

2014

Possibilities for early contractor involvement in infrastructure projects in the Netherlands



Ballast Nedam

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30-5-2014

PROJECT DETAILS

Master thesis project:

Possibilities for early contractor involvement in infrastructure projects in the Netherlands.

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Preface

My name is Carmen van Huuksloot and I am a master student Construction Management and Engineering at the faculty of Civil Engineering at the Technical University in Delft. This report is written as part of my graduation research to the possibilities for early contractor involvement in infrastructure projects in the Netherlands.

During my study I have always been interested in the procurement of major infrastructure projects and thus I was sure that I wanted to use this subject for my graduation research. Nowadays there are many different opinions on the tender procedure in the Netherlands, dependent on the interests of different parties. In addition, there are different approaches to procurement. Every time, something new is introduced to meet the needs of all stakeholders. There was the option to look at existing approaches, but to me it was more challenging to explore something for my graduation research that is uncharted territory in the Netherlands. In this way, I ended up with the approach to procurement in the United Kingdom, called early contractor involvement.

I would like to seize this opportunity to speak a word of thanks. First, I would like to thank Ballast Nedam for the opportunity they gave me to do my research. Within Ballast Nedam I would particularly like to thank Kees Klap for all the knowledge and Erik Aal for the feedback and control of my project. Then, I would like to thank my graduation committee from the TU Delft, which consists of Marcel Hertogh, Leon Hombergen and Martin de Jong. They are carefully selected and did not disappoint me at all. During the research we had several meetings in which very useful feedback emerged. Finally, I also would like to thank all the participants of the interviews. Without them I was not able to describe the desires in the Netherlands and both the domestic and abroad experiences with ECI.

Delft, 30-05-2014

C.C. van Huuksloot

Abstract

Public works are construction or development projects, financed by public funds and constructed for the benefit or use of the general public (BusinessDictionary 2013, TheFreeDictionary 2013). Infrastructure projects are a serious part of these public works. In the Netherlands, these projects are an initiative from Rijkswaterstaat but executed by the building companies. The relationship between Rijkswaterstaat and the building companies has changed over the years. This relationship currently is indirect and standoffish, which is not desired in the field. Infrastructure projects are very complex and major challenges. Besides the relationship between Rijkswaterstaat and the building companies, there are some familiar problematic aspects of infrastructure projects. The biggest problems are related to time, budget and stakeholder satisfaction. Line that can be found in both theory as well as experience is that in the Netherlands there is a clear need for:

- Speeding up procedures
- Clearer line in procedures
- Involve contractors more because they have the knowledge, experience and creativity
- Procurement based on functional specifications instead of a too detailed request
- Less cost overruns
- Dialogue between client and contractor
- Fair distribution of the risks

It is tried to solve this by making adjustments to the current system, but now it is time to completely break new grounds. A possible new approach is the early contractor involvement (ECI) method, which is a new approximation to procurement that is developed in the United Kingdom and works well and within European legislation for several years now (IADC 2011, Simpson Grierson 2012). ECI is the early involvement of the contractor, so that later on in the project the rewards with regard to planning, clarity, disputes, innovation and uniqueness can be reaped. Contractors are getting involved early on in the process, which is positive because they are the experts who can offer technical know-how and innovative ideas to the client (IADC 2011).

Even though this early contractor involvement is successful in the UK and upcoming in other countries like New Zealand, Australia and South-Africa, it is not commonly used in the Netherlands so far (Simpson Grierson 2012). Early contractor involvement might have some unexplored advantages in the Netherlands, but these are not recognized up to now. A closer look to the characteristics, the possibilities, the barriers and the different forms of ECI, as well as a detection of the suitable projects and segments for ECI is required. When this is clear, there might be a change of the main stream in the Netherlands. To explore this, the following research question is answered in this report.

For which infrastructure projects on the Dutch horizon may ECI be effective, so that the current problematic issues can be solved to improve the field of procurement, solutions and project realization?

The Dutch alternatives to early contractor involvement are design and construct (D&C) and interweaving.

- Design and construct
In design & construct contracts (D&C) the contractor is responsible for the design of the infrastructure and for the realization of it. The client specifies a functional description and the contractor has the freedom to apply innovations into the design and realization. In design and construct, both design and construction are executed by the same contractor. The client is still responsible for financing the project and operation of the completed facility.
- Interweaving
The essence of interweaving is that the contractor plays a role in public decision making. The procurement procedure and the planning procedure run parallel and will be cross-linked at a certain moment. The two procedures do not flow into one another, so they formally remain two separate procedures.

But when these two alternatives are compared with early contractor involvement based on the Dutch requirements, it appears that early contractor involvement fit these requirements slightly better than the other two options.

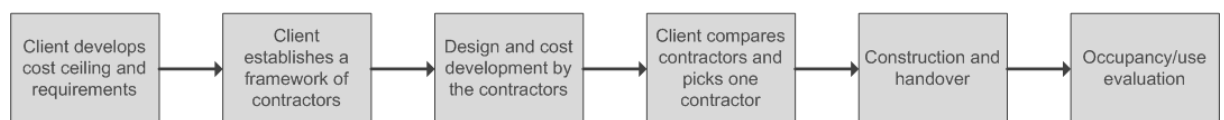
Early contractor involvement (ECI) is an approach to the procurement procedure that is developed in the United Kingdom. The main reason for the development of ECI was the reduction of project costs and it was thought that this could be best achieved when using the knowledge and experience of contractors as early on in the project. This means that in contrast to the traditional approach to procurement, the contractor is already contracted when the conditions are determined instead of the entire project design. The biggest advantage of ECI can be called relational contracting, which means that there is a long term vision that is beneficial for the relationship between client and contractor. This results in better solutions, innovations, greater commitment and a shortened project time. The biggest disadvantage can be called client capture, which means that the client is dependent on the contractor through which switching to an alternative is almost impossible. This results in the chance to end up with higher project costs and less control for the client.

Regarding early contractor involvement, three models can be distinguished that would underpin the drive for better value and affordability. The ECI models embrace early contractor involvement to drive innovation, identify waste and to secure knowledge transfer and growth opportunities. All three models are about early contractor involvement, transparency and integration.

- Cost led procurement (CLP)

Multiple teams work independently of one another to develop a project proposal. The focus is on reducing project costs to increase the chance to get subsequent projects. Subsequent projects are not common for infrastructure projects in the Netherlands. But you never know what might happen.

Cost Led Procurement



- Integrated project insurance (IPI)

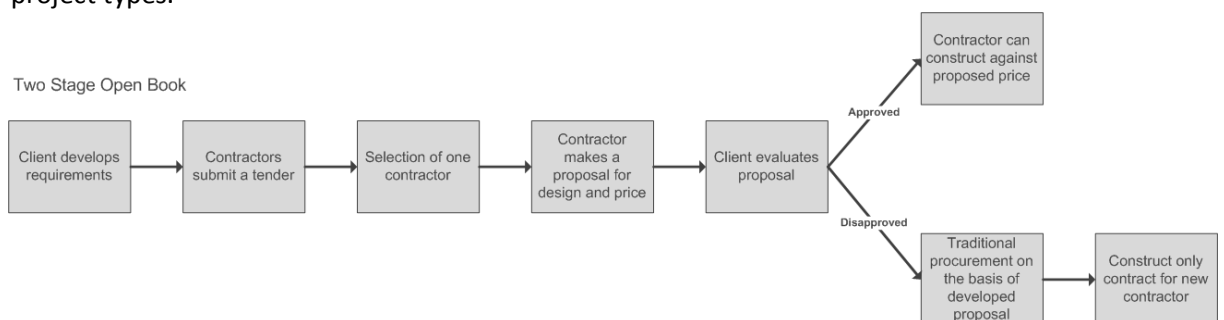
Multiple teams work independently of one another to develop a project proposal. The focus is on reducing the financial effects of risks by adopting an insurance policy.

Integrated Project Insurance



- Two stage open book (TSOB)

Quick selection of one contractor to form a partnership between client and contractor in which an unambiguous project definition is developed. This model is suitable for all kind of project types.



Ultimately, all this knowledge is used to determine appropriate projects on the Dutch horizon to serve as a pilot project for the application of ECI in the Netherlands. Based on the MIRT and the list from Richard Mulder from “Bouwend Nederland”, with future DBFM projects, a first selection of projects was made. Only projects of which realization starts in 2019 or later were included in the evaluation to make sure that no procedures are already started, through which influences are still possible. This has resulted in seven projects that are included in the study; A27 Houten – Hooipolder, Rotterdam Vooruit, Haaglanden, A58 St. Annabosch – Galder, A1 Zone, Capaciteitsuitbreiding Volkeraksluizen and Kanaalzone Gent – Terneuzen.

To serve as a pilot project for the application of ECI in the Netherlands, it applies that:

- Similar projects may be implemented already quite often. A repetitive nature is not wrong.
- The contractor needs to be able to bring its own contribution to the project. An innovative solution or design freedom are good examples of this. It is important that the project is somehow challenging the contractor.
- It is smart to stay near the core competencies of the contractor. This means that the projects may be technically complex, but not socially complex. This is done because the power of the contractor lies within the technical complexity and the social complexity will bring too much pressure for the contractor.
- The turnaround time should be five years or less, because this enables a quick learning curve, which is necessary in pilot projects.
- Projects are particularly suitable when they have a good project sum in addition to a quick turnaround. A lower budget is less risky than a higher budget.

This eventually has led to the conclusion that there are three projects suitable to serve as pilot project for the Netherlands.

A58 St. Annabosch – Galder

The A58 is a 160 kilometer long highway between Vlissingen and Eindhoven. This road connects most major cities in Brabant and is also part of the connections Rotterdam-Antwerp and Rotterdam-Ruhr. , In the high-growth scenario, a bottleneck between Breda and Tilburg can occur. In autumn 2010 it is therefore decided to solve this problem and the thereby mentioned preferred solution is widening to 2x3 lanes on the section St. Annabosch – Galder.

This project has little enormous risks at first glance, which makes it possible to quickly select one contractor. **Two stage open book** is therefore the recommended ECI model. The relation that will be created between the client and contractor will probably ensure the achievement of the optimal solution. This means that Rijkswaterstaat should put a list of the problem and the specific requirements on the market. Contractors can submit a tender with their thoughts, options and proposed project team. Then, the selected contractor and Rijkswaterstaat jointly work out the preferred or a better solution. Based on this design, the contractor shall constitute a price which the client agrees or not. This is decisive for the further cooperation between the two parties.

Capaciteitsuitbreiding Volkeraksluizen

The Volkeraksluizen are identified as a potential capacity bottleneck for shipping. The Volkeraksluizen are the busiest and biggest locks of Europe and are the link between the main routes that connect Rotterdam to the Scheldt ports, and the Scheldt ports with the German hinterland. There is no alternative route to the Rhine-Scheldt corridor so all inland shipping pass the Volkeraksluizen. The challenge is to create optimal hinterland connections and stimulate inland shipping.

Given the large social complexity, it is chosen to involve the contractors early in the project but not to directly select one contractor. Therefore **integrated project insurance** is chosen as the ECI model. Rijkswaterstaat makes its demands known and interested contractors then deliver their proposal. Rijkswaterstaat chooses the best three. These three contractors make a design and finally

the design that best meets everyone's needs and wishes is chosen to be realized. On condition that the price is also acceptable, the creator of the design also realizes the project.

A27 Houten – Hooipolder

On the A27 from Breda to Utrecht, the volume of the automobility increases, through which the travel time does not meet the targets expressed in the Infrastructure and Spatial Planning anymore. This means that widening the road is necessary.

The optimal solution, which solves the problem and fits within budget, is sought. Outside the big budget, there are, at first sight, no alarming issues that could cause huge risks. Quick selection of the contractor is possible and therefore **two stage open book** is advised. Rijkswaterstaat and the quickly selected contractor can jointly retrace all possible solutions and choose the best. When the cooperation pleases and there is agreement on the price, the cooperation can be continued.

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1. Introduction

1.1 Problem analysis

Public works are construction or development projects, financed by public funds and constructed for the benefit or use of the general public (BusinessDictionary 2013, TheFreeDictionary 2013). Infrastructure projects are a serious part of these public works. In the Netherlands these projects are an initiative from Rijkswaterstaat but executed by the building companies. The relationship between Rijkswaterstaat and the building companies has changed over the years. In relation with the building companies, Rijkswaterstaat used to be a large entity with a huge amount of knowledge. The relationship between Rijkswaterstaat and the building companies was close and consisted of direct communication. Due to new EU rules, privatisation and the so called construction fraud in the Netherlands, this relationship has changed dramatically, through which a gap is created between the two entities. Rijkswaterstaat has filled this gap with various advisors and consultants, making good communication between Rijkswaterstaat and the building companies impossible. This entails that the knowledge and experience of the building companies is still insufficiently used, while that may be extremely useful in the development of projects. Therefore it is desired that Rijkswaterstaat and the building companies come to be in direct contact to each other again, so they can both contribute to the development of complex infrastructure projects. This text is schematically shown in figure 1.

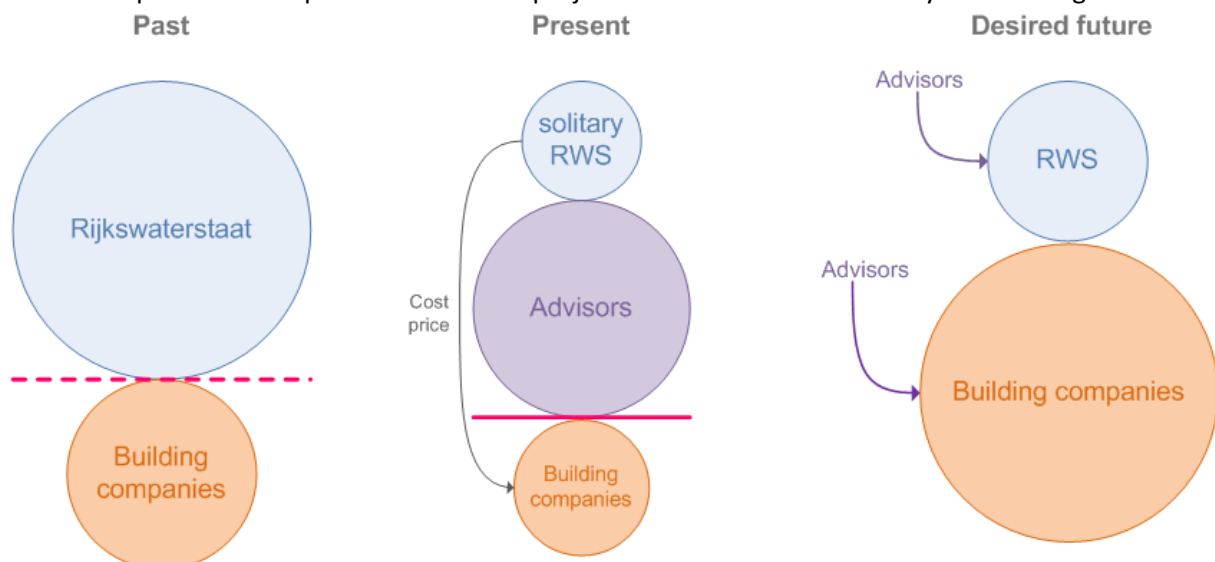


Figure 1: Relationship between client and contractor (Klap 2011)

Infrastructure projects are very complex and have major challenges. Besides the relationship between Rijkswaterstaat and the building companies, there are some familiar problematic aspects of infrastructure projects. Think about projects like the Betuweroute, the High Speed Line South, the Coentunnel, the MAVA and the North/South Line. Problems in the realization of complex infrastructure projects can be classified into three main categories according to Hertogh and Westerveld. The three categories for disappointments in large infrastructure projects are:

- Time
Large infrastructure projects often have to deal with delays. Two important causes for these delays are the lack of political commitment by the entities involved, as well as the lack of interactive management. Biggest delays are visible in the first stages of projects in which the important decisions are made. Advantage of the delays in this stage is that the entities can be prevented from taking decisions too quickly. Which actually means that there is the need to improve the quality of the decision making process and the use of interactive management strategies (Hertogh and Westerveld 2010).

- **Budget**
Large infrastructure projects not only fail in terms of time performance, cost overruns are equally important when it comes to these large and complex projects. Professor Flyvbjerg studied 258 different infrastructure projects and found that cost overruns of 50 to 100 percent are common in large infrastructure projects and even overruns above 100 percent are not uncommon (Flyvbjerg 2007). Attention should be paid to the huge amounts of cost overruns of these projects, so that cost overruns can have a big effect and can limit the possibilities to realize other formulated political ambitions (Hertogh and Westerverld 2010).

| Type of project | Number of cases | Average cost overrun (%) |
|---------------------|-----------------|--------------------------|
| Rail | 58 | 44,7 |
| Bridges and tunnels | 33 | 33,8 |
| Road | 167 | 20,4 |

Table 1: Inaccuracy of large infrastructure projects (Flyvbjerg 2007).

- **Stakeholder satisfaction**
Large infrastructure projects generally not satisfy their stakeholders in terms of added value of the final result of the project. This deficit means that government and other involved entities, are not able to align the project outcomes with the interests of the stakeholders (Nijssen 2006, Hertogh and Westerverld 2010).

Out of these three categories of problems, the time and budget aspects could be problems that may have been arisen in the procurement phase. As appendices A and B show, by means of preliminary research it can be concluded that there are some other issues around procurement in the Dutch infrastructure that can be improved.

