Smart renovation of residential real estate and neighbourhoods

“An exploratory research into the possibilities of open data to support the renovation process in the initiation phase”

Iris Kramer | PS report | Delft University of Technology | 4023137 | 19 January 2016
Dear reader,

The document in front of you is the result of my graduation project. For the last twelve months I have worked on this project and I am proud to present to you the end-result. This document is the final document that is part of the graduation process in achieving a master degree in Architecture, Urbanism & Building Sciences. Within this master I have chosen for the track Real Estate & Housing.

After one year of courses within this domain the graduation project has started in February 2015. This project started with an orientation on the several possible labs to graduate in. I chose to write my thesis within the lab Urban Development Management. After this decision was made a journey started to define the subject and come up with a research approach. This preparation phase ended with a P2 presentation at the beginning of July. As of September I have been working fulltime on this graduation project.

The process of coming to this report was intense and frustrating by times. I would like to use the metaphor of growing up to explain how the process felt. In the first period a lot of guidance was needed to keep me on the right track. I lost myself in other subjects while reading literature and the scope of my research was not defined just yet. Similar to a toddler that needs to learn was he can and cannot do. This phase was followed by a phase in which the subject of the research got more clear and I started to be able to work more independently. A child that learns how to ride a bike without training wheels. After the summer the full time research started, the interviews were conducted and the content of the research got more and more clear. In this phase confidence was met with insecurities and an overwhelming feeling of too much information to process. Comparable with being a teenager. Approaching the P4 deadline all puzzle pieces started to fall together and the whole story became clear. The conclusions could be drawn and a final document could be made. Similar to entering the adolescence phase. Lastly, after the ‘go’ at P4 was achieved and the final changes have been made to the story line of the report, confidence was gained and I feel like I am completely grown up now and ready for the next challenge!

I would like to thank my mentors at the University and at my graduation internship. The conversations with you led me to new insights which broad the end-result to a higher level. Secondly, I would like to thank all the interviewees who made time to talk with me and spread their knowledge. Thirdly, I want to thank all my friends and family who supported my during the process, gave me pep talks when I needed them and gave me some distractions in between deadlines. Fourthly, I want to thank my physiotherapist for helping me overcome and dealing with my RSI complaints which occurred during this project. Lastly, I want to thank all my colleagues at ERA Contour for the inspiring conversations, guidance during the process and welcoming me in the team. I am sorry that I am not a ping pong pro just yet!

By means of this research I hope to give a clear insight in the renovation process, its bottlenecks and the possibilities that are available to use open data in this process.

Enjoy!

Iris Kramer
19 January 2016
ABSTRACT

In this master thesis an exploratory research into the possibly of the implementation of open data in the renovation process of post-war serial built dwellings is described. A user need analysis has been conducted by means of literature review, expert interviews and case studies. This led to a description of the process, the involved stakeholders and bottlenecks in the process. 22 bottlenecks have been identified in the process, these bottlenecks can be put in the categories ‘stakeholder collaborations’, ‘knowledge level’, ‘funding’ and ‘context’. In the research synthesis a link between these bottlenecks and possible information input from open data is made. This led to an analysis of available open data sets in the Netherlands that might aid the renovation process. 57 data sets were identified to be useful for the process. Since none of the bottlenecks has the lack of data or information as its origin, it is unlikely that the implementation of open data would directly solve the bottlenecks. However, it could facilitate to reduce some of the bottlenecks. In this report a framework is presented which could be used by stakeholders in the process as a guideline to find useful data sets in the open data database of the Dutch government. To make the implementation possible the level of awareness and transparency in the process should be raised. Furthermore, both subjects, the renovation process with the focus on energetic sustainability and the availability of open data, should continue to go through the transition, which they are going through currently, before the implementation of open data in the process could be successful.

Keywords: renovation, energetic renovation, energetic sustainability, open data, data use, data re-use, post-war serial built dwellings, residential real estate, residential neighbourhoods
Introduction

The building sector uses 34% of the total energy consumption in the Netherlands (ECN, 2015). This defines the sector as the largest consumer in the country. At the same time the energy prices are rising. These environmental issues make us question the condition of our current real estate stock and thus we need to renovate a large part of this stock in the coming years to make it more energetic sustainable. On global, European and national level attention is paid to develop covenants and policies to make an energy transition possible.

In the years after World War II (WWII) a lot of serially dwellings have been built, these are gallery flats, apartment blocks and terraced house. These dwellings are reaching the end of the technical lifespan and this offers the possibility for serial renovation on a large scale. Most of the times these dwellings are within the social rent sector and owned by housing associations. This means that they are inhabited by households that do not have a lot to spend and currently are spending a major part of their income on their energy bill (Van Hal, 2011).

The last couple of years we have gone through some enormous developments in the field of technology. These new technologies create a lot of data each day. As Cavoukian and Jonas (2012) wrote in 2012 that by then ninety percent of the data in the world was created in the two years before that. Many countries around the world are working on opening up their data and providing these data sets for transparency, internal efficiency and external re-use.

This research combines the topics of renovations of residential real estate and urban areas and the implementation of open data in this process. What are the bottlenecks in the renovation process and how could these challenges be overcome with the implementation of data in the process? Due to the fact that the combination of renovation and data use is still a rather young topic, the research has been set-up as an exploratory research.

Problem statement

The building industry in the Netherlands faces a challenge with the renovation of the current (residential) building stock into more sustainable and less energy consuming properties. This renovation is already occurring, yet this process could still be improved.

Simultaneously, a lot of data is being generated due to technological developments. Furthermore, more and more public and private parties are opening up data sets for re-use.

Figure 0.1 is a visualisation of the problem statement. On the left side the process of renovating existing real estate and neighbourhoods is presented. In the initiation phase there is the quest for more energetic sustainability, which is more and more an important incentive for property owners, in this case housing associations (Van Hal, Van der Steen, & Van der Werf, 2011). On the right side of the illustration the process of the generation of more data in and on cities is presented. The arrow in the middle shows the main focus of this research.

Research questions

This research is based on two subjects, being the renovation process and open data use. These two subjects are combined in the following main research question:

How could open data be used to reduce bottlenecks in the initiation phase of a renovation project of residential real estate and neighbourhoods focussing on energetic sustainability in the Netherlands?
In order to be able to answer this main research question, a few sub questions needed to be answered. These sub questions are:

1. What are the key process steps in the initiation phase of the renovation process?
2. What are the key involved stakeholders in the initiation phase of the renovation process?
3. What bottlenecks can be identified in the renovation process?
4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?
5. What steps are needed to implement open data in the renovation process?

The first three sub questions are answered by literature review, expert interviews and case studies. The fourth sub question is addressed as well in the literature review and expert interviews. In each sub research the process, stakeholders and accompanying bottlenecks of a renovation project are described. This is compared with the findings of available open data. The conclusions of each research are compared and combined in the research synthesis. The answer to the fifth sub question is generated in the research synthesis. This is followed by the presentation of a framework. This framework gives answer to the main research question.

Figure 0.2 shows the conceptual model of the research. This model shows the connections between the several topics that are part of the research subject.

Definitions

In the research questions a few subjects are mentioned that need to be defined. These definitions are:

- **Open data** is all the data and content that can be freely used, modified, and shared by anyone for any purpose (Opendefinition.org, 2015). The Dutch government has published around 7,000 data sets¹ and is still working on making more data sets publicly accessible. In this research the demarcation has been made towards open data provided on the open data portal data.overheid.nl to mark the scope and boundaries of the research.

- A **bottleneck** is a moment in a process in which the process does not go according to plan for certain stakeholders.

- The **initiation phase** is the part of the building life cycle from the moment that the first idea emerges to renovate the existing building or neighbourhood until the moment in which all stakeholders agree upon a plan of approach towards redevelopment. This includes the planning, tender, selection and preliminary design.

- **Renovation** is the process of upgrading an existing building without changing its initial purpose. In this process adjustments are made to increase the technical, economic and social lifespan of a building. Gruis, Visscher, and Kleinhans (2006) define renovation as an overall physical and functional improvement, resulting in life-cycle extension of the building as a whole. Baldiri Salcedo Rahola (2015) defines energy renovation as major renovation projects, resulting in an extension of the service life of the building and a significant improvement of its energy performance.

---

¹ Amount is found on data.overheid.nl, website has been viewed on the 4th of December 2015. Exact amount of openly accessible data sets at that day was 7,229.
- **Sustainability** is the focus on prolonging the healthiness of our planet. It focusses on meeting the needs of the present without compromising the abilities of future generations to meet their own needs. **Energetic sustainability** is the sub section of sustainability that focusses on the use of and the generation of energy. A project could become more energetically sustainable by reducing the amount of energy used in total and/or replacing fossil fuels with renewable energy sources.

**Research objective**

The research objective of this research is two-folded. Firstly, the aim of this research is to give insights on the possibilities to use open data in the process of renovating the existing housing stock. The focus of this research is mainly on serial built post-war dwellings, since those cover a large part of the to be renovated housing stock in the Netherlands. Secondly, by means of this research a framework is developed that can be used by stakeholders involved in the process to decide which information source they could possibly use.

**Research design**

Figure 0.3 is a visualisation of the research design of this graduation work. The research has been set-up based upon theory, expert interviews and case studies. The outcomes of each of these researches build upon each other. Based upon these researches the conclusions on the first three sub questions are given. From the outcomes for the researches a research synthesis is executed in which an analysis into the possible open data sets is done. Based upon this analysis the answer to the fourth sub question can be given. Furthermore, this analysis has been used to design the framework. This framework gives answer to sub question 5. Finally, the whole research answers the main research question.

In the next sub sections in this summary the outcomes on each research subject are combined and not described per research method.

![Figure 0.3: Visualisation of the research design (own illustration)](image-url)
Research findings

The renovation process

Based upon literature a process model for the renovation process has been visualised. This model is presented in figure 0.4. This model has been confirmed by means of expert interviews and the case studies.

To achieve the maximum potential for energy saving in renovation projects, the process performance should be improved (Baldiri Salcedo Rahola, 2015). Currently, a shift can be notified in the process. This has mainly to do with the content of steps ‘creating program of requirements’ and ‘selection / tender process’. The change in these process steps entails more responsibilities that are placed with the market parties. Furthermore, housing associations demand more quality in the plans, which can result in a project that is more energetic sustainable.

Two types of the renovation process can be identified. Being the traditional process and the renewed process. These types have been found back in theory, expert interviews and in the case studies.

In the past housing associations had a maintenance work department who handled small repairs themselves. Larger projects, like renovations, were outsourced most of the times. The housing association did send out an elaborated assignment, in which they described the renovation works in detail. In this assignment the working method, materials and dimensions were specified. Only a small percentage of around 10 percent of the projects had an open contract or different contracting form in which the works were not strictly defined by the housing associations (Straub, 2001). The Dutch word for contractor, ‘aannemer’, does fit this role for the contractor perfectly, they only had to take on the job and execute it for the lowest price, no own interpretation or ideas were expected. Since this process leaves limited room for innovation and the implementation of energy saving measures this process is not sufficient anymore. Figure 0.5 visualises this traditional process.

The Stroomversnelling, which is part of the Energiesprong, is an initiative by the government to change the tendering process and make the focus more on energetic sustainability. The traditional process can be seen as a barrier for the integration of energetic and sustainable measures (Hoppe, 2009). In this renewed process the housing associations ask the market parties to create a consortium with
several different parties and to come up with an innovative approach towards renovating the properties. The tendering process changed from giving a program of requirements and the quest for an offer that is as low as possible, into a wish list and a budget. In this new approach the offering price is not the leading part of the tender anymore, it shifted towards the amount of quality that the project would add. Furthermore, it creates new types of assignments for the consortium such as collaboration, communication with the residents and gaining the 70% participation of the residents. This renewed process is visualised in figure 0.6.

However, as can be derived from the expert interviews and the case studies, there is not merely a traditional process and a renewed process in their extreme forms. Both types of process can be identified in practise and all types of forms in between are possible. What can be concluded is to make energetic sustainable measure be implemented in the process new approaches are necessary. Due to the changing regulations regarding the energy efficiency of dwellings housing associations are obliged to experiment with new types of processes. As both case studies show, this has led to more energy improving measures in the dwellings, however this also led to struggles in the process regarding the changing stakeholder roles.

**Stakeholders**

In the process of renovation three key stakeholders can be identified, being the housing association, the consortium and the residents. Other actors which have a stake in the process are governmental bodies and new parties which did not join the process in the past like energy companies, net companies, insurance companies, suppliers, local entrepreneurs and so on. Figure 0.7 shows a stakeholder map of the interrelations between the stakeholders in the process.

The housing association is the client of the renovation project. In the Netherlands no other type of property owners (investors, owner-occupiers) seems to be working on a large scale improvement of their properties with the focus on energy reduction. In the Netherlands the system regarding housing associations is different compared to other countries in Europe. Due to the semi-public structure of the company they do not gain subsidies by the government, making it rather hard to invest large amounts of money at once.

The consortium consists of a constructor and the constructor could ask other parties to join the team to together have more knowledge. In theory another party could be in the lead for gathering the parties in a consortium, however from expert interviews and in the case studies could be concluded that the constructor is in the most case in the lead.

The resident is a stakeholder that has a specific role in renovation projects compared to other building projects. Most of the renovation projects are executed with the residents staying in their dwellings. This has a major impact on the lives of the residents. An example can be given from the project which was analysed in case I. The building works in the second flat started a few weeks before the summer of 2015 and have ended just before Christmas 2015. Even though the building works in the dwelling take 10 workdays, the works in the rest of the gallery flat create nuisance as well. Half a year these people have to live in this project, which is intense. It is thus noticeable that a lot of the bottlenecks in the process have a link with the residents. Housing associations would like to engage the residents more closely with the decision-making regarding renovation of their dwellings, however at the same time they are hesitant to do so since it might lead to wrong expectations.

*Figure 0.7: Stakeholder map with involved actors in the renovation process and their interrelations (own illustration)*
Bottlenecks

22 bottlenecks have been identified in this research. In figure 0.8 these bottlenecks are projected on the process model.

The names of the bottlenecks are abbreviations for the whole bottleneck description. In the next sections the whole bottlenecks are mentioned and the abbreviated key word is added in italic font.

Firstly, six bottlenecks that do not have a specific point in the process are identified. These bottlenecks are:

- Communication between housing association and residents – Communication
- A transition in the process is needed – Transition
- Changing stakeholder roles needed – Changing roles
- Laws & regulations backlog the renovation process – Regulations
- Collaboration between stakeholders – Collaboration
- Process takes too much time – Time

The second process phase in which bottlenecks occur is the internal process within the housing association when the Program of Requirements is being created. Two bottlenecks in this process phase have been identified, being:

- Lack of funding – Funding
- Strategic decisions of housing associations are not focussed upon energetic sustainability – Decision-making

The third process phase that deals with bottlenecks is the selection / tender process. Five bottlenecks are identified in this phase, being:

- Awareness of energy saving measures among professionals – Awareness
- Technical difficulties – Techniques
- Lack of knowledge about residents – Knowledge
- It is not allowed for the consortium to speak to the residents at the early stages of the project – Speak to
- Competition between market parties – Competition

After the selection process one consortium is chosen to elaborate and execute their plans. Two bottlenecks regarding this elaboration are identified, being:

- End-users are too little involved in the renovation project decision-making – End-user involvement
- New process asks for solving liveability problems by market parties – Liveability problem-solving
The next process phase in which bottlenecks could be found back is the 70% participation process. Four bottlenecks are found, being:

- 70% participation of residents needed for renovation – 70%
- Incorrectly substantiated assumptions by residents – Assumptions
- Lack of interest in energy saving measures – Interests
- Lack of trust in new parties in the neighbourhood – Trust

Lastly, three bottlenecks are identified which occur in the use phase. However, if more attention would be paid to these bottlenecks in the initiation phase they might be overcome. These bottlenecks are:

- Use of energy sustainable dwelling – Use
- Split incentive housing association vs residents – Split incentive
- Net metering – Net metering

Open data

Since the subject of open data is rather young a lot of developments are still occurring on this field. As the trend report of the Algemene Rekenkamer (2015) shows, more and more initiatives of governmental departments to publish data are noticeable and engage re-users. In international benchmark studies the Netherlands are ranked quite positive in the development of open data. However, still the supply of data can be identified as fragmented and unilateral.

The impact of open data will only be positive when data supply is managed correctly on four levels (Van Loenen & Donker, 2014), these levels are:

1. The data set is known of
2. The data set is attainable for the re-user
3. The data set is usable for re-use
4. The governance regarding open data is correct

According to Van Loenen and Grothe (2014) the greatest opportunities for re-use are probably in the field of geographic information. Geographic information is information linked to a place on earth. It combines location, time and characteristics of the location (Van Loenen & Kulk, 2012).

Search on data.overheid.nl is not yet on the expected level of traceability that would be proper enough for re-use. Furthermore, searching on the website can take a significant amount of time. Another bottleneck with open data in the Netherlands is that not all data sets are included in the data.overheid.nl portal. This makes it hard to find the proper data sets. The attainability of open data is ranked rather high in the Netherlands. However, still steps can be made on this part.

The usability of the geographical data sets differs per set. The traditional geodata - building sector, spatial planning and mobility sector and the water sector – have a high level of usability. The non-traditional geodata – energy sector and health care sector – are not usability on a high level just yet. All the researched data set had a limited amount of metadata, which makes it hard to test the quality.

Each governmental body is responsible for its own open data. They have to show own initiative in opening up their data. All data is collected in one central spot. According to Suijkerbuijk not much organisations, governmental and non-governmental, do exactly know what data they have in their organisation. This is caused because hardly any organisation has an open by default or open design process. However, a trend can be noticed which leads towards more and more data being open and available for re-use. Due to this the amount of open data sets will keep on growing (Suijkerbuijk, interview, 24 September 2015). Due to open data being a rather young subject it still finds its foundation with pioneers. These pioneers within the governmental body are important for the success of the data sharing of that specific body (Van Loenen, interview, 6 November 2015).

The publication of open data by governmental bodies has made a lot of progress in the last years. However, this sharing is still occurring in a fragmented manner. Data sets are being published on national, provincial and municipal levels. Van Loenen identifies this as a bottleneck in the process towards proper re-use of data (Van Loenen, interview, 6 November 2015). Another point which backlogs possible re-use is that not all municipalities can provide the same level of quality on their data (Van Loenen, interview, 6 November 2015).

All experts on open data that were interviewed believe in the possibilities to re-use open data in the built environment, even though they are not experts on this field. A lot of information is collected in these data sets, for example the value of a property, ownership, air quality in the neighbourhood, permits given, residential research, statistical information on residents and a lot of other information. Suijkerbuijk (interview 24 September 2015) suggests data sets for the Kadaster, topographical information of the BRT, air quality, traffic information, amenities in the neighbourhood and permits that were given out. Van Loenen (interview, 6 November 2015) suggests to use data sets regarding geographical information, noise nuisance, altitude levels (3D map of the Netherlands, including buildings), thermographic information, registration on addresses and buildings (BAG, Basisregistratie Adressen en Gebouwen), energy
performance levels and energy labels and information on residents through CBS. Windt (interview, 9 November 2015) suggests to add energy use by residents to this list.

**Research synthesis**

With an analysis of the bottlenecks a list of seven categories of data sets that could be useful is generated. These seven categories are:

- Data regarding residents
- Data regarding the neighbourhood
- Data regarding the climate
- Data regarding energy use
- Data regarding energy saving measures
- Data regarding subsidies
- Data regarding companies

Based upon these data categories a list with keywords is generated. These keywords have been put in the search engine of the open data portal. This led to 367 hits of possible data sets. All these hits have been analysed and it can be concluded that 57 data sets are useful for re-use in the renovation process. Of these 57 data sets 50 are web based services only, which entails that they need to be implemented in an application to be re-used. Figure 0.9 shows for each data category the amount of useful hits.

<table>
<thead>
<tr>
<th>Data category</th>
<th>Hits</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data regarding resident</td>
<td>24 data sets</td>
<td>✓</td>
</tr>
<tr>
<td>Data regarding the neighbourhood</td>
<td>15 data sets</td>
<td>✓</td>
</tr>
<tr>
<td>Data regarding climate</td>
<td>2 data sets</td>
<td>X</td>
</tr>
<tr>
<td>Data regarding energy use</td>
<td>12 data sets</td>
<td>✓</td>
</tr>
<tr>
<td>Data regarding energy saving measures</td>
<td>0 data sets</td>
<td>X</td>
</tr>
<tr>
<td>Data regarding subsidies</td>
<td>1 data set</td>
<td>✓</td>
</tr>
<tr>
<td>Data regarding companies</td>
<td>3 data sets</td>
<td>X</td>
</tr>
</tbody>
</table>

*Figure 0.9: Categories of data sets and their availability (own illustration)*

The second objective of this research was to design a framework that could aid stakeholder in finding data sets. Figure 0.10 is a visualisation of this framework.

To make the implementation of open data in the process successful three steps are recommended by the author to execute before this implementation would starts. These suggestions are:

- The level of awareness of the possible use of open data should be raised among all stakeholders.
- The level of transparency within the project team should be raised. It should be transparent for all stakeholders involved what information is available and for what it is being used.
- A transition within the building sector is needed. All stakeholders should be open to change. This is necessary to make the implementation of energetic sustainability possible in the process as well as the implementation of open data.
Figure 0.10: Framework of possible implementation of open data to reduce bottlenecks in the renovation process (own illustration)
Conclusions

In the following sub sections the answers to the sub questions are described. The section ends with the answer to the main research question.

1. What are the key process steps in the initiation phase of the renovation process?

The process steps that are identified in the process have been visualised in figure 0.4. In this process two key parts can be identified. Firstly, the internal process at the housing association which ends with a program of requirements of their wishes. Secondly, the external process in which a tender or selection occurs, a consortium gets selected for the job and the elaboration of this plans is done. At the end of this stage the residents get involved and need to agree upon the plans. Without a 70% agreement of these residents the project plans are rejected. If the 70% participation is gained the project can start and the initiation phase will end.

Currently, a process transition can be notified. This transition is necessary to make it possible to implement energy saving measure in the projects. The transition entails a more open program of requirements as starting point for the tender. The housing association defines a list of wishes and a budget and the consortia are free to design their plans. This leads to more innovative ideas. However, the process transition entails changing roles as well which is still hard for some parties. With this transition the process steps, as described in figure 0.4, stay similar. Yet, the responsibilities in certain process steps shift from one stakeholder to another.

2. What are the key involved stakeholders in the initiation phase of the renovation process?

The key stakeholders are the housing association, the consortium and the residents. Figure 0.7 is a visualisation of a general stakeholder map for a renovation project.

The client of the project is the housing association. Housing associations in the Netherlands are different compared to other European countries. It are semi-public parties that do not have the use the official procurement law. This makes it possible to select consortia which they prefer to work with. Furthermore, housing associations do not get subsidies from the governments, which makes it important for them to have a good business case regarding renovation projects. Housing association in the Netherlands own a large part of the post-war serial built housing stock. There is a large assignment for these property owners to upgrade these dwellings. AEDES, the umbrella organisation for all housing associations in the Netherlands signed a covenant that commits to an average energy label B in 2021.

The consortium is the executing party of the project. It is a gathering of multiple parties that work together in realising the renovation project. The consortium needs at least a constructor to execute the building works. Furthermore, the other parties in the consortium may vary. Examples of possible other parties in the consortium are an architect or a residents guidance company.

The residents have a different role in renovation projects compared with other building projects. They stay in the dwellings during and after the renovation works. This makes it a social assignment. The residents have a large vote in the project due to the 70% participation regulation. However, in most cases the residents are only involved in the project when the plans are in a final stage already. In both the case studies the residents were represented in the process by a neighbourhood association.

The government has a small role in renovation projects, this goes for European, national and municipal governments. They mainly have influence on the projects by means of laws and regulations.

External advisors are hired by the consortium to give advice. This could for example be experts on energy reduction or climate design. In the traditional process these advisors were hired by the housing association to create a detailed program of requirements. Nowadays we can see shift of these advisors to the side of the consortium since less is known at the moment the consortium starts with the assignment.

Lastly, new types of parties enter the process. According to theory this is not specific for renovation projects yet it can be noticed in other types of urban redevelopment projects as well. In the second case study a new type of stakeholder that joined the process was the health insurance company. Since they had a lot of members in the flats they decided to execute some projects that could lead to the prevention of health issues. Another new type of stakeholder that has been interviewed in the expert interviews was the net company. Since renovation have a lot of influence on the gas and electricity nets collaborations could lead to more efficient renovation of both the dwellings as these nets.
3. **What bottlenecks can be identified in the renovation process?**

   By means of this research 22 bottlenecks have been identified in the renovation process. These bottlenecks are put in the process scheme in figure 0.8. The bottlenecks can be divided into four categories:

   1. Stakeholder collaborations
   2. Knowledge level
   3. Funding
   4. Context

   None of the categories and the individual bottlenecks have a direct link to data use. However, the amount of knowledge and information supply and flow can be an underlying cause for some of the bottlenecks.

4. **What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?**

   The Dutch government is working on opening up as much governmental and non-governmental data as possible for transparency, internal efficiency and external re-use. This has resulted in around 7,000 data sets supplied through the open data portal of the government at this moment. However, research has shown that the supply of data is still rather fragmented and unilateral.

   The data sets which will most likely be interesting for the building sector to re-use are data sets related to geographic information. Geographic information is information linked to a place on earth, it combines location, time and the characteristics of a location. Since it is still rather hard to find specific data sets a clear vision on what is needed needs to be created before a search can be started.

   Four data categories that could be effective for the renovation process and in which data sets have been found that are useable have been found by means of this analysis. These data categories are:

   - Data regarding residents
   - Data regarding the neighbourhood
   - Data regarding energy use
   - Data regarding subsidies

   In total these categories include 57 data sets that can be used. Of these 57 data sets 50 are web based services, entailing that these data sets should be implemented in an application before they can be re-used.

The publication of open data sets can be done at each moment of the day, making the outcomes of this research become obsolete directly. It might be possible that in the near future more data sets become available that can be useful for the process. The steps in the research synthesis can be repeated at any moment to check if there are new data sets available.

5. **What steps are needed to implement open data in the renovation process?**

   The bottlenecks that are identified by means of this research do not have a lack of data as its origin. This entails that to implement data in the process steps need to be taken. Furthermore, since both the renovation process with a focus on energy reduction and the re-use of open data are young subjects both subjects need to go through some developments before they will be completely ready for the implementation of open data in the process. Based upon this low level of knowledge about the possibilities to re-use open data with professionals in the renovation process and the transition in the process that is occurring to make energetic sustainable measures implemented in the projects, three steps are suggested to make the implementation possible:

   - Make sure the amount of awareness rises
   - Improve transparency in the process
   - Make the transition towards implementation of open data possible

In the previous paragraphs the sub questions of this research are answered. In this paragraph the main research question is answered. The main research question of this research is:

**How could open data be used to reduce bottlenecks in the initiation phase of a renovation project of residential real estate and neighbourhoods focusing on energetic sustainability in the Netherlands?**

No direct link between a bottleneck and a data source could be found. This makes it unlikely for a data set to solve a bottleneck directly. Most of the bottlenecks are part of the complex process regarding renovation of residential real estate. However, in the analysis data sets have been found which could help to diminish bottlenecks by means of more information supply in the process.
Before the data sets that are found can be implemented in the process a software tool should be developed. This is needed since 50 of the 57 data sources found are only attainable as a web service. This means that these data sets cannot be downloaded, however by means of a URL link can be implemented in a software system.

