schemes.
How	Define energy performance as the key performance criterion. Define the evaluation procedure to check that the contracted performance is being achieved. Define penalties where the performance is not achieved and bonus (share of the savings) where the results are better than defined.
Example	The French SHO ICF Nord-Est has made use of Energy Performance Contracting for the renovation 64 dwellings in Schiltigheim, guaranteeing energy savings of 47%. The contract used had several features: <ul style="list-style-type: none"> - Refurbishment works to upgrade the standard of comfort of both the dwellings and the common areas - Energy renovation with substantial investments in the building shell to achieve a guaranteed level of energy performance - Energy performance guarantee for the buildings for 19 years, through an operation and maintenance contract - Financing of energy renovations, which are progressively repaid by the Client, subject to achieving the guaranteed energy performance Project information Link
Know more	Handbook on Energy Performance Contracting in Social Housing with third party financing, FRESH. Link Energy Exploitation and Performance Contracting for Low Income and Social Housing, ECOLISH Link Toolbox for Energy Performance Contracting, EESI Link Innovative financing mechanisms for energy renovation. (in French) Link Linked to recommendations 3 and 5 of the document "Recommendations for Public Authorities".

DESIGN

Design models by typology of dwellings

Sbs

Why	To take into account positive interactions between different renovations works, i.e. roof replacement and installation of solar cells. To ensure that architectural quality is at least maintained, if not enhanced.
How	Making a renovation design model that can be applied to different dwellings with the same typology. Defining the renovation works to be performed based on this model for the dwelling of this typology.
Example	The UK SHO Black Country Housing Group has categorised its property by building type. This includes the 3-dimensional characteristics of the building together with the specification and condition of key elements, such as the type of heating system present. It also operates a “void standard” repair specification that is applied to all properties when a tenant leaves and before a new tenant takes up residence. Through their SHELTER project this approach has been modified to inform the future step-by-step renovation of the housing stock. Each dwelling type has an improvement specification that will deliver an 80% carbon savings (c.f. 1990); by 2050.
Know more	UK’s National Building Specification Scheduler, enables the specification of work packages by dwelling type. Link

Linked to the recommendation 6 of the document “Recommendations for Public Authorities”

Invite maintenance companies to participate in design phase

DBB

DB

Why	To give useful advice to the design team during the design phase.
How	Invite maintenance companies that are already working for the SHO to participate as advisors in the design process.
Example	An employee of the maintenance service department of the French SHO Dynacité participated in the design phase of renovation projects. Dynacité has also created a tool for the selection of heating systems. This tool uses a simple calculation of investment and maintenance costs. Designers and technical advisors are contractually obliged to use this tool and to propose to Dynacité three possible alternatives for the heating system, including life cycle costs.
Know more	Cost Optimum and Standard Solutions for Maintenance and Management of the Social housing Stock, AFTER Link

Linked to recommendations 4 and 5 of the document “Recommendations for Public Authorities”.

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DESIGN

Strengthen the design team's role

Sbs

DBB

DB

DBM

Why	To benefit from the multiplicity of disciplines that designers (architects and engineers) encompass and to support an integrated approach to project planning. To overcome difficulties in the renovation process which arise from conflicts between urban planning and energy regulations. To avoid the selected project delivery method compromising the designer.
How	Supporting lead-designers, e.g. architects, to undertake the task of coordinating project team members. Designers can go beyond their traditional role in the building process. Their role within partnering projects (apart from coordinating) can be in relation to cost estimating, project scheduling, construction supervising, safety regulations and sustainability aspects. Designers can be directly contracted by the client to provide a quality control service.
Example	<p>In December 2012 the Dutch Institute for Architecture (NAI) and Vernieuwing Bouw (a network organisation for innovation in building processes) organised a meeting about the role of architects in partnering projects similar to those of "Slim & Snel". The conclusions that were drawn for architects are briefly listed below:</p> <ul style="list-style-type: none"> • Architects cannot choose their traditional role in the building process. Instead they have to seek for a new role within partnering projects • The competences of architects are important. Their skills, especially in visualisation at the start of the building process, are of great value. Their contribution brings an added value to a building project. • Architects should focus more on product/process repeatable products. <p>As indicated by the above conclusions, a whole new perspective for the role of architects arises through the innovative renovation approaches followed in the Netherlands, as part of the "Energiesprong" program. Until now, in the fragmented construction "chain", the client has been responsible for the technical specification of a building. For this the client relied on specialised consultants not only for the forming of a proposal, but also for the definition of the problem. Different consultants provided various solutions the final result of which was usually a non-coherent translation into specifications and drawings. Innovative solutions are now examined in the Slim & Snel project, for the renovation of a large part of the Dutch housing stock. Slim & Snel - as part of the "Energiesprong" program - focuses on collaboration processes between all the different stakeholders involved in the construction sector. Based on 3 different starting models (that deal with different processes for putting the problem into context and forming a solution), four experimental projects are under way. In all projects "Slim & Snel" directly involves housing associations, designers and contractors, municipalities and end users to implement innovative renovation concepts and innovative collaboration processes. Among the preliminary conclusions of this process is that the degree to which this integrated design approach can be achieved is highly dependent on the way that the cooperation among the different stakeholders and people takes place. This is a challenge that architects can successfully address by going beyond their traditional roles and assuming a coordinating role in the renovation process.</p>
Know more	<p>Innovation for Energy Efficient Renovation in Dutch Social Housing Link</p> <p>The role of the architect in the supply chain integration (in Dutch) Link</p> <p>Linked to recommendations 6,7,8 of the document "Recommendations for Public Authorities".</p>