Experts in the field of Dutch procurement find that the experience and knowledge of the contractors is insufficiently used in making the design and important decisions. The client sends a request to the market that is highly detailed, through which the contractors are not able to show their creativity and innovative ideas. All experts would like to see a request that is based on a budget, requirements and wishes of the client instead of fully developed design. Another important issue that is expressed during the interviews is the relationship between the client and the contractor. Right now this relationship is a big distance and standoffish one instead of close. This could be improved by increasing the possibility for dialogue and adversarial process to optimize solutions. The last issue expressed, is that the client currently is too busy transferring risks to the market entities. As a result it happens too often that the entity that does not see these risks or estimate them too low wins the tender. Therefor the focus should be on a fair distribution of the risks.

Line that can be found in both theory as well as experience is that there is a clear need for:

- Speeding up procedures
- Clearer line in procedures
- Involve contractors more because they have the knowledge, experience and creativity
- Procurement based on functional specifications instead of a highly detailed request
- Less cost overruns
- Dialogue between client and contractor
- Fair distribution of the risks

It is tried to solve these issues by making adjustments to the current system, but now it is time to completely break new grounds. A possible new approach is the early contractor involvement (ECI) method, which is a new approximation to procurement that is developed in the United Kingdom and works well and within European legislation for several years now (IADC 2011, Simpson Grierson

2012). ECI is the early involvement of the contractor, so that later on in the project the rewards with regard to planning, clarity, disputes, innovation and uniqueness can be reaped.

Contractors are getting involved early on in the process, which is positive because they are the experts who can offer technical know-how and innovative ideas to the client (IADC 2011). By using ECI, there is a change of roles in the process, which is illustrated in figure 2. In figure 3 a simplified reproduction of the ECI process is shown.

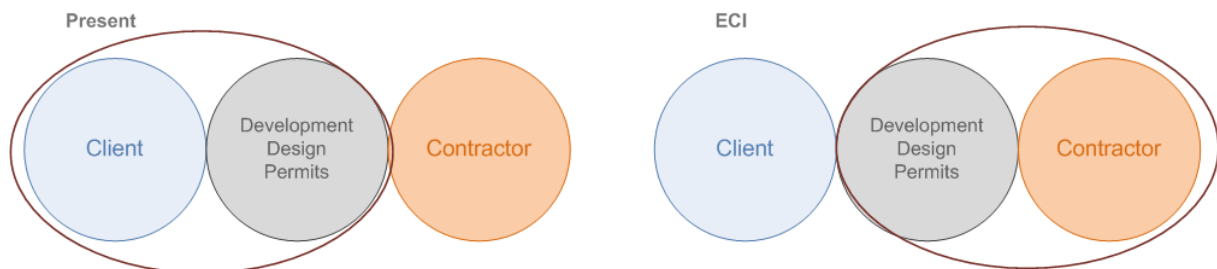


Figure 2: Shift in roles (Klap 2008).

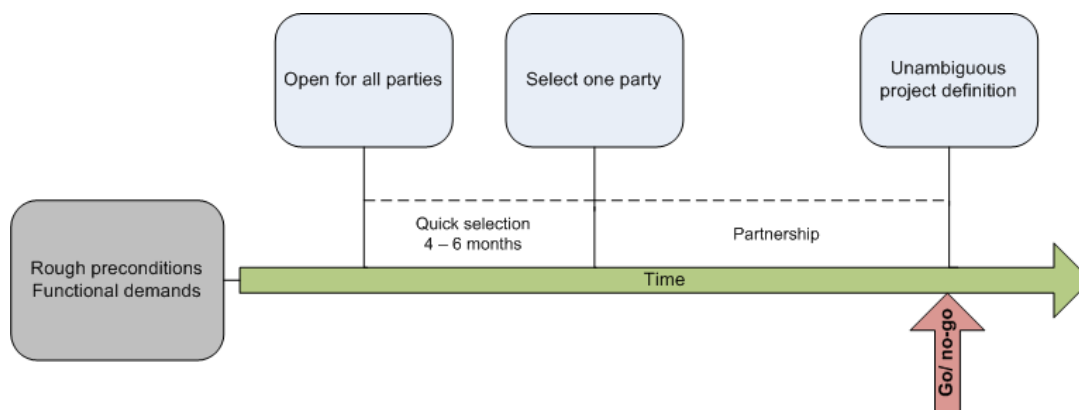


Figure 3: Simplified reproduction of early contractor involvement (own illustration)

The selection of the contractor is an interactive non-price selection in which the capability of the proposed team plays a significant role (Department of Main Roads 2009, Simpson Grierson 2012). When using a proper partnership contract, transparency should be increased, which results in reduced risks and limited reasons for litigation (HM Government 2013).

Even though this early contractor involvement is successful in the UK and upcoming in other countries like New Zealand, it is not commonly used in the Netherlands so far (Simpson Grierson 2012). Early contractor involvement might have some unexplored advantages in the Netherlands, but these are not recognized up to now. While talking to different people in the field of procurement, it seems that everyone is pretty positive about early contractor involvement, but for some reason there is still no adjustment of the main stream. A closer look on the characteristics, the possibilities, the barriers and the different forms of ECI, as well as a detection of the suitable projects and segments for ECI is required. When this is clear, there might be a change of the main stream in the Netherlands.

New approaches, like public-private partnership for example, are increasingly used, but still not completely satisfy the experienced issues. A public-private partnership (PPP) is a contractual agreement between a public agency and a private entity. Through this agreement, the skills and assets of both sectors are shared in delivering a public work. In addition to the sharing of resources, each party shares in the risks and potential rewards in the delivery of the work (NCPMP n.d.).

In the Netherlands it is attempted to apply PPP, but in fact the Dutch version seems to be more private finance initiative instead of public-private partnership. Public finance initiative (PFI) is a

sub-set of the broader PPP approach, in which funding of public infrastructure projects with private capital is the main goal. In PFI there is not a real partnership as envisioned in PPP. This, together with the dissatisfaction expressed in the interviews, indicate that a study to ECI as a new approach to procurement can be effective, desirable and useful.

Early contractor involvement seems to be promising and is successful in the United Kingdom, but is this the new approach for infrastructure projects in the Netherlands? To get an idea about how it is thought about in practice, interviews are executed with the project managers of the 'Sluis Stavoren' project and the 'A12 Zoetermeer – Gouda' project. These interviews can be found in appendix C.

The 'Sluis Stavoren' project was a DBM contract with a total value of approximately 16 million euros. All the facets that were involved in this project together made this project very complex. Ultimately, this project is completed successfully and within the given three years and according to Mr. Stob this has mainly to do with the good cooperation and agreements made with the customer. The design process went less smoothly and that was mainly due to the fact that no one actually possessed the appropriate and necessary knowledge. In addition, it was in the procurement process so that different solutions were not getting the attention they deserved because the customer wanted to treat all parties equally. These problems could have definitely been avoided with ECI, according to project manager Slob. The partnership between client and contractor is what he missed during the design of the lock. What worries him a little bit is the way in which the contractor is going to be selected.

The 'A12 Zoetermeer – Gouda' project is a large project of approximately 100 million euros, whereby ensuring the traffic flows was the most difficult. This project is completed successfully and within three years and according to Mr. Lindeman this has mainly to do with the proper planning that was made in the tender phase and of which all the milestones have been achieved. The realization of this project has gone very well, but afterwards some struggles with the client about the completion of the project and the quality of the end result, while this was not necessary. Project manager Lindemans believes that involving both the client as well as the contractor in the design and the early stage of project can have a significance influence on the course of the project, especially with regard to the agreements that were made. He also wonders how selection of the contractor will work in practice.

The thoughts about ECI as a new approach are positive, but there are still some questions. So, now the time is right to start an investigation into the possibilities of ECI in the infrastructural world of the Netherlands.

1.2 Problem formulation

1.2.1 Research objective

The goal of this research is to explore what early contractor involvement can add to the Dutch infrastructure market and suitable future infrastructure projects which lend themselves perfectly for ECI. The gained knowledge might contribute to make early contractor involvement possible, acceptable and supported in the Netherlands.

1.2.2 Research question

For which infrastructure projects on the Dutch horizon may ECI be effective, so that the current problematic issues can be solved to improve the field of procurement, solutions and project realization?

To answer this research question, central questions and sub-questions are formulated.

- I. *What does the basis of infrastructure projects look like?*
- II. *What is early contractor involvement exactly?*
 - a. What are the characteristics of ECI?
 - b. What are the advantages and disadvantages of ECI?
- III. *What are the different forms of ECI?*
- IV. *What are the alternatives for ECI?*
- V. *What will be suitable infrastructure projects in the Netherlands to apply early contractor involvement?*

1.4 Research methodology

In this paragraph, the research strategy will be described. This research strategy is the entirety of interrelated decisions about how to carry out the study. First, research was done to problems within large infrastructure projects. This research was done based on the thesis from Hertogh and Westerveld. Subsequently, interviews were executed with experts in the field of Dutch procurement to be able to explore what the practical experiences are. These experts know exactly what happens in practice, how they experience the process and where they see potential solutions. This is of great importance to be able to match the solution provided in this report as well as possible to what is desired and experienced in practice. For the interviews, experts from different areas of expertise were chosen, to ensure that all perspectives of the procurement procedure are covered. Individuals for the interviews were selected based on recommendations. The same questions were asked to all of them, which ensures a more precise progress. This, together with the research into problems within infrastructure projects ensure that a clear view on the actual problem was formed.

Then, to be able to answer the research- and central questions, five steps were taken. First, it was important to explore the basis of large infrastructure projects. This addresses the steps between the initial idea and use, the permit procedure and European regulation and procurement. It is important to understand this development before any modifications or improvements to the current system may be advised.

Next part of the research consisted out of exploring what early contractor involvement exactly is. To be able to draw a conclusion over the possibilities for ECI in the Netherlands, it is of great importance to clarify ECI. The background, the characteristics and the advantages and disadvantages are explained.

A preliminary investigation has revealed that there are three different models for applying ECI. These three models are called; cost led procurement, integrated project insurance and two stage open book. These models deserve a closer look, because they can be used in the advice for future projects.

It is also important to explore the alternatives for ECI. These alternatives should be investigated and compared with ECI. Based on these results it can be concluded whether ECI might be effective to recommend for future projects or that it does not make much difference compared to the methods that are currently available. This comparison was done by testing all the possibilities based on the evaluation criteria obtained from the interviews.

If it turns out that ECI is something different/more useful than the alternatives, possible projects for ECI on the Dutch horizon can be examined. This was done by looking at all future projects within the MIRT. A selection between these projects was made by looking at projects that start in 2019 or later, since there are no paths started already for these projects. These projects are briefly described and tested. To test these projects, it is important to explore what kind of projects are suitable for ECI. Then, based on these results, the selected projects are tested and for the projects

that really fit the requirements an advice in relation to the available ECI models will be given for the suitable projects.

Finally, some additional remarks must be made. ECI is not introduced for a very long time and in addition, literature about experiences with ECI is scarce, therefor there is only little empirical information available. In order to get some information from practice, some interviews were executed, but this is not sufficient enough to make a complete empirical list. In addition, this research will largely be inspired by the situation in the United Kingdom, because that is where the principles of ECI come from and where ECI is most developed. Besides that, very little information about the application of ECI in other countries like Finland and Australia can be found.

2. The basis of infrastructure projects

In this chapter the basis of infrastructural projects will be explored. First, the steps of the traditional development of projects will be given in paragraph 2.1. In this paragraph the steps from idea to actual realization will be introduced. For the development of infrastructural projects it is of great importance to take a closer look at the permit/decision-making procedure, therefore this will be clarified in paragraph 2.2. Finally, European regulations and procurement with regard to infrastructural projects will be discussed in paragraph 2.3.

2.1 Steps traditional development of infrastructure projects

The development of infrastructure projects can be broadly divided into design and realization. As these terms already suggest, in the design phase the project is prepared in terms of requirements, functions, appearance, form, budget and schedule. In the realization phase much effort is made to convert the design as accurately as possible into reality. When the process is examined in more detail, it can be seen that it is more than just these two phases. To illustrate this, the different steps in the development of infrastructure projects are presented in figure 4.

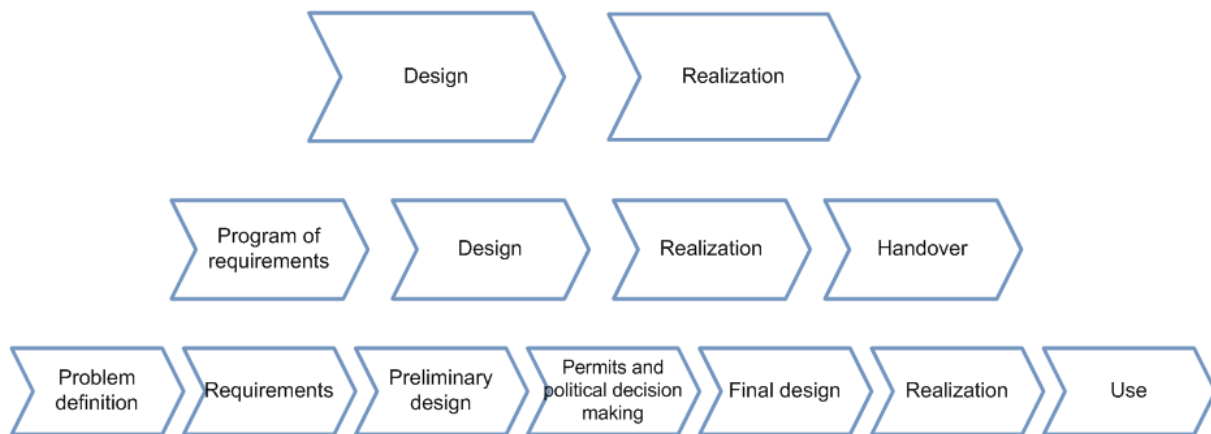


Figure 4: Details of the development of infrastructure projects (own illustration).

In the figure above it can be seen that at a lower level of detail, the development of large infrastructure projects consists of seven sequential steps (Klap 2011).

1. Problem definition
In this step the problem is determined. The undesired situation as well as its causes and consequences are explored in detail. Additionally, concept solutions are created in this phase.
2. Requirements
In this phase the requirements that need to be fulfilled by the final design are established. This implies that a number of concept solutions are directly eliminated.
3. Preliminary design
Here a preliminary design for the project is developed. This design is the basis for obtaining the permits.
4. Permits and political decision making
In this phase, everything around the licenses is arranged. This is an important step, since the construction cannot begin without these permits. In this phase, actually three things can happen; the plan for the project is approved, the plan still needs some adjustments or the plan is completely rejected. In addition, the Lower House of Parliament decides whether or not the project may become reality in this phase.

5. Final design
If the plan still needs some adjustments, the preliminary design is adapted and transformed into the final design. If this is not the case, the preliminary design functions directly as the final design.
6. Realization
This is where the actual construction of the infrastructure takes place.
7. Use
After several years of realization, the infrastructure is finally completed. The project can be delivered and is ready for use by the general public.

2.2 Permit/decision-making procedure

The previous paragraph shows that step 5 of the development of infrastructure projects consists of obtaining permits and making decisions. As illustrated in figure 4, the permit procedure seems to be an easy step, but unfortunately obtaining permits is often a difficult and lengthy process that deserves some extra attention.

For big infrastructure projects in the Netherlands, the procedure called 'Tracéwet' should be applied. Figure 5 shows the different steps of the 'Tracéwet'.



Figure 5: Illustration of the 'Tracéwet' (own illustration).

This procedure should be applied to national infrastructure projects, like motorways, railways and waterways. This procedure is not only obliged for new infrastructure, but also for plans for modifications to existing infrastructure. It should be noticed that this infrastructure act does not apply for municipal/provincial infrastructure like the subway or the tram, for these kind of projects the normal land-use plan procedure should be followed.

Some extra attention should be paid to the exploratory phase in figure 5, because this phase actually is not a part of the procedure. Here it is decided whether or not it is necessary to start the infrastructure planning act procedure, to possibly reduce the costs (Hobma 2012).

Regarding the 'Tracéwet', a distinction is made between a regular and a shortened procedure. The regular procedure is for projects involving new infrastructure, the shortened procedure may be used for making modifications to existing infrastructure. In terms of procedures, it is therefore smarter to modify existing infrastructure instead of building new infrastructure. Within the shortened procedure, a distinction is made between activities that fall under the Environmental Impact Assessment (EIA) obligations and activities that do not. The EIA is an instrument for integrating environmental obligations and considerations into the preparation of plans for infrastructure projects. This assessment is a combination of the Environmental Impact Assessment Directive and the Strategic Environmental Assessment Directive of the European Union. In the Netherlands these directives are implemented in the EA-chapter in the Environmental Management Act and the EA Degree. During the 'Tracéwet' this assessment is completed with an Environmental Impact Statement (EIS) (Koning 2012). Eventually, these distinctions form three variants to the 'Tracéwet', which are all illustrated in the figures below. It must be said that only a few projects fall under the third category, for which a special list is drawn (Hobma 2012).



Figure 6: Procedure for the planning of new infrastructure (own illustration).