Yet, what needs to be kept in mind is that most of the bottlenecks identified are not directly related to data. Most of the bottlenecks have to do with the complex process and the transition which this process is going through with the focus on energetic sustainability. The implementation of open data could be of a small help for these bottlenecks, however will most likely not solve these bottlenecks completely. In figure 0.10 a framework is presented which could be used by stakeholders to see if they could make use of data sets that are available in the open data portal of the Dutch government to diminish the bottlenecks they encounter.

**Recommendations**

In this paragraph recommendations regarding future research and recommendations for practise are given.

**Recommendations for theory**

This research has been set-up as an exploratory research. This entails that the subject researched is rather new. That leads to the following recommendations for theory:

- More research into the renewed renovation process with the focus on energetic sustainability is preferable. Not much could be found on this subject and the stakeholder roles within this process.
- More research into the re-use of open data can be done. Currently there is limited sight on how data sets are being re-used and the effects of these re-uses.
- The same methodology can be applied for the re-use of open data in other types of processes in the built environment.
- A method for analysing which data sets are interesting to re-use in the built environment which depends less on the observations of a researcher could be developed. In this research the analysis of which data sets were interesting is made by the researcher, this generates bias regarding the outcomes. Furthermore, it were now a bit over 300 data sets that needed to be analysed. This amount is still rather tangible, yet when the amount of data sets available will rise this will become impossible to do without a model or any other decision-making method.
- The framework regarding the inquiry for useful data sets that has been presented in this research could be upgraded an include more levels.

**Recommendations for practise**

- The conclusion of this research is that it might be possible to implement open data in the process, however a software tool is needed. The first recommendation for practise is to develop such a tool.
- The second recommendation regards the knowledge about open data among professionals in the building sector. None of the interviewees did know about the existence of open data, this shows that without this knowledge none of them would ever implement data in the process.
- All the bottlenecks identified in this research do not find their origin in a lack of data input. This means that these bottlenecks could be diminished by other methods. Most of the bottlenecks could be diminished with more transparency and openness among stakeholders.
- The steps that were presented in paragraph 5.4.2, awareness, transparency and transition, should be enacted upon to make it possible to re-use data in the renovation process.
SAMENVATTING

Introductie

De gebouwde omgeving gebruikt 34% van de totale energie consumptie in Nederland (ECN, 2015). Hierdoor is de sector de grootste gebruiker van het land. Tegelijkertijd stijgen de energie prijzen. Deze klimatologische problematiek zorgt ervoor dat we ons af moeten vragen hoe de staat van de vastgoedvoorraad in Nederland is. Een groot deel van deze voorraad zal moeten worden gerenoveerd in de komende jaren en zal meer energetisch duurzaam gemaakt moeten worden. Op wereldwijd, Europees en landelijk niveau wordt er aandacht besteed aan deze kwestie en worden convenanten gesloten en wordt beleid gemaakt om de energie transitie mogelijk te maken.

In de jaren na de Tweede Wereldoorlog zijn veel seriematige woningen gebouwd. De typologieën van deze woningen zijn galerijflats, portiekflats en rijtjeswoningen. Veel van deze woningen naderen het einde van hun technische levensduur en dit biedt de mogelijkheid om deze woningen ook op een grote schaal seriematig te renoveren. Vaak bevinden deze woningen zich binnen de sociale huursector en zijn ze dus eigendom van woningcorporaties. Dit betekent dat ze bewoond worden door huishoudens die niet veel te besteden hebben en die op dit moment een groot deel van hun inkomen uitgeven aan energiekosten (Van Hal, 2011).

De laatste jaren hebben zich veel ontwikkelingen voortgedaan op het gebied van technologie. Deze nieuwe technologieën creëren een grote hoeveelheid data elke dag. Zoals beschreven door Cavoukian and Jonas (2012) in 2012 was de hoeveelheid data die op dat moment wereldwijd beschikbaar was gecreëerd in de twee Jaren daarvoor. Veel landen van over de hele wereld zijn bezig met het openen van hun data. De redenen voor dit openbaar maken van deze data sets is voor transparantie, interne effectiviteit en extern hergebruik.

In dit onderzoek worden de onderwerpen renovatie van residentiel vastgoed en stedelijke gebied en de implementatie van open data in dit proces gecombineerd. Wat zijn de knelpunten die zich voordoen in het renovatieproces en hoe zouden deze uitdagingen kunnen worden voorkomen met behulp van implementatie van data in het proces? Doordat renovatie en data gebruik beide redelijk nieuwe onderwerpen zijn is het onderzoek opgezet als een exploratief onderzoek.

Probleemstelling

De bouwsector in Nederland nadert een uitdaging als het gaat om de renovatie van de huidige residentiele gebouwenvoorraad met de focus op duurzaamheid en minder energie verbruik. Renovaties worden al uitgevoerd, toch zou het proces nog kunnen worden verbeterd.

Tegelijkertijd wordt er een grote hoeveelheid data geproduceerd door technologische ontwikkelingen. Verder openen steeds meer publieke en private partijen hun data sets voor extern hergebruik.

Figuur 0.1 is een visualisatie van de probleemstelling. Aan de linkerzijde is het renovatieproces van de bestaande vastgoedvoorraad en wijken weergegeven. In de initiatief fase van het proces is vraag naar meer energetische duurzaamheid, wat door gebouweigenaren als een steeds belangrijkere drijfveer wordt gezien. In dit geval gaat het over woningcorporaties (Van Hal et al., 2011). Aan de rechterzijde van de illustratie is het proces van de ontwikkeling van data in en over steden gepresenteerd. De pijl in het midden visualiseert de focus van dit onderzoek.

Onderzoeksvragen

Het onderzoek is gebaseerd op twee onderwerpen, het renovatieproces en het gebruik van open data. Deze twee onderwerpen zijn gecombineerd in de volgende hoofdvraag:

_Hoe kan open data worden gebruikt om knelpunten in de initiatief fase van een renovatieproject van residentieel vastgoed en residentiele buurten met de focus op energetische duurzaamheid te verminderen?_
Om deze hoofdvraag te kunnen beantwoorden moeten eerst een aantal deelvragen worden beantwoord. Deze deelvragen zijn:

1. Wat zijn de belangrijke processtappen in de initiatief fase van het renovatieproces?
2. Wat zijn de belangrijke stakeholders in de initiatief fase van het renovatieproces?
3. Welke knelpunten kunnen worden geïdentificeerd in het renovatieproces?
4. Welke open data bronnen zijn beschikbaar in Nederland die kunnen faciliteren tot het verminderen van de knelpunten in het renovatieproces?
5. Welke stappen zijn nodig om open data in het renovatieproces te implementeren?

De eerste drie deelvragen zijn beantwoord door middel van een literatuurstudie, expert interviews en casestudies. De vierde deelvraag wordt ook in de literatuurstudie en de expert interviews besproken. Voor elke deelvraag zijn het proces, de stakeholders en bijbehorende knelpunten in een renovatieproject besproken. Dit is vergeleken met de bevindingen over de beschikbare open data sets. De conclusies van elke deelonderzoek zijn vergeleken en gecombineerd in de onderzoeksanalyse. Het antwoord op de vijfde deelvraag is gegenereerd in de onderzoeksanalyse. Gevolgd door een presentatie van een framework. Dit framework geeft antwoord op de hoofdvraag.

Figuur 0.2 laat het conceptuele model van dit onderzoek zien. In dit model zijn de connecties tussen de verschillende onderwerpen in dit onderzoek gevisualiseerd.

**Definities**

In de onderzoeksvragen worden een aantal onderwerpen genoemd die gedefinieerd moeten worden. Deze definities zijn:

- **Open data** is al de data die vrij kan worden gebruikt, gewerkt en gedeeld door iedereen voor elk doel (Opendefinition.org, 2015). De Nederlandse overheid heeft op dit moment rond de 7.000 data sets² gepubliceerd en is nog steeds bezig met meer data sets openbaar toegankelijk te maken. In dit

² Hoeveelheid is gevonden op data.overheid.nl, deze website is bekeken op 4 december 2015. De exacte hoeveelheid openbaar toegankelijke data sets op die dat was 7.229.
functionele levensduur van een gebouw en een significante verbetering van de energieprestatie.

- **Duurzaamheid** is de focus op het verlengen van de gezondheid van onze planeet. Het focust op het voldoen aan de hedendaagse behoeften zonder te schikken in de mogelijkheden voor onze toekomstige generaties om te kunnen voldoen aan hun behoeften. **Energetische duurzaamheid** is het onderdeel van duurzaamheid dat zich focust op het gebruik van en de opwekking van energie. Een project wordt meer energetisch duurzaamheid als de hoeveelheid energie die wordt gebruikt wordt gereduceerd en/of als het gebruik van fossiele brandstoffen wordt vervangen door hernieuwbare energiebronnen.

**Doel van het onderzoek**

Het doel van dit onderzoek is tweeledig. Ten eerste, is het doel om inzichten te geven in de mogelijkheden om open data te gebruiken in het renovatieproces van de bestaande woningvoorraad. De focus in dit onderzoek is op naoorlogse seriematig gebouwde woningen, omdat dit een groot deel van de woningvoorraad in Nederland die aan renovatie toe is beslaat. Ten tweede, is het doel om door middel van dit onderzoek een framework te ontwikkelen die stakeholders betrokken in het proces kan helpen om te kiezen voor informatiebronnen die hun wellicht kunnen ondersteunen in het proces.

**Onderzoeksopzet**

Figuur 0.3 is een visualisatie van de onderzoeksopzet van dit afstudeeronderzoek. Het onderzoek is opgezet gebaseerd op literatuuronderzoek, expert interviews en casestudies. De uitkomsten van elke van deze deelonderzoeken bouwen op elkaar. Gebaseerd op deze deelonderzoeken zijn de conclusies op de eerste drie deelvragen gegeven. De uitkomsten vormen ook de input voor de onderzoeksynthese, in welke een analyse van de mogelijk bruikbare open data sets gedaan is. Gebaseerd op deze analyse is het antwoord op de vierde deelvraag gegeven. Verder is deze analyse gebruikt om het framework te ontwerpen. Dit framework geeft antwoord op deelvraag 5. Al laatste heeft het gehele onderzoek antwoord op de hoofdvraag.

In de volgende deelparagraphen in deze samenvatting zijn de uitkomsten over elke onderzoeksonderwerp gecombineerd en niet per onderzoeksmethode beschreven.

![Figuur 0.3: Visualisatie van de onderzoeksopzet (eigen illustratie)](image-url)
Onderzoeksresultaten

Het renovatieproces

Gebaseerd op literatuur is een procesmodel voor het renovatieproces gemaakt. Dit model is gepresenteerd in figuur 0.4. Het model is geverifieerd door middel van expert interviews en casestudies.

Om het maximale uit Energiebesparing in renovatieprojecten te halen moet de procesprestatie worden verbeterd (Baldiri Salcedo Rahola, 2015). Op dit moment kan een shift in het proces worden geobserveerd. Deze procesverandering heeft voornamelijk invloed op de processtappen 'het maken van een programma van eisen' en 'het selectie-/aanbestedingsproces'. De veranderingen in deze stappen houden in dat meer verantwoordelijkheden worden verplaatst naar de marktspartijen. Verder vragen woningcorporaties naar meer kwaliteit in de plannen zodat het project meer energetisch duurzaam kan worden.

Twee types van het renovatieproces kunnen worden geïdentificeerd. Dit zijn het traditionele proces en het vernieuwde proces. Deze types zijn teruggevonden door middel van theorie, expert interviews en casestudies.

In het verleden hadden woningcorporaties een onderhoudsafdeling die kleine ingrepen zelf regelde. Grotere projecten, zoals renovaties, werden meestal uitbesteed. De woningcorporatie zet een compleet bestek in de markt met een uitgebreide beschrijving van de opgave. In deze omschrijving waren de bouwmethode, materialen en dimensies gespecificeerd. Maar een klein percentage van ongeveer 10 procent van de projecten heeft een open contract of een ander contract ten grondslag waarin de werken niet strikt gedefinieerd waren door de woningcorporatie (Straub, 2001). De Nederlandse benaming 'aannemer' past goed bij deze rol. Aangezien ze alleen maar de opdracht hoefde aan te nemen en uit te voeren voor de laagste prijs. Eigen interpretatie of ideeën zijn niet nodig. Omdat dit proces weinig ruimte laat voor innovatie en de implementatie van energiebesparende ingrepen is dit proces niet afdoende meer. Figuur 0.5 is een visualisatie van dit traditionele proces.

De Stroomversnelling, een programmaonderdeel van de Energiesprong, is een initiatief van de overheid om het aanbestedingsproces te veranderen en te zorgen dat de focus op energetische duurzaamheid verbeterd. Het traditionele proces kan als een barrière worden gezien voor de integratie van energetisch duurzame elementen in een ontwerp (Hoppe, 2009). In het vernieuwde proces vraagt de woningcorporatie
marktpartijen om een consortium te vormen en samen te komen tot een innovatieve methode om de renovatie van de woningen uit te voeren. Het aanbestedingsproces is verandert van het geven van een programma van eisen met de vraag om dit zo goedkoop mogelijk aan te bieden tot een wensenlijst en een budget. In het vernieuwde proces is de aangeboden prijs niet meer leidend en is de focus meer op de hoeveelheid kwaliteit die er aan het project wordt toegevoegd. Verder ontstaan er nieuwe opgaven voor het consortium zoals samenwerken, communicatie met de bewoners en het behalen van de 70% participatie van de bewoners. Het vernieuwde proces is gevisualiseerd in figuur 0.6.

Echter, zoals kan worden opgemerkt door middel van de expert interviews en de casestudies, is er niet louter een traditioneel proces en een vernieuwd proces. Beide type processen worden teruggevonden in de praktijk, maar ook alle vormen die hiertussen liggen zijn mogelijk. Wat kan worden geconcludeerd is dat om energetisch duurzame ingrepen mogelijk te maken nieuwe benaderingen in het proces nodig zijn. Door de veranderende regelgeving over de energieprestatie van woningen worden woningcorporaties gedwongen om te experimenteren met nieuwe type processen. Zoals kan worden geconcludeerd uit beide casestudies heeft een vernieuwd proces geleid tot meer energieprestatie verbeterende ingrepen in de woningen, echter heeft dit ook tot strubbelingen in het proces geleid met het oog op veranderende stakeholder rollen.

Stakeholders

In het renovatieproces kunnen drie belangrijke stakeholders worden geïdentificeerd. Deze stakeholders zijn de woningcorporatie, het consortium en de bewoners. Andere actoren die een belangrijk aandeel in het proces hebben zijn de overheidsorganen en nieuwe partijen die voorheen geen rol in het proces hadden, zoals energieleveranciers, netbedrijven, verzekeringenbedrijven, leveranciers, lokale ondernemers enzovoorts. Figuur 0.7 laat een stakeholdermap zien waarin de relaties tussen de verschillende stakeholders in het proces zijn weergegeven.

De woningcorporatie is de opdrachtgever in een renovatieproject. In Nederland zijn geen andere gebouweigenaren (investeerders, eigenaar-bewoners) bezig met het verbeteren van hun bezit met de focus op energiereductie. In Nederland het systeem rondom woningcorporaties is anders dan in andere Europese landen. Door de semipublieke structuur van de corporaties krijgen zijn geen subsidies van de overheid, wat het lastig maakt om grote bedragen in een keer te investeren.

Het consortium bestaat uit een aannemer en de aannemer heeft de mogelijkheid om andere partijen te vragen om zich bij het consortium aan te sluiten zodat ze samen meer kennis hebben. In theorie kan een andere partij ook de leidende partij voor het samenstellen van een consortium zijn, echt uit de expert interviews en casestudies blijkt dat de aannemer in de meeste gevallen deze initiërende rol heeft.

De bewoner is een stakeholder met een specifieke rol in renovatieprojecten vergeleken met andere bouwprojecten. De meeste renovatieprojecten worden uitgevoerd in bewoonde staat. Dit heeft een grote impact op het leven van de bewoners. Een voorbeeld kan worden gehaald uit de eerste casestudie. De bouwwerkzaamheden in de tweede flat zijn een aantal weken voor de zomer van 2015 gestart en zijn vlak voor kerst 2015 afgerond. Ook al nemen de werkzaamheden in een specifieke woning maar 10 werkdagen in beslag, het werk in de rest van de flat zorgt wel voor overlast. Een half jaar lang moeten deze mensen wonen in dit project, wat intens is. Het is dus logisch dat veel van de knelpunten in het proces te maken hebben met bewoners. Woningcorporaties willen bewoners meer betrekken in de besluitvorming rondom de renovatie van hun woningen, echter zijn te tegelijkertijd aarzelend omdat dit wellicht foutieve verwachtingen kan scheppen.

Figuur 0.7: Stakeholdermap met de betrokken actoren in het renovatieproces en de relaties tussen deze actoren (eigen illustratie)
**Knelpunten**

22 knelpunten zijn geïdentificeerd in dit onderzoek. In figuur 0.8 zijn deze knelpunten geprojecteerd op het procesmodel.

Ten eerste zijn er zes knelpunten geïdentificeerd die niet tot een specifiek punt in het proces behoren. Deze knelpunten zijn:
- Communicatie tussen de woningcorporatie en de bewoners – **Communicatie**
- Een transitie in het proces is nodig – **Transitie**
- Veranderende stakeholder rollen zijn nodig – **Veranderende rollen**
- Wet- & regelgeving houdt het proces tegen – **Regelgeving**
- Samenwerkingen tussen stakeholders – **Samenwerkingen**
- Het proces neemt teveel tijd in beslag – **Tijd**

De tweede procesfase waarin knelpunten voorkomen is het interne proces binnen een woningcorporatie waar het programma van eisen wordt opgesteld. Twee knelpunten in deze procesfase zijn geïdentificeerd, zijnde:
- Te kort aan financiering – **Financiering**
- Strategische beslissingen van woningcorporaties zijn niet gefocust op energetische duurzaamheid - **Besluitvorming**

De derde procesfase waarin knelpunten voorkomen is het selectie- / aanbestedingsproces. Vijf knelpunten zijn geïdentificeerd in deze fase, zijnde:
- Het bewustzijn van energiebesparende methodes door professionals – **Bewustzijn**
- Technische moeilijkheden – **Technieken**
- Te kort aan kennis over de bewoners – **Kennis**
- Het is niet toegestaan voor het consortium om te spreken met de bewoners in de beginfases van het project – **Spreken met**
- Competitie onder marktpartijen – **Competitie**

Na het selectieproces is een consortium geselecteerd om de plannen uit te werken en uit te voeren. Twee knelpunten met betrekking tot deze uitwerking zijn geïdentificeerd, zijnde:
- Eindgebruikers zijn niet voldoende betrokken bij de besluitvorming in renovatieprojecten – **Eindgebruikersbetrokkenheid**
- In het nieuwe proces ligt de verantwoordelijkheid voor het oplossen van leefbaarheidsproblemen bij de marktpartijen - **Leefbaarheidsproblemen**
De volgende procesfase waarin knelpunten zijn gevonden is het 70% participatieproces. Vier knelpunten zijn gevonden, zijnde:

- 70% participatie van de bewoners is nodig voor een renovatie kan starten – 70%
- Ontrekend onderbouwde aannames door bewoners – Aannames
- Te kort aan interesse in energiebesparing – Interesse
- Te kort aan vertrouwen in nieuwe partijen in de buurt – Vertrouwen

Als laatste zijn drie knelpunten geïdentificeerd welke zich vooroden in de gebruiksfase. Echter, wanneer er meer aandacht zou worden besteed aan deze knelpunten in de initiatief fase zouden ze wellicht kunnen worden verminderd. Deze knelpunten zijn:

- Het gebruik van energiezuinige woningen – Gebruik
- Verdeeld motief woningcorporaties versus bewoners – Verdeeld motief
- Saldering - Saldering

Open data

Het onderwerp open data is jong onderwerp en veel ontwikkelingen doen zich voor op dit gebied. Zoals het trendrapport van de Algemene Rekenkamer (2015) laat zien zijn er steeds meer initiatieven van overheidsorganen om hun data te publiceren zichtbaar en om hergebruik te stimuleren. In de internationale benchmarkstudies wordt Nederland vrij positief beoordeeld als het gaat over de zichtbaarheid van open data. Echter, wanneer er meer aandacht zou worden besteed aan deze knelpunten in de initiatief fase zouden ze wellicht kunnen worden verminderd. Deze knelpunten zijn:

- Het gebruik van energiezuinige woningen – Gebruik
- Verdeeld motief woningcorporaties versus bewoners – Verdeeld motief
- Saldering - Saldering

Elke overheidsorgaan is verantwoordelijk voor zijn eigen open data sets. Het initiatief om data te openen moet vanuit de eigen organisatie komen. Alle data is verzameld op een centraal punt. Volgens Suijkerbuijk weten niet veel organisaties, publiek en privaat, precies welke data er beschikbaar is in hun organisaties. Dit komt omdat weinig organisaties een ‘open by default’ of ‘open by design’ proces hebben. Toch kan een trend worden opgemerkt dat meer data openbaar wordt gemaakt en beschikbaar is voor hergebruik. Hierdoor blijft de hoeveelheid open data sets die om het proces van hergebruik tegenwerkt is dat niet elk overheidsorgaan zijn belangrijk voor het succes van het delen van data (Van Loenen, interview, 6 november 2015).

De publicatie van open data door overheidsorganen heeft al veel ontwikkelingen doorgemaakt in de afgelopen jaren. Toch gebeurt het delen van informatie nog op een gefragmenteerde manier. Data sets worden gepubliceerd op nationaal, provinciaal en gemeentelijke niveaus. Van Loenen identificeert dit als een knelpunt in het proces voor goed hergebruik van de data (Van Loenen, interview, 6 november 2015). Een ander punt dat het proces van hergebruik tegenwerkt is dat niet alle gemeentes hetzelfde kwaliteitsniveau kunnen leveren (Van Loenen, interview, 6 november 2015).

Alle experts op het gebied van open data die zijn geïnterviewd geven in de mogelijkheden die hergebruik van open data in de gebouwde omgeving biedt, ook al zijn deze experts geen experts op dit gebied. Veel informatie is vermeld in deze data sets, bijvoorbeeld de waarde van een gebouw, eigenaarschap, luchtwaardigheid, uitgegeven bouwvergunningen, residentieel onderzoeken, statistische informatie over bewoners en nog veel meer informatie. Suijkerbuijk (interview 24 september 2015) stelt
het Kadaster, topografische informatie in het BRT, luchtkwaliteit, verkeersinformatie, voorzieningen in de buurt en vergunningen die zijn uitgegeven voor. Van Loenen (interview, 6 november 2015) stelt het gebruik van geografische informatie, geluidsoverlast, hoogtekaarten, thermografische informatie, BAG, energieprestatielevels en energie labels and informatie over de bewoners uit het CBS voor. Windt (interview, 9 november 2015) voegt energiegebruik door bewoners toe aan deze lijst.

Onderzoeksynthese

Gebaseerd op een analyse van de knelpunten is een lijst met zeven categorieën van data sets die bruikbaar kunnen zijn gemaakt. Deze zeven categorieën zijn:

- Data met betrekking tot bewoners
- Data met betrekking tot de buurt
- Data met betrekking tot het klimaat
- Data met betrekking tot energiegebruik
- Data met betrekking tot energiebesparende ingrepen
- Data met betrekking tot subsidies
- Data met betrekking tot bedrijven

Gebaseerd op deze data categorieën is een lijst met trefwoorden gemaakt. Deze trefwoorden zijn in de zoekmachine van het open data portaal gestopt. Dit heeft geleid tot 367 treffers van mogelijke data sets. Deze treffers zijn allemaal geanalyseerd en het kan worden geconcludeerd dat 57 van deze data sets nuttig zijn voor hergebruik in het renovatieproces. Van deze 57 data sets zijn 50 alleen beschikbaar als webdienst, wat betekent dat de data sets geïmplementeerd moeten worden in een applicatie om ze bruikbaar te maken voor hergebruik. Figuur 0.9 laat voor elke data categorie het aantal bruikbare treffers zien.

Het tweede onderzoeksdoel van dit onderzoek was het ontwerpen van een framework dat stakeholder kan helpen bij het vinden van de juiste data sets. Figuur 0.10 is een visualisatie van dit framework.

Om de implementatie van open data in het proces succesvol te maken worden drie stappen aangeraden bij de auteur om uit te voeren voordat deze implementatie zou starten. Deze suggesties zijn:

- Het niveau van bewustzijn van de mogelijkheid om open data te gebruiken moet worden verhoogd bij stakeholders.
- Het niveau van transparantie binnen een project team moet worden verhoogd. Het moet transparant zijn voor elke betrokken stakeholder welke informatie er beschikbaar is en waar het voor wordt gebruikt.
- Een transitie in de bouwsector is nodig. Alle stakeholders moeten open staan voor verandering. Dit is belangrijk om de implementatie van energetische duurzaamheid mogelijk te maken in het proces, alsmede de implementatie van open data.

Figuur 0.9: Data set categorieën en hun beschikbaarheid (eigen illustratie)
Figuur 0.10: Framework voor de mogelijke implementatie van open data om de knelpunten in het renovatieproces te verkleinen (eigen illustratie)
Conclusies

In de volgende secties worden de antwoorden op de deelvragen beschreven. Het stuk eindigt met een antwoord op de hoofdvraag.

1. Wat zijn de belangrijke processtappen in de initiatief fase van het renovatieproces?

De processtappen die zijn geïdentificeerd in het proces zijn gevisualiseerd in figuur 0.4. In het proces twee belangrijke onderdelen kunnen worden geïdentificeerd. Ten eerste, het interne proces bij de woningcorporatie welke eindigt met de vorming van het programma van eisen met de wensen van de corporatie. Ten tweede, het externe proces waarin een aanbesteding of selectie plaatsvindt, een consortium wordt geselecteerd en de uitwerking van het plan is gemaakt. Aan het einde van deze fase worden de bewoners betrokken en moeten ze de plannen goedkeuren. Zonder 70% van de bewoners die participeren worden de plannen afgewezen. Wanneer deze participatie wel wordt behaald eindigt hier de initiatief fase.

Momenteel kan er een procestransitie worden opgemerkt. Deze transitie is nodig om energiebesparende ingrepen te integreren in projecten. De transitie houdt in dat het programma van eisen minder vast is wanneer de aanbesteding gestart wordt. De woningcorporatie definieert een lijst met wensen en een budget en de consortia zijn veel vrijer in hun ontwerp. Dit leidt tot meer innovatieve ideeën. Dit proces vraagt veranderende rollen van de stakeholders, wat lastig is voor sommige partijen. Met deze transitie blijven de processtappen, zoals deze in figuur 0.4 zijn gepresenteerd, hetzelfde. De enige wijziging is de verschuiving van de verantwoordelijkheden van de ene naar de andere stakeholder.

2. Wat zijn de belangrijke stakeholders in de initiatief fase van het renovatieproces?

De belangrijkste stakeholders zijn de woningcorporatie, het consortium en de bewoners. Figuur 0.7 is een visualisatie van de generieke stakeholdermap voor renovatieprojecten.

De opdrachtgever van het project is de woningcorporatie. Verder kunnen de overige partijen die in het consortium zitten variëren. Voorbeelden van andere partijen in het consortium zijn een architect of een bewonersbegeleider.