CONSTRUCTION

Organise meetings with all the project team members

DBB

Why	To help to create a collaborative environment between contractors, subcontractors and designers. To have a better knowledge of the parties involved.
How	Organizing a meeting at the beginning of the construction phase with designers, contractors and subcontractors. Organizing a meeting after the first construction phase of the renovation to evaluate the results and propose modifications in case needed.
Example	The pilot development of Bulgarian Housing Association successfully implemented an innovative project management model for subsidised renovation of multi-story apartment buildings. This model strongly relies on the active collaboration of all parties involved. The main result achieved has been a clear understanding that a project management unit is needed specifically to provide co-ordination. This is especially in regard to the professional leadership of the overall project development process. The project management unit is required to guarantee the integrity of the project process, phase by phase. This governed the relationships between the different people in the energy renovation of condominiums; through regular meetings with all the project team members. Regular meetings provided efficiency in the project development process; in terms of costs and timing. The main impacts of the project collaboration trial are related to the greater cost effectiveness of the renovation; in terms of greater energy savings for the same cost of renovation which means better return on investment. This is mainly achieved by the improved bidding procedures for the different type of construction works. In addition, the process led to a better quality of the construction works; mainly due to the improved coordination between the different parties such as designers, contractors and subcontractors. Finally, this innovative project collaboration reduced the overall construction time.
Know more	Energy renovation of Bulgarian homes. Support for energy efficiency in multifamily residential buildings. Link

Linked to recommendations 4 and 6 of the document "Recommendations for Public Authorities"

MAINTENANCE

Agree transfer process from construction to maintenance

Sbs

DBB

DB

Why	To ensure that there is a proper knowledge transfer about the installation from the construction company to the maintenance companies at the end of the works.
How	Planning several meetings between the construction and maintenance companies during the first year of operation.
Example	The sustainable building rating system BREEAM details the value of a Building User Guide in transferring information about the building to subsequent managers and users. This includes maintenance contractors. In order to produce such a guide the design team regularly agrees what needs to be in the Building User Manual and how it should be communicated. This is especially important for complex building services, such as combined heat and power systems. BCHG used this model during a recent new-build project and implemented it, for the first time in renovation, in their SHELTER pilot project.
Know more	Soft Landing guidance, BSRIA. Link Make energy change happen toolkit, Changing Behaviour. Link Developing and implementing effective household energy awareness, BewareE. Link

Linked to recommendations 4, 5 and 17 of the document "Recommendations for Public Authorities".

Curriculum vitae

Tadeo Baldiri Salcedo Rahola (1979) was born in Mérida, Venezuela, and raised in Barcelona, Spain. He obtained his industrial engineering degree from the Barcelona School of Industrial Engineering of the Polytechnic University of Catalonia in 2005. He worked as a project manager at Geòtics, a ground source heat pump installation company, and at Acciona Instalaciones, a building installations company. He also worked as a mobility advisor at the Bicicleta Club de Catalunya before moving to the Netherlands. From 2008 to 2010 he worked as a researcher at the faculty of Technology, Policy and Management of TU Delft. In 2010, he started his PhD at the Faculty of Architecture and the Built Environment of TU Delft. In 2014, he began working as a research project manager and lecturer at the Academy for Technology, Innovation & Society Delft of The Hague University of Applied Sciences.

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Reduction of CO2 emissions to 20 per cent below their 1990 levels by 2020 is one of the goals of the European Union. Renovation of the existing housing stock is seen as one of the most promising alternative routes to achieving this ambition. However, the ageing of the housing stock and the economic crisis have affected both the finances of social housing organisations and the finances of their tenants and is hampering the scale of housing renovation projects and the energy savings achieved. How can social housing organisations improve the performance of energy renovation processes under these circumstances?

This research, involving cases in several European countries, led to the conclusion that the Design-Build-Maintain project delivery method offers the best opportunity to facilitate the active involvement of all actors, obtains the best possible project performance and guarantees the quality of the end results.

Knowing that almost 9.5 per cent of the European housing stock is owned by social housing organisations, this book offers a valuable contribution in achieving the EU goals.

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