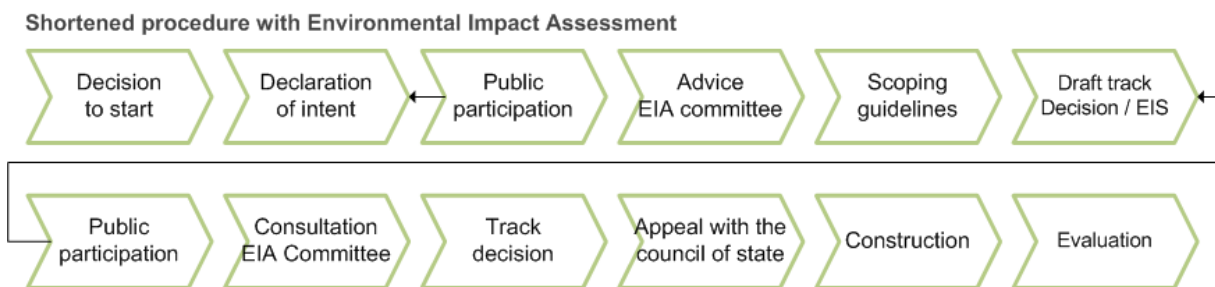


Figure 7: Shortened procedure for activities falling under the EIA obligations (own illustration).



Figure 8: Shortened procedure for activities not falling under the EIA obligations (own illustration).

2.3 European regulation and procurement

Because every entity should have equal rights and chances to execute a public work, there is a procurement procedure in the European Union (Noppen 2012). Procurement law was introduced because of the fact that getting an assignment by knowing specific people was not desired anymore. Procurement law in the Netherlands is basically a translation of the European Directives about procurement (Holleman 2013). EU directives lay down certain objectives that must be achieved in every member state of the European Union. National authorities have to adapt their laws to meet these objectives and are free to decide how to do so. Each directive specifies the date on which the national law must be adapted. The European Directives are used to bring different national laws in line with each other (European Commission 2012). These European Directives, Directive 2004/18/EC and Directive 2004/17/EC (Chao-Duvis, Koning et al. 2012), are introduced because the European Union aimed to take away the barriers to provide freedom of movement of people and goods/services, so that the economic welfare of all member states can be improved. An interesting side effect of these Directives is the duty to transparency (Chao-Duvis 2012).

Procurement is the purchasing of goods or services by the government (in this research Rijkswaterstaat) from an outside body (in this research the contractors). For this purchase both contract and award procedure are specified (Chao-Duvis 2012). This European Law is based on the idea of a common internal market, liberation of regulated markets and the implementation of free market principles in the European Union (Beekers 2012).

Procurement law governs the way in which Rijkswaterstaat finds contracting parties. Individuals are free to enter into a contract with whomever they please and are free to choose a contract partner, but this freedom does not apply to Rijkswaterstaat. Regulating this intends to give everyone an equal chance in the large governmental market. Assignments above the European threshold values must be put to the European market (Chao-Duivis, Koning et al. 2012). These European thresholds are established by the EU every two years and for 2014-2015 the threshold value for works is established at 5.186.000 euros (Rijksoverheid 2013, Pianoo 2014).

In the Netherlands, Directive 2004/18/EC and Directive 2004/17/EC are translated into the Dutch Procurement Act (Chao-Duivis, Koning et al. 2012). Directive 2004/18/EC refers to the classical sector and is about the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts. Directive 2004/17/EC coordinates the procurement procedures of entities in water, energy, transport and postal services sectors (Authority for the supervision of public contracts 2010, Broerse, Peelen et al. 2013).

The main principles of these directives imply that procurement procedures must satisfy the requirements of non-discrimination, transparency and proportionality (Broerse, Peelen et al. 2013). Other specific procurement and tendering regulations are based on the objectivity principle and the competition principle (Bregman 2009).

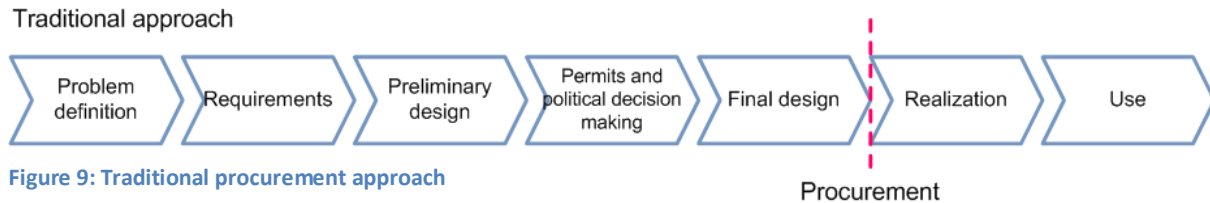
| Principle | Explanation | Reference |
|---------------------------|--|-----------------------------|
| Non-discrimination | No restrictions should be placed on the procurement process limiting the pool of potential tenderers and candidates on the basis of their nationality or the country of origin of the supplies | (DG ECHO n.d) |
| Transparency | Stipulates that preferences are eliminated Refers to the unobstructed visibility and openness in all transactions, ensuring that all information on procurement procedures, opportunities and processes are clearly defined and made widely known and available | (Bregman 2009, DG ECHO n.d) |
| Proportionality | Requires that procedures for awarding a contract must be proportionate to the value of the contracts | (DG ECHO n.d) |
| Objectivity | States that the tenders' awarding norms/award criteria should be predetermined and controllable | (Bregman 2009) |
| Competition | Makes sure that the organization of tender procedures is accompanied with enough competition between the entities involved | (Bregman 2009) |

Table 2: European Principles for procurement.

Much of the current construction management focuses on releasing the request once the design has already been developed. The contractor is expected to deliver the project within a specified design, planning, budget and quality. This can be seen as the traditional perspective of procurement (Walker and Lloyd-Walker 2012). The traditional approach, which is main stream in the Netherlands, is illustrated in figure 9.

In this traditional approach, building contracts are generally preceded by a single-stage procedure to select a suitable contractor. This contractor has offered a price that is based on designs developed by other entities. Instead of reflecting the wishes and needs of the client and its contractors, this procedure reflects a long-established complex and fragmented sector (Mosey 2009).

In the traditional start-up of projects, the public party, also called the client, takes lead. Tendering procedures start after completion of the planning phase. Contractors, who have extensive knowledge about executing infrastructure works, are involved after the public decision-making, which limits their ability to optimize the project with innovative solutions (Valkenburg, Lenferink et al. 2008).



Given the Dutch Procurement Act, Rijkswaterstaat can be seen as the client and building companies as the contractors. Rijkswaterstaat is obliged to follow the Dutch Procurement Act because most of the time the issued contracts have a large value and are above the European thresholds. Rijkswaterstaat uses two different procurement forms (Holleman 2013):

1. Open procurement;
Every interested entity can subscribe itself. The decision for the best of all interested parties is based on the lowest price or the most economically advantageous tender (MEAT) (Holleman 2013). The entities do not only submit an offer, but also explain how they fit the requirements (Chao-Duvis 2012).
2. Restricted procurement;
Everyone can express interest, but tenders are invited from a limited number of providers (Chao-Duvis 2012). After application of the entities, a selection will be made and only five of them can subscribe and deliver an offer. This selection can take place through a ranking of the best entities or a drawing of lots between the appropriate entities who satisfy the given requirements. The contractors prefer the ranking method, because of the fact that they want to be judged on their qualities. Despite that, Rijkswaterstaat still sometimes uses ranking for the first three companies and drawing of lots for the other two, to give smaller and new companies also a chance. The five chosen entities are compared with each other and the winner is based on the MEAT (Holleman 2013).

Rijkswaterstaat can choose to shape the process with competitive dialogue or not. Competitive dialogue is a formal procedure in which selection takes place in several phases. With this method you go from five to three parties with whom you are going to have a dialogue to figure out whether or not they understand the problem and how well their solutions fit to the problem. Eventually, the best entity is picked by comparing the dialogues with each other. Competitive dialogues can be used in case of particularly complex contracts in which Rijkswaterstaat is not objectively able to define the technical, financial and/or legal aspects of the project (Chao-Duvis, Koning et al. 2012).

2.4 Chapter conclusion

Infrastructure projects generally consist of seven sequential steps; problem definition, requirements, preliminary design, permits and political decision making, final design, realization and use. Especially the permit and political decision making step is difficult and time-consuming, but it is of great importance.

Infrastructure projects are bound to European regulations and therefor often have to go through a procurement procedure. This procedure is used to select an appropriate contractor for the work. In the traditional procurement procedure the contractor is introduced in the project once the final design is made and approved. The choice for the contractor is often price-based.

In this chapter, better insights into the development of infrastructure projects are gained. It is important to understand this development before any modifications or improvements to the current system may be advised. From this point on, early contractor involvement will be examined as a new approach to procurement for infrastructure projects in the Netherlands.

3. What is early contractor involvement exactly?

Given the current way of working in the infrastructure sector, some problematic issues are experienced which are expressed in the literature as well as in interviews with experts in this field. To solve this it might be time to completely break new grounds. A possible new approach is the in the United Kingdom developed early contractor involvement (ECI) approach.

To be able to draw a conclusion over the possibilities for ECI in the Netherlands, it is of great importance to make clear what ECI exactly is. That is why the background of ECI will be introduced in paragraph 3.1. In paragraph 3.2 the course of ECI is outlined. The characteristics and the advantages and disadvantages are explained in paragraph 3.3 and paragraph 3.4.

3.1 Background of ECI

The Government Construction Strategy, presented in May 2011, set out a range of measures intended to stimulate growth in the construction sector in the United Kingdom. These measures relate to the way in which projects are managed and procured and are opportunities to generate savings (Government construction team 2012).

Cabinet Office wants to reduce the public sector construction costs with fifteen to twenty percent by 2015 (Morby 2012). In order to make this possible, the public sector and private contractors need to work together. That is the essence of the Cabinet Office's approach to procurement in the construction industry (Hicks 2012).

The client is interested in completing a project efficiently without claims or disputes. Without a clear preconstruction contractual model, there is a greater likelihood for decisions being delayed. To achieve a complete and functional design, that can result in an efficient project completion, it has been recognized that contractors and specialists should make design contributions (Mosey 2009).

More and more, governments are involving all kind of stakeholders to ensure a better end result with higher public support. Private contractors play a larger role than ever before. This development started in the United Kingdom as early contractor involvement (Beekers 2012). The challenge to deliver work within the smaller budgets has been made easier, by the Government's willingness to include private contractors in an early stage of the project (Hicks 2012).

The aim is to involve contractors in the planning process to be able to increase the value for money of projects. The result is the ability to design more innovative solutions for specific situations which could not be designed without the knowledge and experience of the contractors (Valkenburg, Lenferink et al. 2008, Tillema and Arts 2009). Another important reason to involve market entities in the planning phase implies changing behavior towards environmental and social effects. Those effects are not always taken into account during the design phase, through which projects are often not fully supported by their users. The early involvement of market entities and other stakeholders enables them to influence the design in a positive way, through which the planning process is likely to run smoother and project results are probably better (Flyvbjerg, Bruzelius et al. 2003).

This early involvement method uses both price and non-price selection criteria at predetermined stages of the selection process. The client and contractor work together to develop the design, the planning, the price and the risk allocation. This combined input allows well-informed decision making early in the process, which can have significant impact on project outcomes (Department of Main Roads 2009). Contractors can bring their expertise to the table and deliver efficiencies and savings (Hicks 2012).

3.2 Early contractor involvement

As the name already suggests, contractors are involved at an early stage of the project in early contractor involvement. This because they have the necessary knowledge and experience that can provide creativity, innovative approaches, better decisions and a smoother and faster progress of the process. In contrast to the traditional approach to procurement, the contractor is already contracted

when the conditions instead of when the entire project design is already determined. The difference between the traditional approach and early contractor involvement is depicted in figure 10.

Early involvement means that construction issues can be injected into land requirements and environmental treatments and the contractor can gain a much better appreciation of overall risks and the context of the works (Department of Main Roads 2009). In the United Kingdom, the commonly used course of this approach can be found in figure 11.

ECI is the early involvement of the contractor, so that later on in the project the rewards with regard to planning, clarity, disputes, innovation and uniqueness can be reaped.

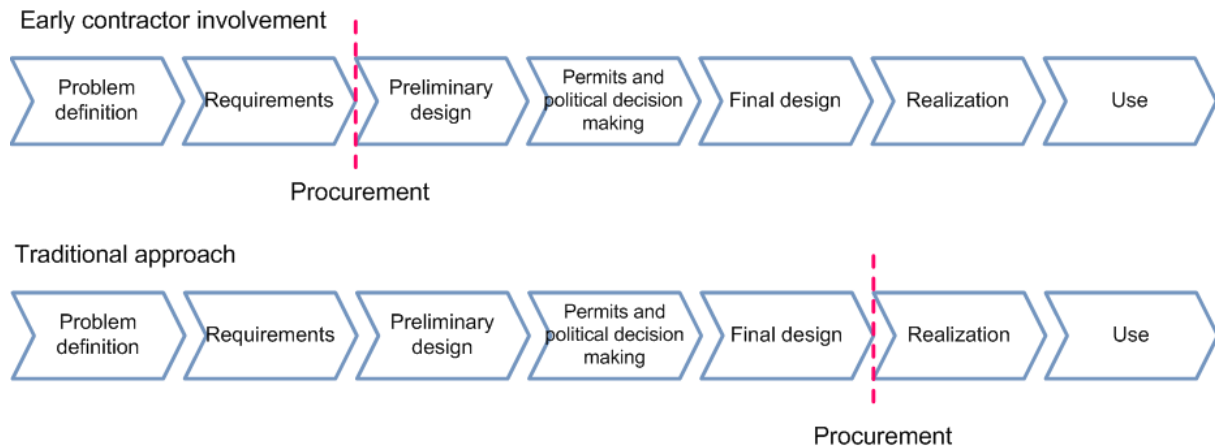


Figure 10: Early contractor involvement versus the traditional approach (own illustration).

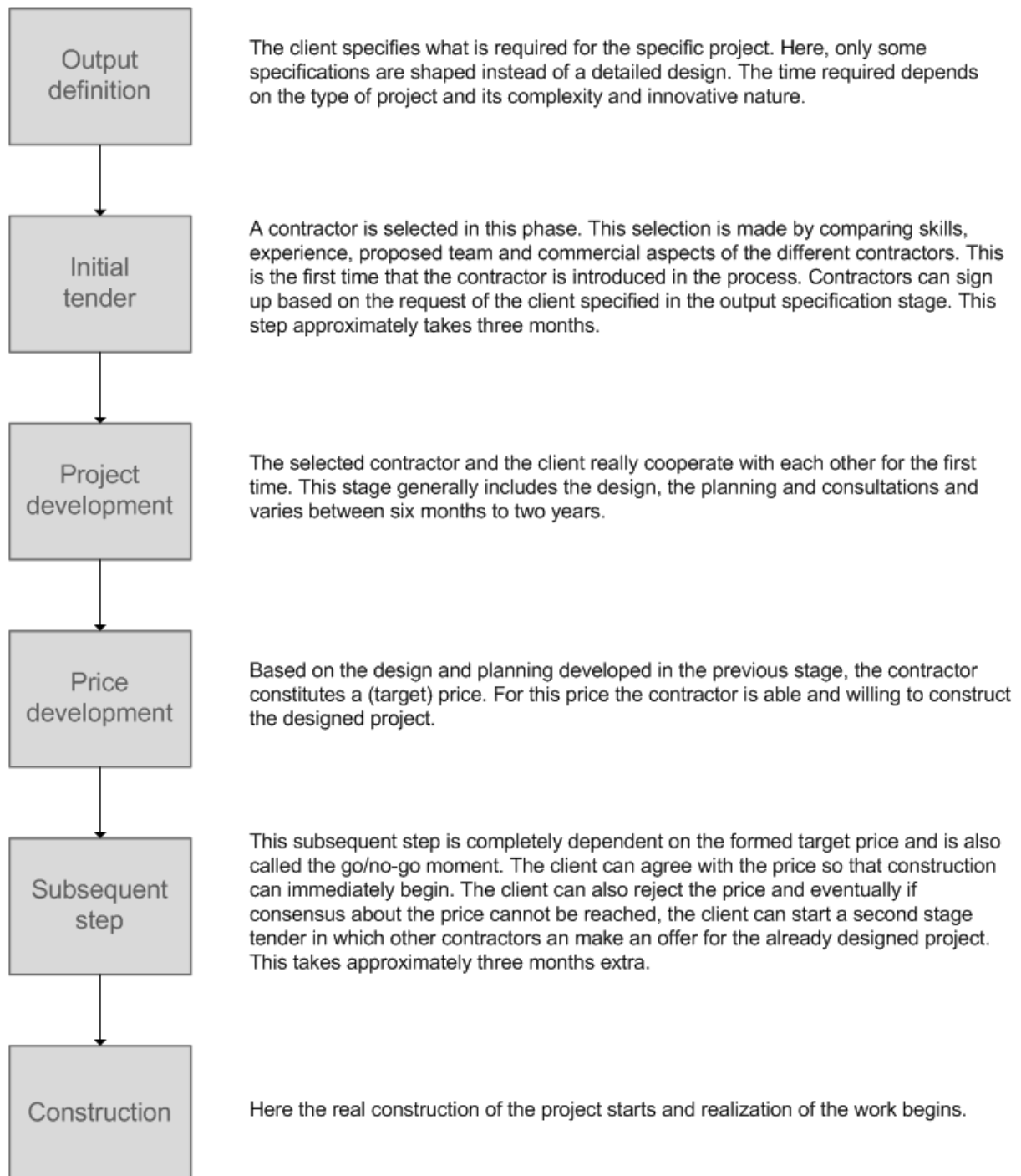


Figure 11: Current progress of ECI in the UK (own illustration).