Momenteel kan er een procestransitie worden opgemerkt. Deze transitie is nodig om energiebesparende ingrepen te integreren in projecten. De transitie houdt in dat het programma van eisen minder vast is wanneer de aanbesteding gestart wordt. De woningcorporatie definieert een lijst met wensen en een budget en de consortia zijn veel vrijer in hun ontwerp. Dit leidt tot meer innovatieve ideeën. Dit proces vraagt veranderende rollen van de stakeholders, wat lastig is voor sommige partijen. Met deze transitie blijven de processtappen, zoals deze in figuur 0.4 zijn gepresenteerd, hetzelfde. De enige wijziging is de verschuiving van de verantwoordelijkheden van de ene naar de andere stakeholder.

Ten slotte, raken nieuwe type partijen betrokken bij het proces. Gebaseerd op het literatuuronderzoek kan worden geconcludeerd dat dit niet specifiek voor renovatieproject geldt, maar ook andere type processen in de herontwikkeling van bestaande gebieden. In de tweede casestudie is een zorgverzekeringsmaatschappij betrokken bij het proces als een nieuwe partij. Omdat ze zagen dat veel van de bewoners in de flat een verzekering bij de desbetreffende partij hadden besloot de
verzekeringsschappij om zich preventief met de zorgvraagstukken in deze flat bezig te houden. Een ander nieuwe type stakeholder die is geïnterviewd in de expert interviews sectie was een netbeheerder. Omdat renovatie veel invloed heeft op het gas- en elektriciteitsnet kunnen samenwerkingen leiden tot efficiëntere renovatie van zowel de woningen als de bestaande netwerken.

3. Welke knelpunten kunnen worden geïdentificeerd in het renovatieproces?

Door middel van dit onderzoek zijn 22 knelpunten in het renovatieproces geïdentificeerd. Deze knelpunten zijn in het processchema geplaatst in figuur 0.8. De knelpunten kunnen worden onderverdeeld in vier categorieën:

1. Stakeholder samenwerkingen
2. Kennisniveau
3. Financiering
4. Context

Geen enkele van deze categorieën en afzonderlijke knelpunten heeft een directe link met data gebruik. Echter, de hoeveelheid kennis en informatievoorziening en -stroom zouden een onderliggende oorzaak kunnen zijn voor sommige van de knelpunten.

4. Welke open data bronnen zijn beschikbaar in Nederland die kunnen faciliteren tot het verminderen van de knelpunten in het renovatieproces?

De Nederlandse overheid is bezig om zoveel mogelijk overheid gerelateerde en niet-overheid gerelateerde data beschikbaar te stellen om transparantie, interne efficiëntie en extern hergebruik te stimuleren. Dit heeft geleid tot ongeveer 7.000 data sets die op dit moment worden aangeboden op het open data portaal van de overheid. Echter, laat onderzoek nog wel zien dat het aanbod van data nog steeds gefragmenteerd en eenzijdig is.

De data sets die waarschijnlijk interessant zijn voor de bouwsector om te hergebruiken zijn data sets met geografische informatie. Geografische informatie is informatie dat is gelinkt aan een plaats op aarde, het combineert locatie, tijd en de eigenschappen van een locatie. Omdat het vrij lastig is om specifieke data te vinden moet vooraf een duidelijke visie worden gecreëerd voordat een zoekactie naar data kan worden gestart.

De vier data categorieën die effectief kunnen zijn voor het renovatieproces en waarbij bruikbare data sets zijn gevonden door middel van dit onderzoek zijn:

- Data met betrekking tot bewoners
- Data met betrekking tot de buurt
- Data met betrekking tot energiegebruik
- Data met betrekking tot subsidies

In totaal bevatten deze categorieën 57 data sets die zouden kunnen worden gebruikt. Van deze 57 data sets zijn 50 webdiensten, wat inhoudt dat deze data sets moeten worden geïmplementeerd in een applicatie voordat ze kunnen worden hergebruikt.

De publicatie van open data sets kan worden gedaan op elk moment van de dag, wat ervoor zorgt dat de uitkomsten van dit onderzoek verouderd zijn binnen een seconde. Het kan zijn dat in de nabije toekomst meer data sets beschikbaar komen die bruikbaar zijn voor het proces. De stappen in de onderzoeksynthese kunnen op elk moment worden herhaald om te controleren of er nieuwe data sets beschikbaar zijn.

5. Welke stappen zijn nodig om open data in het renovatieproces te implementeren?

De knelpunten die zijn geïdentificeerd door middel van dit onderzoek hebben geen van allen een te kort aan data als oorsprong. Dit betekent dat stappen moeten worden gezet voordat data zou kunnen worden geïmplementeerd in het proces. Verder, omdat zowel het renovatieproces met de focus op energiebesparing als het hergebruik van open data relatief nieuwe onderwerpen zijn, moeten beide onderwerpen eerst door een aantal ontwikkelingen gaan voordat ze geheel klaar zullen zijn voor de implementatie van open data in het proces. Gebaseerd op dit lage kennisniveau over de mogelijkheid om open data te hergebruiken in het renovatieproces onder professionals en de transitie in het proces om het mogelijk te maken om energetisch duurzame ingrepen te implementeren in projecten, zijn drie suggesties gegeven om de implementatie van open data mogelijk te maken:

- Zorg dat het bewustzijn niveau wordt vergroot
- Verbeter de transparantie in het proces
- Bevorder de transitie om de implementatie van open data mogelijk te maken
In de vorige secties zijn de deelvragen van dit onderzoek beantwoord. In dit gedeelte wordt de hoofdvraag beantwoord. De hoofdvraag van dit onderzoek is:

_Hoe kan open data worden gebruikt om knelpunten in de initiatief fase van een renovatieproject van residentieel vastgoed en residentiele buurten met de focus op energetische duurzaamheid te verminderen?_

Geen directe link tussen de knelpunten en data bronnen is gevonden in dit onderzoek. Dit maakt het onwaarschijnlijk dat een data set een knelpunt direct zal oplossen. De meeste knelpunten zijn onderdeel van het complexe proces van de renovatie. Echter, in de analyse zijn data sets gevonden die de knelpunten zouden kunnen verminderen door middel van meer informatievoorziening in het proces.

Voordat de data sets die zijn gevonden in het proces zouden kunnen worden geïmplementeerd moet een software tool worden ontwikkeld. Dit is nodig omdat 50 van de 57 data sets die zijn gevonden alleen maar beschikbaar zijn als een webdienst. Dit betekent dat deze data sets niet kunnen worden gedownload, maar via een URL link in een software system moeten worden geïmplementeerd.

Wat echter in gedachten moet worden gehouden is dat de meeste knelpunten die geïdentificeerd zijn niet direct gerelateerd zijn aan data. De meeste van de knelpunten hebben te maken met het complexe proces en de transitie die het proces doormaakt met de focus op energetische duurzaamheid. De implementatie van open data zou tot hulp kunnen zijn bij het verkleinen van deze knelpunten. Maar dit zal de knelpunten niet geheel oplossen. In figuur 0.10 is het framework gepresenteerd dat kan worden gebruikt door stakeholders om te kijken welke open data sets beschikbaar zijn in het open data portaal van de Nederlandse overheid om de knelpunten die ze tegenkomen te verkleinen.

**Aanbevelingen**

_Aanbevelingen voor vervolgonderzoek_

Het onderzoek is opgezet als een exploratief onderzoek. Dit houdt in dat het onderwerp dat is onderzoek redelijk nieuw is. Wat leidt tot de volgende aanbevelingen voor een vervolgonderzoek:

- Meer onderzoek kan worden gedaan over het vernieuwde renovatieproces met de focus op meer energetische duurzaamheid. Weinig informatie kan op dit moment worden gevonden in literatuur over dit onderwerp en de stakeholder rollen binnen dit proces.
  - Meer onderzoek kan worden gedaan over het hergebruik van open data. Op dit moment is er weinig zicht op hoe data sets worden hergebruikt en wat de effecten van dit hergebruik zijn.
  - Dezelfde onderzoekspopulatie zou kunnen worden toegepast voor de hergebruik van open data in andere processen binnen de gebouwde omgeving.
  - Een methode voor de analyse van welke data sets bruikbaar zijn voor hergebruik in de gebouwde omgeving die minder rust op de observatie van de onderzoek moet worden ontworpen. In dit onderzoek is deze analyse gedaan door de onderzoeker, wat ervoor kan hebben gezorgd dat de uitkomsten bias zijn. Op dit moment bevat de analyse 300 data sets. Dit aantal is nog redelijk behapbaar, maar wanneer dit aantal zal stijgen, zal het onmogelijk zijn om deze analyse uit te voeren zonder een model of een andere besluitvormingsmethode.
  - Het framework dat is gepresenteerd in dit onderzoek kan nog verder worden uitwerkt en zou meer verschillende niveaus kunnen bevatten.

_Aanbevelingen voor de praktijk_

- De conclusie van dit onderzoek is dat het waarschijnlijk mogelijk is om data te implementeren in het proces, maar zijn daarvoor welk software tools nodig. De eerste aanbeveling voor de praktijk is dan ook om deze tool te ontwikkelen.
  - De tweede aanbeveling gaat over het kennisniveau over open data bij professionals in de bouwsector. Geen van de geïnterviewden wist precies wat hij met open data zou kunnen doen, wat laat zien dat zonder deze kennis geen van deze professionals ooit gebruik zou maken van open data in het proces. Dit kennisniveau zal dus omhoog moeten worden gebracht voordat gebruik van open data mogelijk is.
  - Alle knelpunten die door middel van dit onderzoek gevonden zijn hebben geen te kort aan data input als grondslag. Dit betekent dat deze knelpunten zouden moeten kunnen worden verkleind door middel van andere methodes. De meeste knelpunten kunnen waarschijnlijk worden verkleind wanneer er meer transparantie en openheid tussen stakeholders zou zijn.
  - De processtappen die eerst moeten worden uitgeoefend zoals ze in dit onderzoek worden aanbevolen, bewustzijn, transparantie en transitie, zullen eerst moeten worden verbeterd voordat hergebruik van open data in het renovatieproces mogelijk is.
# TABLE OF CONTENTS

Preface ............................................................. I
Abstract .................................................................. III
Summary ............................................................... V
Samenvatting ................................................................ XVII

Reader’s guide ........................................................... 5

1 – Research design .................................................. 7
   1.1 Introduction ...................................................... 7
   1.2 Problem statement ............................................ 8
      1.2.1 Problem analysis ......................................... 8
      1.2.2 Problem statement ....................................... 9
   1.3 Research questions .......................................... 9
      1.3.1 Definitions ..................................................10
   1.4 Research relevance .........................................11
      1.4.1 Personal motivation ......................................11
      1.4.2 Scientific relevance ......................................11
      1.4.3 Societal relevance .......................................12
   1.5 Research objective .........................................12
   1.6 Research design .............................................12

2 - Theory ................................................................ 15
   2.1 Introduction .................................................... 15
      2.1.1 Energetic sustainable renovation vs. available open data ....15
      2.1.2 Provocation of the need for energetic sustainable renovation....16
   2.1.3 Provocation of open data availability ........................................ 20
   2.2 The renovation process ...................................... 21
      2.2.1 Decision-making in a renovation process ...................... 23
      2.2.2 A traditional renovation process versus a renewed process ....24
   2.3 Stakeholders .................................................. 25
   2.4 Bottlenecks ......................................................27
   2.5 Open data ......................................................30
      2.5.1 Open data sets applicable for the renovation process ..........30
      2.5.2 Relation of data to the bottlenecks ..............................31
   2.6 Conclusions ..................................................32
      2.6.1 Summary provocations ......................................32
      2.6.2 The renovation process ......................................32
      2.6.3 Stakeholders ...............................................32
      2.6.4 Bottlenecks ...............................................33
      2.6.5 Open data ................................................33
      2.6.5 Conceptual model ..........................................33

3 – Expert interviews ................................................ 35
   3.1 Summary previous findings .................................. 36
   3.2 The renovation process ...................................... 36
   3.3 Stakeholders ..................................................38
   3.4 Bottlenecks ......................................................40
   3.5 Open data ......................................................44
      3.5.1 Open data sets applicable for the renovation process ..........45
      3.5.2 Relation of data to the bottlenecks ..............................46
   3.6 Conclusions ..................................................47
      3.6.1 The renovation process ......................................47
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 – Case studies</td>
<td>49</td>
</tr>
<tr>
<td>4.1 Summary previous findings</td>
<td>49</td>
</tr>
<tr>
<td>4.2 Case selection</td>
<td>50</td>
</tr>
<tr>
<td>4.3 Case I – Smitsveen, Soest</td>
<td>51</td>
</tr>
<tr>
<td>4.3.1 The renovation process</td>
<td>52</td>
</tr>
<tr>
<td>4.3.2 Stakeholders</td>
<td>55</td>
</tr>
<tr>
<td>4.3.3 Bottlenecks</td>
<td>57</td>
</tr>
<tr>
<td>4.3.4 Data use</td>
<td>59</td>
</tr>
<tr>
<td>4.4 Case II – Bilgaard, Leeuwarden</td>
<td>60</td>
</tr>
<tr>
<td>4.4.1 The renovation process</td>
<td>60</td>
</tr>
<tr>
<td>4.4.2 Stakeholders</td>
<td>62</td>
</tr>
<tr>
<td>4.4.3 Bottlenecks</td>
<td>65</td>
</tr>
<tr>
<td>4.4.4 Data use</td>
<td>67</td>
</tr>
<tr>
<td>4.5 Conclusions</td>
<td>67</td>
</tr>
<tr>
<td>4.5.1 The renovation process</td>
<td>67</td>
</tr>
<tr>
<td>4.5.2 Stakeholders</td>
<td>67</td>
</tr>
<tr>
<td>4.5.3 Bottlenecks</td>
<td>68</td>
</tr>
<tr>
<td>5 – Research synthesis</td>
<td>69</td>
</tr>
<tr>
<td>5.1 Summary previous findings</td>
<td>69</td>
</tr>
<tr>
<td>5.1.1 The renovation process</td>
<td>69</td>
</tr>
<tr>
<td>5.1.2 Stakeholders</td>
<td>69</td>
</tr>
<tr>
<td>5.1.3 Bottlenecks</td>
<td>70</td>
</tr>
<tr>
<td>5.2 Relation of bottlenecks to data</td>
<td>72</td>
</tr>
<tr>
<td>5.3 Available open data sets</td>
<td>74</td>
</tr>
<tr>
<td>5.4 Framework</td>
<td>76</td>
</tr>
<tr>
<td>5.4.1 Discussion of framework</td>
<td>78</td>
</tr>
<tr>
<td>5.4.2 Steps to make implementation successful</td>
<td>78</td>
</tr>
<tr>
<td>5.5 Conclusions</td>
<td>79</td>
</tr>
<tr>
<td>5.5.1 Open data</td>
<td>79</td>
</tr>
<tr>
<td>5.5.2 Steps for implementation</td>
<td>79</td>
</tr>
<tr>
<td>6 – Conclusions</td>
<td>81</td>
</tr>
<tr>
<td>6.1 Conclusions</td>
<td>81</td>
</tr>
<tr>
<td>6.1.1 The renovation process</td>
<td>81</td>
</tr>
<tr>
<td>6.1.2 Stakeholders</td>
<td>82</td>
</tr>
<tr>
<td>6.1.3 Bottlenecks</td>
<td>83</td>
</tr>
<tr>
<td>6.1.4 Open data</td>
<td>84</td>
</tr>
<tr>
<td>6.1.5 Steps for implementation</td>
<td>84</td>
</tr>
<tr>
<td>6.1.6 Answer to the main research question</td>
<td>85</td>
</tr>
<tr>
<td>6.2 Discussion</td>
<td>86</td>
</tr>
<tr>
<td>6.3 Limitations</td>
<td>86</td>
</tr>
<tr>
<td>6.4 Recommendations</td>
<td>88</td>
</tr>
<tr>
<td>6.4.1 Recommendations for theory</td>
<td>88</td>
</tr>
<tr>
<td>6.4.2 Recommendations for practice</td>
<td>88</td>
</tr>
<tr>
<td>6.5 Reflection</td>
<td>89</td>
</tr>
<tr>
<td>6.5.1 Reflection on subject</td>
<td>89</td>
</tr>
<tr>
<td>6.5.2 Reflection on process</td>
<td>90</td>
</tr>
<tr>
<td>6.5.3 Reflection on planning</td>
<td>91</td>
</tr>
</tbody>
</table>
This report has the following structure. In chapter 1 the research design is elaborated. This section contains a brief introduction into the research subject; secondly, the problem analysis and problem statement are described. Followed by a paragraph in which the main research question and accompanying sub questions are presented. Fourthly, the relevance of the research is elaborated upon. Fifthly, the research objective of the project is described. Lastly, the research design, research methods and timeline are presented.

In chapter 2 the findings from the literature review are presented. The chapter starts with an elaboration on the provocation of the two central research subjects. Followed by paragraphs on the renovation process, the involved stakeholders, the bottlenecks in the process and open data. The chapter ends with a concluding paragraph in which a first answer to the first four sub questions is given.

Chapter 3 builds upon the findings from literature. It starts with a paragraph in which a summary of the findings from the literature review are summarized. The second paragraph elaborates upon the renovation process, followed by a paragraph on the involved stakeholders and a paragraph on the bottlenecks in the process. The fifth paragraph elaborates upon the availability of open data. The chapter ends with a concluding paragraph in which answers to the first four sub questions are given based upon the findings from the expert interviews.

In chapter 4 two case studies are described. Two renovation projects have been selected and are investigated by means of interviews and document analysis. In the first paragraph the findings from literature review and the expert interviews are summarized. The second paragraph elaborates on the case selection procedure. In the third paragraph the first case study is described, followed by the description of the second case study in the fourth paragraph. Both case studies have the same structure as has been used in the previous chapters. The chapter ends with a paragraph in which an answer to the first three sub questions is given based upon the case studies.

In chapter 5 the research synthesis is described. The chapter starts with a summary of the findings from theory, expert interviews and the case studies. This is followed by a paragraph in which the relation of the bottlenecks to data is analysed. In the third paragraph an elaboration on the available open data sets is presented. In the fourth paragraph the framework is presented and described. The chapter ends with a paragraph with conclusions to the fourth and fifth sub question.

Chapter 6, the last chapter of this report, elaborates upon the conclusions of this research. In the first paragraph an elaborate description of the answers to the research questions is given. In the second paragraph the outcomes of the research have been discussed. Followed by a paragraph in which the limitations of the research are described. The fourth paragraph pays attention to the recommendations for further research and for practise. In the last paragraph a reflection on the research is presented.

Table 0.1 visualises the subjects and in which paragraph information regarding these subjects can be found.
<table>
<thead>
<tr>
<th>RESEARCH QUESTIONS</th>
<th>PROCESS</th>
<th>STAKEHOLDERS</th>
<th>BOTTLENECKS</th>
<th>OPEN DATA</th>
<th>LINK BOTTLENECK VS DATA</th>
<th>CONCLUSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>Q5</td>
<td>Main Q</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RESEARCH DESIGN</th>
<th>§1.1-1.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td>§2.1</td>
</tr>
<tr>
<td>EXPERT INTERVIEWS</td>
<td>§3.1</td>
</tr>
<tr>
<td>CASE STUDIES –</td>
<td>§4.1</td>
</tr>
<tr>
<td>CASE I</td>
<td></td>
</tr>
<tr>
<td>CASE STUDIES –</td>
<td>§4.1</td>
</tr>
<tr>
<td>CASE II</td>
<td></td>
</tr>
<tr>
<td>RESEARCH SYNTHESIS</td>
<td>§5.1</td>
</tr>
<tr>
<td>CONCLUSIONS</td>
<td>§6.1.1</td>
</tr>
</tbody>
</table>

Table 0.1: Reader’s guide (own work)
1 – RESEARCH DESIGN

In this chapter an introduction to the research subject is given. Furthermore, the research questions are presented and the plan of approach towards answering these questions is described.

1.1 INTRODUCTION

As we all might know, our current way of living as humans across the globe is affecting the environment in a rapid pace. However, what most people do not realize is that 34% of all energy consumption is used by the building sector, making it the sector with the largest contribution to energy usage in the Netherlands (ECN, 2015). These environmental issues make us question the condition of our current real estate stock and thus we need to renovate a large part of this stock in the coming years to make it more energetically sustainable. On global, European and national level attention is paid to develop covenants and policies to make an energy transition possible. Furthermore, property owners and the building industry are working on developing methods to renovate dwellings with the focus on energy reduction.

In the years post World War II (WWII) a lot of dwellings have been built in a serial manner. The typologies of these dwelling are gallery flats, apartment blocks and terraced houses. In the coming years the assignments within urban areas will be more focusing on the transformation and renovation of the existing residential building stock and the liveability in existing urban areas (Jonker-Verkaart, 2015). One of the assignments which follows this development is the quest for more energetic sustainability in the existing urban fabric. As the European and Dutch government encourage, there is a need to renovate this existing serial built housing stock in a smart, speedy and energy efficient way. However, most of the times these dwellings are within the social rent sector and owned by housing associations. This means that they are inhabited by households that do not have a lot to spend and currently are spending a major part of their income on energy (Van Hal, 2011). It asks for new approaches, strategies and more extensive implementation (Van Hal et al., 2011).

The last couple of years we have gone through some enormous developments in the field of technology. These new technologies create a lot of data each day. As Cavoukian and Jonas (2012) wrote in 2012 that by then ninety percent of the data in the world was created in the two years before that. Many countries around the world are working on opening up their data and providing these data sets for transparency, internal efficiency and external re-use. The European Commission (EC) is encouraging these developments.

This research combines the topics of renovations of real estate and urban areas and the implementation of data in this process. The focus is on residential real estate and neighbourhoods that are predominantly residential. What are the bottlenecks in the renovation process and how could these challenges be overcome with the implementation of data in the process? Due to the fact that the combination of renovation and data use is still a rather young topic, the research has been set up as an exploratory research.
1.2 PROBLEM STATEMENT

In this paragraph the problem analysis and problem statement are elaborated upon.

1.2.1 PROBLEM ANALYSIS

As mentioned in the introduction, it is needed to save energy to lower the emission of CO₂ and thus the green house effects. Furthermore, we start to run out of fossil fuels and we need either to save energy or to create renewable energy sources and energy. Covenants on international level as well as national level are made which indicate a will to do so and go through this energy transition. This has influence on the practical level as well. In a covenant of AEDES, the umbrella organisation for all the housing associations in the Netherlands, the commitment was made to renovate a large part of the housing stock of these associations and thus reduce the energy consumption of their tenants. The covenant states that all the housing associations should have an average energy label B by the year 2021 (AEDES, 2012).

Another issue regarding this subject is the estimated rise of energy prices (ECN, 2015). Most of the dwellings with low energy labels, and thus relatively high energy bills, are inhabited by households in the lowest income group. Which makes them a vulnerable group if energy prices were to rise. To protect these households, and simultaneously the incomes of the housing associations, energy related measures should be applied to these dwellings.

So how could this energy reduction and renovation of the social housing stock be executed? A large part of the dwellings owned by housing associations and with low energy labels are built in the years after WWII. In this period the Netherlands, as well as many other countries in Europe, have rebuilt their housing stock in a fast manner with a serial approach. This means that most of these residential properties are fairly similar. Due to this serial approach, a serial approach for the renovation of these dwellings is possible as well. That is why the Dutch government together with Platform31 started the initiative ‘de Energiesprong’ (Energiesprong, 2015). This initiative was started to incubate the renovation process and scale up the initiatives regarding this subject. To make this transition happen technological innovations, mind-set shifts and process innovations are needed.

Simultaneously to the rising awareness on the climate issues, the field of technology is developing in a rapid pace. Due to these innovations and their implementation in our urban fabric, a lot of data on the use of cities and real estate is being generated. Furthermore, governments are in favour of opening up their data to encourage transparency, internal efficiency and external re-use of the data (Bregt, Grus, & Eertink, 2014). This creates opportunities to freely make use of a lot of information on cities, residents and multiple other subjects. This raises the question if this is possible for the building industry as well. Through this research the link between the available data and the moments in the renovation process in which it could be helpful are analysed.
1.2.2 PROBLEM STATEMENT

The building industry in the Netherlands faces a challenge with the renovation of the current (residential) building stock into more sustainable and less energy consuming properties. This renovation is already occurring, yet this process could still be improved. Simultaneously, a lot of data is being generated due to technological developments. Furthermore, more and more public and private parties are opening up data sets for re-use.

Figure 1.5 is a visualisation of the problem statement. On the left side the process of renovating existing real estate and neighbourhoods is presented. In the initiation phase there is the quest for more energetic sustainability, which is more and more an important incentive for property owners, in this case housing associations (Van Hal et al., 2011). On the right side of the illustration the process of the generation of data in and on cities is presented. The arrow in the middle shows the main focus of this research. This research answers to the question if these two topics could be combined and add value to each other.

1.3 RESEARCH QUESTIONS

In this paragraph the main research question and accompanying sub research questions are presented. This research is based on two subjects, being the renovation process and open data use. These two subjects are combined in the following main research question:

How could open data be used to reduce bottlenecks in the initiation phase of a renovation project of residential real estate and neighbourhoods focusing on energetic sustainability in the Netherlands?

In order to were able to answer this main research question, a few sub questions needed to be answered. These sub questions are:

1. What are the key process steps in the initiation phase of the renovation process?
2. What are the key involved stakeholders in the initiation phase of the renovation process?
3. What bottlenecks can be identified in the renovation process?
4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?
5. What steps are needed to implement open data in the renovation process?

The first three sub questions are answered by literature review, expert interviews and case studies. The fourth sub question is addressed as well in the literature review and expert interviews. In each sub research the process, stakeholders and accompanying bottlenecks of a renovation project are described. This is compared with the findings regarding available open data sets. Each of these researches ends with a conclusion. The researches build upon the findings of the previous chapter. The conclusions of each research are compared and combined in the research synthesis. Based upon the conclusions of the first four sub question the conclusion on the fifth sub question is drawn in the research synthesis. This is followed by the presentation of a framework. This framework gives answer to the main research question.

Table 1.1 shows a matrix with the research questions and in which part of the report this question is answered. The arrows show the way in which the findings are
built upon each other. Each chapter ends with a paragraph in which the first conclusions to the sub questions are written down.

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td>$\S$2.2</td>
<td>$\S$2.3</td>
<td>$\S$2.4</td>
<td>$\S$2.5</td>
<td></td>
</tr>
<tr>
<td>EXPERTS</td>
<td>$\S$3.2</td>
<td>$\S$3.3</td>
<td>$\S$3.4</td>
<td>$\S$3.5</td>
<td></td>
</tr>
<tr>
<td>CASES – CASE I</td>
<td>$\S$4.3.1</td>
<td>$\S$4.3.2</td>
<td>$\S$4.3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASES – CASE II</td>
<td>$\S$4.4.1</td>
<td>$\S$4.4.2</td>
<td>$\S$4.4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYNTHESIS</td>
<td>$\S$5.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRAMEWORK</td>
<td></td>
<td></td>
<td></td>
<td>$\S$5.4</td>
<td></td>
</tr>
<tr>
<td>CONCLUSIONS</td>
<td>$\S$6.1.6</td>
<td>$\S$6.1.1</td>
<td>$\S$6.1.2</td>
<td>$\S$6.1.3</td>
<td>$\S$6.1.4</td>
</tr>
</tbody>
</table>

Table 1.1: Matrix of research questions and accompanying paragraphs in which they are address (own work)

1.3.1 DEFINITIONS

In the research questions a few subjects are mentioned that need to be defined. In this paragraph the definitions for open data, bottlenecks, the initiation phase, renovation and energetic sustainability are described extensively. These definitions are based on existing terminologies and own interpretations of the author.