3.3 How about...?

3.3.1 Characteristics of ECI

The development and application of early contractor involvement in the UK has a number of characteristic features.

- Contractors are engaged in the procurement procedure at the point of maximum influence, ideally once the required outputs are known and the solution is still in the initial stages of development (HM Treasury and Infrastructure UK 2013, Free 2014).
- This tender process complies with procurement law but does not adopt overly cautious strategies (HM Treasury and Infrastructure UK 2013). Selection of contractors is at an early stage and is based on their capability, staff quality, some level of pricing and a schedule.

- Once the contractor is selected it is paid to develop the project and prepare a (target) price for carrying out the created plan. After the price submission there often is a break point, also known as the go/no-go moment, in which the client is allowed to retender the work of the contractor if a price cannot be agreed. The intellectual property is owned by the client (Free 2014).
- The procedure consist of flexible payment terms and contract terms and utilizes incentive strategies that reward all levels of the supply chain (HM Treasury and Infrastructure UK 2013).
- Because ECI is a new way of approaching procurement, a client who is open to new contract forms and dares to take the lead is crucial. Just like the selection of an appropriate project, which is central to success because not every project lends itself to ECI (IADC 2011).
- Specific project related proposals

3.3.2 Regulations and transparency

Of course, ECI should comply with the European Union regulations. These regulations allow for a client to seek professional advice from contractors at an early stage of a project's development as long as the principles of transparency and equal treatment are taken into account. The principle of transparency implies that all the conditions and detailed rules of the award procedure must be drawn up in a clear, precise and unequivocal way. If transparency exists in the form of transparent contracts and transparent cooperation with colleagues on all organizational levels everyone will know where they stand, what their responsibilities are and what is expected of them. Transparency in ECI will develop trust and teamwork, which are the foundations for making ECI successful (IADC 2011).

A flexible procedure that preserves competition is allowed when open or restricted procedures are not sufficient enough. According to Directive 2004/18/EC, Recital 31: "Contracting authorities which carry out particularly complex projects may, without this being due to any fault on their part, find it objectively impossible to define the means of satisfying their needs or of assessing what the market can offer in the way of technical solutions and/or financial/ legal solutions. This situation may arise in particular with the implementation of important integrated transport infrastructure projects" (IADC 2011).

3.3.3 Contractor selection

In early contractor involvement contractor selection is based on a wider range of criteria than pricing elements alone. Aspects that play an important role during selection are:

- Technical knowledge and skills: experience in engineering elements and appropriate design capacity
- Management skills: managing time, costs, value, quality, risk, health and safety
- Internal organization: clear communication, sound administration and empowered staff
- Collaborative culture: partnering, positive lead from the top and client focus
- Human resources: qualified and enthusiastic personnel available to do the job
- Supply chain management: proper dealing with subcontractors and suppliers and established relationships
- Financial resources: sound balances and cash flow, reliable references
- Sound, relevant and demonstrable experiences in the past

Such criteria are more demanding for the client and its consultants to assess than a straightforward comparison of prices, but they provide valuable information that will assist the client in making the right choices (Mosey 2009).

3.3.4 Risk distribution

At the start of a project, the first thing that is done with regard to risks, is trying to eliminate these risks. There always remains a residual risk and with regard to those risks, there are two possibilities for dealing with them. The first possibility is reducing the contractor's potential benefit should the

risks arise. This is not a fair distribution of the risks, because the client and his consultants have enough time to organize and assess their risks, whereas a bidding contractor only has a few weeks to explore the risks as part of its response to the client's invitation to tender. So a better strategy for risk management would be the sharing of risk through joint risk management (JRM) (Mosey 2009). JRM is an approach that highlights the importance of collaboration between the involved entities in managing risks that cannot be identified at the start of the project (Osipova and Eriksson 2013). Bennett and Pearce state that risk management will be more successful if the whole project team is appointed at an earlier stage in the project. Contractors, consultants and other key suppliers bring knowledge and experience about construction, delivery and related financial risks that are helpful in jointly managing project risks (Mosey 2009).

3.3.5 Relationship between client and contractor

Effective relationship management between client and contractor is a major component for successful application of early contractor involvement, because it can improve the management of risk as well as stimulate innovation and performance and reduce costs and potential disputes. Relationship management is about agreeing on project objectives, procedures for communication and processes for resolving issues before they can become formal disputes. Both client and contractor nominate representatives to form the relationship management team who are required to participate in relationship workshops to develop a team approach. The objective is to form commitment, improve communications and avoid disputes between client and contractor (Department of Main Roads 2009). It has been suggested that a great start at the begin of the project results in improved performance of the entities and an improved overall project result.

In ECI it is of great importance that the client has great commitment to the project, this is not only important for the progress of the ECI procedure, but it will also help the client in fulfilling its responsibilities to end users and stakeholders.

Communication between the parties involved is the basis for a good relation. That is why a communication system with specific agreements is laid down for each project. Attention must be paid to the fact that a lack of communication can lead to misunderstandings and missed opportunities, but on the contrary, too much communication can lead to a waste of time (Mosey 2009).

3.3.6 Go/no-go moment

During the ECI process, the contractor develops a target price, for which the contractor is able and willing to realize the construction project, and an unambiguous project definition, in which the project is design and planned. The price is based on the collective developed design and planning. As said before, the client has the right to approve or reject this price and project definition. The moment in which the client can decide to do so is called the go/no-go moment. Once the client decides to give the construction a go, he automatically approves the contractor's price and project definition. The client can also decide to reject the contractor's price or definition. Then they can try to collectively establish a new price or adjustments to the project definition, but once agreement can not be reached, the construction of the project gets a no-go. This means that the cooperation between client and contractor is ended and the client needs to look for a new contractor in a second stage tender. This second stage tender has the form of a normal build contract, so contractors make an offer based on the already formulated design and planning. Here it can be seen that the client has the intellectual property of all formed documents, because the client has already paid for it. In the interview with Bill Free from Carillion Rail it became clear that this no-go decision is usually a threat but that it is also used very occasionally (Free 2014).

3.4 Advantages and disadvantages of ECI

In this paragraph the advantages and disadvantages of ECI will be explored. Practical experiences and interests are taken into account by mentioning advantages and disadvantages of ECI during the interviews with the experts in the field of procurement, this information is subjective. Advantages

and disadvantages of ECI described in the literature, is scientific and independent and therefore objective. Therefore a distinction is made in this paragraph between the advantages and disadvantages described in the literature, and the ones mentioned during the interviews. First in paragraph 3.4.1 the advantages and disadvantages according to the literature will be given. In paragraph 3.4.2 the thoughts of experts in the field of procurement on the advantages and disadvantages of ECI will be examined.

3.4.1 Advantages and disadvantages of ECI according to the literature.

| Advantage | Explanation | Reference |
|---|---|---|
| Reduced tendering costs | Only one design process is undertaken through which inherent duplication of effort is avoided. | (Department of Main Roads 2009, Simpson Grierson 2012) |
| Greater commitment of contractor | Early involvement provides contractors genuine value and it allows them to have an early “buy-in” in the project. The collaboration between client and contractor creates a feeling of ownership which encourages greater commitment to performance and quality. | (Simpson Grierson 2012) |
| A cost-effective, more efficient and less-adversarial structure | ECI provides efficient means of designing and planning infrastructure projects. Contractors are involved before the key-decisions have been made. Therefore a design could be made with sufficient know-how and knowledge about available techniques, equipment and potential innovative solutions from the contractor. | (IADC 2011, Hicks 2012, Simpson Grierson 2012) |
| Unique added-value solutions | In ECI there is no need to compromise on an already designed project because of a cooperation between contractor and client from the moment. So with input from all entities involved, extra value can be reached. | (Department of Main Roads 2009, IADC 2011, Simpson Grierson 2012) |
| No claim-no blame culture | ECI improves initial data collection and encourages innovation and most often leads to successful project completion within budget and time. | (IADC 2011, Beekers 2012) |
| Fewer changes in later stadium | For contractors, the projects are business as usual. Involving them early means that their state-of-the-art knowledge can be used from the start of the project, which takes care of better awareness and understandings of risk profiles which will result in fewer changes. | (IADC 2011) |
| More detailed and accurate EIA possible | Sometimes the Environmental Impact Assessment (EIA) application requires a lot of operational details that may not be part of the client’s knowledge but the contractor might have this specific knowledge. | (IADC 2011) |
| Shortened project time | Right from the start all parties are on the same page, through which procedures and processes can be completed faster and conflicts are less likely to occur. | (Department of Main Roads 2009, Beekers 2012) |

Table 3: Advantages of ECI according to the literature

| Disadvantage | Explanation | Reference |
|--|--|---|
| Competition | There is the image that ECI takes off the edge of competitive pricing and competition, while this is not the case when using transparency and independent audits. | (Simpson Grierson 2012) |
| Chance to end up with higher project costs | There is a chance that project costs are higher than the costs when traditional procurement was used. Reason for this is that a selection based on price only is not possible and more innovative and unique solutions are realized. | (Beekers 2012, Rijkswaterstaat: Ministerie van Infrastructuur en Milieu 2013) |
| New development | New developments are never received really well in the construction sector. | (Beekers 2012) |
| Choose difficulties | Client needs to possess a well judging incline to pick the right partner so early on in the process. It is possible that the client does not have sufficient knowledge to oversee all market entities. | (Rijkswaterstaat: Ministerie van Infrastructuur en Milieu 2013) |
| Early investment | Market entities need to make an early investment, this can cause companies choose to not participate in it. There are additional upfront costs of time and money. | (NAVFAC 2011, Rijkswaterstaat: Ministerie van Infrastructuur en Milieu 2013) |

Table 4: Disadvantages of ECI according to the literature

When ECI would work as written in the books, all this would have the effect of lower tender costs, great commitment of all involved entities, unique solutions and shortened project time. This would mean that ECI can make a contribution to speeding up and clarify the process, better utilization of contractors and more dialogues between client and contractor.

Disadvantage of ECI is that it is a new development, through which people immediately see it as a bad idea. In addition, there is a chance to end up with higher project costs, which is something that is really undesired in the construction sector. Finally, the early choose and early investment within ECI are troublesome aspects that still know some resistance.

The question now remains whether these advantages and disadvantages actually occur in practice. Therefore, it is of great importance to investigate the experiences with ECI to be able to explore the advantages and disadvantages as they are actually experienced in practice. The experiences from the field will be introduced in the next paragraph.

3.4.2 Advantages and disadvantages according to experts in the field of procurement

| Advantage | Explanation | Reference |
|---------------------|--|--|
| Saves time | ECI saves a lot of time compared to traditional procurement because of the fact that there are no multiple tenders and contractor is involved right from the beginning so there are no ambiguities for the contractor through which there are less discussions. Besides that, the contractor can only blames himself if unforeseen events arise. | (Bouman 2014, Dekker 2014, Free 2014, Hansford 2014) |
| Promising solutions | ECI creates promising solutions by having conversations, because conversations create | (Bouman 2014, Hansford 2014, |

| | | |
|----------------|---|----------------------------------|
| | solutions instead of objections. Additionally, the practical input from the contractors leads to more innovative ideas and there are more possibilities to find the right solution and to optimize when there is cooperation. | Oehler 2014, Wassenaar van 2014) |
| Proper process | ECI is a process with a clear scope for all the entities involved and in which sharpness is reached quickly. This is caused by understanding and commitment of the parties. | (Dekker 2014, Oehler 2014) |
| Team approach | ECI provides an extensive team approach instead of an individual approach, which is more pleasant to tackle complex projects. | (Dekker 2014, Holleman 2014) |

Table 5: Advantages of ECI according to experts in the field of procurement.

| Disadvantage | Explanation | Reference |
|-------------------------|---|---|
| Big commitment | Both the client as well as the contractor need to make a big commitment right from the start, which is a big risk because you do not know how everything goes. | (Free 2014) |
| Control | The control for the client is questionable. Because it is harder to control the situation if turns out that the wrong contractor is chosen and some clients find it harder to control contractors instead of consultants and engineers. | (Free 2014) |
| Concerns from outsiders | Outsiders concern that there is an unfair competitive advantage to those involved in the ECI process. They also see a poor position for the public client, because this client need to create value for the money of the taxpayer en they doubt whether or not this value can be obtained. | (Bouman 2014, Hansford 2014, Oehler 2014) |
| Old habits | ECI goes against the old habits of the construction sector. It is difficult for the entities to go against their old habits and ECI does not work with their short-term orientation. Through which a lot of steering and management is necessary to make it work. Besides it is important to continuously keep each other involved to make it work. | (Dekker 2014, Egas 2014) |
| Fear | <ul style="list-style-type: none"> - Fear for the unknown - Fear to reveal intellectual property so early while there are no certainties yet - Fear that others misuse the system to get more money afterwards | (Holleman 2013, Linden van der 2013, Holleman 2014, Wassenaar van 2014) |

Table 6: Disadvantages of ECI according to experts in the field of procurement.

According to experts in the field, the use of ECI contributes to a shorter project time, promising solutions, proper process and a team approach. Downsides which are seen as results of the application of ECI are the fear for this new development, the necessary big commitment of all entities and the concerns of outsiders.

It turns out that both literature and experience, even though it is in other words, basically describe the same pros and cons when it comes to ECI. These benefits can make a major contribution to the wishes of the Netherlands, which makes an investigation into the possibilities for ECI in the Netherlands worthwhile.

3.5 Chapter conclusion

In this chapter early contractor involvement is explored in more detail. This chapter is based on the situation in the United Kingdom, because the UK is the founder of ECI and there ECI is developed the most.

The main reason for the development of ECI was the reduction of project costs and it was thought that this could be best achieved when using the knowledge and experience of contractors as early on in the project. This means that in contrast to the traditional approach to procurement, the contractor is already contracted when the functional specifications instead of when the entire project design is already determined. Biggest advantage of ECI can be called relational contracting, which means that there is a long term vision that is beneficial for the partnership between client and contractor. This results in better solutions, innovations, greater commitment and a shortened project time. Biggest disadvantage can be called client capture, which means that the client is dependent on the contractor through which switching to an alternative is almost impossible. This results in the chance to end up with higher project costs and less control for the client. But, overall ECI should lead to more optimal solutions and better business cases or costs. Also extra incentives can be involved such as profit rates connected to certain targets.

4. Alternatives for ECI

Another point worth investigating with regard to early contractor involvement are the alternatives for this approach. The first alternative is design and construct (D&C). This alternative will be further elaborated in paragraph 4.1. The second alternative to ECI is called interweaving, which is further elaborated in paragraph 4.2. In paragraph 4.3 a comparison between the alternatives and early contractor involvement will be presented.

4.1 Design and construct

ECI is effectively a cousin to the design and construct (D&C) model, which also seeks to use a contractor's knowledge of construction processes to the benefit of the design process (Simpson Grierson 2012). In design & construct contracts (D&C) the contractor is responsible for the design of the infrastructure and for the realization of it. The client specifies a functional description and the contractor has the freedom to apply innovations into the design and realization (Ministerie van infrastructuur en milieu n.d.). In design and construct, both design and construction are executed by the same contractor. The client is still responsible for financing the project and operation of the completed facility (Wai 2004).

In the Netherlands, design and construct is used for construction projects and major maintenance projects. In a D&C contract it is the responsibility of the contractor to determine what work needs to be performed in order to be able to carry out the assignment. It is expected that the contractor:

- controls the project as an expert
- applies quality management on the basis of his NEN-EN-ISO-9001 certificate
- cooperates intensively and constructively (Ministerie van infrastructuur en milieu n.d.).

When D&C is compared with ECI, these two approaches initially seem quite identical. However, when one looks closer, it can be seen that both methods indeed involve the contractor early on in the process, but this is done even earlier by ECI than with D&C. The underlying idea is that during this early stage of project planning the greatest influence on capital costs and project outcomes is possible (Simpson Grierson 2012). Another difference is that public decision making is not part of the responsibilities of the contractor in D&C, while this is the case in ECI. This means that the contractor is more involved in ECI than in D&C and this might do the design some benefits. Figure 12 briefly indicates the differences between D&C and ECI. Similarities and differences of D&C compared with ECI are listed in table 7.