**Open data** is all the data and content that can be freely used, modified, and shared by anyone for any purpose (Opendefinition.org, 2015). Many governments around the globe are now working on making governmental data as open as possible. The Netherlands did join this action plan as well in 2011 (Open Government Partnership, 2015). With this open data they offer the possibility to everyone to re-use this data with the purpose that these initiatives will support the local economy. The Dutch government has published around 7,000 data sets and is still working on making more data sets publicly accessible. Open data does not necessarily have to be data offered by governmental bodies. It can also be companies or other parties which supply their data openly to make re-use possible. In this research the focus is on open data provided on the open data portal [data.overheid.nl](http://data.overheid.nl) to mark the scope and boundaries of the research.

A **bottleneck** is a moment in a process in which the process does not go according to plan for certain stakeholders. They have reached a point in which new challenges emerge.

The **initiation phase** is the part of the building life cycle from the moment that the first idea emerges to renovate the existing building or neighbourhood until the moment in which all stakeholders agree upon a plan of approach towards redevelopment. This includes the planning, tender, selection and preliminary design.

**Renovation** is the process of upgrading an existing building without changing its initial purpose. In this process adjustments are made to increase the technical, economic and social lifespan of a building. Gruis et al. (2006) define renovation as an overall physical and functional improvement, resulting in a life cycle extension of the building as a whole. Baldiri Salcedo Rahola (2015) defines **energy renovation** as major renovation projects, resulting in an extension of the service life of the building and a significant improvement of its energy performance.

**Sustainability** is the focus on prolonging the healthiness of our planet. It focusses on meeting the needs of the present without compromising the abilities of future generations to meet their own needs. **Energetic sustainability** is the sub section of sustainability that focusses on the use of and the generation of energy. A project could become more energetically sustainable by reducing the amount of energy used in total and/or replacing fossil fuels with renewable energy sources.

---

$^3$ Amount is found on data.overheid.nl, the website has been viewed on the 4th of December 2015. The exact amount of openly accessible data sets at that day was 7,229.
1.4 RESEARCH RELEVANCE

In this paragraph the relevance of the research subject is elaborated. The first sub section explains the personal motivation of the author to choose for this subject. Followed by a section on the scientific relevance and the societal relevance of the subject.

1.4.1 PERSONAL MOTIVATION

"I have chosen to study architecture because I always wanted to be an architect whilst growing up. However, throughout the Bachelor degree I discovered that I did like the field of architecture, yet I did not necessarily like the design side of this degree. That is why I decided to choose for the Master track Real Estate & Housing. This track focusses more on the managerial part of the field. I like the initiative phase and conceptual phase, and this was always the part in the design projects which I was the best at. Furthermore, in retrospect I can say that I have chosen to study at the faculty of Architecture based upon three reasons, being the combination of design, technology and the social factor of the field of profession.

The main provocation of this research is a larger focus on sustainability. I find it of utmost importance that more and more sustainable measures will be applied to our way of living. Since this is a complex and rather intangible subject, I did like to focus on a part that is tangible, the upgrading of existing dwellings into more sustainable properties. That is why I have chosen to focus on the existing city and real estate. It has led to existing real estate in the residential sector since these are properties that are closely related to their inhabitants and do have an enormous impact on our lives. Which makes it socially important, one of the factors that I found important from the start of my studies.

Furthermore, I prefer to always look into the future and be innovative. That is why I did like to make a link with a rather new subject, being the use of open data in the process. With this subject I like to implement the technology part of my interests into the research.

I think that it could really aid the process when more data could be implemented in the way of working and communication with each other. That was the main drive for starting this research. By combining these subjects I hope to have created an interesting research subject which fits my own interests as well as contributes to science and practice."

1.4.2 SCIENTIFIC RELEVANCE

Since the subject of open data is relatively young, not much has been written about it yet. Governments open their data, however the implementation of this data in new projects is hard to monitor. They do not know much about the re-use of this data. However, it could be assumed that there are a lot of successful projects that derive from it. An example is the open data set of the Kadaster, the governmental body that registers real estate and geographical information. The Kadaster opened up its data in 2012. From that moment the amount of downloads increased enormously (Bregt et al., 2014). Yet, they do not know whom is re-using this data and for what purpose. By looking into the possible manners of re-use within the renovation of existing residential real estate this could give relevant insights.

If the scientific search engines are browsed on the internet, it is hard to find articles or books that combine the subject of data and the subject of the renovation of existing buildings. Connections between open data and the building sector than can be found mostly relate to the smart city, real-time data use and strategical real estate investment decision-making. These are all subject that have to do with the management of the existing city and not with the development and redevelopment process. This makes it an interesting subject to research and write about. Yet, it also makes it more difficult to research. That is why an exploratory research approach is needed.

Not only on the combination of these two subjects is not much written, also on the two separate subjects is not much written yet. Open data is a young subject and according to Sayce, Baldiri Salcedo Rahola, and Straub (2013) there is little literature related to energy renovation processes as well.

Lastly, as Batty (2013) advocates, as data gets bigger, the number of correlations increases exponentially. In terms of cities and their functioning, the search for such correlations would be something of a diversion. The only way to discover what we need to look for in data can be found through the lens of theory. Thus, there is currently a knowledge gap regarding the implementation of open data in building processes. Since a large assignment regarding energetic sustainability is focussing on the renovation of residential real estate this is an appropriate process to focus on in this research.
1.4.3 Societal Relevance

Due to rising energy prices it is important to look for measures to lower the energy bill of households in the lowest income class. By means of this research one possible measure to improve the process of renovating dwellings and lowering the energy consumption is investigated. Energy saving measures have a societal side by lowering the energy bill and increasing the comfort in the dwelling. It does have an environmental side as well by decreasing climate issues and less use of fossil fuels (Van Hal, 2011).

At this moment, almost 50% of the housing associations in the Netherlands is working on changing parts of their real estate stock into more energy efficient or even energy neutral dwellings. Research show that sustainability is mentioned by these housing associations as the main driver for the renovation projects (Duurzaamgebouwd.nl, 2015). This shows that it is a relevant subject at this moment and process innovations could aid these developments.

The process regarding renovation is changing. Stakeholders in this process are struggling with finding new roles to fulfil. More input in the process can be interesting for these stakeholders, making this research practically relevant.

Furthermore, the increasing amount of data on many subjects offers possibilities to solve societal issues and create new economic changes for entrepreneurs (Brabant.nl, 2015).

1.5 Research Objective

The research objective of this research is two-folded. Firstly, the aim of this research is to give insights on the possibilities to use open data in the process of renovating the existing housing stock. The focus of this research is mainly on serial built post-war dwellings, since those cover a large part of the to be renovated housing stock in the Netherlands. Secondly, by means of this research a framework is developed that can be used by stakeholders involved in the process to decide which information source they could possibly use.

1.6 Research Design

In this paragraph the design of the research is described. Figure 1.6 is a visualisation the research design of this graduation project. The next sections give short introductions into the several separate parts within the research and the research methods that have been used.

Literature review

The research has started with an explorative literature review. Based on these finding the research set-up and research questions have been generated. After these demarcations were made the literature review has been continued through the whole research project. Outcomes of this analysis can be found in chapter 2 of this report. Based upon the literature review a list of bottlenecks has been generated.

Expert interviews

Interviews are conducted with experts on several parts of the research subjects. In the interviews the findings from theory regarding the process, stakeholders, bottlenecks and data use are tested. The interviews are conducted with three types of interviewees, being experts on the field of sustainable housing transformation, stakeholders in the process and experts on open data. The outcomes of the interviews are presented in chapter 3.
Case studies

One of the used research methods is the case study method. Chapter 4 elaborates upon these case studies and their outcome. The cases are analysed by means of desk research into secondary documents on the cases. Furthermore, interviews with stakeholders involved with the specific cases are held. The case studies have been done on two residential areas that recently have been renovated. The case studies are used to make the renovation process tangible by examples as well as verify the list of bottlenecks generated by means of literature review and expert interviews.

Research synthesis

Based upon the findings from literature, the case studies and the expert interviews, conclusions are drawn. In the research synthesis the findings are compared. This has been done by means of the qualitative data analysis software Atlas.ti. With an inductive coding approach the qualitative data that derived from the researches has been analysed. A complete list of all the codes created in this analysis can be found in appendix II. By means of this user need analysis a suggestion is given which types of data sets might be interesting to implement in the process. In the research synthesis an analysis is done into the available open data sets and their link to the needs in the renovation process. The research synthesis is presented in chapter 5.

Framework

One of the objectives of this research is the design of a framework which stakeholders can use to find out which data sets could be interesting for them and at what moment they should apply it to the process. This framework is part of the research synthesis and is presented in paragraph 5.4.

Research methods

The research is set-up as a qualitative research. Multiple research methods are used to triangulate the outcomes of the research (Bryman, 2012). In the previous sections the separate parts of the research have been described. To sum up, these are all the research methods used in this research:

- Literature review
- Semi-structured interviews
- Case studies with document analysis and semi-structured interviews
These research methods are used for a user need analysis into the needs of stakeholders in the renovation process. Based upon this user need analysis a desk research has been done into the possible open data sets that could be implemented.

Since the topic of this research is rather new and it has not been much investigated yet in academic writing, an exploratory research approach has been used. This method is often used when the relationship between multiple concepts is unknown. Exploratory researches often rely on secondary data analysis and qualitative approaches by means of case studies, interviews, informal discussions and focus group sessions. This fits the above mentioned research methods that are chosen to be used for this research.

Research organisation

The research has been conducted to achieve a master degree in Architecture, Urbanism and Building Sciences at the faculty of Architecture and the Built Environment at the Delft University of Technology. This thesis is part of the mandatory curriculum and took one whole year to write. It equals 39 ECTS (European Credit Transfer System).

The thesis has been written within the master track Real Estate & Housing. Within this track the graduation laboratory Urban Development Management was chosen. This lab is chaired by Dr. Ir. Erwin Heurkens. The graduation research has been guided by Dr.Yawei Chen MSc. and Dr. Ir. Sake Zijlstra.

Furthermore, the research was conducted at the graduation company ERA Contour. ERA Contour is a constructor that develops and builds. The company was founded around 50 years ago with as core business the serial approach for housing construction, the typologies of the dwellings that are analysed in this research. ERA Contour has a strong focus on the existing city, residents and the sustainability assignments which are occurring nowadays. Within the company the author was able to get the right contacts, analyse the process of renovation in multiple phases and get guidance in the research by the employees. Ir. Saskia van der Weerd and Timo Stoopman MSc. are the mentors from ERA Contour for this research.

Lastly, the Examination Board is represented during the official presentations (P2, P4 and P5) by Drs. Fransje Hooimeijer.
In this chapter the research subject is described from the perspective of existing literature sources. The chapter starts with a short introduction into the provocations of the research subject. This provocations have been summarized in a model, which can be seen in figure 2.1. This model sketches the context for the explorative research, it shows the provocations for the two central subjects of the research.

The focus in the rest of the chapter is on the two central subjects, being the renovation process at the one hand, and the availability of open data on the other hand. To give answer to the first four sub questions of the research the literature reviews has been built up as follows. Firstly, in paragraph 2.2, the renovation process has been described. Followed by, in paragraph 2.3, a short description of the involved stakeholders in this process. These two subjects give answer to sub question 1 and 2 and are necessary to describe to put the bottlenecks into context. Paragraph 2.4 includes all bottlenecks in the renovation process which have been identified in existing literature, these have been linked to specific process steps and involved stakeholders. This paragraph gives answer to sub question 3. Since no direct academic sources on bottlenecks in the renewed renovation process could be found, this analysis has been based upon literature sources regarding process change in the renovation process, energetic sustainability in renovation projects and older sources on how renovation projects were executed in the past. Paragraph 2.5 focusses on open data. The availability of open data is explained and the link to the renovation process is made. This paragraph answers sub question 4. The chapter ends with a concluding paragraph in which a first answer to sub questions 1, 2, 3 and 4 is given based upon the findings from literature. In this concluding paragraph a conceptual model which forms the base for the expert interviews and case studies in the next chapters is presented as well.

2.1 INTRODUCTION

The building industry in the Netherlands faces a challenge with the renovation of the current (residential) building stock into more sustainable and less energy consuming properties. Simultaneously, the Dutch government and other parties are opening up large amounts of data sets. This data might create opportunities for the building industry to support steps in the building process. In the problem statement presented in the previous chapter, this has been identified as the main subject for this research. Figure 2.1 summarizes the subject and accompanying provocations of the subject. In the next sub paragraphs each of these subtopics are elaborated briefly.

2.1.1 ENERGETIC SUSTAINABLE RENOVATION VS. AVAILABLE OPEN DATA

The research objective of this research consists of two parts, being to explore if there is a possible link between energetic sustainable renovation and open data and to design a framework that supports the implementation of open data in this process. The subjects of energetic sustainable renovation and available open data are the main subjects of this research. These subjects are visualised in the middle of the model in figure 2.1. The dotted line with the question mark in the middle represents the research objective. In the next subparagraphs the background of the two research subjects is elaborated upon.
2.1.2 PROVOCATION OF THE NEED FOR ENERGETIC SUSTAINABLE RENOVATION

This subparagraph represents the upper section of the model; the provocations that have led to the need for energetic sustainable renovation.

End of lifespan

The housing stock in the Netherlands has suffered enormously during World War II (WWII). In the following years, 1950-1975, 450,000 new dwellings have been built, which consist for about 15% of the total new constructed houses during that period. The typologies of these dwellings are detached terraced dwellings, gallery flats and apartment blocks (Liebregts & van Bergen, 2011). Due to the high housing shortage, the Dutch government was obliged to take a leading role in the planning and construction of new housing. Which has resulted in fast and cheap production of serial dwellings.

One third of the current housing stock in The Netherlands dates from these post-war years and a large part of these dwellings are fairly similar, since they were built in series (Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer, 2009; Van Hal et al., 2011). Most of these dwellings are now around 50 years old. Which means that, in most cases, they are approaching the end of their technical lifespan. The quality of these dwellings is low, due to the lack of qualitative building materials and the amount of properly trained employees at the time. Moreover, the increased wealth and technical developments in the Netherlands did cause an increase in the standard of living. Together with rising energy prices, this causes the quest for energy saving measures (Van der Werf, 2011). Due to all these events, the challenge arises for renewal of these houses. Depending on the condition of these houses, they may be renovated, enlarged, demolished and replaced, or upgraded. However, all these options are expensive. The largest share of these post-war dwellings is owned by housing associations and inhabited by households with low incomes, which causes challenges to renew these properties in a feasible manner (Whitehead & Scanlon, 2007). In a survey conducted by De Kleijn and van Leerdam (2013) 61% of the 800 respondents which live in social rental dwellings said that they could not manage to pay more for their housing and energy expenses. Thus an upgrading strategy is needed that does improve the energy efficiency of these dwellings without increasing the monthly expenses of the residents and the housing association.

Figure 2.1: Visualisation of provocations of research subjects (own illustration)
Serial renovation

In the past housing associations preferred demolishing and replacing these types of dwellings. However, in the last few years renovation is appreciated as a proper alternative. This is based upon several grounds. First of all, the concrete bearing structure of these properties is still in good shape, and it can be expected that this will be so for many more years. Secondly, preserving these structures saves up to 70% of CO₂ emission compared to the CO₂ that is emitted during the demolition and new build process. Thirdly, the process of renovation is faster. Fourthly, in many renovation projects the residents can stay in their homes during the construction works and do not have to move. Lastly, due to the systematic approach of construction that these dwellings had, possibilities arise to renovate these dwellings in a systematic manner as well, which could be fast and cheap (van Bergen Bravenboer, 2015). Another event that has led to the shift towards renovating existing dwellings instead of the demolition and new build alternative is the economic crisis. As a result of the economic crisis that started in 2008 in the Dutch construction industry the focus changed from building new houses towards upgrading and re-using the existing housing stock. In a short amount of time energy efficiency in the existing housing stock became a big issue (van Hal, Nieboer, & Dulski, 2012). Furthermore, due to changing regulations regarding housing associations they are more encouraged to choose for renovation over demolition and new build.

Besides decreasing the amount of energy consumed does sustainable building renovation improve the whole condition of the building: its exploitation, noise insulation conditions, exterior and comfort for the users. It prolongs the life span of the building, increases the value of the property, reduces negative impact to the environment and guarantees more healthy living and working conditions (Mickaityte, Zavadskas, Kaklauskas, & Tupenaite, 2008).

Reduce CO₂ emission

The subject of sustainability is a topic that has gotten more and more important in the last few years. The most common known and used definition of sustainability is the one that was drafted by the Brundtland commission in their report ‘Our Common Future’ in 1987 (Brundtland, 1987):

*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of ‘needs’, in particular the essential needs of the world’s poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs."

The Dutch government has translated this definition into the definition of sustainable development as an economic, socio-cultural and ecological development in which the current generation is able to satisfy its own needs without preventing future generations from doing the same (Gruis et al., 2006). If this is translated to the building sector, Baldwin (1996) presents four goals for sustainable buildings, being:

- Minimization of climatic changes and risks to human health and biodegradation in consequence of economic activities.
- Optimal use of non-renewable resources.
- Employing renewable resources such as solar energy for heating of houses and wind and water for energy accumulation.
- Building such objects which will enable future generations to meet their needs in the domain of quality, durability, flexibility and adaptability and town planning.

In this research the focus is on the energetic part of sustainability. Which means improving the quality of life for our next generations by lowering energy use and increasing the production and use of renewable energy sources and thus lowering the amount of CO₂ emission. A building could be defined as energy neutral when the energy used in a building or an urban area from fossil fuels will be compensated by sustainable renewable energy produced on the location itself. This building will have an ECP (energieprestatiecoefficient, English: Energy Performance Coefficient) of zero (Agentschap NL, 2013). As of January 2014 all social rental dwellings are obliged to have an energy label in the Netherlands, followed by all owner-occupied dwellings in January 2015 (Energielabel.nl, 2015). As agreed upon by the housing associations in the Netherlands, they need to have an average energy label B by 2021, which complies with an ECP of 0.61 to 0.75. The ECP of existing residential real estate is calculated based upon building characteristics, installations and the average energy use by residents (DTW Timmerwerken, 2015).
Rising energy prices

Around 1980, after the energy crises of 1973 and 1979 and the resulting energy saving measures that were applied to dwellings, residents were against new energy saving measures. They thought that by saving energy the prices would rise again. In the ‘90 this argument changed into: ‘the rent may rise faster than the energy prices, so we do not want changes to the dwellings which could adjust the rental prices’. Nowadays, the energy prices are relatively much higher than the rental prices, which makes it financially more interesting to invest in energy saving measures (Hasselaar, 2009). According to Guertler and Royston (2013) was in 2013 1.6% of the households in the Netherlands unable to pay their energy bill. The reason for this inability was the rise of the energy prices. It can be assumed that the energy prices will rise in the future, due to the scarcity of fossil fuels (Agentschap NL, 2012). This will mean that for dwellings with high energy consumption the energy bill will become a larger part of the housing costs of these households (Agentschap NL, 2013). Figure 2 visualizes the expected gas price increase and the expected rent for the coming years. It shows that measures on dwellings which will have as effect a lower level of energy or gas use will have a positive influence on the amount of money paid for housing.

In 2000 the average energy bill was €1,460 per year, in 2010 this rose to €1,780 (ECN, 2015). In this period the gas price doubled and the price of electricity rose with approximately 20% (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2011). In 2014 the gas and electricity prices dropped, which means that it is estimated that the average annual energy bill of 2015 will be around €1,640. However, the expectation is that the energy prices will rise in the coming years, partly due to the expected increase of gas and electricity prices and partly due to the rise in the collection of renewable energy. Rising energy prices and decreasing energy use will compensate each other in the coming years. The estimation is that the average household will have an energy bill that increased with €150 in the period between 2015 and 2020. However, this price includes the implementation of some energy saving measures, like solar panels. Without these measures the energy bill will increase with €400 (ECN, 2015). Figure 2.3 is a visualisation of the energy prices in the last 15 years and also shows a projection of the estimated prices in the coming 15 years, showing an estimated rise of the energy prices.

Figure 2.2: Development housing expenses. Expected rise of rent compared to the estimated gas price increase (Verberne, 2011)

Figure 2.3: Energy prices in the last years and prospect for the coming years (ECN, 2015)

4 These amounts are corrected for inflation and the change in currency from Gulden to Euro.
Policies and covenants

Since the ’60 and ’70 of the last century climatologists are finding proof for global warming. This was rapidly followed by the conclusion that this was caused by the increase of the amount of CO₂ gas in the atmosphere. In 1992, twenty years after these discoveries, all the United Nations member states came together in Rio de Janeiro and held the first climate conference. This led to the Kyoto protocol which was officially signed in 1997 (Europa Nu, 2015). As a reaction to these global movements the European and national governments created local covenants and policies. The European Commission is encouraging saving energy in the housing sector by making the existing housing stock more sustainable. In this section a short overview of all covenants regarding energy reduction in residential real estate is given. In Appendix I an elaborated overview of all the events which led to the development and execution of climate policies which focus on the existing building sector in the Netherlands is given (Hoppe, 2009).

In 2007 the EU leaders set the 2020 climate & energy package, which was enacted in legislation in 2009. This package includes three key targets (European Commission, 2015a):

- 20% cut in greenhouse gas emissions (from 1990 levels)
- 20% of EU energy from renewables
- 20% improvement in energy efficiency

This has led to binding annual targets per European country, which vary according to national wealth. In the Netherlands this induces a reduction of greenhouse gas emissions of 16% (base year 2005). Furthermore, 14% of the total energy consumption should be from renewable sources in 2020 (European Commission, 2013).

Currently, the EU is on track to meet the 20% target for 2020. In 2013 the total estimated EU emissions were 1.8% lower than 2012, thus already 19% below the level in 1990. According to this development the estimation is that in 2020 the level will be 21% lower (European Commission, 2015d). However, the Netherlands is lacking behind in achieving the energy reduction and production of renewable energy sources goals (Bouwformatie, 2015).

The housing sector is regulated by a few measures regarding these targets. An example is that it is now mandatory to have energy efficiency certificates if a building will be sold or rented, this is done by the energy labels (European Commission, 2015b). Furthermore, member states are allowed to make their own policies to reduce the energy consumptions in the built environment and to encourage energy saving measures in the existing building stock.

In the Netherlands four covenants were made to achieve these energy saving measures. These are:

4. Energieakkoord voor duurzame groei (energy covenant for sustainable development) (2013)

The Meer Met Minder covenant, which was signed in 2008, is a joint initiative of the national government, housing associations through AEDES, construction companies through Bouwend Nederland, the installation sector and energy companies. The goal is to make 3.2 million existing buildings 20 to 30% less energy consuming by 2020 (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2011).

The most important covenant for the social rental sector and renovation projects is the document called Convenant Energiebesparing Sociale Huursector. This covenant was signed in 2008 by the national association of housing associations in the Netherlands, AEDES (Van Hal et al., 2011). When all the ambitions in the covenant will be fulfilled by the end of the period in 2021, it will lead to an energy reduction of 33%. This will result in average energy label B for all the 2.4 million social rental dwellings in the Netherlands (AEDES, 2012). The terms of this covenant have forced Dutch housing associations to find a way to integrated contracts and conduct a competitive tender procedure, since they need to find creative ways to improve the efficiency of renovation process and increase the output level (Baldin Salcedo Rahola, 2015).

As agreed upon in the Lente-Akkoord of 2012, before 2020 the emission of CO₂ should be decreased by 20% compared to 1990 (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2012). The covenant is an agreement between the national government and market parties to build energy neutral. This covenant is focusing on new build. The intention is to improve the energy performance of the sector with 25% in 2011, 50% in 2015 and eventually build energy neutral buildings in 2020 (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2011).

In the Energieakkoord voor duurzame groei is the focus on a totally energy neutral built environment. This covenant was signed by over 40 organisations, of which one is the national government. The goal of the covenant is to make the built environmental energy neutral by 2050 (Sociaal-Economische Raad, 2013).
Most of the covenants regarding climate change will expire in 2020. This year was set in the Kyoto protocol in 1997. In December 2015 the annual climate conference of the United Nations did take place in Paris. The goal of this conference was to come to a new agreement on climate change. This new agreement will have to start in 2020, when the current one expires. All attendees of the conference did agree upon the new climate agreement. With the actions following this agreement the global warming will be reduced with a maximum value of 2 degrees in 2100 (Europa Nu, 2015).

2.1.3 PROVOCATION OF OPEN DATA AVAILABILITY

This subparagraph represents the lower section of the model which was presented in figure 2.1; the provocations that have led to the availability of open data.

Open data by the Dutch government

Open data has been on the policy agenda in the Netherlands since 1997 (Van Loenen & Donker, 2014). However, the development of open data only really took off in 2011. In March 2011 minister Verhagen of the ministry of Economic affairs, Agriculture and Innovation announced open data in his Digital Agenda NL. In May 2011 Minister Donner of the ministry of Interior and Kingdom Relations announced to stimulate the re-use of governmental information by some changes in the law. In October 2011 Minister Schultz van Haegen of the ministry of Infrastructure and Environment announced as well to start opening up data, which started with opening up the data of the Kadaster. Lastly, EU commissioner Kroes did pledge in December 2011 that the European Committee would provide all its information publicly for private parties and businesses (Van Loenen & Verdonk, 2012). These commitments have led to the national government starting to work on projects to stimulate governmental bodies to open up their data sets. At this moment almost 7,000 data sets are available through the website www.data.overheid.nl.

The same as the Netherlands are other countries opening up their data as well. This is partly driven by the European Commission (EC). The EC is striving towards a data-driven economy (European Commission, 2014). According to the EC data has become a key asset for the economy and our societies. For each sector there might be information that is interesting to re-use, which can lead to innovations in technology, development of new tools and new skills (European Commission, 2015c).

The most developed open data portals can be found in the United Kingdom (UK) and United States of America (US). However, EU member states, regions and even cities are creating their own open data portals as well (Shadbolt, 2010).

---

5 Ministerie van Economische Zaken, Landbouw en Innovatie
6 Ministerie van Binnenlandse Zaken en Koninkrijksrelaties
7 Ministerie van Infrastructuur en Milieu
8 Amount is found on data.overheid.nl, website has been viewed on the 4th of December 2015. Exact amount of openly accessible data sets at that day was 7,229.
Not all governments across the globe have the same motivations to open up their data sets. However the main arguments of governments are: transparency, internal efficiency and external re-use (Bregt et al., 2014). This also goes for the Netherlands.

**Transparency**

The goals regarding transparency have to do with the empowerment of the citizen. The standard in democracies nowadays is that citizens expect governments to show where the money has been spent and what the results have been. A more informed citizen is a more empowered citizen in this belief (Huijboom & Van den Broek, 2011).

**Internal efficiency**

The second motivation for opening up governmental data is to increase internal efficiency. The government is a collection of many different bodies and departments. It is believed that these individual public bodies could be strengthened by the use of data sets from other parties. Examples are to strengthen policy making and law enforcement (Huijboom & Van den Broek, 2011).

**External re-use**

Governments belief that based upon the open governmental data new innovation can be created. ICT companies are able to generate new business in developing digital services and advanced content based on public data. Citizens can convert ideas and creativity into solutions for problems they have in their daily life. This is all based upon the belief in user-driven innovation (Huijboom & Van den Broek, 2011). Since exploiting these new flows of information could improve the performance of a company or start new initiatives, it is interesting that these data sets are publicly accessible. However as McAfee, Brynjolfsson, Davenport, Patil, and Barton (2012) define, first the decision-making structure of a process should be change before data could be implemented properly.

2.2 THE RENOVATION PROCESS

Renovation is the process of upgrading a building without changing its function. A dwelling will keep the original function as dwelling and the residents can stay in their homes after the renovation process has been completed. One of the advantages of renovation over new build is that renovation is less sensitive to economic fluctuations (Buijs, 2015). It is becoming more and more common to renovate a dwelling, this can be seen when looking at the amount of permits for renovation, in the last years private house owners as well as housing associations have applied more for these permits (Buijs, 2015).

The process of renovating a dwelling goes through certain stages, which are the same as other building projects. Literature defines four phases within the building sector (Franzen, Hobma, Jonge, & Wigmans, 2011, pp. 90-93), being:

- **Initiation phase:** the phase in which the initiative is taken to develop a certain project. The ambitions and goals need to be defined within the context and conditions. Support must be found amongst other involved stakeholders. This phase offers the most opportunities to add quality to a project.
- **Planning phase:** when the mutual interest amongst all the stakeholders is created the planning phase can start. The phase runs up to the start of the construction works. The design of the plan and the best options for feasibility need to be created during this phase.
- **Realisation phase:** in this phase the plan will be put into effect by the relevant parties that have reached agreement in previous phases. Construction takes place in this phase.
- **Maintenance phase:** this phase follows the realisation of the project. In this phase there is a distinction between the maintenance of the buildings and that of the public space.

When the urban area or real estate within this area in the maintenance phase does not fit the requirements of the involved stakeholders anymore the process can start over again with a new initiative.

In this research the focus is on the initiation phase of the project.
Hasselaar (2012) identified in his research the following process steps in a renovation project from the perspective of the building owner, which is in most cases a housing association:

1. Identification of need for renovation
2. Scheduling of project (when to execute)
3. Appointing project leader to project
4. Creating program of requirements
5. Selection / tender process
6. Elaboration phase: Identifying consequences for rent level
7. 70% participation process9
8. Communication about renovation towards the tenants
9. Planning phase
10. Execution of project
11. Completion of project
12. Use phase

In figure 2.4 a visualisation of these process steps is presented.

Dutch housing associations are not obliged to comply with public procurement regulations. This means that they are not legally bounded to have an open call round for the pre-selection. They can invite the parties which they would like to work with (Baldiri Salcedo Rahola, 2015). Step 5, the selection / tender process, is thus not regulated by law and can be executed in the way the housing association prefers. Since there is no regulation that defines the process the words ‘selection’ and ‘tender’ are used interchangeable in theory and practise.

To achieve the maximum potential for energy saving in renovation projects, the process performance should be improved, especially when the aim is to achieve high sustainability and energy efficiency targets. However, how to improve the performance of construction processes has long been and is still one of the key issues of the construction industry sector, social housing included (Baldiri Salcedo Rahola, 2015). Currently, a shift can be notified in the process. This has mainly to do with the content of step 4 and 5. By changing these process steps more responsibilities are placed with the market parties and housing associations can demand more quality in the plans, which can result in a project that is more energetically sustainable. In subparagraph 2.2.2 the changes in the process are elaborated. Firstly, in paragraph 2.2.1 a short elaboration on decision-making in process and the link of this theory to the renovation process is given.

---

9 It is legally obliged to gain 70% participation of the residents in a complex. If 70% of the residents is agreeing with the plans the housing association is allowed to execute the project.
2.2.1 DECISION-MAKING IN A RENOVATION PROCESS

The process steps identified in the last paragraph include many decision-making moments. Decisions are being made based upon information that is available and are thus data related. Simon (1960) presented a decision-making model which consists of four main stages, being:

- **Information collection – initial stage.** In this stage the definition of a problem, the main purposes, the source information collection and the comparison of the real situation and the expected changes are defined.
- **Decision-modelling stage.** The stage in which the analysis of the obtained information is done, the problem is modelled, criteria are selected, alternatives are weighted and decision methods are chosen.
- **Decision-making stage.** In this stage the implementation of experiments and research is done, the results are evaluated and the best alternative is chosen.
- **Decision-implementation stage.** The stage in which implementers are informed about the decision, an examination occurs if the best alternative was chosen, the implementation of the decision and the assessment of the results takes place.

The theory of Simon is still an applied theory. Figure 2.5 is a visualisation of the decision-making process based upon this theory.

The decision-making process regarding large scale neighbourhood or building block renovation starts with laying down agreements in covenants that cover a statement of intent between local governments and housing associations (Hoppe, 2012). Furthermore, a housing association has to make many decisions in regard to a renovation project; they have to decide whether to put the project in the multiannual schedule, they have to create the project group, make decisions on boundary conditions and requirements, the team, the content of the project, the tender process, the budget, the execution and the maintenance process afterwards (Hasselaar, 2012). Since participation of tenants can cause problems, this creates another set of decision-making moments. Whether or not the 70% participation is gained has influence on the project. However, this conversations with the residents can only be conducted when the project has been developed quite far. If the 70% is not achieved this has technical and financial impact on the project (Hasselaar, 2012).

In each process step within the renovation process (figure 2.4) the above mentioned steps in the decision-making process are taken. This leads to informed decisions. As the process steps show, firstly it is important to collect all the information on the subject. Data is a form of information. Bottlenecks related to data will thus have influence of the decision-making of the housing association or other stakeholders involved. By including more information in the process the decision-making steps can be made more informed and thus more substantiated.

---

**Figure 2.5: Decision-making process model by Simon (Zavadskas, Kaklauskas, Tupėnaitė, & Mickaitytė, 2008)**
2.2.2 A TRADITIONAL RENOVATION PROCESS VERSUS A RENEWED PROCESS

The urban renewal as this took place in the last couple of years found its foundation in subsidies of the national government as well as the increase in welfare and the demographic growth. Nowadays, this large scale urban redevelopment, in which whole neighbourhoods are improved in an integral manner, seems to be not feasible any more. According to Jonker-Verkaart (2015) this finds its cause in a few reasons. First of all, municipalities, housing associations and developers do have access to less financial means than before due to the economic crisis and new laws and regulations. Secondly, investments in dwellings do not necessarily lead to an increase in the value of the property anymore. Which could influence decision-making of owner-occupiers and housing associations. Thirdly, the changing demographic developments in the Netherlands have influence on the populations in certain regions and cities. This can have influence on the neighbourhoods and the development of these neighbourhoods. Due to these changes in urban area redevelopment the processes within these neighbourhood renewal projects had to change as well. Liveability problems could no longer be addressed on a neighbourhood level and needed to become included within renovation projects.

In the past housing associations had a maintenance work department who handled small repairs themselves. Larger projects, like renovations, were outsourced most of the times. The housing association did send out an elaborated assignment in which they described the renovation works in detail. In this assignment the working method, materials and dimensions were specified. Only a small percentage of around 10 percent of the projects had an open contract or different contracting form in which the works were not strictly defined by the housing associations (Straub, 2001). The Dutch word for contractor, ‘aannemer’, does fit this role for the contractor perfectly, they only had to take on the job and execute it for the lowest price, no own interpretation or ideas were expected. Figure 2.6 visualises this traditional process.

Furthermore, the maintenance projects that were executed at the end of the 20th century and the start of the 21st century had mainly to do with renovations on the outer shell of the buildings and small maintenance works in the dwellings to live up to the new building regulations. Other approaches that were used often were demolition and new build and the selling of dwellings to private parties (Straub, 2001).

The Stroomversnelling, which is part of the Energiesprong, is an initiative by the government to change the tendering process. The traditional process can be seen as a barrier for the integration of energetic and sustainable measures (Hoppe, 2009). In this renewed process the housing associations ask the market parties to create a consortium with several different parties and to come up with an innovative approach towards renovating the properties. The tendering process changed from giving a program of requirements and the quest for an offer that is as low as possible, into a wish list with a budget. In this new approach the offering price is not the leading part of the tender anymore, it shifted towards the amount of quality that the project would add. The study of Baldiri Salcedo Rahola (2015), which is based upon an analysis of eight renovation projects undertaken by housing associations in the Netherlands, shows that Dutch housing associations apply a range of mechanisms in order to influence the ambition, collaboration and long-term view of the consortia that participate in competitive tenders for integrated renovation projects. The scale of the ambition is raised through the competitiveness of the selection process. Several parties are invited to join the tender, however only one will be selected. Furthermore, by setting high yet achievable minimum requirements a high minimum performance level can be achieved. Lastly, the candidates are encouraged to perform their best by being rated by award criteria that evaluate their performance. This changing process and the accompanying changing stakeholder roles is something that has occurred and will keep on occurring in all parts of the building sector. The shift in which more responsibilities are put with the market parties, and thus further along the process chain, is identified in literature as forward integration (Geraedts, 2009). This renewed process is visualised in figure 2.7.
2.3 STAKEHOLDERS

Building projects, like other complex projects, involve a large number of actors that interact in different phases of the process (Sayce et al., 2013). According to Van Bueren (2015) the process of urban redevelopment is changing. New stakeholders enter the process. In the past these developments only included municipalities, real estate developer and housing associations. Nowadays, parties like energy companies, water authorities and technology companies are entering the arena. This has effect on the stakeholder roles and the way these parties collaborate. This statement is confirmed by Heurkens (2009), who defines a shift in urban area development projects from public-led to private-led. This complies with the shift in the renovation process in which a forward integration is occurring.

With the focus on the renovation process three key stakeholders can be identified, being the housing association, the consortium and the residents. These stakeholders can also be seen in the process scheme in figure 2.4. Other actors which have a stake in the process are governmental bodies and new parties which did not join the process in the past like energy companies, net companies, insurance companies, suppliers, local entrepreneurs and so on. To make an energy transition possible, stakeholders should change their way of working. In the plan of approach towards energy reduction in the built environment\(^{10}\), a publication of the national government, these changing stakeholder roles are described briefly (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2011). The building owners should be encouraged to change their behaviour and have to improve the quality of their properties. Furthermore, constructors, engineers, isolation companies and energy companies should make sure that the supply of products, concepts and services is on a high level. These changing stakeholder roles fit the changing process as has been described in the previous paragraph.

In the next subsections each stakeholder will be described briefly. A short general description of the stakeholder is followed by a description of their role in the renovation process. Figure 2.8 shows a stakeholder map of the interrelations between the stakeholders in the process.

---

\(^{10}\) Plan van Aanpak Energiebesparing Gebouwde Omgeving

**Government**

The government can be subdivided into the European, national, provincial and municipal government. The roles of the European and national government are mainly focussing on setting the boundaries for development through policies and covenants. These policies and covenants are elaborated upon in paragraph 2.1.2.

In the Netherlands the national government is not using laws and regulations for the implementation of energy saving measures in the existing housing stock (Hoppe, 2009). In contrast to the new build construction sector are there no legal standards for the renovation and maintenance of the existing stock. However, this is
not just in the Netherlands, it also applies to other Western European countries (Hoppe, 2012).

It seems to be that there is no role for the provincial government in the renovation process, as this stakeholder has not been mentioned once in the analysed literature.

The role of the municipality is in most cases reluctant. No active role in the process can be identified. However, they do have a stake in the process since cities are bounded by regulations to become more sustainable. They can influence the process through local policies and subsidies. Policy programs are set up, featuring multiple policy instruments like disseminating information to raise awareness, the provision of monetary incentives and legal standards for target groups. Local governments are able to influence and encourage housing associations to adopt energy efficiency goals, by making trade-offs while strategically using urban renewal subsidies and legal permits (Hoppe, 2012).

According to Hoppe (2009) are renovation projects in most of the times executed on the moment which is the most logical for the property owner. Almost never does the government have influence on this moment.

**Housing association**

Housing associations are professional property owners that aim to provide affordable, healthy and comfortable housing for their tenants. Despite the limitations on their financial and procurement activities, they are fully capable of adapting and implementing construction management methods to improve the performance of their construction processes (Priemus, 2012). Housing associations are committed to their tenants and do have social responsibility towards the less affluent in the country. Sustainability has become an embedded goal in the last few years (Baldiri Salcedo Rahola, 2015). Dutch housing associations differ from other European countries, since they do not receive any direct subsidies from the national government (Baldiri Salcedo Rahola, 2015).

Previously the willingness of housing associations to invest in energy reduction could be identified as low (Van Hal, Postel, & Van der Flier, 2009). The introduction of energy labels in 2008 has changed this. As of that moment the mind-set shifted and more housing associations started to see energy reduction as important and as one of their societal duties. This is shown by the ambitious covenants which umbrella organisation AEDES signed in name of the Dutch housing associations. The role of the housing association in the renovation process is the client.

**Consortium**

A consortium can consist of multiple market parties working together on a building project. Per project the composition of the consortium can differ. The consortium needs a constructor to execute the renovation works. Furthermore, it could include an architect, developer, advisors, suppliers, or other parties which can be interested in engaging in the process (Geraedts, 2009). In the Netherlands housing associations are not public parties, like in most European countries, but semi-public parties. This has as a consequence that they are not bound by procurement law in their renovation projects (Baldiri Salcedo Rahola, 2015). Which means that no general contract form is used in assigning a consortium to a project. This means that constructors, or any other initiating market party of the consortium, can decide with whom they prefer to work. In many cases companies prefer to work with the same companies in multiple projects since the collaboration in these teams has already been proven to work.

**Residents**

Residents are the inhabitants of a dwelling. In the case of a renovation process these are the households that do live in a social rental dwelling. This indicates that in most cases these households do not have a lot of money to spend and are part of a low social class.

The role of a resident in a renovation project is different compared to the role of a resident in another project. In a renovation project the resident stay in the dwelling during the construction works and after the project has been finished. This can cause a lot of disturbance for the residents. Furthermore, the residents has a large stake in the end-result of the renovation project. That is why the residents have participation powers by means of a vote. If 70% of the residents do agree with the plans proposed for their dwellings the project can be execute. This leads to influence on the end-result for the residents.
2.4 BOTTLENECKS

In this paragraph all the bottlenecks that could be identified in the various literature sources analysed are explained. This is done in a chronological order of appearance of the bottlenecks in the process of a renovation project. To explain these bottlenecks they are linked to the process scheme which has been presented earlier on in this report in figure 2.4. In figure 2.9 this scheme is presented once more, yet this time it includes the bottlenecks that were identified in theory.

The names of the bottlenecks are abbreviations for the whole bottleneck description. In the next sections the whole bottlenecks are mentioned and the abbreviated key word is added in italic font.

Firstly the bottlenecks that do not have a specific point in the process, yet have to do with the whole process are elaborated. Six bottlenecks have been identified in theory regarding this phase.

- **Communication between housing association and residents – Communication**
  Throughout the years the communication between housing associations and their tenants has not always been right. Due to the economic crisis a lot of projects have been postponed. Because of miscommunications in the past the residents do not believe that the things the housing association is communicating about energy savings and lowering the energy bill can be truthful information. Furthermore, due to these project delays tenants have become impatient. This has caused a lack of support amongst residents in energy saving renovation projects (De Kleijn & van Leerdam, 2013; Hasselaar, 2009; Hoppe, 2012).

- **A transition in the process is needed – Transition**
  As mentioned by multiple theory sources, a transition in the process of renovation is needed to implement energetic and sustainable measures. This transition asks for new stakeholder roles and different manners of working. This can be seen as hard for stakeholders and needs time to be implemented (Baldiri Salcedo Rahola, 2015; Hoppe, 2009; Slim&Snel, 2015a).

- **Changing stakeholder roles needed – Changing roles**
  Due to the changing process, which has been described in paragraph 2.2, stakeholder roles are changing. In the past the housing association appointed the architect and other advisors for example. The constructor had as most important role to execute this project. Since the demand of the housing association is changing, the composition of the consortium changes as well. This, for example, results in the architect being in the consortium (Baldiri Salcedo Rahola, 2015).

- **Laws & regulations backlog the renovation process – Regulations**
  The current laws in the Netherlands put a restriction on the advantages of energy neutral buildings; since it is not possible to save the overplus of produced energy in the Netherlands it is less attractive to develop energy
neutral buildings. It is possible to sell the overplus to the net, however the price paid for this energy is rather low (Koenders, 2015).

- **Collaboration between stakeholders – Collaboration**
  In practice it is still noticeable that there is a lack of trust between project partners. This is one of the bottlenecks that is backlogging the implementation of energy saving systems in social housing (Hoppe, 2012).

- **Process takes too much time – Time**
  In general renewal projects of housing associations have seen delays in the past. Furthermore, the process can be seen are rather lengthy due to legal permit procedures. This has caused discontent with residents (Hoppe, 2012).

The second process phase in which a bottleneck occurs is the internal process within the housing association when the Program of Requirements is being created. One bottleneck in this process phase could be identified in theory, being:

- **Lack of funding – Funding**
  This bottleneck is two-folded. Firstly, it has to do with a lack of funding with the housing association. Secondly, it has to do with a lack of funding with the residents.

  Regarding the housing association: housing associations are social enterprises that deliver dwellings for the less affluent households in the country. This means that they have limited funding based on the incomes they gain from their tenants. In the Netherlands the housing associations are not supported by the government, which causes them to have a limited budget. The height of the initial investments and the long term for the return on investment make housing associations reluctant to start a renovation project (Baldiri Salcedo Rahola, 2015; Hoppe, 2009; Koenders, 2015; Roders, Straub, & Visscher, 2013).

  Regarding the residents: the residents that do live in social housing have often not much money to spend. Which makes them resistant to changes regarding their housing costs. If a renovation project is proposed, it entails a rental increase in most cases. Yet, it also includes a reduction of the energy bill. This reduction, however, cannot be guaranteed and will only be visible at the end of the first year after the renovation project has been executed. This causes insecurity with the residents and can let to them being hesitant about the renovation project (Burton, 2012; Hoppe, 2009; Van Hal et al., 2009).

The third process phase that deals with bottlenecks is the selection / tender process. Two bottlenecks are identified in theory, being:

- **Awareness of energy saving measures among professionals – Awareness**
  The first step towards the implementation of climate change adaptation measures requires the creation of awareness among the employees of housing associations. Currently, in relation to climate change adaptation measures in the daily work of the staff members and policymakers, awareness is low, especially considering the threats resulting from climate change and the obligations of housing associations created by regulations to provide a healthy living environment. If the employees of housing associations are unable to recognize these threats in daily practice it is unlikely that they will start implementing adaptations (Hasselaar, 2009; Roders et al., 2013).

  Furthermore, awareness should also be created amongst parties within the consortium. According to a research conducted by the government, architects do not have innovative techniques embedded in their ‘design language’ as much as would be necessary to make energy renovation succeed. Energy saving and sustainability measures are identified as an add on to the design and not as an integral element within architecture (Burton, 2012; Hoppe, 2009).

- **Technical difficulties – Techniques**
  It is already possible to renovate to an energy neutral level. However, these techniques are not implemented in many projects, with the exception of some pioneers. The potential that could be achieved is not achieved just yet. It is believed that renovating to a B label has a better cost-benefit ratio. More research and development needs to be done to make energy neutral measures the most profitable and implemented in the renovation process (Baldiri Salcedo Rahola, 2015; Koenders, 2015).

After the selection process one consortium is chosen to elaborate and execute their plans. A bottleneck regarding this elaboration which was identified in theory is:

- **End-users are too little involved in the renovation project decision-making – End-user involvement**
  A problem which has been indicated by many scholars who study the transition to a green built environment, is that end-users are too little or too late involved in the renovation project decision-making. This causes distrust towards the housing association. Furthermore, building work creates a
disruption of the daily life. It is important to engage residents closely in the renovation of their dwellings (Burton, 2012; Hoppe, 2012).

The next process phase in which bottlenecks could be found back in theory is the 70% participation process. Three bottlenecks are found, being:

- **70% participation of residents needed for renovation – 70%**  
  By law the housing association is required to gain 70% of the households in a building block to participate before a renovation project can start. This goes for all adjustment to their dwellings that have a rent increase as a result or are of major impact to their daily life. Therefore, residents have a large say in the project, can influence the process and need to be consulted by the housing association and consortium (Hoppe, 2012; Van Hal et al., 2009).

- **Incorrectly substantiated assumptions by residents – Assumptions**  
  Residents are reluctant to have energy saving measures installed in their dwelling since this might cause a rise of their monthly rent. Even though this will save them money on the energy bill, they find it hard to trust the housing association and the constructor on this subject. A lack of knowledge on technologies and the benefits lead to a fear that costs and benefits would not add up at the end of the project (Hoppe, 2009, 2012).

- **Lack of interest in energy saving measures – Interests**  
  Lack of interest in energy saving measures amongst residents is based on multiple aspects. The first one, which was explained in the previous bottleneck, are incorrect assumptions of the impact. The second one, is the rise of the monthly rent. The third one, is based on the perception of residents. Most of the residents find noise disturbance and drafts more important to be solved than to save energy (Burton, 2012; De Kleijn & van Leerdam, 2013; Van Hal, 2011; Van Hal et al., 2011).

Lastly, two bottlenecks are identified in theory which occur in the use phase. However, if more attention would be paid to these bottlenecks in the initiation phase they might be overcome. These bottlenecks are:

- **Use of energy sustainable dwelling – Use**  
  When the houses are renovated and do save energy, there is still an important component which should be taken into account: the behaviour of the user. After the dwelling has been upgraded, the residents should know how to use it properly to achieve the set energy saving goals (Sunikka, 2006).

- **Split incentive housing association vs residents – Split incentive**  
  Housing associations have to pay for the investments in energy reductions, however the benefits, lower energy costs and more comfort, land with the residents. The rent setting system (het puntensysteem) only gives a relatively small weight to energy performance (Hoppe, 2012; Van Hal et al., 2009). This bottleneck will most likely be dissolved by the start of 2016 when the EPV will be officially adopted by the government. If a project is renovated to energy neutral housing associations are then allowed to ask for an energy fee in addition to the rent. At the start of January the House of Representatives had a debate on this subject and all the members were positive, this will most likely lead to an implementation of this law (Tweede Kamer der Staten-Generaal, 2016).

An overview of the coding system which was used to identify the bottlenecks can be found in appendix II. A table with all the bottlenecks and a description can be found in appendix III.
Since the subject of open data is rather young a lot of developments are still occurring on this field. As the trend report of the Algemene Rekenkamer (2015) shows, more and more initiatives of governmental departments to publish data are noticeable and engage re-users. In international benchmark studies the Netherlands is ranked quite positive in the development of open data. However, still the supply of data can be identified as fragmented and unilateral.

The impact of open data will only be possible when data supply is managed correctly on four levels (Van Loenen & Donker, 2014), these levels are:

1. The data set is known of
2. The data set is attainable for the re-user
3. The data set is usable for re-use
4. The governance regarding open data is correct

The first three levels can be found back in theory in the concentric shell model for re-use of Backx (2003). This model is shown in figure 2.10. The first level, known, has to do with the knowledge of the re-user regarding the existence of the data set. The data set needs to be found easy in search engines. If the data set cannot be found, its impact on society will be limited. The second level, attainable, has to do with the re-user being able to use the data set for the purpose intended by the re-user. Laws and regulations should not backlog this re-use. However, the data set must also be physically attainable. The re-user needs to be able to reach the data set in what kind of form whatsoever. Lastly, the data set should be financially attainable. The third level, usable, has to do with the technical characteristics of the data set. These need to comply with the needs of the user. Furthermore, a sufficient amount of metadata is needed to generate transparency of the technical quality of the data set and thus the trustworthiness.

According to Van Loenen and Donker (2014) does the model of Backx not cover all the defining characteristics of the re-use of open data. The governance regarding open data defines an institutional context. The definition of governance in this regard is the interaction between public and/or private parties with the goal to realise communal goals. This can be controlled by laws and regulations, process and instruments which structure the interaction between the parties. The governance regarding open data has to do with the three levels of the model of Backx as well as the answer to the questions: who is in charge? Who is the person of contact? Who can guide the process? And who can reduce barriers and bottlenecks?

Metadata is ‘data about data’. It defines the context of a data set.

2.5 OPEN DATA SETS APPLICABLE FOR THE RENOVATION PROCESS

Access to public sector information offers unprecedented opportunities for the development of new products and applications. According to Van Loenen and Grothe (2014) the greatest opportunities for re-use are probably in the field of geographic information. Geographic information is information linked to a place on earth. It combines location, time and characteristics of the location (Van Loenen & Kulk, 2012). Geographic information is essential in the development and maintenance of the physical environment.

Within the geographic information sector five themes have been defined by the government, business sector and academia together (Van Loenen & Donker, 2014). These themes are:

1. Building sector
2. Energy sector
3. Spatial planning and mobility sector
4. Water sector
5. Health care sector

Figure 2.10: Concentric shell model for re-use (Backx, 2003)
This results in a list of twenty data sets which can be seen as the basic registers for geographic information in the Netherlands. This list has been created in 2014. In figure 2.11 these 20 data sets are given.

The research of Van Loenen and Donker (2014) shows that the top20 data sets are generally quite reasonably known. However, there are problems with the traceability of these data sets. General search terms lead to not related data sets. Search on data.overheid.nl is not yet on the expected level of traceability that would be proper enough for re-use. Furthermore, searching on the website can take a significant amount of time. Another bottleneck with open data in the Netherlands is that not all data sets are included in the data.overheid.nl portal. This makes it hard to find the proper data sets. The attainability of open data is ranked rather high in the Netherlands. However, still steps can be made on this part.

The usability of the geographical data sets differs per set. The traditional geodata - building sector, spatial planning and mobility sector and the water sector – have a high level of usability. The non-traditional geodata – energy sector and health care sector – are not usability on a high level just yet. All the researched data set had a limited amount of metadata, which makes it hard to test the quality.

2.5.2 RELATION OF DATA TO THE BOTTLENECKS

In paragraph 2.4 a list of fifteen bottlenecks has been presented that occur in the renovation process. In paragraph 2.5 and 2.5.1 a short introduction into open data in the Netherlands has been given. To be able to answer the research question the link between these bottlenecks and the available data sets needs to be made.

What can be notified is that each bottleneck can be put into one of the following four categories:

1. Stakeholder collaborations
2. Knowledge level
3. Funding
4. Context

None of these categories has a direct link to possible data sets. However, some of the bottlenecks have some relation to data. Some are based upon the level of information which is supplied to other stakeholders. For example, incorrect assumptions of residents could be prevented by means of more information supply towards the residents. In appendix III a table of all bottlenecks defined in this research is presented. This table also includes the relation of each bottleneck to data. What can be concluded from the literature review is that none of the sources analysed directly indicates a link between open data and the renovation process.
2.6 CONCLUSIONS

This chapter has started with an elaboration of the provocations of the two research subjects, being the renovation process of post-war serial built dwellings and the availability of open data in the Netherlands. This is followed by an analysis of literature regarding the renovation process, the stakeholder involved, the bottlenecks in this process, available open data and the link of the bottlenecks to data.

This literature review was done to give an answer to the first four sub questions of this research. These sub questions were:

1. What are the key process steps in the initiation phase of the renovation process?
2. What are the key involved stakeholders in the initiation phase of the renovation process?
3. What bottlenecks can be identified in the renovation process?
4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?