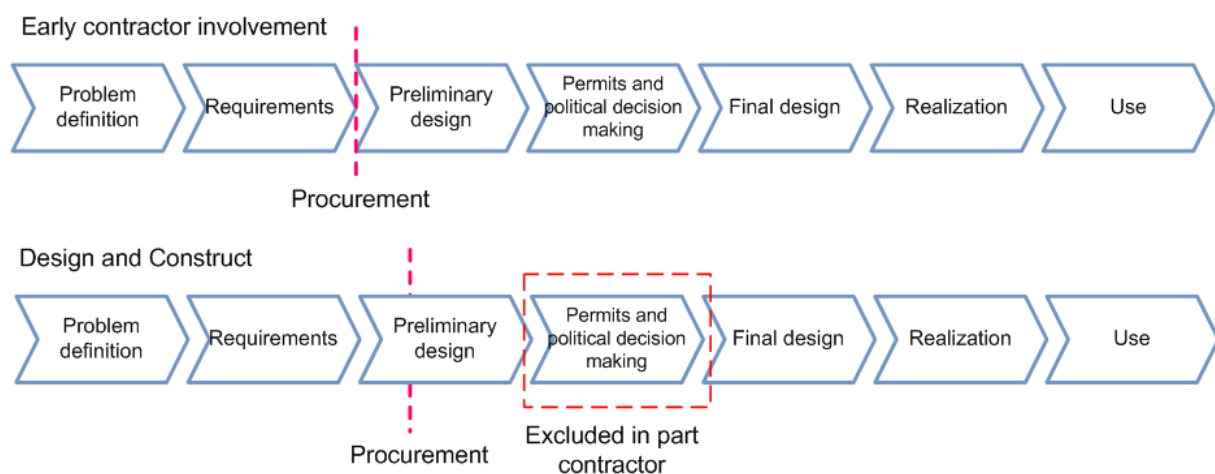


Figure 12: Comparison ECI and D&C (own illustration).

| Similarities | Differences |
|---|---|
| Both approaches know the contribution of contractor's expertise into the design process. | Contractor is not included in the public decision making part in D&C. |
| Both approaches know a short lead time, because design and construction are the responsibility of the same person. | Contractor is a bit earlier involved in the project with ECI than with D&C, which means that functional specifications play a larger role in procurement with ECI than with D&C. |
| Both approaches make it easier for the client to provide the request, because a global design and a set of requirements is sufficient enough. | Any client-initiated change or interference may jeopardize the major benefit of integrity with D&C. While with ECI, the client plays a role throughout the whole project, so it can initiate changes. |
| Both approaches may not produce the cheapest infrastructure in terms of life cycle costs | Additional requirements, such as turnover and experience, are often so heavy that smaller employers cannot participate in D&C. These additional requirements are introduced by the client to contain the risk for failure of the project. |

Table 7: Similarities and differences of D&C compared with ECI (Wai 2004, Simpson Grierson 2012, Vree de n.d.)

4.2 Interweaving

The essence of interweaving is that the contractor plays a role in public decision making. The procurement procedure and the planning procedure run parallel and will be cross-linked at a certain moment (Ministerie van verkeer en waterstaat 2005, Rijkswaterstaat n.d.). Given the increasing complexity of infrastructure projects, there is a need for the creativity of the market. However, if the tender procedure will only start when the planning procedures are already adopted, only proposals and solutions that fit within the planning procedures can be included. This results in little room for creativity. This creates the need to involve the market in the process before the planning procedures started. The procurement process and the planning procedure are parallel and will be cross-linked at a certain time in interweaving. The two procedures do not flow into one another, so they formally remain two separate procedures (Ministerie van verkeer en waterstaat 2005).

When comparing interweaving and ECI, it is noticeable that the contractor is involved a little earlier in the process in ECI than in interweaving. In both approaches, the contractor does play a role in the public decision making and planning process, leaving more room for creativity on the part of the contractor. In the Netherlands, the method of interweaving is the most innovative and complex way to involve contractors in the project until this point (Beekers 2012, Bouman 2013). Figure 13 briefly indicates the differences between D&C and ECI. Similarities and differences of interweaving compared with ECI are listed in table 8.

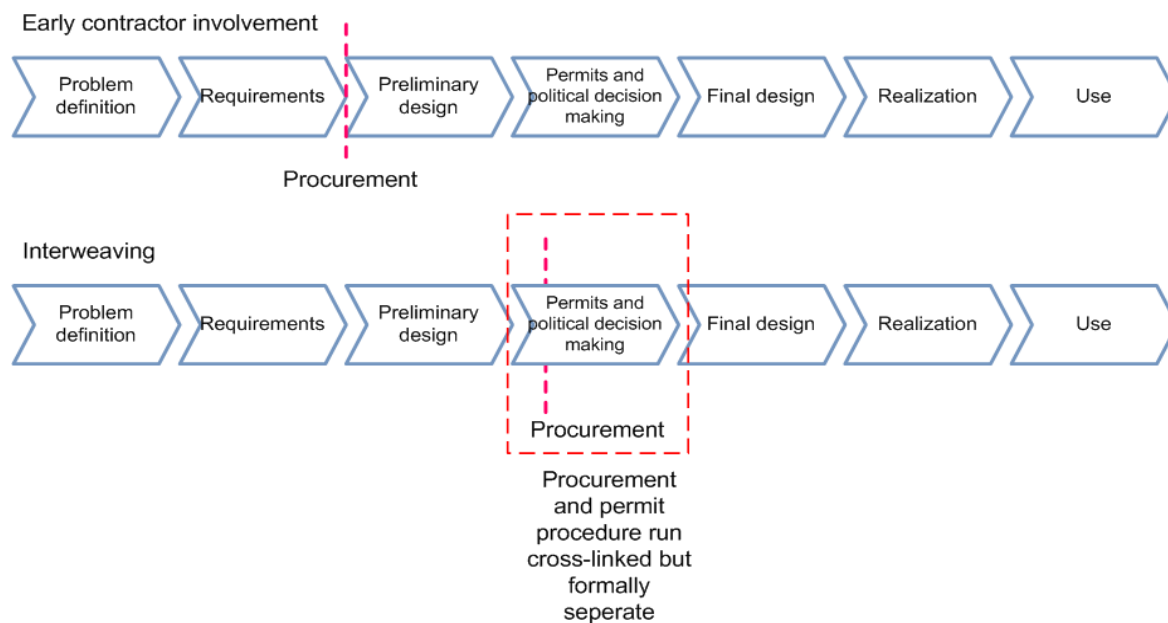


Figure 13: Comparison ECI and interweaving (own illustration).

| Similarities | Differences |
|--|--|
| Use of contractor's experience and knowledge can lead to more innovative and creative solutions, through which the optimal solution can be achieved with greater probability. In both approaches the experience and knowledge of the contractor is used. | In ECI, procurement starts earlier than in interweaving. In ECI there only the functional specifications are available while in interweaving the design already started a bit before contracting a contractor. |
| Both approaches provide a broader solution space for contractors because design isn't fully developed. | Contractors play a larger role in designing the project in ECI than in interweaving. |
| Higher commitment of the contractor and a stronger relationship between all the parties involved is provided by both approaches. | Interweaving provides more budget certainty than ECI. |
| Both approaches know a better management of time periods through which time savings can be gained in the turnaround time. Besides that, both approaches offer acceleration of the plan and development phase. | |
| In both the approaches the contractor plays a role in public decision making. | |

Table 8: Similarities and differences of interweaving compared with ECI (Beekers 2012, Simpson Grierson 2012).

It has to be said that in interweaving the reference design is not leading, but may be adapted by the contractor. Interweaving is on the right road to ECI and can be developed to ECI. Rijkswaterstaat already develops interweaving by not drawing reference designs and leading budgets anymore, through which ECI in the Netherlands is getting closer.

4.3 Comparison with ECI

In this paragraph a comparison between the alternatives and early contractor involvement to make sure the research to ECI is still useful takes place. This comparison is done on the basis of evaluation criteria, which are based upon the desired in the Netherlands. These are obtained by means of the interviews with experts in the field of Dutch procurement, which can be found in appendices A and B. The criteria that play a role within this comparison can be found in table 9 below.

| Criteria | Explanation |
|----------------------------------|---|
| Speed | Process from problem definition till use should be accelerated |
| Clarity | Progress, requirements and costs of the process should be clear in advance and during the process |
| Use of contractors | Contractors should be used more often. Contractors own knowledge, experiences and creativity that can add value to design, decision-making and planning |
| Functional specifications | Client should give functional specifications instead of a detailed design in its request |
| Cost overruns | There should be more budget certainty by reducing the cost overruns of projects |
| Cooperation | Client and contractors need to work together throughout the whole process. This can only be realized if there is balance between the interests of these parties and enough dialogues between them |
| Risk distribution | A fair and balanced distribution of the risks over all parties involved is necessary to maintain cooperation and commitment |
| Tender costs | Tender costs for contractors should decrease. Currently the tender costs are a too large proportion of the total sum |

Table 9: Evaluation criteria for the comparison.

Now that the criteria are known, the actual comparison can be made. For this comparison, table x is made. In this table a ranking of the three options is provided for each criterion, in which the scores vary between ++ and - -. Hereby is the highest score represented by a ++ and the lowest by - -. An alternative can also score neutral for a certain criteria nans this is represented by a 0. To be able to provide the options with scores, the available literature and the previously listed similarities and differences are used.

| Criteria | ECI | D&C | Interweaving |
|---------------------------|----------|----------|--------------|
| Speed | ++ | + | + |
| Clarity | 0 | 0 | 0 |
| Use of contractors | ++ | + | + |
| Functional specifications | ++ | + | 0 |
| Cost overruns | - - | - - | + |
| Cooperation | + | - | + |
| Risk distribution | 0 | 0 | 0 |
| Tender costs | + | 0 | 0 |
| Total score | 6 | 0 | 4 |
| Ranking | 1 | 3 | 2 |

Table 10: Comparison of the options.

Speed

The sooner the contractor is involved in the project, the greater the probability that the duration of the project will be shortened. This has to do with the fact that there are fewer disputes likely to arise and design and realization are more closely aligned. Of all three options, the contractor is involved in the project earlier ECI, that is why ECI scores ++. Although the contractor plays a role in the project earlier in D&C than in interweaving, both alternatives score a +. This has to do with the fact that the contractor plays a greater role in the design of the project in D&C but is not involved in the public decision making, and this is exactly the opposite with interweaving.

Clarity

The clarity depends on the project and it is difficult to conclude anything about this based on the basic characteristics. For that reason each of the alternatives scores a 0.

Use of contractors

Of all three options, the contractor is used most effectively in the early contractor involvement approach. The contractor is part of the team from an early stage, through which its input can be fully used. For D&C and interweaving the use of the contractor is approximately equal, because in D&C the contractor is used for the design whereas in interweaving it is used during the permit procedure.

Functional specifications

The earlier the contractor is picked, the more the request is based on functional specification instead of detailed designs. In the preceding paragraphs it can be seen that the sequence of approaches with regard to involvement of the contractor is; ECI, D&C and interweaving.

Cost overruns

Of all three options, interweaving is the option that offers the most budget certainty according to the literature. D&C and ECI offer this certainty to a much lesser extent and they even may not produce the cheapest infrastructure in terms of life cycle costs. This is because the solution that is presented by these approaches often has a more unique and innovative character.

Cooperation

Cooperation between client and contractor is most embraced in early contractor involvement and interweaving, because the contribution of both entities is highly appreciated and even somewhat expected. This does not apply to D&C, where any client-initiated change or interference may jeopardize the major benefit of integrity.

Risk distribution

The risk distribution depends on the project and it is difficult to conclude anything about this based on the basic characteristics. For that reason each of the alternatives scores a 0.

Tender costs

In the literature it is explicitly stated that ECI should reduce the tender costs compared with the traditional approach to procurement, for this reason ECI scores a + for this criterion. ECI does not score a ++, because this was not mentioned by the experts during the interviews. For the other alternatives little is said regarding the tender costs, thus both score a 0 here.

4.4 Chapter conclusion

In this chapter, ECI is compared with its alternatives to make sure that ECI can indeed be an answer to the expressed desires in the Netherlands. The alternatives which have been included in the comparison are design & construct and interweaving. In design and construct (D&C) the contractor is responsible for both the design as well as the realization of this design. D&C differs from ECI because in D&C the contractor does not play a role in public decision making. In contrast to interweaving, in

which the contractor plays a role in the public decision making but to a lesser extent in the design of the project. The three options are compared with each other based on the by the experts expressed desires. The comparison shows that ECI, with a small lead on interweaving, overall scores best. D&C is finished last. Of course, it should always be kept in mind that the used criteria are the wish of a limited part of the overall sector, through which the ranking of approaches cannot be generalized. This comparison is used to decide whether or not ECI can be considered as a possible new approach that meets the needs for future projects. The table 10 shows that this is worth it, so it is right to explore what future infrastructure projects in the Netherlands are suitable for ECI. But before that, the next chapter first looks at the various applications of ECI.

5. Available ECI models

In this chapter, the different available ECI models will be explored. To gain a better understanding of the models, the background and requirements for the models will be introduced in paragraph 5.1 and 5.2. Then the available models will be explored and described in paragraph 5.3. Some attention should be paid to the fact that these models are relatively new. Some of the test projects are not even finished. This means that there is very little empirical information available.

5.1 Background

The UK government has sought to engage the industry in improving its methods and processes and delivering better value. The latest effort is contained in the Government Construction Strategy report, in which the desire to employ more innovative and effective procurement processes in the construction sector is published (Udom 2012). The UK Government wants to achieve a fifteen to twenty per cent cost savings for the construction sector by 2015, so a need to look at the process by which projects are procured is recognized (Craven and Sirhan 2012, Government construction team 2012).

To deliver the identified objectives, the Procurement and Lean Client Group was established in autumn 2011. Representatives from central and local authority clients worked together to develop the reforms and to turn outline objectives into solid proposals. The group focused on opportunities to generate savings through the way projects are managed and procured by public sector clients (Government construction team 2012).

The group found three new procurement methods that would underpin the drive for better value and affordability. It is expected that by ensuring a faster selection of partners, the new methods will reduce the time and amount spent on complex procurement processes (Udom 2012). The new procurement models embrace early contractor involvement to drive innovation, identify waste and to secure knowledge transfer and growth opportunities (Mosey 2012).

The common features of the new procurement methods are:

- Early contractor involvement
- Transparency
- Integration (Udom 2012)

5.2 Requirements

Each of the new models require:

- A clear definition of what the client wants to achieve with realizing the project. So there should at least be a functional outcome.
- A challenging maximum cost for the project, also called a cost ceiling. Based on available data, benchmarking and cost planning work, the client should be able to establish a realistic yet challenging budget for the project.
- Projects to be delivered under standard forms of contracts with no amendments to clauses, risks or payment terms.
- A robust review process to ensure appropriate plan definition, create commercial tension, monitor plan development and address any unnecessary scope, risks and potentially missed opportunities. (Government construction team 2012, Udom 2012, CabinetOffice and Efficiency and Reform Group 2014).

5.3 ECI models

During its research, the Procurement and Lean Client Group identified three new procurement models that offer reduced costs, reduced risks, greater innovation, improved relationships and more certainty (CabinetOffice 2012). The concerned models are:

- Cost Led Procurement (CLP) – section 5.3.1
- Integrated Project Insurance (IPI) – section 5.3.2
- Two Stage Open Book (TSOB) – section 5.3.3

All these models embrace early contractor involvement as a factor that will drive innovation, identify and secure knowledge transfer and corresponding growth opportunities (Mosey 2012). Besides that, higher levels of integration and transparency and the option of independent assurance are embraced by these models as well (CabinetOffice 2012). All three models are designed to reduce the commercial risk of construction procurement, execution and commission (CabinetOffice and Efficiency and Reform Group 2014). The presumption for all ECI models is that high levels of integration, innovation, and good cooperation between client and contractor will lead to a significant change in the costs and risks of construction projects (CabinetOffice and Efficiency and Reform Group 2014).

5.3.1 Cost led procurement

Description of the method

While applying the cost led procurement (CLP) method, the client can use its knowledge to set a cost ceiling and output specifications, against which the contractors can bring experience and innovation. CLP provides the opportunity to continually improve on the costs of the project while working together with the contractors (CabinetOffice and Efficiency and Reform Group 2014). Objective of this method is to increase the chance for contractors to get subsequent projects (Mosey 2012). It should be mentioned that subsequent projects generally do not apply to infrastructure projects in the Netherlands.

Cost Led Procurement

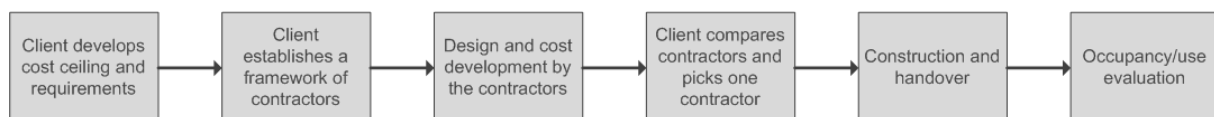


Figure 14: Cost led procurement (own illustration).

In this approach the client sets a challenging but realistic cost ceiling to establish a framework of integrated project teams early in the project (Hicks 2012). Selection of the teams is primarily based on the ability to work collaboratively, to deliver below the cost ceiling and to achieve further reductions in the subsequent projects (Udom 2012). Two or more of these teams are invited to develop a project proposal that meets the functional outcome and stays within the predefined budget (Government construction team 2012). Assuming that at least one of the teams can beat the cost ceiling, it is then selected on the relative scored attractiveness of its commercial and physical proposition and of its team members before being awarded the contract to deliver the project (CabinetOffice 2012). If the cost ceiling cannot be met or bettered by the framework teams, the project must be offered to suppliers outside the framework. Where the budget cannot be met at all, the project should not proceed; it is therefore important for the client to set a realistic costs ceiling (Udom 2012).

Successful completion of the project by the selected team would lead to it being offered similar projects, but with the expectation of lower cost, achieved through continuous improvement (Craven and Sirhan 2012). As said before, this is not applicable to infrastructure projects.

Recommended contract form

For cost led procurement the recommended contract form is the NEC 3 Option C contract (Government construction team 2012), which is a target contract with activity schedule. The initial target price is the sum of the activity prices and the fee. During the course of the contract, the target price is adjusted to cater for compensation events that are set out in the contract. Payment is made based on actual costs with an incentive mechanism for the contractor to minimize costs. Savings and over-runs are shared between the client and the contractor in an agreed proportion. The sharing of risk in the target cost approach is likely to reduce the occurrence of disputes (Galliford Try Infrastructure 2007).

Example project

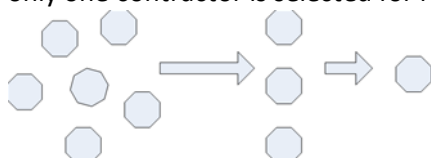
| Rye Harbour Western Training Wall | |
|-----------------------------------|---|
| Client | Waterways and Environment Agency |
| Project value | £ 9.6 million (pre-saving) |
| Form of project | Flood defence – replacement of failing structure / steel sheet pile retaining wall providing navigable harbour entrance channel |
| Main contractor | Jackson Civil Engineering |
| Percentage saving | 6% |
| Overall saving | £ 600,000 |

Table 11: Example project cost led procurement (CabinetOffice 2012, Hynes n.d.).

The Rye Harbour Western Training Wall project involved the replacement of a failing structure / steel sheet pile retaining wall as part of the Environment Agency's flood defence program. For this project the cost led procurement method was adopted. This enabled the EA to generate savings of six per cent and to complete the entire project in fourteen months, through which the program time was halved. Due to the funding requirements on this project, these savings in cost and time were essential to the successful delivery of this project.

The cost led procurement method facilitates integration and collaborative working on a project from a very early stage. On Rye Harbour, this helped to unlock and drive forward benefits due to the involvement of the contractor and their supply chain, who brought extensive knowledge and experience to the project. ECI was established during the development of the bid. Due to the tight timeframe and some complexities of the project, the project team collaborated extensively to come up with solutions to some of the specific problems and challenges (Hynes n.d.).

- Multiple teams work independently of one another to develop a project proposal. After that, only one contractor is selected for realization of the project.



- Focus is on reducing the project costs
- This procurement method is best suited to projects where costs cannot be exceeded and where there is a highly functional and historically repetitive aspect to the project such as schools, prisons and defence accommodations (Procurement and Lean Client Group n.d.).
- This model is focused on subsequent projects, which is not common for infrastructure projects in the Netherlands.

5.3.2 Integrated project insurance

Description of the method

The Integrated Project Insurance (IPI) method offers the client the opportunity to create a holistic and integrated project team which can eliminate the blame/claim culture. The innovative integrated project insurance package limits the risk for the individual members of the team, promotes commitment to the project and reduces the likelihood of cost and time overruns (CabinetOffice and Efficiency and Reform Group 2014). The teams develop a solution to achieve savings against the existing budget. These solutions are reviewed and challenged by an independent third party, to help the team and client both secure a robust and balanced proposition (Mosey 2012). In IPI, a collaborative project team works together to establish a clear cost basis for a project, which is then insured against cost-overruns (Hicks 2012).

Integrated Project Insurance

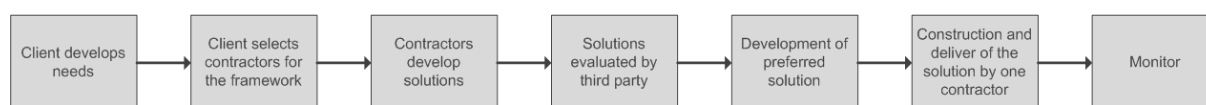


Figure 15: Integrated project insurance (own illustration).

In this method of procurement the client appoints members of an integrated project team based on elements such as competence and track record. The team that is chosen works together to present a solution with cost savings against existing costs benchmarks. This solution goes through a third party verification process to maintain good value in the project and to ensure that a balanced commercial position has been struck (Udom 2012). The difference between IPI and CLP is that, having developed a solution, the whole project then adopts a single third-party assured insurance policy. This policy covers all project risks, removing the potential for a blame culture within the project. Any cost overruns above an agreed ceiling would be met by the insurance policy. The likely cost of such insurance has been estimated at 2.5 per cent of the project sum, which is significantly less than the savings that are predicted to be achieved as a result of the use of this model (Craven and Sirhan 2012, Government construction team 2012).

Recommended contract form

The PPC2000 contract is recommended for the integrated project insurance model (Government construction team 2012). PPC2000 is a medium to achieve greater integration and better results in the procurement of any project. The PPC2000 is a multi-party contract that:

- Integrates all members of the team under a single multi-party contract
- Covers the entire duration of the design, supply and construction process
- Includes new team-based timetables, controls and problem-solving mechanisms (Trowers & Hamlin 2005).

Example project

Royal Marines Lymington - new build training rooms

| | |
|------------------------------------|--|
| Client | Ministry of Defence and Defence Infrastructure Organization |
| Project value | £ 7.6 million (pre-saving) |
| Form of project | New-build training wing at the Royal Marines base in Lymington, containing offices, classrooms, training and stores. |
| Perceived saving percentage | 15 – 20% |

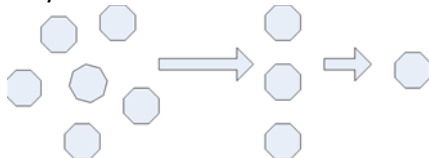
Table 12: Example project integrated project insurance (CabinetOffice 2012, HM Government n.d.).

The Royal Marines Lymestone project is the first pilot project of the Ministry of Defence with regard to integrated project insurance. If the pilot project proves successful in helping to cut costs and program, the government will then roll out the IPI models across the public sector. Until this point, the Royal Marines Lymestone project is not finished.

The purpose of this project is to provide a new facility that will allow for the disparate elements of the specialist training wing to conduct their discrete functions and training program whilst under one roof. Other project objectives include the provision of synergies in training and operational command practices that will generate ongoing efficiencies.

The accommodation is currently spread across the commando training centre. These facilities have become impossible to support and maintain due to their age and are rapidly being out grown by the unit's requirement to deliver specialist military training to support Royal Marine's core operational output (HM Government n.d.).

- Multiple teams work independently of one another to develop a project proposal. After that, only one contractor is selected for realization of the project.



- Focus is on elimination of the financial effects of risks
- IPI is currently being tested in the United Kingdom. The projects they have used have a value between 10 and 25 million pound. When they are done testing they expect that this model can also be used for projects with a higher value (Procurement and Lean Client Group 2014).

5.3.3 Two stage open book

Description of the method

Two stage open book (TSOB) is the method that is currently most used in the United Kingdom to employ early contractor involvement (Free 2014). Using TSOB, a client invites contractors to bid for a project. Following the first stage competition, the appointed team works alongside the client to build up a proposal. The construction contract is awarded at the second stage (Craven and Sirhan 2012). TSOB differs from CLP in reducing industry bidding costs, enabling faster mobilization and in providing the opportunity for clients to work earlier with one contractor (CabinetOffice and Efficiency and Reform Group 2014). Key features of this procurement method are that the submission of proposals takes place in two stages and that bidders can assist in defining the technical requirements and the scope of work (Lynch n.d.). Two-stage tendering is used to involve the contractor prior to the completion of all the information required, to enable them to offer a fixed price (Designing buildings 2013). As the name already suggests, TSOB happens on an open book basis, through which transparency is guaranteed throughout the entire process (Hicks 2012).

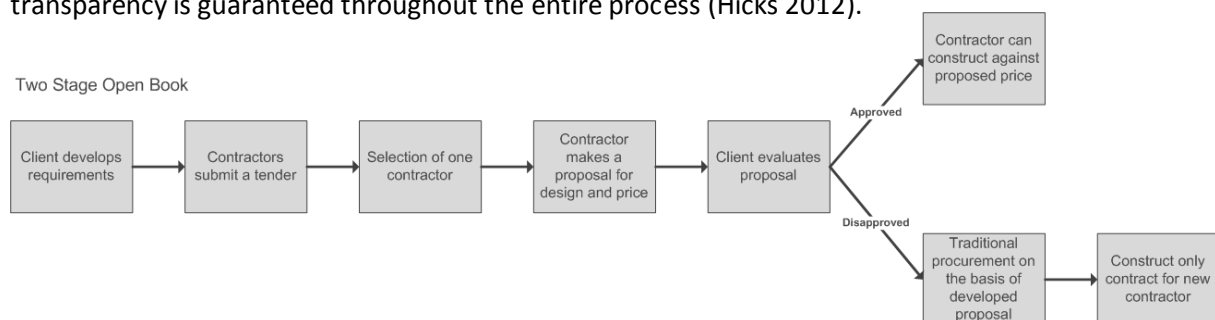


Figure 16: Two stage open book (own illustration).

The TSOB method represents a third ECI model. In fact, this method consists of three instead of two stages.

- **Stage 0**
This stage includes tender planning and tendering activities by the client and ends in the awarding of a contract before progressing to Stage 1. Contractors can show their interests and thoughts based on the functional specifications provided by the client. Then a preferred tenderer is chosen based on non-price selection criteria and some input cost related criteria.
- **Stage 1**
In stage 1, the contractor formulates a proposal in which the planning and price for the realization of the projects are published. A strong relationship between all parties is necessary during this stage. The client can either choose to accept or reject the offer from the contractor.
- **Stage 2**
If the stage 2 offer is accepted, the project moves into detailed planning, design and construction. This is the desired result for all concerned entities. If the offer is rejected and a compromise was not possible, the design is completed so that tender documents can be developed and the work will be advertised as a construct-only contract. The stage 1 contractor will not be invited to tender (Department of Main Roads 2009).

Recommended contract form

The recommended contract form for the two stage open book model is the JCT Constructing Excellence contract (Government construction team 2012). This is a collaborative contract that is used for the procurement of construction works and construction related services and is suitable for partnering and collaborative working. JCT Constructing Excellence contract:

- Encourages collaborative behaviour
- Is usable throughout the supply chain
- Utilises a risk register and risk allocation schedules
- Meets the needs of local authorities who wish to partner with suppliers
- Provides alternative payment regimes i.e. target cost and lump sum (Finch 2009).

Example project

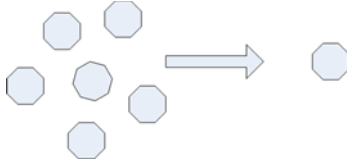
| Project Horizon | |
|--------------------------|---|
| Client | Surrey County Council |
| Project value | £ 100 million (pre-saving) |
| Form of project | Highways repair and improvement program |
| Main contractor | May Gurney |
| Percentage saving | 15% |

Table 13: Example project cost led procurement (CabinetOffice 2012, Mosey n.d.)

Surrey County Council has worked successfully together with the main contractor May Gurney and its subcontractors to achieve savings, improved quality and an integrated team culture in the delivery of capital highways repairs and improvement works across Surrey.

Project Horizon has demonstrated the benefits of properly structured early contractor involvement and supply chain improvement processes under the two stage open book method. Two Stage Open Book enabled a culture of collaborative working at all levels of the supply chain as well as the creation of integrated project teams with better defined roles for individuals employed by the client, contractor and subcontractor supply chain members (Mosey n.d.).

- Quick selection of one contractor to make the project proposal.



- Focus is on partnership and development of good relationship between client and contractor.
- The trial projects demonstrate that potential benefits of TSOB are not limited to any particular type of construction or engineering project (Kings College London n.d.).
- Currently most used ECI model in the UK.

5.4 Chapter conclusion

In this chapter the available ECI models are explored. To deliver cost savings, the Procurement and Lean Client Group was established. They focused on opportunities to generate savings through the way projects are managed and procured. The group found three new models:

Cost led procurement (CLP)

Multiple teams work independently of one another to develop a project proposal. The focus is on reducing project costs to increase the chance to get subsequent projects. Subsequent projects are not common for infrastructure projects in the Netherlands. But you never know what might happen, and that is the reason that this model is not excluded from this research yet.

Integrated project insurance (IPI)

Multiple teams work independently of one another to develop a project proposal. The focus is on reducing the financial effects of risks by adopting an insurance policy. This model is currently tested in the United Kingdom with projects with a value between 10 and 25 million pounds. Following the contact with Phil Heenan from Cabinet Office, in which he said; *“As there is limited practical experience of applying the IPI model so far, the approach is initially being kept to a project size range that offers the opportunity for the model to prove its worth within a perceived acceptable degree of risk. Once there have been a number of demonstration projects it is likely that that initial £10-25m value band will be reviewed”* other reasons for using this limit, besides testing the IPI model, could not really be mentioned. This is the reason that this limit will not be used for this study. This means that IPI is included in the remainder of this research.

Two stage open book (TSOB)

Quick selection of one contractor to form a partnership between client and contractor in which an unambiguous project definition is developed. This model is suitable for all kind of project types, which means that this model is also used in the remainder of this research.

This implies that all three models are included in the next chapter, in which the search for suitable infrastructure projects on the Dutch horizon takes place.

6. Suitable infrastructure projects on the Dutch horizon

In this chapter, the acquired knowledge with regard to ECI is applied to the Dutch practice. Infrastructure projects on the Dutch horizon that are suitable for the application of ECI are identified here. To be able to do this, the perspectives of both the client as well as the contractor should be considered in paragraph 6.1. It is important to make these perspectives clear, because there probably exists a difference between them, through which the perception of suitable projects for the application of ECI differs from each other. Besides that, it is important to get an idea of the specific characteristics of ECI projects, which is done in paragraph 6.2. In paragraph 6.3 promising projects within the MIRT are selected and described. These projects will be tested in paragraph 6.4 on the basis of the characteristics obtained in paragraph 6.2. Eventually, the suitable projects on the Dutch horizon will come forward with this test.

6.1 Perspectives of client and contractor

Earlier in this report it is already shown that ECI would be a suitable approach for what is desired in the Netherlands. The question that remains is what kind of projects are going to be used for the application of ECI in the Netherlands. ECI is still in its infancy here and the first projects will thus function as a test. To be able to let this work out properly, the projects must be seen as appropriate by both the client and the contractor and therefore it is important to look at their perspectives with regard to early contractor involvement.

Both parties see the advantages that early contractor involvement can offer. However, when it comes down to it, they both consider other things as important. For the client it is of great importance to:

- find the optimal solution
- with minimal risks throughout the project
- without wasting valuable resources
- while satisfying all stakeholders
- and where possible providing innovations.

However, the contractor wants:

- as much freedom as possible in designing and constructing the project
- to provide own input, particularly in the technical aspects
- to feel in control of the project to avoid ambiguities and disputes during the project and afterwards
- and to provide innovations where possible.

The perspectives on what is important are different, but not impossible to combine with each other, making the pilot projects experienced compatible by both parties.

6.2 Specific characteristics ECI projects

In this paragraph, the project characteristics that make the application of ECI interesting and a good choice, are introduced. When you get into conversation with someone, it is often thought that ECI is applicable to large, unique and complex projects. As this report is about the first application of ECI in the Netherlands, these characteristics are adapted to the Dutch situation and the perspectives of both client and contractor in the Netherlands. If these characteristics are met by a specific infrastructure project, it might be wise to apply early contractor involvement.

Character

In the Netherlands the client wants to minimize the risks for the introduction and evaluation of ECI, and therefore it is less desirable to start with a very unique project. The Dutch projects may actually have a repetitive character, because then the client dares to give the projects out of hands faster. Regarding uniqueness for ECI projects in the Netherlands it counts that:

- Similar projects may be implemented already quite often. A repetitive nature is not wrong.

- The contractor needs to be able to bring its own contribution to the project. An innovative solution or design freedom are good examples of this. It is important that the project is somehow challenging the contractor.

Complexity

With regard to complexity, a distinction is made between social complexity and technical complexity. Regarding the introduction of ECI in the Netherlands, the first projects should not be socially complex, but technically complex. This is done because the power of the contractor lies within the technical complexity and the social complexity will bring too much pressure for the contractor. Especially in the beginning, it is smart to stay near the core competencies of the contractor.

Social complexity

Infrastructure projects have an important significance for society. A lot of people have to deal with these projects, some of them reap the benefits of it and others are disadvantaged. Every project has its winners and its losers. The following factors can cause social complexity:

- The project has a huge impact on the environment
- A lot of stakeholders are involved in the project
- A great variety and dynamics in preferences and goals of users
- A long cycle time, which makes it possible for new drawbacks and problems to arise
- A large dependence on preferences among users
- Busy environment with a lot of activities going on, through which much inconvenience is caused
- Third parties have the power to thwart the project (Tweede Kamer der Staten-Generaal 2004).

Technical complexity

Infrastructure projects often are technical highlights, for which the expectations are very high. When the first steps of such a project are taken, there generally is no turning back. Technical problems can put the progress of the project under great pressure and provide an incentive for many new questions about the value of the project as a whole. Following factors enables the technical complexity of a project to increase:

- Difficult problem that cannot be solved easily
- The application of innovative techniques that have not often been tested
- Tight coupling between the different components of the project, through which problems in one part of the project have a direct negative effect on other parts of the project
- Tight planning leaving no time for testing and experimenting (Tweede Kamer der Staten-Generaal 2004).

Project size

It is said that ECI contracts remain an option for major highways schemes where there is significant scope for input from the supply chain (Highways Agency 2012). But the size of the project does not always say something about the complexity and the extent to which a new approach is or is not desirable. Because it is difficult to value the of a project and because ECI is a new concept in the Netherlands, the main focus is on the turnaround time of the projects. Just because ECI is new in the Netherlands, we want to learn as quickly as possible and draw conclusions, making a short turnaround offers more advantages than a long turnaround. For this research, the limit is set on five years. So projects with a turnaround time of 5 years or less, are considered suitable as pilot projects.