2.6.1 SUMMARY PROVOCATIONS

In the years post WWII a major redevelopment of the Dutch housing stock has occurred. This resulted in a large number of serial built dwellings. The typology of these dwellings are detached terraced houses, gallery flats and apartment blocks. Since most of these dwellings are now around 50 years old, they reach the end of their technical lifespan. Furthermore, changing attitudes regarding energy consumption in the built environment and rising energy prices ask for the implementation of more energy saving measures in these dwellings. This results in a large scale renovation assignment for Dutch housing associations in the coming years. Since most of these dwellings are inhabited by households with a low income it is important to do this renovation in a feasible way.

At the same time the development of open data is taking large steps. The Dutch government and other parties are opening up their data for internal efficiency, transparency and external re-use. Most opportunities for re-use can be found regarding data with geographical information. This link to a location makes it interesting to re-use open data in the built environment.

2.6.2 THE RENOVATION PROCESS

1. What are the key process steps in the initiation phase of the renovation process?

Currently the renovation process is changing. To implement more energetic sustainability in the process the process needs to change. The main change in this process is more outsourcing for the housing association towards the consortium. This asks for changing stakeholder roles for each stakeholder. The process steps that are identified in the process have been visualised in figure 2.4. In this process two key parts can be identified. Firstly, the internal process at the housing association which ends with a program of requirements of their wishes. Secondly, the external process in which a tender or selection occurs, a consortium gets selected for the job and the elaboration of this plans. At the end of this stage the residents get involved and need to agree upon the plans. Without a 70% agreement of these residents the project plans are rejected. If the 70% participation is gained the project can start and the initiation phase will end.

2.6.3 STAKEHOLDERS

2. What are the key involved stakeholders in the initiation phase of the renovation process?

The key stakeholders in the renovation process are the housing association as the client, the consortium as the executing party and the residents since they will stay in the dwelling during and after the renovation process. Even though the residents are key for the process, since they have a large vote with the 70% participation rule, they are only involved at the end of the initiation phase.

Within the renewed process it can be notified that new stakeholders are entering the process, like energy companies. However, this is not yet a general observation and these stakeholders do not get a key role in the process.
2.6.4 BOTTLENECKS

3. What bottlenecks can be identified in the renovation process?

Based upon theory fifteen bottlenecks have been identified in the renovation process. These bottlenecks are put in the process scheme in figure 2.9. The bottlenecks can be divided into four categories:

1. Stakeholder collaborations
2. Knowledge level
3. Funding
4. Context

None of the categories and the individual bottlenecks have a direct link to data use. However, the amount of knowledge and information supply and flow might be an underlying cause for some of the bottlenecks.

2.6.5 OPEN DATA

4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?

The Dutch government, as well as other Western governments, is working on opening up as much governmental and non-governmental data as possible for transparency, internal efficiency and external re-use. This has resulted in around 7,000 data sets supplied through the open data portal of the government at this moment. However, research has shown that the supply of data is still rather fragmented and unilateral.

The data sets which will most likely be interesting for the building sector to re-use are data sets related to geographic information. Geographic information is information linked to a place on earth, it combines location, time and the characteristics of a location. Since it is still rather hard to find specific data sets a clear vision on what is needed needs to be created before a search can be started.

2.6.5 CONCEPTUAL MODEL

Figure 2.12 summarizes the findings from theory. This conceptual model is the base for the expert interviews and case studies which are presented in the next chapters. The figure shows the connections between the several topics that are part of the research subject.

Figure 2.12: Conceptual model based upon theory (own illustration)
In the previous chapter the findings from literature were presented. This chapter gives answer to the same sub questions by means of expert interviews. The experts that were interviewed are experts on the field of sustainable housing transformation, multiple stakeholders in the renovation process and experts on the field of open data use. By means of these interviews experts who are primarily working from the academic point of view as well as experts from practise are interviewed. This makes it possible to compare the outcomes of this chapter with the theory outcomes as well as the case study outcomes which are elaborated in chapter 4. An elaboration of the interview protocol is added to this report in appendix IV, this interview protocol includes a description of the interviewees and why it is chosen to interview these persons. Summaries of the interviews conducted can be found in appendix V. Figure 3.1 is a visualisation of the interviews projected on the conceptual model.

The expert interviews are used to confirm the findings that have been found in the literature review, which has been presented in the previous chapter. The outcomes of the interviews show what the current state regarding the renovation process and open data is in practise.

The chapter starts with a paragraph in which the main findings from the literature review are summarized. The following paragraphs discuss the renovation process, stakeholders, bottlenecks and open data from the perspective of the interviewees. The chapter ends with a concluding paragraph in which an answer is given to the first four sub questions from the perspective of the interviewees.

---

13 Transcripts and/or recordings of the interviews are available upon request at the author.
3.1 SUMMARY PREVIOUS FINDINGS

In the previous chapter the provocations for renovation with the focus on energetic sustainability and the provocations for the availability of open data have been elaborated. This was followed by a description of the renovation process, involved stakeholders and bottlenecks which can be identified in theory. Furthermore, the availability and possible use of data has been elaborated. The main findings of the literature inquiry are:

- A process transition is occurring to make the implementation of energy saving measures in renovation projects possible. This process transition focussing on more outsourcing of the design elements of the project to market parties. These market parties gather in a consortium to execute the project. This leads to projects with a higher focus on quality instead of financial motives. Furthermore, it leads to changing roles of the main stakeholders.
- The main stakeholders in a renovation project are the housing association as the client, the consortium as a combination of market parties to execute the project and the residents who stay in the dwellings during and after the renovation project.
- By means of literature fifteen bottlenecks have been identified. These bottlenecks have been described elaborately in the previous chapter. Through the interviews these bottlenecks are checked with experts.
- The Dutch government is opening data to be more efficient, to have transparency towards citizens and to make external re-use possible. The geographical data sets in the Netherlands are rather complete and offer possibilities to re-use in the building sector. However, research shows that the supply of open data is not perfect yet. There are still problems with the findability of the data sets for re-users.
- The bottlenecks identified in the literature review have no direct link to data. For some of the bottlenecks it might be possible to solve them indirectly by means of data implementation. However, multiple steps are necessary to make this possible.

3.2 THE RENOVATION PROCESS

The changing process as it has been described in the literature review chapter has been backed up by multiple interviewees. According to van Hal the projects should not be tailor made anymore but change into the way car factories work. Since a large part of the housing stock is developed in a serial way, the renovation of these dwellings could be serial as well. This results in a supply of measures that could be applied to the dwellings. Market parties are reacting on this by offering multiple concepts which could be applied to the renovation of these dwellings (Van Hal, interview, 22 September 2015).

Stutvoet is researching the process of transition needed for the renovation of dwellings. In this research the cases of the program Slim&Snel of the Energiesprong were analysed. In this program a starter is given towards a renewed renovation process. According to the Energiesprong, to make the renovation process better new forms of collaboration needed to be found. This asks for more innovation in the building sector (Stutvoet, interview, 23 September 2015). According to the program the best way to achieve this innovation is by asking market parties to actively collaborate in the process. Market parties are asked to think along and work together in an early stage of the project (Slim&Snel, 2015a).

According to Loman (interview, 2 November 2015) this shift in the process is caused by four trends. Firstly, this focus has shifted from budget towards results. The lowest offer is no longer the best solution, higher quality is more important since liveability problems have to be solved in a new manner. Secondly, large scale reorganisations within housing associations led to a lower amount of capacity within the companies. This has as a result that more work should be outsources to the market. Thirdly, it is caused by new forms of trust towards market parties. Fourthly, with the economy at this moment it is financially profitable to buy now and not in a few months or years. Loman noticed that due to this last fact their way of tendering might change in the future again due to costs of materials. Currently, they prefer this manner of assigning market parties to their projects because it saves a lot of time to not go through all the official tender process steps and not having to create a detailed program of requirements and accompanying specifications.

These four trends have led to a change in the content of the tender. Next to the physical adjustments to the neighbourhood, social interventions become part of the assignment. Which creates a new type of approach for market parties. They suddenly have to think more about the residents, about how to approach them and how to communicate to them. In the past these things were arranged by the housing association.
Van der Weerd and Stoopman notify the process change as well. Yet, as they mentioned traditional processes are also still occurring. All types of forms between the traditional and the renewed process are noticeable in practice (interview, 27 November 2015).

The process steps which can be identified in renovation projects at the housing association Rochdale are (Loman, interview, 2 November 2015):

1. Identification of a physical, social or financial problem
2. Project leader assigned to the project
3. Study into the problem by project leader
4. Feasibility study of the redevelopment of the property by project leader
5. Decision made by board of directors on what type of redevelopment should be applied (demolishment, renovation, transformation, do nothing etc.)
6. Generation of conditions for the project
7. Pre-selection process with multiple market parties
8. Tender process with a few market parties
9. Granting of project to one market party
10. Preparation phase in which the project will be designed in detail and the residents will be included in the process

These process steps are consistent with the process steps identified in theory and summarized in the process scheme. In these steps the main focus is on the internal process steps by the housing association.

The process steps that are identified from the perspective of the consortium are (Hetem, 3 November 2015):

1. Quest is put in the market or through the network of the company the selection project is put on the agenda of the company.
2. Pre-selection by means of a short pitch, not directly case related (average of ten parties are invited).
3. Tender is send out by the housing association to a few market parties (average of three or four parties are invited).
4. Consortium is being created. The internal team consists of a board member, process leader, cost expert, logistical expert, building work preparer and a manager. External parties are asked to work along in a consortium. It depends on the type of assignment which parties are asked. Most of the times these are advisors, engineers and subcontractors.
5. Project plan is being made.
6. A presentation round is held in which all parties present their proposal. Tender is granted to one consortium.
7. Consortium meets with the housing association to define the plan and make some adjustments when needed.
8. Creation of plan. Together with evaluation moments in which the consortium starts talking to the residents about their needs.
9. Housing association has final say in the project.
10. Start of renovation works.

These process steps are consistent with the process steps identified in theory and summarized in the process scheme. In these steps the main focus is on the external process steps by market parties.

A plan can still change a lot after the project has been granted to one of the consortia. After the awarding moment the housing association and the constructor have a meeting to discuss the proposal. The contract phase starts. In this meeting the housing association might want to change certain parts of the project. Feasibility studies are being conducted in this phase as well. Afterwards the 70% participation of the residents needs to be gained as well. The residents thus do also have a say in the project. Furthermore, other departments within a housing association are getting involved, and might have different wishes as well. In most cases this process and changes in the project lead to a delay in the starting moment of the renovation project (Van der Weerd & Stoopman, interview, 27 November 2015).

The findings regarding the process from theory are confirmed by multiple interviewees. The perspective of the interviewees can be seen in the answers given and the focus on the process phases which they are in. Yet, the answers confirm the process steps and the process model (figure 2.4) can be used as a base for the rest of the research.
3.3 STAKEHOLDERS

In the previous chapter the stakeholders which were identified in theory have been elaborated. From the literature review it can be concluded that the actors with the largest stake in the project are the housing association, the consortium and the residents. Furthermore, governmental bodies have a steering role. It can be recognized as well that new types of parties are entering the process arena. Based upon this analysis six interviews were held with stakeholders in the process. Figure 3.2 shows the stakeholder map as it has been created based upon theory with the interviews included.

**Government**

The government can be subdivided into the European, national, provincial and municipal government. No interview has been conducted with a governmental body since they do not have an active role in the process.

According to Stutvoet the municipalities are withdrawing in most of the projects. They leave it to the housing association and the market parties. This happens because of the reorganisation of the municipalities in the Netherlands and in which they have less capacity to work on certain projects. However, they are cooperative and are trying to not backlog the process as good as possible (Stutvoet, interview, 23 September 2015).

**Housing association**

Housing associations are professional property owners that aim to provide affordable, healthy and comfortable housing for their tenants. An interview has been conducted with Loman (interview, 2 November 2015), project leader at housing association Rochdale.

In the first years of this century housing associations dealt with a large scale housing assignment. This resulted mainly in demolishment and new build. Furthermore, the liveability in some neighbourhoods was very low. Which asked for assignments on that level. This resulted in a certain manner of working for housing associations until 2010. As of that moment the crisis hit and the individual sale of properties was not successful anymore. This caused a change in business models. Furthermore, some scandals in the real estate sector led to new working methods. For Rochdale this resulted in more focus on existing properties and the renovation of these buildings. The government had influence on this transition as well. Due to regulations housing associations should focus on their core business and are not allowed to develop homes for sale anymore. The mind-set shifted, demolishment and new build is no longer the solution for liveability problems anymore. Moreover, focussing on the existing building stock and the redevelopment and renovation of these properties is less risky compared to strategies that were applied in the past (Loman, interview, 2 November 2015).

The housing association works with a five year agenda as Loman explained. Each year the department leaders together decide which projects should be added to this agenda. Based upon physical, financial and social analysis of a building or neighbourhood it is decided which projects should be put on the agenda. Feasibility studies are done and multiple solutions are analysed. Furthermore, the market has influence on which development path is the best choice (Loman, interview, 2 November 2015).
Consortium

A consortium can consist of multiple market parties working together on a building project. Per project the composition of the consortium can differ. The consortium needs a constructor to execute the renovation works. Furthermore, it could include an architect, developer, advisors, suppliers or other parties which can be interested in engaging in the process. Two interviews have been conducted with employees of the constructor ERA Contour. The first interview has been conducted with Hetem (interview, 3 November 2015). Hetem is process manager renovation. The second interview was conducted with Van der Weerd and Stoopman (interview, 27 November 2015), end-user and concept coordinators for existing buildings.

Due to the changing process the role of the consortium has changed. The consortium is responsible for the communication towards the residents in the renewed process. This is new for constructors and new types of employees and job descriptions are necessary. Furthermore, the development of concepts for renovation is a new trend amongst constructors. With these concepts they go actively to possible clients and the market (Hetem, interview, 3 November 2015; Van der Weerd & Stoopman, interview, 27 November 2015).

The process changes have led to changes in all stakeholder roles involved. The changing roles of the housing association and constructor have been described elaborately. Other parties in a consortium like advisors or suppliers have a changing role as well according to Hetem (interview, 3 November 2015), yet this is not happening that much. To make innovation possible this should start with the advisors, they should have a more active role in creating innovative concepts for renovation and supplying new types of products. The same goes for suppliers, they are currently working based upon the demand. According to Hetem a mind-set shift could occur and suppliers could innovate with the products that they offer to the market.

Residents

Residents are the inhabitants of a dwelling. In the case of a renovation process these are households that do live in a social rental dwelling. Since residents are not yet included in the process in the initiation phase it was chosen to interview professionals that work with the residents in a later phase to represent these tenants. Two interviews were conducted. The first interview was conducted with Karsenbarg (interview, 5 October 2015). Karsenbarg is consultant at the Centrum voor Woononderzoek, a company that monitors residents’ satisfaction during renovation projects. The second interview was conducted with Zijgers (interview, 5 October 2015). Zijgers does residents communication in building projects and is currently working on a renovation project of Portaal and Heijmans.

What was mentioned by both interviewees is that in most project the residents do not have problems with the executing of the renovation works, the problems lie in most of the cases in the communication towards the residents up front. This is one of the bottlenecks that has been mentioned in the literature review as well.

New types of stakeholders

Next to the traditional stakeholders new types of stakeholders join the process. An example of these new types of stakeholders that wants to be more involved in the renovation process when it is focussing on energy reduction are net companies. An interview has been conducted with De Pater (interview, 9 November 2015). De Pater is program manager at Netbeheer Nederland, the overarching organisation of all net companies in the Netherlands.

Net companies and energy companies need to changes their business model to be able to adjust to the changes in the dwellings. If for example the housing association decides to choose for an all-electric renovation the gas network becomes obsolete. Furthermore, net companies might join the project to include maintenance on their cables at the same time as the renovation project occurs.
3.4 BOTTLENECKS

Figure 3.3 shows the process scheme as it has been presented earlier. This version of the scheme shows the bottlenecks identified by means of the expert interviews. The names of the bottlenecks are abbreviations for the whole bottleneck description. In the next sections the whole bottlenecks are mentioned and the abbreviated key word is added in italic font. The bottlenecks that have already been explained elaborately are mentioned in the next section, however without an elaborated description. Merely when the interviewees added a new perspective to a bottleneck this is described. In the literature review fifteen bottlenecks have been identified, all of which have been supported by the expert interviews. Furthermore, seven extra bottlenecks have been identified. These bottlenecks are visualized in figure 3.3 with an underlining and are underlined in the text as well.

Firstly the bottlenecks that do not have a specific point in the process, yet have to do with the whole process will be elaborated. Six bottlenecks were identified in the theory, all of these bottlenecks have been back up by the expert interviews.

- **Communication between housing association and residents - Communication**
  This bottleneck has been identified by Van Hal (interview, 22 September 2015), Stutvoet (interview, 23 September 2015), Van de Groep (interview, 13 October 2015), Loman (interview, 2 November 2015), Hetem (interview, 3 November 2015), Van der Weerd & Stoopman (interview, 27 November 2015), Zijgers (interview, 3 October 2015) and De Pater (interview, 9 November 2015).
  Karsenbarg adds to this bottleneck that in almost all projects residents are more than satisfied with the end result of the renovation of their dwelling. They do not have problems with the work man and construction company either. The problems are mostly with the process leading up to the renovated dwelling. In many cases there are problems with the housing association which have been built up over a period of time. For many residents this is hard to let go and does cause a certain attitude towards the renovation project (Karsenbarg, interview, 5 October 2015).

- **A transition in the process is needed – Transition**
  This bottleneck has been identified by Stutvoet (interview, 23 September 2015), Van de Groep (interview, 13 October 2015), Van der Weerd & Stoopman (interview, 27 November 2015) and De Pater (interview, 9 November 2015).

- **Changing stakeholder roles needed - Changing roles**
  This bottleneck is identified by Loman (interview, 2 November 2015), Hetem (3 November 2015), Van der Weerd & Stoopman (interview, 27 November 2015) and De Pater (interview, 9 November 2015).
In the explanation of this bottleneck based upon theory the focus was mainly on the changing role of the consortium. However, as has been identified in the interview with Stutvoet (interview, 23 September 2015), housing associations have difficulties with this new way of working as well. They still have struggles to relinquish the project towards the market parties. Furthermore, all employees and layers of the organisation should be on board. Which is hard for some employees, mainly on the operational level, since they are losing some of their tasks. This might even lead to them being superfluous to the organisation and the fear of losing their jobs. This statement was also mentioned by Van de Groep (interview, 13 October 2015).

- **Laws & regulations backlog the renovation process - Regulations**
  This bottleneck has been identified by Van Hal (interview, 22 September 2015), Van de Groep (interview, 13 October 2015), Hetem (interview, 3 November 2015) and Stutvoet (interview, 23 September 2015). Stutvoet adds another law to the bottleneck which was not identified in theory, being the Verhuurdersheffing. This caused housing association to be less affluent. Furthermore, European regulation and national regulations caused a larger focus on the core business of the housing associations, which backlogs them in creativity and innovation (Stutvoet, interview, 23 September 2015).

  From the perspective of net companies are the current laws and regulations supportive and do they not necessarily backlog the process (De Pater, interview, 9 November 2015).

- **Collaboration between stakeholders – Collaboration**
  This bottleneck has been identified by Stutvoet (interview, 23 September 2015), Van der Weerd & Stoopman (interview, 27 November 2015) and Karsenbarg (interview, 5 October 2015). Furthermore, according to Van de Groep (interview, 13 October 2015) the information systems of housing associations are quite complicated. It is hard to gain the right information from it. Due to this it is hard to supply the consortia with the proper information they need.

- **Process takes too much time – Time**
  This bottleneck has been identified by Van de Groep (interview, 13 October 2015), Loman (interview, 2 November 2015), Hetem (interview, 3 November 2015), Van der Weerd & Stoopman (interview, 27 November 2015), Karsenbarg (interview, 5 October 2015) and Zijgers (interview, 5 October 2015).

The second process phase in which bottlenecks occurs is the internal process within the housing association when the Program of Requirements is being created. One bottleneck in this process phase could be identified in theory. This bottleneck is also identified by the experts. Furthermore, a second bottleneck in this process phase is identified.

- **Lack of funding – Funding**
  This bottleneck is two-folded. Firstly, it has to do with a lack of funding of the housing association (Loman, interview, 2 November 2015; Stutvoet, interview, 23 September 2015; Van de Groep, interview, 13 October 2015). One of the struggles housing associations have is finding the right subsidies to make energetic sustainable measures possible (Loman, interview, 2 November 2015).

  Secondly, it has to do with a lack of funding of the residents (Loman, interview, 2 November 2015; Van der Weerd & Stoopman, interview, 27 November 2015; Zijgers, interview, 3 October 2015). According to De Pater (interview, 9 November 2015) the financing of renovation projects needs to be improved. Profitable business cases need to be developed for all stakeholders in the process. Furthermore, the way housing associations can earn their investment back, through the EPV, should be explained to the residents in a clear manner.

- **Strategic decisions of housing associations are not focussed upon energetic sustainability – Decision-making**
  According to Van de Groep (interview, 13 October 2015) housing associations could be more strategic in their portfolio management. There is, in many cases, not a long term vision and project occur just because someone has put it on the renovation agenda. However, upfront these decisions could be based upon more information and so strategic choices could be made. For example, first renovate a flat with the most collaborative inhabitants. Furthermore, if you know what solutions are available through concepts of market parties, it might be interesting to make certain decisions. For example, the renovation of terraced dwellings seems to be easier regarding the techniques that are available at the moment. So it might be more interesting to execute these projects first before other project on which less concepts are available.

  Another factor of this bottleneck is based upon the funding of the residents. Due to the social responsibility of housing associations they see the rising energy prices as a threat for their tenants. Affordability of housing is thus a subject that is important for them in the renovation projects. This issue is more
important to the housing association and its tenants compared to sustainability issues (Loman, interview, 2 November 2015). This bottleneck is identified by Hetem (interview, 3 November 2015) as well.

The third process phase that deals with bottlenecks is the selection / tender process. Two bottlenecks were identified in theory. Three extra bottlenecks have been identified by the expert interviews. The bottlenecks in this process phase are:

- **Awareness of energy saving measures among professionals – Awareness**
  In the projects that Stutvoet has analysed the employees of companies were enthusiastic about energy saving measures at the start. However, not all employees might share the same innovative mind-set. This creates problems and wrong assumption within companies. As Stutvoet mentioned it is still dependent on individuals to make a difference in the process (Stutvoet, interview, 23 September 2015).
  This bottleneck has also been identified by Van de Groep (interview, 13 October 2015) and Van der Weerd & Stoopman (interview, 27 November 2015).

- **Technical difficulties – Techniques**
  This bottlenecks has been mentioned by Van Hal (interview, 22 September 2015), Stutvoet (interview, 23 September 2015), Van de Groep (interview, 13 October 2015) and Van der Weerd & Stoopman (interview, 27 November 2015).
  According to Hetem technically renovation to an energy label B is relatively easy to execute. Renovations to an A label are still hard, especially in high rise buildings. Furthermore, innovations on neighbourhood level such as sharing solar panels with multiple blocks or new heating systems are still hard to implement. Innovations and developments on this fields are necessary to makes these measures financially and technically feasible (Hetem, interview, 3 November 2015).

- **Lack of knowledge about residents – Knowledge**
  In many projects there is not much known about the residents that do live in the dwellings. If more knowledge was available up front, certain design decision can be made more substantiated. Most barriers in the renovation process are now approached in a rather technical manner. However, many of the residents do not have knowledge or interests regarding the subject of energetic sustainability. If the parties would know more about the residents up front they could include the measures that are technically important into a design which includes more tailor made ideas for the residents as well (Van Hal, interview, 22 September 2015). According to Van de Groep benefits can be achieved if more information was available about the specific residents in the neighbourhood up front. If the meetings with the residents are done in a more informed way it will be easier to address certain problems of residents. Information from for example liveability researches and CBS might offer solutions here (Van de Groep, interview, 13 October 2015). This bottleneck has also been identified by Van der Weerd & Stoopman (interview, 27 November 2015) and Zijgers (interview, 3 October 2015).

- **It is not allowed for the consortium to speak to the residents at the early stages of the project – Speak to**
  A bottleneck in the process is that the residents are only involved when the consortium already has been granted with the project. The project starts then with ‘warme opnames’, meetings in which the constructor visits all households and checks the conditions of the dwelling. Furthermore, this is the first contact moment to speak to the residents and ask them about their wishes and needs. Due to this meetings the whole project might be starting over if these wishes and needs and the conditions of the dwellings do not comply with the information given up front by the housing association (Van de Groep, interview, 13 October 2015).
  This bottleneck has also been identified by Van der Weerd & Stoopman (interview, 27 November 2015).

- **Competition between market parties – Competition**
  In the renewed process suggested by the Slim&Snel program collaboration between consortia in a tender is desired. However, in the projects analysed by Stutvoet this proved to be complicated for most of the consortia in the running for the tender. It was intended that they would share their ideas and plans to all have a better end result and help each other in the initiation process. However, it turned out to be hard for these parties to be completely open and transparent towards each other. They still felt the competition since only one of them would be granted with the project. Without this collaboration innovations in the renovation process are backlogged (Stutvoet, interview, 23 September 2015).
After the selection process one consortium is chosen to elaborate and execute their plans. In theory one bottleneck has been found regarding this phase. Another bottleneck has been identified by means of the expert interviews, being:

- **End-users are too little involved in the renovation project decision-making – End-user involvement**
  According to Van de Groep (interview, 13 October 2015) the role of the tenant needs to change. In the ideal situation the tenant should become the process owner. Which means that the tenant is included in the process as much as possible. He knows the process and the project and if certain things change, for example the planning, he will be able to reflect this change and accept it easier.

- **New process asks for solving liveability problems by market parties – Liveability problem-solving**
  Since the process is changing the type of work of the market parties is changing as well. In the past this was based on exact wishes of the housing association and the constructors only had to execute these renovation works. In the new process this is changing towards projects on more levels, in many projects solving liveability problems is part of the assignment as well. Which is new for the market parties and the best approach still needs to be found (Hetem, interview, 3 November 2015; Stutvoet, interview, 23 September 2015; Van der Weerd & Stoopman, interview, 27 November 2015).
  In the past liveability problems were addressed by changing the neighbourhood composition by means of demolishment and new build. Nowadays housing associations do not see this as the one solution anymore. If possible they like to keep their properties intact. They will only chose for demolishment if no other solution is suitable anymore. The focus is now on renovating the existing building stock and next to that developing new build dwellings in other areas. The key thought on solving liveability problems is now by changing the combinations of types of households within an area (Loman, interview, 2 November 2015).

The next process phase in which bottlenecks are found is the 70% participation process. Three bottlenecks are identified in theory. Another bottleneck is added to this list by the experts.

- **70% participation of residents needed for renovation – 70%**
  This bottleneck has been identified by Van Hal (interview, 22 September 2015), Stutvoet (interview, 23 September 2015), Van de Groep (interview, 13 October 2015), Loman (interview, 2 November 2015), Karsenbarg (interview, 5 October 2015), Zijgers (interview, 3 October 2015) and De Pater (interview, 9 November 2015).
  Due to the changing process the gaining of the 70% participation has become the responsibility of the consortium in most projects. This is a new type of assignment and can be seen as hard by consortia (Van der Weerd & Stoopman, interview, 27 November 2015).

- **Incorrectly substantiated assumptions by residents – Assumptions**
  This bottleneck has been identified by Stutvoet (interview, 23 September 2015), Van de Groep (interview, 13 October 2015), Loman (interview, 2 November 2015), Van der Weerd & Stoopman (interview, 27 November 2015), Karsenbarg (interview, 5 October 2015) and Zijgers (interview, 3 October 2015).

- **Lack of interest in energy saving measures – Interests**
  This bottleneck has been identified by Van Hal (interview, 22 September 2015), Loman (interview, 2 November 2015), Hetem (interview, 3 November 2015), Van der Weerd & Stoopman (interview, 27 November 2015), Karsenbarg (interview, 5 October 2015), Zijgers (interview, 3 October 2015) and De Pater (interview, 9 November 2015).

- **Lack of trust in new parties in the neighbourhood – Trust**
  Multiple interviewees have identified the lack of trust in new parties in a neighbourhood by residents as a bottleneck. Since they do not know the parties yet they do not trust them immediately (Van de Groep, interview, 13 October 2015). However, Loman identifies this as an opportunity from the perspective of the housing association. He says that by bringing a new party to the project this party will be trusted easier in comparison to the housing association (Loman, interview, 2 November 2015).
  This bottleneck has also been identified by Van der Weerd & Stoopman (interview, 27 November 2015).
Lastly, in theory two bottlenecks have been identified which occur in the use phase. Another bottleneck has been added to this list by means of expert interviews. These bottlenecks are:

- **Use of energy sustainable dwelling – Use**
  This bottleneck has been identified by Van der Weerd & Stoopman (interview, 27 November 2015).

- **Split incentive housing association vs residents – Split incentive**
  This bottleneck has been identified by Stutvoet (interview, 23 September 2015) and Van de Groep (interview, 13 October 2015).

- **Net metering – Net metering**
  This bottleneck has to do with the system in the Netherlands regarding selling the over plus of generated energy back to the net. In the Netherlands the amount of money pack of this energy is lower than the amount that is costs to buy energy. Since no systems have been developed yet that make it possible to save energy for a longer period it is still not profitable to generate more energy than necessary. This makes property owners question the profits of generating energy themselves (De Pater, interview, 9 November 2015; Stutvoet, interview, 23 September 2015; Van de Groep, interview, 13 October 2015; Van Hal, interview, 22 September 2015).

Appendix V shows a table which visualises which interviewee mentioned which bottleneck. In the research synthesis in chapter 5 an elaborated analysis of this matrix is presented.

### 3.5 OPEN DATA

As already has been mentioned in the literature review, the goals of the national government on opening up their data are based upon three pillars, being: transparency, internal efficiency and external re-use. This statement is confirmed by Suijkerbuijk (interview, 24 September 2015). The Netherlands are currently world leading in the sharing of geographical data (Van Loenen, interview, 6 November 2015).

Open data finds its foundation in two laws, being ‘de wet openbaarheid van bestuur’ (law open government) and the second one is ‘de wet hergebruik van overheidsinformatie’ (law re-use of governmental information). The first one has as a result that data should be available as open data. The second one means that this data should be in a re-usable format, readable for a computer, re-usable for a computer, without restrictions or with only a small fee when being used. These two laws form the legal framework regarding open data. According to Suijkerbuijk are not the laws and regulations backlogging the process of more available data, yet is it more related to cultural aspects. For example, opening certain data sets may bring risks with it, it could be interpreted in the wrong way or it could simply cost a lot of money (Suijkerbuijk, interview, 24 September 2015).

Each governmental body is responsible for its own open data. They have to show own initiative in opening up their data. All data is collected in one central spot being data.overheid.nl. Currently this website included around 7,000 references to data sets. According to Suijkerbuijk not much organisations, governmental and non-governmental, do exactly know what data they have in their organisation. This is caused because hardly any organisation has an open by default or open design process. However, a trend can be noticed which leads towards more and more data being open and available for re-use. Due to this the amount of open data sets will keep on growing. Furthermore, it causes that it is hard to estimate how many data sets could become available (Suijkerbuijk, interview, 24 September 2015). Due to open data being a rather young subject it still finds its foundation with pioneers. These pioneers within the governmental body are important for the success of the data sharing of that specific body. Van Loenen mentioned a few examples of governmental parties in which the pioneer left the process and as a result the open data projects diminished (Van Loenen, interview, 6 November 2015).

The publication of open data by governmental bodies has made a lot of progress in the last years. However, this sharing is still occurring in a fragmented...
manner. Data sets are being published on national, provincial and municipal levels. Which makes it hard to find specific data sets when you do not know where to look for it. Van Loenen identifies this as a bottleneck in the process towards good re-use of data. He places a critical remark with the open data website of the Dutch national government. This website is a gathering point of all data sets available in the Netherlands. However, there are also municipalities and provinces who do prefer to publish their data sets on their own website without a link to the national website. It is being encouraged to all public bodies to publish their data sets also on the portal of the government, however this is not being regulated (Van Loenen, interview, 6 November 2015).

Another point which backlogs possible re-use is that not all municipalities can provide the same level of quality on their data. An example Van Loenen mentioned is the thermographic recording in cities. Scans are being made of all rooftops and exterior walls of the buildings in a city to show the heat emission of these buildings. This can be an interesting data set to re-use in the renovation process of dwellings, however since the responsibility of this analysis lies with the municipality not all cities do conduct this research, the research is not being done in one general manner and not all cities do supply this data set as open data (Van Loenen, interview, 6 November 2015).

These difficulties – availability for re-use, scatterings of the sources and different quality levels – cause it to be hard to re-use the data sets in the most profitable manner and for people or companies who want to make use of these data sets hard to start this process (Van Loenen, interview, 6 November 2015).

Another struggle regarding open data is privacy. It is hard to find the balance between privacy and open data, since with the combination of multiple data sets it can be quite easy to trace the aggregation level back to one household or person (Van Loenen, interview, 6 November 2015).

The struggles on the path towards an ideal supply of open data are not unique to the Netherlands. Across to globe all countries are dealing with the same struggles and are working on this process. The question is how this supply can be presented in the best manner so every user is able to find the right information and use it to their best abilities. One of Van Loenen’s colleagues at the Kenniscentrum Open Data has done research into the re-use of open data and concluded that this is not only the task of the governmental bodies in how to supply the open data, there is also a large responsibility with the user. Users can take a more active attitude towards asking for the right information. According to this research the users are now too passive and waiting for the right information to come their way (Van Loenen, interview, 6 November 2015).

### 3.5.1 Open Data Sets Applicable for the Renovation Process

All experts on open data that were interviewed believe in the possibilities to re-use open data in the built environment, even though they are not experts on this field. A lot of information is collected in these data sets, for example the value of a property, ownership, air quality in the neighbourhood, permits given, residential research, statistical information on residents and a lot of other information. Suijkerbuijk (interview 24 September 2015) suggests data sets for the Kadaster, topographical information of the BRT, air quality, traffic information, amenities in the neighbourhood and permits that were given out. Van Loenen (interview, 6 November 2015) suggests to use data sets regarding geographical information, noise nuisance, altitude levels (3D map of the Netherlands, including buildings), thermographic information, registration on addresses and buildings (BAG, Basisregistratie Adressen en Gebouwen), energy performance levels and energy labels and information on residents through CBS. Windt (interview, 9 November 2015) suggests to add energy use by residents to this list.

Data sets that are currently openly available and that are related to the built environment are for example dwelling related; this is data available at the Kadaster about WOZ values, ownership, vacancy and so on. Furthermore, data relating topographical information is available in the BRT (Basis Registratie grootchalige Topografie). This includes information on the spatial planning in the Netherlands. Other data sets that Suijkerbuijk suggests for this research are related to the quality of the environment. For example air quality, traffic information, amenities in the neighbourhood and permits that are given out. Furthermore, the housing research WoON gives a lot of longitudinal quantitative data on housing in the Netherlands. Resident related is a lot of information available within the data of the CBS (Centraal Bureau voor de Statistiek) (Suijkerbuijk, interview, 24 September 2015).

According to Windt, an opportunity could be if data from IP-addresses would be openly accessible. This data will give a lot of information on the residents and their interests. However, this is closely linked to privacy issues. A bottleneck that Windt mentions for the use of data is those privacy issues as well. People may not like the amount of data that is available on them. They get the ‘Big Brother is watching you.
feeling’. Windt experienced this in previous projects by comments of residents associations (Windt, interview, 9 November 2015). To gain participation of the residents in a renovation project it does not have to do that much with the techniques or budget available, it has to do with the circumstances and needs of the residents. By having more information on these residents up front this could be done more grounded and successful. According to Windt this is not done enough at the moment, the constructors are mainly talking about techniques and not enough about the soft sides of the renovation project, thus the wellbeing of the residents (Windt, interview, 9 November 2015).

Lastly, more profit could be made if not only residents’ data yet also data about energy use would be used to prove that certain concepts are profitable. If both would be combined a new type of information would be available which could be really fruitful for the end result of the project (Windt, interview, 9 November 2015).

3.5.2 RELATION OF DATA TO THE BOTTLENECKS

In the interviews with the experts on sustainable housing transformation and the stakeholders in the process none of the interviewees mentioned a currently link between the process and the use of open data. However, all interviewees were interested in the possibilities which might be there.

The experts on open data gave a few examples of possible open data sets that might be useful for projects in the built environment. Again, these interviewees are not experts in the renovation projects so it cannot be considered as possible directly.

Yet, the outcomes of all interviews show the possibility for the implementation of data in the process.

The bottlenecks that were identified in theory have all been backed up by the experts that were interviewed. Furthermore, 7 other bottlenecks have been added to the list. These bottlenecks were not found in the literature sources analysed. However, it does not necessarily mean that these bottlenecks are new. The new bottlenecks are mostly related to practise, which can explain the lack of these bottlenecks in theory. Furthermore, it might be possible that there are other literature sources which would indicate these bottlenecks which have not been used in the literature review.

The same as the bottlenecks identified in theory do the extra bottlenecks identified through expert interviews not directly have a link to data. Again, some of the bottlenecks might have an indirectly link to data or could be solved by means of more information input that could come from open data. More on this subject in chapter 5, the research synthesis.
3.6 CONCLUSIONS

In this chapter the findings from the literature review have been validated. This has been done by means of expert interviews with experts on the field of sustainable housing transformation, stakeholders in the renovation process and experts on open data. The structure of the chapter is built up in the same manner as the theory chapter to make the chapters comparable. In the next sub paragraphs the sub questions 1 to 4 are answered. The similarities and differences of the outcomes from the literature review and the expert interviews are described and elaborated upon.

3.6.1 THE RENOVATION PROCESS

1. What are the key process steps in the initiation phase of the renovation process?

The changing process, which has been described in literature, is mentioned by multiple interviewees as well. The process steps in both the traditional and the renewed process are fairly similar. The main shift can be noticed with the outsourcing of the tasks of the housing association to the market parties. The process steps as they have been identified in theory and visualised in figure 2.4 are confirmed by the interviewees. A more in-depth explanation of the process steps is given by the stakeholders in the process from the perspective of the housing association as well as the perspective of the consortium. These in-depth explanations of the process steps they go through did align with the findings from theory. The conclusion to this sub question which was presented in chapter 2 is confirmed by the expert interviews.

3.6.2 STAKEHOLDERS

2. What are the key involved stakeholders in the initiation phase of the renovation process?

As has been answered to this sub question in chapter 2, the key stakeholders are the housing association, the consortium and the residents. The expert interviews have confirmed this finding. A more elaborated description of these stakeholders and the process they go through has been presented in this chapter. The stakeholder map as it has been drawn based upon theory has been confirmed by the expert interviews as well.

3.6.3 BOTTLENECKS

3. What bottlenecks can be identified in the renovation process?

Based upon theory fifteen bottlenecks have been identified in the renovation process. All these bottlenecks have been confirmed by the experts that were interviewed. Furthermore, seven other bottlenecks have been added to the list. All bottlenecks are visualised in the process scheme in figure 3.3.

3.6.4 OPEN DATA

4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?

The experts on open data suggested data sets that are possible to re-use in the renovation process. This indicates a possibility. Data sets that were suggested by the experts on open data are:

- The value of a property
- Ownership
- Air quality in the neighbourhood
- Permits given
- Residential research
- Statistical information on residents
- Kadaster
- Topographical information of the BRT
- Traffic information
- Amenities in the neighbourhood
- Geographical information
- Noise nuisance
- Altitude levels (3D map of the Netherlands, including buildings)
- Thermographic information
- Registration on addresses and buildings (BAG, Basisregistratie Adressen en Gebouwen)
- Energy performance levels
- Energy labels
- Energy use by residents

This list shows suggestions of data sets that might possibly be re-used. However, this research has been set-up as a user need analysis. This means that based
upon the needs from the bottlenecks an inquiry into the possible data set which are available in the open data database of the Dutch government will be done. This analysis is presented in the research synthesis chapter.

Since open data is a topic that has only gotten on the political agenda since a few years it is still in the development phase. There are still problems with data sets that are not open yet and the fragmentation of the data sets that are available. These problems have been identified by the interviewees on open data.

Furthermore, the aggregation level of the data sets can be a problem. Most data sets are available on six digit postal code level. For terraced dwellings this amount of dwellings will not be that large, however for gallery flats more dwellings will most likely have the same six digit postal code. This raises questions regarding the possibilities for re-use of the data sets.
In this chapter the analysis of two renovation cases from practice is described. These cases have been analysed with the focus on the process in the initiation phase, the stakeholders involved and the bottlenecks that occurred in this process. Furthermore, the level of data use is analysed.

The case study method is used to understand the complex social phenomena that comes with a renovation project. In this research it is used to understand a real-life phenomenon in depth in its contextual conditions (Yin, 2013). It is used to triangulate the findings from the previous chapters as well as make them more tangible. These case studies are set up as instrumental case studies to verify if the findings from theory and interviews can be found back in practice (Stake, 2003).

In the first paragraph a summary of the findings from literature and expert interviews is given. Followed by a paragraph on the case selection that generates insight in the reasoning behind the selection of the cases. This is followed by a description of the two cases, which are based upon secondary document analysis as well as semi-structured interviews with stakeholders. Furthermore, a paragraph on the comparison of the cases is presented. The chapter finishes with a paragraph in which the conclusions based on the case studies are written down.

4.1 SUMMARY PREVIOUS FINDINGS

In the previous chapters the first four sub research questions have been addressed by respectively literature review and expert interviews. In these analyses the subjects of the renovation process, the involved stakeholders and bottlenecks were addressed. Furthermore, the availability and possible use of data has been elaborated. The main findings of these analyses were:

- A process transition is occurring to make the implementation of energy saving measures in renovation projects possible. This process transition is focussing on more outsourcing of the design elements of the project to market parties. These market parties gather in a consortium to execute the project. This leads to projects with a higher focus on quality instead of financial motives. Furthermore, it leads to changing roles of the main stakeholders. This process transition is encouraged by the Energiesprong program. However, in practise the traditional process, and every kind of process form in between the traditional and the renewed process, are still occurring as well. The process in the initiation phase can be defined into two parts. First there is the internal phase in which the housing association defines what the requirements for the assignment are. Secondly, the external process in which a consortium is selected through a tender process and the project gets elaborated.

- The main stakeholders in a renovation project are the housing association as the client, the consortium as a combination of market parties to execute the project and the residents who stay in the dwellings during and after the renovation project. In the expert interviews all these stakeholders or representatives of these stakeholders have been interviewed. The findings from theory regarding these stakeholders have been confirmed.

- By means of literature fifteen bottlenecks have been identified. The expert interviews added seven extra bottlenecks to this list. All of the bottlenecks have been described elaborately in the previous chapters.

- The Dutch government is opening data to be more efficient, to have transparency towards citizens and to make external re-use possible. The geographical data sets in the Netherlands are rather complete and offer possibilities to re-use in the building sector. The experts on open data that were interviewed suggested many data sets that might be of value for processes in the built environment. However, still problems occur since the development and re-use of open data is still young. There are still problems with the scatteredness of the availability of data sets and the findability for re-users.

- The bottlenecks identified in the literature review and by means of the expert interviews have no direct link to data. For some of the bottlenecks it might be possible to solve them indirectly by means of data implementation. However, multiple steps are necessary to make this possible.
4.2 CASE SELECTION

To select cases that were relevant to research, several selection criteria were written down up front. Each of the cases complies with these selection criteria. The selection criteria were:

- The research is conducted in residential areas.
- The focus is on renovation of existing dwellings.
- The focus of the renovation is on creating more sustainable dwellings, with a focus on energy use reduction and levelling up the energy label of the building.
- Most of the end-users that lived in the dwellings before the renovation have been continuing to live in their dwellings after the renovation has finished.
- The research is not only focusing on the renovation of the dwelling, the direct surroundings are part of the inquiry as well.
- The research focus is on the initiation phase of the renovation; however, the cases that are analysed do not necessarily have to be in that phase at this moment.
- The size of the cases is on the level of a few blocks.
- Interviews are conducted with multiple different stakeholders.
- The type of housing should comply with the post war serial built projects.
- The cases are selected in the Netherlands; since each country has its own regulations and subsidies regarding renovation and making houses more energy neutral. Furthermore, norms and values may differ in each country. When the focus is merely on cases in the Netherlands, this variable has been excluded.

Based on these selection criteria two cases have been selected, being:

1. Smitsveen, Soest
2. Bilgaard, Leeuwarden

Since the research is focusing on literature review, expert interviews and case studies it has been chosen to do two case studies in this part of the research, one which was part of the Energiesprong program and one that was executed in almost the same year but which was not part of the Energiesprong program. Because of this limited amount of cases a limitation of this research is that it is not possible to draw conclusions that are generalizable. However, these case studies have been used to confirm the findings from literature and the expert interviews and to make them more tangible by showing examples. In the research synthesis in chapter 5 the findings from literature, expert interviews and case studies are compared and combined.

The case studies have been built up in the same structure as the previous chapters have been. Firstly, an introduction on the background of the case is given. Followed by a description of the process. Thirdly, the stakeholders involved in the project are described. Fourthly, the bottlenecks that did occur in this project are mentioned. The case study ends with a paragraph on the level of data used in the project.

According to Yin (2013) case study evidence can be collected from six sources, being: documents, archival records, interviews, direct observation, participant-observation and physical artefacts. The information sources for these case studies were secondary data analysis and semi-structured interviews with multiple stakeholders. The author has also visited the projects, however since the focus of this research is on the initiation phase and both projects have already past that phase this cannot be seen as an information source that can directly lead to the right information. The secondary data analysis is based upon openly accessible data through the internet. These are mainly newspaper articles and other grey literature sources. Furthermore, for the first
case selection documents were used as well. In both cases semi-structured interviews were conducted. In the first case these were with the constructor (Vermerris & Van der Wal, interview, 16 November 2015) and the housing association (Van de Werken, interview, 1 December 2015). In the second case three interviews were conducted. These were with the consortium (Hordijk, interview, 21 September 2015), the process coach (Van Herwaarden, interview, 5 November 2015) and the housing association (Kruijer, interview, 7 December 2015). By means of these document analysis, interviews with multiple stakeholders and own observations in the neighbourhood a general overview of the cases could be given. These case studies are presented in the following paragraphs.

4.3 CASE I – SMITSVEEN, SOEST

Soest is a city in the Dutch province Utrecht. The municipality has approximately 45,000 inhabitants ("Soest," 2015).

The neighbourhood Smitsveen has been built in the period from 1967 to 1972. It is a typical Dutch post-war ‘60 neighbourhood. There is a repeating grid of blocks existing of apartment buildings and terraced houses in a rectangular structure. There are large open spaces in between the buildings. The neighbourhood consists of 1,137 apartments and 718 terraced houses, approximately half of these houses are owner-occupied, the other half is socially rented dwellings and owned by the housing association Portaal. Smitsveen houses around 4,700 residents. In the ‘90 of the last century a large scale renovation of the green spaces has been conducted to increase the social safety of the area. The rest of the open space has been renovated in the period between 2002 and 2006. In 2013-2014 the public space in the middle of the neighbourhood has had an upgrade to make the area more attractive (Gemeente Soest, 2015).

In the last couple of years the housing association Portaal has put a lot of effort in the improvement of quality and comfort of its dwellings. This process will continue for the next couple of years as well. The housing association does own just over 900 dwellings in the neighbourhood (Portaal, 2015). This specific project was put on the agenda since there are a lot of liveability problems in the neighbourhood. The municipality and the housing association are trying to lower these problems by upgrading and renovating the neighbourhood. The flats had a maintenance backlog, there are living a lot of problematic households in the buildings and the service and maintenance expenses are relatively high. Furthermore, due to the commitment of the Dutch housing associations to have an average energy label B on their real estate the housing association decided to renovate these complexes.

The specific renovation project has been an integral tender by the housing association Portaal. The project consists of 299 apartments in two gallery flats in Soest. One of the requirements for the project was a minimum energy label B. These dwellings have been built at the end of the ‘60s. The dwellings are relatively spacious, 76 m², affordable, average rent of €370 per month after housing allowance and are accessible

---

14 These were accessible through the graduation internship at ERA Contour.
by elevator. The direct surroundings are good and there is a large supply of amenities in the neighbourhood. The dwellings are mostly inhabited by 1 or 2 person households with a low income.

Figure 4.2 shows a map of the neighbourhood and their status. The green flats are part of this renovation.

Figure 4.3 to 4.5 give a visualisation of the properties within this project.

Figure 4.3: Picture of one of the gallery flats before the renovation (Portaal, 2013)
Figure 4.4: Picture of first gallery flat after the renovation, picture was made on 9 October 2015 (ERA Contour, 2015)
Figure 4.5: Picture during realisation second gallery flat, picture was made on 5 November 2015 (own picture)

4.3.1 THE RENOVATION PROCESS

This project is not part of one of the Energiesprong programs. However, a shift in the process can be noticed. The housing association did not send out a complete detailed assignment but asked the consortia to come up with their own plans. This led the consortium that won the tender to even be able to renovate the dwellings to an A label and still stay within the budget of the housing association.

The housing association choose for a collaboration in the form of a building team (bouwteam) to challenge the market to be innovative. The housing association was more than pleased with the solutions that the consortia came up with (Hemubo, 2015).

There have already been plans for many years to change the current state of these buildings. In the past, around 2009, there were plans for demolition and new build. During the years these plans have changed again and eventually it was chosen to renovate the buildings. One of the reasons to choose for renovation over demolition and new build is the large amount of households living in these buildings. To rehouse all these households in other dwellings in the city of Soest would be nearly impossible.
After the internal process steps within the housing association, the project started with a pre-selection with 10 parties. The housing association asked the market parties to create a consortium with multiple market parties. ERA Contour and Hemubo had worked together in a previous project and this combination had proven to be successful. They applied for the tender together. Furthermore, they included advisors in the consortium. After the pre-selection 3 consortia had been selected to continue in the tender. The project was an all-in assignment in which the consortia had to think of the plan themselves. There were only a few requirements, of which one an energy label B was. Since there were only a few requirements the consortium had a lot of freedom in creating the plan. This caused new problems, since it is an existing building there were still a lot of things unknown.

In the selection process the consortium is not yet allowed to speak to the residents. This was the case in this project as well. This is something that is hard for consortia, since they need to define their plans. In renovation projects it is most likely that the residents will stay in the dwellings during the renovation, which makes it a project with a high social component. The consortium mentioned that if they were allowed to speak to a random sample of the residents during the selection project, this would help them a lot. However, also visiting the complexes gives an impression of the type of residents that do live in the dwellings.

At the end of the selection phase Hemera, a collaboration between the constructors ERA Contour and Hemubo, was selected as the consortium the execute the renovation works.

In this new assignment Portaal sent out for this renovation project one of the things the consortium had to do was gaining the 70% participation of the residents. This was rather new for the consortium. In the past they have helped with this process step, however most of the times the housing association was the one responsible and in charge for this participation. To deal with this new assignment a renovation coach was added to the consortium, this coach spoke with all the residents in the building to inform them about the project and gain their participation. However, in this case the consortium had troubles with gaining the participation, especially in the second flat. According to the consortium this had to do with the relationship between the residents and the housing association. Since the communication had been bad up till the renovation project, the residents were still hesitant. According to the housing association this lack of participation had to do with the two large ethnic groups within the flats. If the leader of the group did not like the project he could easily persuade the other households to reject the project, leading to a too small percentage of votes in favour of the project. Another motivation for the residents in the second flat was that they on average had a higher income. This meant that the rental increase would be a direct increase in housing expenses for them. Compared to their neighbours in the first flat who earned a lot less money and received a higher amount of rental allowance and thus a rental increase will not lead to a direct housing expenses increase since the rental allowance will increase as well. Even though this will be compensated with a lower energy bill it is a risk for the residents to take.

After a second attempt the 70% participation of the residents was gained and the execution of the project could start. To make residents aware of the energetic measures that were applied in the dwellings and how they should deal with these, information nights were held in which these measures were explained to the residents.

Before the summer of 2015 some problems occurred between the housing association, the constructor and the residents in the neighbourhood. The local political party PvdA hosted a meeting on the 11th of June 2015 to discuss what the problems of the residents were with the process. This was combined in a document (PvdA Soest, 2015). The main problems the residents notified were:

- The level of information given in the initiation phase of the renovation process was not high enough and too optimistic.
- The process takes too long. Up front it was told that the renovation would take two weeks per dwelling, in some cases this renovation took up to two months.
- Damages that were made to the dwellings were not fixed or paid for.
- It was promised that a replacement house would be offered, this did not happen.
- Residents were pushed into signing off the renovation, however in many cases this was not even finished yet.
- Safety is not secured since emergency services could hardly reach the entrance of the building due to the location of the construction site.
- The interim communication has been of poor quality.
- The housing association and the constructor are hard to reach when one wants to ask questions.
- The quality of the new materials is poor.
- Lack of respect for other cultures (Ramadan during the renovation works).

This meeting led to a building stop by order of the municipality. The constructor, Hemera, did not recognize itself in the complaints and asked for an explanation. What turned out was that this residents’ meeting was not only with the
residents of the two flats in this case. A little further into the neighbourhood, in de Eng, was at the same time another renovation project occurring. Most of the complaints did belong to that project\textsuperscript{15}. However, this has caused a lot of discontent with the residents and a delay in the process. Resulting in more residents who try to ask for financial compensation in the execution phase with every little conflict or miscommunication.

The consortium was able to create an expansion of the life span of the buildings of 35 years. First of all the basic maintenance works were included in the project. On top of these basic maintenance works were dwelling improvement measures, like the isolation of the end facades and the roof and the replacements of the windows with better isolating glass. Furthermore, new elevators are placed on the ends of the buildings to make them more suitable for elderly tenants. To increase the comfort level in the dwellings changes are made to the ventilation system and the isolation of the ground floor. The left over investments are put in the lowering of the energy index and the energy bill of the tenants. These investments led to an energy label A instead of the required B label, which made more subsidies available for the renovation project. Furthermore, this led to an increase of the rent when new tenants would enter a dwelling, which was financially profitable for the housing association. The project has been finished in December 2015.

Figure 4.6 shows the process steps of this case projected on the process model which have been presented earlier in the theory and expert interviews chapters. The timeline of the project is added to the illustration. The timeframes in figure 4.6 are based upon the schedule which was communicated towards the consortia at the start of the pre-selection process and the interview with the housing association.