Projects are particularly suitable when they have a good project sum in addition to a quick turnaround. A lower budget is less risky than a higher budget. Especially when a new method as ECI need to be tested in the Netherlands, it is pleasant if the project sum of the pilot projects is not extremely high.

6.3 Promising projects within the MIRT

In order to make a selection from all the projects on the Dutch horizon, it is decided to take a look at the MIRT, in which all known future infrastructure projects are introduced. Based on the MIRT and the list from Richard Mulder from Bouwend Nederland, with future DBFM projects, a first selection of projects is made. Subsequently, a second selection is made by excluding the projects of which realization starts before 2019. Only projects of which realization starts in 2019 or later are included in the remainder of this chapter. This is done to make sure that no procedures are already started, through which influences are still possible. Eventually, the following seven projects are included in the test. The description of these projects is based on the description in the MIRT project book 2014 (Schultz van Haegen 2013).

A27 Houten – Hooipolder

On the A27 from Breda to Utrecht, the volume of the automobility increases, through which the travel time does not meet the targets expressed in the Infrastructure and Spatial Planning anymore. Therefor four widening alternatives have been studied on the basis of the notification of intent.

- 2x3 lanes with regional connections
- Partly 2x3 and partly 2x4 lanes
- Partly 2x3 and partly 4x2 lanes
- A highway

Given the limited budget, there is the need to start from a more sober alternative, with an as large as possible problem-solving ability. Under this alternative, the priority is given to the partial itineraries Houten – Everdingen and Scheiwijk – Werkendam. It should also be examined how interpretation can be given to improving the flow of Hooipolder within the budget.

| | |
|-------------------|---|
| Tracébesluit | 2017 |
| Start realization | 2019 |
| Opening | 2023-2025 |
| Budget | 721 million euros |
| Execution | The way in which market entities can be involved is examined |
| Added value | This project contributes to solving the bottlenecks 9, 39, 48 and 50 from the 'File Top 50' |

Rotterdam Vooruit

The goal of the MIRT reconnoitring 'Regio Rotterdam' and 'Haven Duurzaam Bereikbaar' is to come to:

- A clear idea of the problem and solutions for the accessibility of the Rotterdam region in the period to 2040. Starting points are multimodality (car, public transport and cycling), comprehensiveness, sustainability and environmental quality.
- An idea of the costs and the (social) benefits of the solutions, including the provision of public-private partnership
- An overview of the main environmental effects
- The preparation of subsequent plan development and decision-making processes.

Within the survey, five subprojects are distinguished:

1. Nieuwe Westelijke Oeververbinding (NWO).
2. Kwaliteitssprong OV op Zuid.
3. Herontwerp Brienenoord- en Algeracorridor (HBAC).
4. A20 Nieuwerkerk aan de IJssel-knooppunt Gouwe.
5. Multimodal nodes and strengthening networks.

| | |
|-------------------|---|
| Budget | Not yet determined |
| Start realization | > 2021 |
| Added value | This project contributes to solving the bottlenecks 8, 21, and 49 from the 'File Top 50' |
| Stakeholders | Ministry of IenM; Province Zuid-Holland; municipality Rotterdam; Stadsregio Rotterdam; Stadsregio Westland; Stadsregio Hoeksche Waard; Haaglanden and Drechtsteden. |

Haaglanden

A number of studies show that accessibility problems in the Haaglanden area remain after 2020. This calls for an integrated approach, including the spatial economic development of the region in question. In the survey, the flow of traffic on the A4 on the route Harnaschknoop-Ypenburg-Prins Claus-Leidschendam is considered in connection with the operation of the access roads and the underlying (urban) road, the spatial development and public transport.

The analysis and prioritization of spatial mobility issues is completed in October 2009. Phase B is to bring promising alternatives that contribute to the realization of the shared ambitions, to keep the Haaglanden area accessible and to enhance the spatial economic structure. For the road issues, two promising alternatives are made of which the effects are integral weighed. This consists of a coherent package of measures on the A4 passage, the connections and access roads.

| | |
|-------------------|---|
| Budget | Not yet determined |
| Start realization | > 2022 The implementation of measures by the region is expected to start in 2015 |
| Added value | This project contributes to solving bottleneck 20 from the 'File Top 50' |
| Stakeholders | Ministry of IenM; Province Zuid-Holland; Stadsgeewest Haaglanden and residents |

A58 St. Annabosch – Galder

The A58 is a 160 kilometre long highway between Vlissingen and Eindhoven. This road connects most major cities in Brabant and is also part of the connections Rotterdam-Antwerp and Rotterdam-Ruhr. The NMCA from May 2011 shows that, in the high-growth scenario, a bottleneck between Breda and Tilburg can occur. At the MIRT meeting in autumn 2010 it is decided to solve this problem and the thereby mentioned preferred solution is widening to 2x3 lanes on the section St. Annabosch – Galder.

| | |
|-------------------|--|
| Planning | Shortened procedure |
| Start realization | 2023 The cuts in the coalition agreement of 2012 mean that the government funds are available from 2023 |
| Budget | 116 million euros |
| Added value | Preventing the emergence of a new bottleneck |
| Execution | Market approach still unknown |

A1 Zone

The government and the region see development opportunities in the A1 zone between Apeldoorn and the German border, to enhance the spatial quality and durability and to exploit the economic development potentials. The accessibility of the A1 zone; the road network and the A1 between Apeldoorn and Azelo, is from both a regional as well as a (inter)national perspective important.

The government and the region have worked on the reconnoitering of the A1 zone. Based on the findings, there is agreement on the desired spatial concept and the way in which the capacity expansion of the A1 between Apeldoorn – Azelo can take place. It now is the region's turn give

further shape to the spatial quality and design of the A1 zone in accordance with the spatial concept. The scope of the capacity expansion of the A1 is: 2x4 lanes between Apeldoorn-South and Deventer-East and 2x3 lanes between Deventer-East and Azelo.

| | |
|-------------------|---|
| Budget | 403 million euros Region finances 25% Other 75% will be paid with government funds, but the cuts in the coalition agreement of 2012 mean that these funds are available from 2024 |
| Start realization | 2024 |
| Added value | The use of development potentials and strengthening the environmental quality and sustainability |
| Stakeholders | Government; Provinces Overijssel and Gelderland; cities of Apeldoorn, Deventer and Zutphen; Region of Twente and the municipalities within the A1-Zone |

Capacity expansion Volkeraksluizen

In the 'Structuurvisie Infrastructuur en Ruimte' (SVIR) the Volkeraksluizen are identified as a potential capacity bottleneck for shipping. The Volkeraksluizen are the busiest and biggest locks of Europe and are the link between the main routes that connect Rotterdam to the Scheldt ports, and the Scheldt ports with the German hinterland. There is no alternative route to the Rhine-Scheldt corridor so all inland shipping pass the Volkeraksluizen. The challenge is to create optimal hinterland connections and stimulate inland shipping.

In April 2013, the minister has therefor taken a decision, consisting of:

- Quick wins in order to reduce the waiting time in the short-term
- Monitoring of the development of the waiting time
- An additional shipping chamber for commercial shipping if this turns out to be necessary on the basis of the waiting time (expected to be between 2020 and 2030).

| | |
|-------------------|--|
| Project decision | 2014 (Quick wins) |
| Start realization | 2014 (Quick wins) 2020 (Fourth lock chamber) |
| Opening | 2015 (Quick wins) 2024-2026 (Fourth lock chamber) |
| Budget | 157 million euros |
| Added value | Preventing the emergence of a potential capacity bottleneck for shipping |
| Stakeholders | Government, Schuttevaer and Havenbedrijf Rotterdam |

Kanaalzone Gent – Terneuzen

By developments in dimensions of vessels and increasing congestion, the locks in Terneuzen are perceived as an increasing bottleneck. In addition, there is an expected capacity bottleneck of the locks for inland shipping.

The Vlaams-Nederlandse Scheldec commissie (VNSC) is preparing the construction of a new sea lock at Terneuzen. The scope of this project includes the preparation, construction and infrastructure maintenance for thirty years. Principle is that the lock should be realized within the existing lock complex in Terneuzen. In the plan development phase, the following lock dimensions are the starting point: 427 m x 55 m x 16 m

| | |
|-------------------|---|
| Plan development | End of 2015 |
| Start realization | > 2021 |
| Budget | 1.085 million euros (construction: 1.004 mln euros and maintenance: 81 mln euros) |

| | |
|--------------|---|
| Added value | Solving the bottleneck of the lock complex in Terneuzen and preventing the emergence of a new bottleneck of the locks for inland shipping |
| Execution | Basically through an integrated DBFM contract. If the plan development phase shows that a different form offers more advantages, it still may be subject to a different form of contract. |
| Stakeholders | Ministry of IenM; Vlaamse Departement Mobiliteit en Openbare Werken; Province Zeeland; Zeeland Seaports; Municipality Terneuzen and Havenbedrijf Gent |

6.4 Suitable projects on the Dutch horizon

In this paragraph the seven projects that are described in the previous paragraph are evaluated based on the in the in paragraph 6.1 introduced characteristics of ECI projects. In table 14 the extent to which the projects meet these features or not is checked. This is indicated by pluses and minuses, where the range is from + + to - -. Subsequently, in table 15 an overview of the final score of the projects with regard to the question whether these projects are suitable for ECI or not is given. This table also provides an advice with respect to the available ECI models that are described in chapter 5.

| Project | Criteria | Uniqueness | Social complexity | Technical complexity | Project size |
|---------------------------------|----------|---|--|--|---|
| A27 Houten-Hooipolder | | Widening of a road is something that happens quite often in the Netherlands. Contractor can choose between different options, but otherwise it's not a real challenge for them. | For this project, there are few factors known that actually increase the social complexity. There are not that much stakeholders and the cycle time is not extremely long. | This kind of project happens quite often and there are no special requirements in this project that will increase the technical complexity. The only thing that matters is that there is a tight planning. | The turnaround time of this project is within the limit of 5 year, which means that we are able to learn from this project reasonably quick. On the other hand, the budget is quite large, through which the risks increases. |
| | | + | ++ | - | + |
| Rotterdam Vooruit | | Projects like this do not happen quite often. It is a very unique project with a lot of different aspects. | A lot of stakeholders are involved in this project, who all have their own opinions. | Very difficult problem of large size and with different aspects. In addition, this project involves several modalities, so much knowledge is necessary. | This is a huge project and even though the turnaround and budget are still unknown, it can already be estimated that it will not meet these characteristics. |
| | | -- | - | ++ | -- |
| Haaglanden | | Projects like this do not happen quite often. It is a very unique project with a lot of different aspects. | A lot of stakeholders are involved in this project, who all have their own opinions. | Very difficult problem that is connected with the operation of the access roads and the underlying (urban) road, the spatial development and public transport. | This is a huge project and even though the turnaround and budget are still unknown, it can already be estimated that it will not meet these characteristics. |
| | | -- | - | ++ | -- |
| A58 St. Annabosch-Galder | | Widening of a road is something that happens quite often in the Netherlands. Contractor can choose between different options, but otherwise it's not a real challenge for them. | For this project, there are few factors known that actually increase the social complexity. There are not that much stakeholders and the cycle time is not extremely long. | This kind of project happens quite often and there are no special requirements in this project that will increase the technical complexity. The only thing that matters is that there is a tight planning. | This project is not that big. The budget is reasonable and even though the turnaround time is unknown, it is expected that it is possible to finish within the 5 years. |
| | | + | ++ | - | ++ |

| Project | Criteria | Uniqueness | Social complexity | Technical complexity | Project size |
|---|----------|---|--|--|--|
| A1 Zone | | Although the main task of this project is widening the road, it is still considered unique, because there is more to it than just this widening. It is also important to enhance the spatial quality and durability and to exploit the economic development potentials. | A lot of stakeholders are involved in this project, who all have their own opinions. Besides that, this project will take place in an extremely busy environment. | This kind of project happens quite often and there are no special requirements in this project that will increase the technical complexity. But it does have a lot of different components through which the complexity increases. | The turnaround time of the project is not given, but it can be expected that this project will not be finished within five years. Besides that, the budget is 403 million euros, which is quite big, through which the risks increase. |
| | | ++ | -- | + | - |
| Capaciteitsuitbreiding Volkeraksluizen | | Even though there is fairly often worked on locks, it remains unique and challenging to work on such a large and important lock. | A lot of stakeholders are involved in this project, who all have their own opinions. Besides that, this project has a huge impact because there are no alternative routes available. | This project consist of several parts and a tight planning ,because there is no alternative routes, through which the technical complexity increases. In addition, locks are always complex matter. | The quick wins can be realized in one year and the fourth lock chamber (if necessary) in five years. This, together with the fact that the budget is 157 million euros, make this project suitable. |
| | | ++ | -- | ++ | ++ |
| Kanaalzone Gent-Terneuzen | | Even though there is fairly often worked on locks, it remains unique and challenging to work on such a large and important lock. | A lot of stakeholders are involved in this project, who all have their own opinions. Besides that this project contributes to solving an important problem. | Project consist of different steps from preparation to maintenance of thirty years. In addition, locks are always complex matter. | Even though the turnaround time is unknown, the enormous budget already indicates that this is a mega project, that will probably not be finished within five years. Besides that, it is questionable whether or not you should be willing to try a new method on such a mega project. |
| | | ++ | -- | ++ | -- |

Table 14: Evaluation of the seven projects.

Now it is known to what extent the projects meet the characteristics and requirements, it is possible to draw a conclusion with regard to the suitable infrastructure projects in the Netherlands. Table 15 on page 51 not only displays an overall ECI score for all the projects, it also provides recommendations with regard to the available ECI models. The overall ECI score is represented by pluses and minuses and the range goes from ++ to - -, where ++ indicates that the project is perfect for the application of ECI and - - the exact opposite. For the recommendation of ECI models there could be, as concluded in Chapter 5, chosen from the three ECI models:

- Cost led procurement
- Integrated project insurance
- Two stage open book.

In table 15 it can be seen that, of the seven projects that are included in the study, three projects are suitable as pilot projects for the application of ECI. The suitable projects are:

- A58 St. Annabosch – Galder
Two stage open book
- Capaciteitsuitbreiding Volkeraksluizen
Integrated project insurance
- A27 Houten – Hooipolder
Two stage open book

6.5 Chapter conclusion

In this chapter the possibilities for early contractor involvement in practice in the Netherlands are explored. To be able to do this, the characteristics, that need to be fulfilled by projects in order to be suitable for the application of ECI, were explored at first. To serve as a pilot project for the application of ECI in the Netherlands, it applies that:

- Similar projects may be implemented already quite often. A repetitive nature is not wrong.
- The contractor needs to be able to bring its own contribution to the project. An innovative solution or design freedom are good examples of this. It is important that the project is somehow challenging the contractor.
- It is smart to stay near the core competencies of the contractor. This means that the projects may be technically complex, but not socially complex. This is done because the power of the contractor lies within the technical complexity and the social complexity will bring too much pressure for the contractor.
- The turnaround time should be five years or less, because this enables a quick learning curve, which is necessary in pilot projects.
- Projects are particularly suitable when they have a good project sum in addition to a quick turnaround. A lower budget is less risky than a higher budget.

Subsequently, seven projects, whose realization start after 2019 and seemed appropriate for the application of ECI at first glance, were selected from the MIRT. The projects that were included in the research are called; A27 Houten – Hooipolder, Rotterdam Vooruit, Haaglanden, A58 St. Annabosch – Galder, A1 Zone, Capaciteitsuitbreiding Volkeraksluizen and Kanaalzone Gent – Terneuzen. These projects are evaluated on the six characteristics above.

Besides the suitable projects, a recommendation with regard to the available ECI models is also given. Ultimately, all this has led to the following overview of suitable projects:

- A58 St. Annabosch – Galder
Two stage open book
- Capaciteitsuitbreiding Volkeraksluizen
Integrated project insurance
- A27 Houten – Hooipolder
Two stage open book





| Project | Overall ECI score | Remarks | Recommended ECI model |
|---|-------------------|--|--|
| A27 Houten – Hooipolder | + | Even though this project is technically not that complex, this project does meet the other characteristics. The budget is big, but given the repetitive character and the fact that it is socially not that complex, this project can still be considered as a suitable pilot project for the application of ECI in the Netherlands. | Two stage open book This project has at first glance not a huge risk, making it possible to quickly select one contractor. In addition, TSOB can lead to a good relationship between client and contractor, which has a positive influence on the course and can lead to the optimal solution. |
| Rotterdam Vooruit | - - | This project is way too big, unique and socially complex to take this project as a pilot project for ECI in the Netherlands. When turns out in practice that ECI indeed is better than its alternatives, we can always switch to this type of projects. |  |
| Haaglanden | - - | This project is way too big, unique and socially complex to take this project as a pilot project for ECI in the Netherlands. When turns out in practice that ECI indeed is better than its alternatives, we can always switch to this type of projects. |  |
| A58 St. Annabosch – Galder | + + | This is a project that seems to be made for the application of ECI. Even though it has a lot similarities with the A27-project, the small budget makes sure that this project is even slightly more suitable. | Two stage open book This project has at first glance not a huge risk, making it possible to quickly select one contractor. In addition, TSOB can lead to a good relationship between client and contractor, which has a positive influence on the course and can lead to the optimal solution. |
| A1 Zone | - | Despite of the repetitive character and the technical complexity the social complexity and the budget take care of the fact this project is not as suitable as a pilot project for the implementation of ECI. |  |
| Capaciteits-uitbreiding Volkeraksluizen | + | Basically, this project seems to be made for the application of ECI. Only the high social complexity creates a negative effect on the overall score. This will therefore have to be taken into account in the development of ECI for this project, as previously already been told that social complexity is not desirable at the beginning of the application of this new method. | Integrated project insurance As mentioned, the social complexity should be taken into account in the elaboration of this project. It is advisable to choose for a model that allow multiple contractors, who all think about this project, through which the optimal solution can emerge. In view of the fact that there is not a series of projects, IPI seems to be the best choice. The fact that IPI makes sure that this project is directly insured against the financial impact of risks, ensures that social complexity can be carried even better |
| Kanaalzone Gent - Terneuzen | - - | Only the huge budget of 1085 million already indicates that this project has too many risks to be used as a pilot for ECI in the Netherlands. This, together with the social complexity make this project unsuitable. |  |

Table 15: The suitable future projects.

7. Conclusion and recommendations

7.1 Conclusion

Public infrastructure works are offered to the market entities by means of a procurement procedure. In the Netherlands clients and contractors would like to see this procedure to be accelerated, more clear and based on functional requirements instead of a complete design. Besides that, the contractors should be involved more, there should be better way to solve risks as much as possible and a fair distribution of the risks, less cost overruns and a better relation between client and contractor. Early contractor involvement (ECI) seems to be the proper approach to live up to these desires. That is why suitable infrastructure projects in the Netherlands for the application of ECI are explored. This could contribute to improvements in the field of procurement, final solutions and project realization. This research has produced the following results.

There are three available ECI models that are planned to be suitable for infrastructure projects in the nearby future:

Cost led procurement (CLP)

Multiple teams work independently of one another to develop a project proposal. The focus is on reducing project costs to increase the chance to get subsequent projects. Subsequent projects are not common for infrastructure projects in the Netherlands. But you never know what might happen.

Integrated project insurance (IPI)

Multiple teams work independently of one another to develop a project proposal. The focus is on reducing the financial effects of risks by adopting an insurance policy. This model is currently tested in the United Kingdom with projects with values between 10 and 25 million pounds. Following the contact with Phil Heenan from Cabinet Office, in which he said; *“As there is limited practical experience of applying the IPI model so far, the approach is initially being kept to a project size range that offers the opportunity for the model to prove its worth within a perceived acceptable degree of risk. Once there have been a number of demonstration projects it is likely that that initial £10-25m value band will be reviewed”* other reasons for using this limit, besides testing the IPI model, could not really be mentioned. This is the reason that this limit is not used for this study.

Two stage open book (TSOB)

Quick selection of one contractor to form a partnership between client and contractor in which an unambiguous project definition is developed. This model is suitable for all kind of project types.

To serve as a pilot project for the application of ECI in the Netherlands, it applies that:

- Similar projects may be implemented already quite often. A repetitive nature is not wrong.
- The contractor needs to be able to bring its own contribution to the project. An innovative solution or design freedom are good examples of this. It is important that the project is somehow challenging the contractor.
- It is smart to stay near the core competencies of the contractor. This means that the projects may be technically complex, but not socially complex. This is done because the power of the contractor lies within the technical complexity and the social complexity will bring too much pressure for the contractor.
- The turnaround time should be five years or less, because this enables a quick learning curve, which is necessary in pilot projects.
- Projects are particularly suitable when they have a good project sum in addition to a quick turnaround. A lower budget is less risky than a higher budget.

Seven projects, of which the realization start after 2019 and seemed appropriate for the application of ECI at first glance, were selected from the MIRT. After evaluating these seven projects on the characteristics described above, the following three projects turned out to be suitable to serve as pilot projects for the application of early contractor involvement in the Netherlands.

A58 St. Annabosch – Galder

The A58 is a 160 kilometer long highway between Vlissingen and Eindhoven. This road connects most major cities in Brabant and is also part of the connections Rotterdam-Antwerp and Rotterdam-Ruhr. , In the high-growth scenario, a bottleneck between Breda and Tilburg can occur. In autumn 2010 it is therefore decided to solve this problem and the thereby mentioned preferred solution is widening to 2x3 lanes on the section St. Annabosch – Galder.

This project has little enormous risks at first glance, which makes it possible to quickly select one contractor. **Two stage open book** is therefore the recommended ECI model. The relation that will be created between the client and contractor will probably ensure the achievement of the optimal solution. This means that Rijkswaterstaat should put a list of the problem and the specific requirements on the market. Contractors can submit a tender with their thoughts, options and proposed project team. Then, the selected contractor and Rijkswaterstaat jointly work out the preferred or a better solution. Based on this design, the contractor shall constitute a price which the client agrees or not. This is decisive for the further cooperation between the two parties.

Capaciteitsuitbreiding Volkeraksluizen

The Volkeraksluizen are identified as a potential capacity bottleneck for shipping. The Volkeraksluizen are the busiest and biggest locks of Europe and are the link between the main routes that connect Rotterdam to the Scheldt ports, and the Scheldt ports with the German hinterland. There is no alternative route to the Rhine-Scheldt corridor so all inland shipping pass the Volkeraksluizen. The challenge is to create optimal hinterland connections and stimulate inland shipping.

Given the large social complexity, it is chosen to involve the contractors early in the project but not to directly select one contractor. Therefore **integrated project insurance** is chosen as the ECI model. Rijkswaterstaat makes its demands known and interested contractors then deliver their proposal. Rijkswaterstaat chooses the best three. These three contractors make a design and finally the design that best meets everyone's needs and wishes is chosen to be realized. On condition that the price is also acceptable, the creator of the design also realizes the project.

A27 Houten – Hooipolder

On the A27 from Breda to Utrecht, the volume of the automobility increases, through which the travel time does not meet the targets expressed in the Infrastructure and Spatial Planning anymore. This means that widening the road is necessary.

The optimal solution, which solves the problem and fits within budget, is sought. Outside the big budget, there are, at first sight, no alarming issues that could cause huge risks. Quick selection of the contractor is possible and therefore **two stage open book** is advised. Rijkswaterstaat and the quickly selected contractor can jointly retrace all possible solutions and choose the best. When the cooperation pleases and there is agreement on the price, the cooperation can be continued.

7.2 Recommendations

This report is a first exploration of the possibilities for ECI in infrastructure projects in the Netherlands. To get a full understanding of ECI further research into the following points is recommended:

- This research is focused on the United Kingdom, because ECI originated from the UK and is most developed there. Yet it is also recommended to look at the application of ECI in other countries, through which it will be ruled out that things have been overlooked. It is recommended to look at New Zealand, Australia and Finland.
- A research into empirical information about experiences with ECI will give a clear image of ECI and its efficacy in practice.
- The result of this research is a list with pilot projects in the Netherlands and recommended ECI models. Now further research to the precise approach and design of ECI for this and other future projects is necessary.
- It is striking that none of the above suitable projects have **cost led procurement** as recommended model. This has to do with the fact that none of the projects is part of a series of projects. Series of projects could for example include the proposed project to replace approximately 100 Dutch crossovers. This might be a good opportunity to also test cost led procurement in the Netherlands. It is therefore important to explore this opportunity.

Reflection

I have started this study with enthusiasm and good cheer. In my mind it would become a fun time where I would learn a lot and would deliver a good conclusion. Once started, it proved to be a more difficult subject than originally thought. Besides the fact that this subject and these side of projects were new for me, it was found that early contractor involvement was new for a lot of people. This was expressed in the fact that there was little scientific information available, which was not to the benefit of my research. It was also showed that many different views and opinions existed on the subject, making it, especially for someone with no experience in practice, difficult to make an objective selection. This resulted in continually adjusting my pieces and always exploring a different direction. At that moment I regretted that very much, but in the end I am convinced that it has led to a better quality and a more useful outcome. Early contractor involvement is an interesting subject, but before this can be successfully applied in the Netherlands, much more research is necessary in my opinion.

References

Authority for the supervision of public contracts (2010). "The comparative survey on the national public procurement systems across the PPN." 11-12.

Beekers, A. (2012). Combining Early Contractor Involvement and Availability-Based Contracting in Complex Infrastructure Projects. Delft.

Bouman, D. H. (2013). Interview 20-11-2013: First insights in Dutch procurement. Nieuwegein.

Bouman, D. H. (2014). Interview 05-02-2014: Desired situation in Dutch procurement. Nieuwegein.

Bregman, A. (2009). Afstemming van besluitvorming bij combinatieprojecten. Den Haag, Instituut voor Bouwrecht.

Broerse, D., et al. (2013). "Public procurement in the Netherlands: overview." Retrieved 22 January, 2014, from <http://uk.practicallaw.com/3-522-7902?q&qp&qo&qe>.

BusinessDictionary (2013). "Public works." Retrieved 26 November, 2013, from <http://www.businessdictionary.com/definition/public-works.html>.

CabinetOffice (2012). "Government Construction - Construction Trial Projects."

CabinetOffice and Efficiency and Reform Group (2014). "New models of construction procurement." Retrieved 3 March 2014, 2014, from <https://www.gov.uk/government/collections/new-models-of-construction-procurement>.

Chao-Duivis, M. A. B. (2012). Lecture 5: Legal and Governance AR8002TU.

Chao-Duivis, M. A. B., et al. (2012). A Practical Guide to Dutch Building Contracts. The Hague, ibv.

Craven, R. and W. Sirhan (2012). "Procurement: new government recipes for a lean future." Retrieved 29 January, 2014, from <http://www.lexology.com/library/detail.aspx?g=41d41900-b04c-49fd-ae2-d1822352af4c>.

Dekker, W. (2014). Interview 11-02-2014: Experiences with early contractor involvement.

Department of Main Roads (2009). "Early contractor involvement." Standard Contract Provisions Roads 6.

Department of Main Roads (2009). "Early Contractor Involvement (ECI) Contract." Standard Contract Provisions Roads 6.

Designing buildings (2013). "Two-stage tender." Retrieved 29 January, 2014, from http://www.designingbuildings.co.uk/wiki/Two-stage_tender.

DG ECHO (n.d). "Mandatory principles of procurement." Retrieved 5 February, 2014, from http://www.dgecho-partners-helpdesk.eu/implementing_an_action/procurement/mandatory_principles.

Egas, M. (2014). Interview 25-02-2014: Desired procurement procedure in the Netherlands. Hoofddorp.

European Commission (2012). "Application of EU law." Retrieved 26 November, 2013, from http://ec.europa.eu/eu_law/introduction/what_directive_en.htm.

Finch, R. (2009). "JCT Constructing Excellence Contract." Retrieved 1 April, 2014, from <http://www.thenbs.com/topics/ContractsLaw/articles/jctConstructingExcellence.asp>.

Flyvbjerg, B. (2007). "Truth, Lies About Megaprojects."

Flyvbjerg, B., et al. (2003). Megaprojects and Risks: An anatomy of Ambition. Cambridge, Cambridge University Press.

Free, B. (2014). Interview 30-01-2014: Early Contractor Involvement. United Kingdom.

Galliford Try Infrastructure (2007). "NEC3 Options."

Government construction team (2012). "Interim Report of the Procurement/Lean Client Task Group."

Hansford, P. (2014). Interview 19-02-2014: Early Contractor Involvement.

Hertogh, M. J. C. M. and E. Westerverld (2010). "Playing with Complexity: Management and organisation of large infrastructure projects."

Hicks, J. (2012). "Executive summary: Procurement in focus."

Highways Agency (2012). "The Highways Agency: tendering for projects." Retrieved 27-05-2014, 2014, from <https://www.gov.uk/the-highways-agency-tendering-for-projects>.

HM Government (2013). "Construction 2025."

HM Government (n.d.). RM Lympstone.

HM Treasury and Infrastructure UK (2013). Infrastructure procurement routemap: a guide to improving delivery capability: 17-18.

Hobma, F. A. M. (2012). Procedures for the planning of new infrastructure. TU Delft.

Holleman, W. F. S. (2013). Interview 20-11-2013: First insights in Dutch procurement. Utrecht.

Holleman, W. F. S. (2014). Interview 28-01-2014: Desired procurement procedure in the Netherlands. Utrecht.

Hynes, D. (n.d.). Rye Harbour.

IADC (2011). "Early Contractor Involvement in infrastructure projects." IADC 3.

Kings College London (n.d.). Project procurement and delivery guidance: Using Two Stage Open Book and Supply Chain Collaboration.

Klap, C. Q. (2008). Procesontwikkeling grote infrastructurele werken.

Klap, C. Q. (2011). TU Delft lecture "Collaboration Processes in Civil Engineering": contractors perspective.

Koning, A. Z. R. (2012). Environmental Law.

Linden van der, S. (2013). Interview 06-12-2013: First insights in Dutch procurement. . Nieuwegein.

Lynch, J. (n.d.). "Two-Stage Tendering." Retrieved 29 January, 2014, from <http://www.procurementclassroom.com/two-stage-tendering/>.

Ministerie van infrastructuur en milieu (n.d.). "Design & Construct." Retrieved 10-12-2013, 2013, from http://www.rijkswaterstaat.nl/zakelijk/zakendoen_met_rws/werkwijzen/gww/contracten_gww/dc/.

Ministerie van verkeer en waterstaat (2005). "Werkwijzer vervlechting tracé/m.e.r.- en aanbestedingsprocedure bij infrastructurele projecten."

Morby, A. (2012). "Government cuts construction costs by 7%." Retrieved 29 January, 2014, from <http://www.constructionenquirer.com/2012/02/10/government-cuts-construction-costs-by-7/>.

Mosey, D. (2009). Early Contractor Involvement in Building Procurement. Oxford, Wiley-Blackwell.

Mosey, D. (2012). "Procurement for growth and savings." Construction Law: 17-19.

Mosey, D. (n.d.). Project Horizon.

NAVFAC (2011). "Early Contractor Involvement (ECI)."

NCPPP (n.d.). Retrieved 25 March, 2014, from <http://www.ncppp.org/ppp-basics/7-keys/>.

Nijssen, B. (2006). " Process Guidance at the Charles."

Noppen, J. P. (2012). Lecture 3 CT3980: Voorbereiding en uitvoering van werken in de bouw.

Oehler, J. (2014). Interview 21-02-2014: Desired procurement procedure in the Netherlands. The Hague.

Osipova, E. and P. E. Eriksson (2013). "Balancing control and flexibility in joint risk management : Lessons learned from two construction projects." from <http://pure.ltu.se/portal/en/publications/balancing-control-and-flexibility-in-joint-risk-management%28ab3c3b6f-205e-4f58-bc96-5337528c5b9b%29.html>.

Pianoo (2014). "Drempelwaarden Europees aanbesteden." Retrieved 21 January, 2014, from <http://www.pianoo.nl/regelgeving/drempelwaarden-europees-aanbesteden>

Procurement and Lean Client Group (2014). The Integrated Project Insurance (IPI) Model: Project Procurement and Delivery Guidance.

Procurement and Lean Client Group (n.d.). Cost Led Procurement Guidance: Guidance for the procurement and management of capital projects.

Rijksoverheid (2013). "Europese regelgeving voor aanbestedingen." Retrieved 22 January, 2014, from <http://www.rijksoverheid.nl/onderwerpen/aanbesteden/europese-regelgeving-aanbestedingen>.

Rijkswaterstaat (n.d.). "Parallelschakeling en vervlechting." Retrieved 10 December, 2013, from http://www.rijkswaterstaat.nl/zakelijk/zakendoen_met_rws/werkwijzen/gww/aanbesteden_en_contracteren/parallelschakeling_vervlechting/.

Rijkswaterstaat: Ministerie van Infrastructuur en Milieu (2013). Ruimte voor Innovatie.

Schultz van Haegen, M. H. (2013). "MIRT Projectenboek 2014."

Simpson Grierson (2012). "ECI: what is it, why use it and where is it going?"

TheFreeDictionary (2013). "public works." Retrieved 26 November, 2013, from <http://www.thefreedictionary.com/public+works>.

Tillema, T. and J. Arts (2009). Road infrastructure planning in the Netherlands; problems and trends for increasing sustainability. . Groningen, Rijksuniversiteit Groningen.

Trowers & Hamlins (2005). "PPC2000 Briefing Note."

Tweede Kamer der Staten-Generaal (2004). Onderzoek naar infrastructuurprojecten. The Hague.

Udom, K. (2012). "New procurement methods coming to a project near you." Retrieved 17 December, 2013, from <http://www.thenbs.com/topics/contractslaw/articles/newProcurementMethods.asp>.

Valkenburg, M. v., et al. (2008). Early Contractor Involvement: A new strategy for 'buying the best' in infrastructure development in the Netherlands.

Vree de, J. (n.d.). "D&C." Retrieved 24 February, 2014, from <http://www.ioostdevree.nl/shtmls/d-en-c.shtml>.

Wai, C. S. (2004). "Major Features, Advantage and Disadvantages of Generic Procurement Categories." ETWB TCW 32/2004(Appendix A).

Walker, D. H. T. and B. Lloyd-Walker (2012). "Understanding Early Contractor Involvement (ECI) procurement forms." Procs 28th Annual ARCOM conference: 877-887.

Wassenaar van, A. (2014). Interview 03-02-2014: Desired procurement procedure in the Netherlands. Amsterdam.