As can be seen in the timeline the period between the first initiative and the start of the pre-selection phase has taken a long time. In this period the plans of the housing association have changed multiple times and the communication towards the residents can be seen as poorly. Mixed signals were given. Furthermore, due to the scale and the complexity of the project the whole renovation process has taken a long time. This caused disturbance with the residents. However, the time that the workmen are in each specific dwelling took only 10 workdays.

\textsuperscript{15} Based upon personal communication with Gerard van Kleef, executor at Hemera, during the location visit on 5 November 2015. This has been confirmed by Rob van de Werken, project leader at Portaal.
4.3.2 STAKEHOLDERS

Based upon the sources found on the project and the interviews a stakeholder map has been drawn. This map is presented in figure 4.7. This map is rather similar to the stakeholder map that has been presented in the literature review and expert interviews chapters. The main difference is that there are no new types of stakeholders involved in this project and all advisors were included in the consortium. Furthermore, the residents are represented by a neighbourhood association.

In the following sub sections each stakeholder will be elaborated briefly. Their role in the project is described and some problems they had during the project are elaborated.

**Housing association**

The housing association which was the client of this project is Portaal. A rather large housing associations who owns dwellings in five regions in the Netherlands, being: Utrecht, Amersfoort, Arnhem, Nijmegen and Leiden. It owns 56,000 dwellings in total. The housing association is almost merely focussing on the renovation of its existing stock instead of demolishment and new build. Furthermore, Portaal is engaged with the Stroomversnelling program of the Energie spring. However, this specific case in Soest was not part of the Stroomversnelling. Since renovating towards energy neutral dwellings is still rather difficult technically, they are only doing this with terraced dwellings at this moment. The focus with the dwellings in Soest was to renovate to a B label, since that is the minimum requirement by the signed covenant in 2021.

**Consortium**

The execution of this project has been realised by ERA Contour in cooperation with Hemubo. Together they founded the VOF Hemera for the collaboration in this project. Hemera worked together with DPA Cauberg Huygen, an advisor, architectural firm Rudy Uytenhaak, maintenance company Vastgoed Onderhoud Centrale and Kop bewoners en communicatie for residents communication.

**Residents**

The block include 299 households. On average the residents of the blocks had a poor relationship with the housing association. There was a lot of discontent with the housing association due to promises that had been made in the past which were not enacted upon. In the past there were plans for demolishment and new build for these blocks, these plans were made and communicated to the residents in 2009.

Furthermore, according to the housing association do in general residents have doubts about renovation projects, they always think ‘What’s in it for me?’. This leads to second thoughts about the rising rent after the renovation project. Portaal is only asking 75% of the reduction on the energy bill as an increase in the rent. This leads to a benefit for the residents. However, they have problems trusting the housing association. It is a fact that the rent will rise, yet it must be assumed that the energy bill will decrease since that can only be proven at the end of the first year after the renovation project has been finished. In this case it will only be sure if the energy bills have decreased at the end of 2016. Another problem with the participation is that at...
the moment the residents had to sign the paper it is not exactly clear what will happen in each dwelling. If a resident, for example, has built a new kitchen in his dwelling and he wants to know what is going to happen with his kitchen, the plans are not that far developed to give answer to that question. What can lead to the resident being hesitant towards the renovation project.

What has been notified in the first flat is that after the renovation project has been finished all the residents are content with the renovation. However, upfront almost all households do have a certain kind of hesitance towards the project.

The rental increase in this project was 35 Euros. Of which 22 Euros were a real rental increase and the rest is extra service fee. If the calculations have been made properly the energy bill will decrease with 47 Euros a month.

Neighbourhood association

There is a rather active association which is representing the residents in the neighbourhood. Furthermore, after the renovation projects in the neighbourhood got the political attention a residents committee for the Smitsweg complexes was founded. The housing association has a fortnightly meeting with the neighbourhood association and the resident committee to manage the problems of the residents with the renovation works. However, this all is only occurring in the execution phase of the project. For the housing association the neighbourhood association is the party to which they listen and which represents the residents in the blocks.

Municipality

The municipality of Soest is working on the liveability problems in the Smitsveen neighbourhood. However, due to budget cuts and the focus of municipalities on their core tasks, does the municipality of Soest has limited money to spend. The ideas for this project did also include some changes to the open space surrounding the blocks. However, due to a lack of money with the municipality these changes were not executed. Even for a small piece of new pavement towards the new entrance of the new building was no money. The housing association decided to pay for this part by themselves in the end.

According to Portaal should the municipality be more include in renovation projects. One of the provocations of this renovation was the high service fee in these complexes. A mind-set shift with the residents is needed to make them care more about their building and use it more properly. To make this succeed the neighbourhood police officers should be included in the project as well, since they could help with creating this new mind-set in the neighbourhood. To make this possible the municipality should be engaged as well. However, up till now the housing association was not able to convince the municipality for about participation.

---

16 Only the outcomes of the first renovation could be researched at the time of writing. What the residents of the second flat think of their dwellings is still unknown.
4.3.3 BOTTLENECKS

Figure 4.8 shows the process scheme as it has been presented earlier. This version of the scheme shows the bottlenecks identified in the Smitsweg project.

The names of the bottlenecks are abbreviations for the whole bottleneck description. In the next sections the whole bottlenecks are mentioned and the abbreviated key word is added in italic font. In this case study 13 bottlenecks have been identified, all of which have been found back in literature and/or expert interviews in the previous chapters. In the next sub sections these bottlenecks will be briefly mentioned per process phase.

Firstly, the bottlenecks that do not have a specific point in the process, yet have to do with the whole process will be elaborated. Six bottlenecks were identified in the theory and by means of the expert interviews. All of these bottlenecks have been found back in this case.

- **Communication between housing association and residents - Communication**
  Since a large part of the residents in this flats do not have Dutch as their first language the communication was troublesome. All the interviewees indicated that problems with residents occur often in renovation projects. Furthermore, due to changing plans of the housing associations the residents did not trust the housing association anymore on what was going to occur in their dwellings.

- **A transition in the process is needed – Transition**
  Even though the project is not part of any of the Energiesprong programs, a process shift can be notified in this project. However, as has been mentioned by multiple interviewees, this process shift was still hard for the stakeholders to deal with.

- **Changing stakeholder roles needed - Changing roles**
  Due to the process shift the housing association is outsourcing more tasks and the constructor is becoming part of the social assignment as well. Constructors still need to learn how to deal with this. According to the interviewees of the constructor in this project, their company sees social sustainability as one of their corporate social responsibilities. Not all constructors have that mind-set. That is also something that has been notified by the housing association in this project. They still want to stay in charge since their core business is the social housing.

- **Laws & regulations backlog the renovation process – Regulations**
  In renovation projects there has to be dealt with residents that will continue living in the dwellings during the preparation phase, the execution phase and after the renovation has been done. Because of this you do not want the process to take too long, this will cause disturbance for the residents.
However, the flora and fauna regulations in the Netherlands cause a major backlog in the process, if you would execute this protocol in a proper manner it will take five quarters. The same goes with regulations regarding asbestos. Since at the start there is no clear view on the amount of asbestos that is used in this building, this could backlog the process. For example in this specific case it turned out that there was asbestos in the window frames. Because of this the frames could not be replace at the moment when the builders were planning to work in the dwelling, which causes a backlog in the schedule. This has as a result that not in all dwelling the renovation works have been finished in 10 days, which was promised upfront.

- **Collaboration between stakeholders – Collaboration**
  In the interviews with both the housing association and the consortium it could be notified that both stakeholders have the intention to collaborate smoothly and transparent towards each other. However, the executing of the collaboration did not go according to plan the whole project. The process transition and changing stakeholder roles caused difficulties in this collaboration.

- **Process takes too much time – Time**
  As has been mentioned in the process description, the initial plans for this project were already started in 2009. In 2011 the renovation project got put on the agenda of the housing association. Which eventually resulted in a start of the construction works in the beginning of 2015 and a finishing of this works at the end of 2016. This whole process is quite lengthy and could have been of a disturbance for the residents.

The second process phase in which bottlenecks occurs is the internal process within the housing association when the Program of Requirements is being created. One bottleneck in this process phase could be identified in theory (funding). This bottleneck is also identified by the experts. Furthermore, a second bottleneck in this process phase is identified (decision-making). Only the first bottleneck is identified in this case study, being:

- **Lack of funding – Funding**
  As mentioned before, the residents in these dwelling do not have a lot of money to spend and are thus reluctant to a raise of the monthly rent. The housing association decided to only let the rent rise with 75% of the reducing of the energy bill. Which in the end means a financial benefit for the residents.

The third process phase that deals with bottlenecks is the selection / tender process. One two out of the five bottlenecks that were identified previously in this phase have been found back in this project. The bottlenecks in this process phase are:

- **Awareness of energy saving measures among professionals – Awareness**
  Within the housing association there is still not enough knowledge on techniques that could save energy according to the consortium. The program of requirements should focus more on these techniques to make the implementation possible.

- **It is not allowed for the consortium to speak to the residents at the early stages of the project – Speak to**
  This bottleneck has been mentioned in the process description in paragraph 4.3.2. Consortia would prefer to speak to some of the residents before handing in their final proposal for the tender.

After the selection process one consortium is chosen to elaborate and execute their plans. One of two previously identified bottlenecks have been found back in this case. Being:

- **New process asks for solving liveability problems by market parties – Liveability problem-solving**
  The social component of the renovation project is put with the consortium with more outsourcing of the tasks from the housing association. The consortium asked upon this by putting a residents consultant in the consortium. This consultant has contact with each household in the building. Furthermore, one of the garage boxes in the basement of the building has been transformed into a ‘Toolbox’ in which residents could borrow tools to use in their dwellings. This Toolbox and some other methods are used by the consortium to create more social cohesion in the buildings. However, for constructors it is still a search to find the right methods to implement in these kind of projects.

The next process phase in which bottlenecks are found is the 70% participation process. Two bottleneck were identified in this project. Being:

- **70% participation of residents needed for renovation – 70%**
  Large communities with the same ethic background are living in the blocks. Because of this these households had a major influence on each other, leading to a failure in gaining the 70% participation the second gallery flat during the
first try. However, in a second attempt the participation level was achieved. This was achieved after a lot more time and effort was put in the persuasion of the residents by the housing association and the constructor.

“A large Somali community does live in the second flat. They tend to heat their houses to 25 degree. For them the renovation would entail a raise in comfort, since the house will be less draughty and a decrease in their energy bill. Once we made this clear to them they were convinced!”

- **Lack of interest in energy saving measures – Interests**
  As mentioned by the housing association the residents do not care about energy saving measures. A new kitchen or less disturbance are more important for them.

Lastly, the one bottleneck which some of the stakeholders worry about that is going to occur in the use phase of this project is:

- **Use of energy sustainable dwelling – Use**
  To make the implementation of the energy saving measures profitable, residents should know how to deal with their new dwelling. This was a concern of the housing association, since they want their promise that the energy bills would decrease to come true. That is why in the execution phase information nights were given to guide the residents and learn them how to use their dwellings.

As mentioned in the beginning of this paragraph only 13 out of the 22 bottlenecks have been verified by this case study. This does not necessarily mean that these bottlenecks are not possible to occur in another project. Why these bottlenecks did not occur in this project could have to do with the specific collaborations between the stakeholders. For example, due to a highly educated son of one of the residents that spoke fluently Dutch as well as Somali the information supply towards this community could be done properly. Which made the bottleneck of incorrectly substantiated assumptions by residents obsolete. Furthermore, since the focus of this renovation project was a B label (which eventually turned out the become an A label), this explains the absence of the bottlenecks regarding the technical difficulties, the net metering and the split incentive. For each of the absent bottlenecks a logical explanation can be given. No questions should be raised regarding the findings from literature and expert interviews regarding this case. The case study confirms these findings.

### 4.3.4 DATA USE

The information supplied to the consortia by the housing association was limited. This led to a lot of freedom for the consortia in their design. However, it also raised a lot of questions. The transition to this new type of process is still hard and stakeholder have to figure out their new role in the process.

When the housing association was asked what kind of information sources they use they mainly pointed towards internal data bases with information about residents and external information sources from advisors, residents and the asset management department. No external data sources are being used in the process.

When the constructor was asked the same question they answered that they used the information offered by the housing association. However, they identified the level of information supplied as low. Furthermore, a market analysis has been done by Peeter Windt (one of the interviewees in the expert interview chapter) as well as information about energy use in the complexes is used.

A data source which is lacking according to all the interviewees is information on the current state of dwellings. Residents do intent to change a lot in the dwellings over the years, which creates surprises for the housing association and the consortium when they are finally able to enter the dwelling.

---

17 Rob van de Werken, interview, 1 December 2015
4.4 CASE II – BILGAARD, LEEUWARDEN

Bilgaard is one of the largest residential neighbourhoods in Leeuwarden. It is a post-war residential neighbourhood designed by Van den Broek and Bakema. The inhabitants of the area are mainly elderly and immigrants. The dwellings in the area are rather cheap and there is a diversity between terraced houses and apartment blocks. There is a strong social cohesion between the residents (“Bilgaard,” 2015).

In the last 10 to 15 years a lot of renewal projects were executed in the neighbourhood. This consist of upgrading open spaces, the redevelopment of the local shopping centre after it burned down in 2006, some residential renovation project and some demolish and new build of gallery flats. In 2012 the housing association WoonFriesland announced a tender project for two gallery flats and a block of terraced dwellings in the neighbourhood. The main question of the housing association was energy reduction in the properties, however liveability was a large part of the assignment as well (Slim&Snel, 2015b). The exact size of the renovation project was 194 dwellings in gallery flats, 95 terraced rental dwellings and 41 owner-occupied terraced dwellings (Slim&Snel, 2015c). These blocks were spread over the

4.4.1 THE RENOVATION PROCESS

The project was part of the Slim&Snel, Smart&Speedy, program of the Energiesprong. The housing association was at that moment capable of investing more in projects and decided to collaborate in this experiment. The process approach of these projects is new. To make the renovation process better, new forms of collaboration needed to be found. This asks for more innovation in the building sector. According to the program the best way to achieve this innovation is by asking market parties to actively collaborate in the process. Market parties are asked to think along and work together in an early stage of the project (Slim&Snel, 2015a).
The housing association asked market parties to combine their specialisms in a consortium. A lot of consortia did apply for the project. In the pre-selection 10 parties were invited to join. After the pre-selection 3 parties were chosen to continue working on the project. They started a collaborative process in which they had to be open and transparent towards each other. The goal for this collaboration was that the plans created would be innovative and concepts were developed which were not tailor made for this specific project but could be replicated and applied to other projects as well.

The consortium that won the tender in the end included the constructor Bouwgroep Dijkstra Draisma, the advisor for the owner-occupiers KUUB, the architect/residents communication KAW and the energy advisory Ekwadraat. The consortium founded the Wijkbedrijf Bilgaard.

After this collaborative tender process the Wijkbedrijf Bilgaard has been founded. The Wijkbedrijf is a consortium of private companies and inhabitants of the neighbourhood who planned, next to the rather basic renovation works, to work on the improvement of the neighbourhood as a whole. They intended to stay active in the area for 20 years (Wijkbedrijf Bilgaard, 2015). In 2014 the Wijkbedrijf won the Herman Wijffels innovation price for social sustainability.

The ideas of the Wijkbedrijf were quite extreme and innovative regarding the approach for the renovation and the long term maintenance which followed the renovation. It was planned to have energy supply been arranged communal in the neighbourhood. The renovation of owner-occupied dwellings could also be arranged through the Wijkbedrijf. All the social rented dwellings got a new kitchen, bathroom and insulation. Energy production should have been arranged on a neighbourhood level through solar panels and heath is produced on a central place and distributed through the neighbourhood. The possibility to switch from gas to electric cooking was offered as well. The residents paid the Wijkbedrijf for the renovations and saved in that way on their energy bill. Furthermore, this method would offer new jobs in the neighbourhood, since inhabitants could work as paid volunteers on the maintenance. Because of the set-up of the Wijkbedrijf, the consortium is able to distribute the income of the neighbourhood and thus also improve the neighbourhood on other fields like green and playgrounds (KAWarchitecten, 2013).

However, these ambitious plans were not all executed. Up front and in the communication the housing association was very enthusiastic and supportive of these plans. The Wijkbedrijf started the renovation process of the dwellings, which was in execution pretty traditional. The innovative part could be found in the social parts of the project. Which consisted of the engagement of the community into the project and arrange energy supply on a neighbourhood level by means of solar panels and heath production on a central spot. The solar panels were put on the roofs of the building, however until this day have not been connected to the net. This is caused by the distrust of the housing association that emerged during the project. This distrust had to do with the changing context in which the housing association was at the moment the contracts needed to be signed. In the meantime the Verhurdersheffing was enacted upon which had as a result that housing associations should focus more on their core business. The contract which needed to be signed to make the ideas of the Wijkbedrijf feasible should be signed for at least 20 years. Due to the focus on their core business and some hesitant signals from the residents and employees of the housing association it was chosen to not commit to this project in such an extreme form at this moment. This decision was made in June 2015. It is not said that the project cannot be executed later, however at this moment it is not realistically to do so. The Wijkbedrijf is currently doing some small daily maintenance in the blocks with volunteers, so a smaller version of the ideas is executed. Furthermore, the dwellings have been renovated and currently have an A label and the residents are happy with the increased level of comfort. Lastly, some liveability projects have started which improved the neighbourhood.

The intention was to sign a Design, Build & Maintenance (DBM) contract for this project (Baldiri Salcedo Rahola, 2015). The contract consisted of multiple parts. The first part of the contract, the one for the renovation project, was signed first, the construction works could start from that moment. The Wijkbedrijf invested extra money in the neighbourhood since they thought they would be connected to this neighbourhood for the next 20 years. However, once the next contract needed to be signed, the one that committed to the volunteer work of inhabitants, the housing associations withdrew. This had to do with second thoughts within the company. They were insecure about handing over these jobs to another party and losing their own jobs. To conclude, the renovation works have been conducted properly and all the residents are more than satisfied with the outcome, however there were a lot of promises done towards the residents about saving money and being able to do volunteer work in their own community and those were not executed.

Figure 4.11 shows the timeline of this project presented on the process model.
4.4.2 STAKEHOLDERS

Based upon the sources found on the project and the interviews a stakeholder map has been drawn. This map is presented in figure 4.12.

Some different stakeholders can be noticed if this map is compared to the map based upon theory and expert interviews. First of all, the residents in this case are not only tenants, there are also households included that are owner-occupiers. Furthermore, a neighbourhood association is representing both residents’ groups. Secondly, a new type of stakeholder has entered the project, the health insurance company. Lastly, a process coach did assist the consortia during the selection process and eventually stayed during the whole execution phase.

In the next sub sections each stakeholder will be described briefly.
**Housing association**

The housing association and thus the owner of the rental dwellings and the commissaire in this project is WoonFriesland.

In more traditional projects a housing association makes a detailed assignment of what they want with the dwellings. In this project the housing association joined the experiment of Slim&Snel and executed the tender in a renewed manner. They only had a list with wishes and led everything to the consortia to come up with solutions. For both parties this was difficult to deal with at first. The consortia were used to asking the housing association exactly what they wanted. In this new process this was not possible anymore. The consortia had to shift from reactive to proactive, the housing association vice versa.

As noticed by the process coach in the project, the housing association still had troubles with the outsourcing process. On a strategical level they are willing to do this, however on a more operational level it still creates problems. They do not know exactly how to deal with this just yet. This caused a backlog in the process and made it difficult to make agreements with the Wijkbedrijf concrete.

**Consortium**

This consortium is called Wijkbedrijf Bilgaard and consists of the constructor Bouwgroep Dijkstra Draisma, the advisor for the owner-occupiers KUUB, the architect/residents communication KAW and the energy advisory Ekwadraat. Together they have founded the Wijkbedrijf. An official company that is able to execute the maintenance of the neighbourhood for a period of 20 years with help of volunteers from the neighbourhood.

Even though the project eventually has not been executed in the way the consortium wanted, the residents are content with the renovation project that did occur in the neighbourhood. Furthermore, the consortium now has a concept which could be applied to other projects as well. They are now working on a similar project in Selwerd, Groningen.

**Process coach**

The process has been guided by a process coach from the Energiesprong. During the selection process all three consortia had their own process coach which assisted them to make the right process steps. The process coaches were purely focussing on the process itself, they had no preference in which consortium would be granted with the tender. The Wijkbedrijf was guided by the process coach Irma van Herwaarden, an independent entrepreneur.

The process coach had to guide the project and make sure that the consortia worked open and transparent during the selection process. In total there were 10 group sessions in which all the consortia came together and were able to discuss problems and ask questions to the housing association.

After the selection had been won by one consortium the process coach was still involved in the project. The consortium and the housing association had to become one united team for the planning and execution phase of the project. In the beginning they had still struggles with this, which is why the process coach was hired to stay a bit longer. Since the project also entailed a maintenance project for the next 20 years it was still hard for the housing association to deal with this. They had never done a project like that. This caused struggles, mainly in the legal field.

**Neighbourhood association**

The neighbourhood consists of a very active neighbourhood association. This neighbourhood association helped the Wijkbedrijf in the communication towards the residents. Furthermore, they were responsible for the volunteers in the neighbourhood, since the contracts were not arranged yet. The neighbourhood association was only included in the process during the planning and execution phase.

**Residents rental**

During the tender process the consortia were not allowed to speak to the residents. Since the housing association did not want it to be a disturbance to the residents. Since the ideas of the Wijkbedrijf were new and did include the residents as a key stakeholder in the maintenance phase of the process, this was a risk the consortium had to take (Jonker-Verkaart, 2015). After the tender had been granted to the consortium they could start to evaluate the support for the proposal among the residents. With this first evaluation they found out that there was a lot of distrust, a lack of interest and in some cases even aggression regarding the project. This was caused by the long process that had been going on regarding the renovation of the flats. The communication towards the residents had been various over the previous years. The first thing the consortium did was change the strategy and strive towards gaining trust among the residents. They have started as soon as possible with the
technical renovation of the flats. Within a year this renovation project has been executed. During the first six months the consortium decided not to talk about the other plans except the renovation works. During the last part of the year (starting in February 2014) the consortium started talking again to the residents about their long term plans (Jonker-Verkaart, 2015).

A group of residents was already included in the selection process of the consortia. Thus they were involved in an early stage of the project. Before the selection there were a few sessions with the residents in which the consortia could ask questions to the residents. After the selection has been granted a new phase started in which the plans were defined and the contracts were created between the housing association and the consortium. This process took a long time, approximately 1.5 year. After this period, the renovation occurred in a rather traditional way. The social liveability plans by the consortium had not been implemented. This caused discontent with the residents. Yet another time they were promised things which were not executed in the end.

Residents owner-occupiers

A part of the detached terraced dwellings is owned by owner-occupiers. A few years ago the housing association started an individual sales project for these dwellings. The aim was to sell all dwellings to the residents that did already live in the dwellings or find new possible owners. Since this project partly failed, not all dwellings were sold and at the time of the renovation project still a large part was occupied by households in the social rent sector. This caused a split reaction of the owner-occupiers. On the one hand they were pleased that finally adjustments were made to the dwellings of their neighbours. This will most likely cause a rise in the worth of their dwellings. Yet, on the other hand there were still discontent feelings towards the housing associations. Since they intended to sell all the dwelling in the block, owner-occupiers bought their dwellings with this in their mind. Because this did not succeed, it will probably mean a lowering of the worth of the dwellings.

The owner-occupiers had the option to adjust their dwelling in the same way as the rental dwellings did. Just a few joined this renovation project. The reasons why not all the owner-occupiers joined had to do with the fact that some of them just did a renovation project of themselves or some wanted to do their own project in the near future. No problems or critique was given on the offered renovation project.

Municipality

The municipality was more on the background in this specific project. This was a conscious choice by the municipality as well as the housing association and consortium. They gave the consortium the opportunity to do the project by themselves. However, the municipality was part of the jury during the selection of the consortium and was thus able to give a vote to one of the consortia and have influence on the outcome in this manner. After the selection, when the project started to become more specific, the role of the municipality grew a bit. They needed to be involved to make arrangements regarding how to deal with the payment of the volunteers and making sure that they could still keep their allowance. Furthermore, the municipality wanted to outsource the maintenance of the green open spaces in the neighbourhood. Since the Wijkbedrijf and the neighbourhood association did already had a whole group of volunteers who wanted to work in the neighbourhood and earn money with these chars this could easily be arranged.

The attitude of the municipality towards the plans of the consortium was sympathetic yet commercial. They first had doubts about the support of residents for the plans of the consortium. The social situation in the neighbourhood is backlogging initiatives of the residents. That is why the consortium insisted on creating an incubator in the area to make bottom up initiatives possible. After a while the municipality gave the consortium the benefit of the doubt and led them execute their plans (Jonker-Verkaart, 2015).

Health insurance company

One of the gallery flats in the project, Gealanden 12 hoog, is inhabited by a lot of elderly people. The health insurance company De Friesland knew how much they contributed to the healthcare of these households. They wanted to get involved in the renovation project to have influence on the adjustments made to the dwellings as well as give workshops which could lower the amount of accidents. An example of a workshop that was given was a fall prevention workshop. Furthermore, they are trying to arrange care by volunteers differently in the neighbourhood. By joining the initiatives of the Wijkbedrijf and the neighbourhood association these types of healthcare in the neighbourhood could be arranged more efficient and save the insurance company money.
4.4.3 Bottlenecks

Figure 4.13 shows the process scheme as it has been presented earlier. This version of the scheme shows the bottlenecks identified in the Bilgaard project.

The names of the bottlenecks are abbreviations for the whole bottleneck description. In the next sections the whole bottlenecks are mentioned and the abbreviated key word is added in italic font. In this case study 11 bottlenecks have been identified, all of which have been found back in literature and/or expert interviews in the previous chapters. In the next sub sections these bottlenecks will be briefly mentioned per process phase.

Firstly, the bottlenecks that do not have a specific point in the process, yet have to do with the whole process will be elaborated. Six bottlenecks were identified in the theory and by means of the expert interviews. Five of these bottlenecks have been found back in this case. The only bottleneck which has not been found back in this case study is the bottleneck regarding the laws and regulations. The bottlenecks that have been identified in this case are:

- **Communication between housing association and residents - Communication**
  In the previous years a lot of different plans were communicated towards the residents. Which made them distrustful to the execution and success of this particular plan. The initiation phase of the process took too much time which was inconvenient for the residents. This also caused a backlog in the quality of the neighbourhood. Small repairs were postponed and the mutation rate in the neighbourhood rose.

- **A transition in the process is needed – Transition**
  Another bottleneck was the changing process. Up front a new approach was introduced, which all parties supported. However, when this new process should be executed it could be discovered that not all organisations and specific employees within the organisations were up to the change and the employees of certain companies did not support the changes.

- **Changing stakeholder roles needed – Changing roles**
  The renewed process asked for new stakeholder roles. However, since not all employees at each party were on board with the plan, this caused miscommunications between several stakeholders as well as struggles and delays in the project. The process transition is still hard and changing stakeholder roles are needed. However, it is believed by the initiators of the Slim&Snel program that this process transition is needed to make energetic sustainability possible in renovation projects.

- **Collaboration between stakeholders – Collaboration**
  This bottleneck has been mentioned in the description of the previous two bottlenecks.
- **Process takes too much time – *Time***
  These buildings were the last building to be renovation in the neighbourhood. In the past the plans for these buildings have had various forms. The terraced dwellings were partly sold to private parties. Since all these plans were communicated to the residents and changed again a lot of distrust has been generated. Due to the lengthiness of these decisions to make the process took too much time.

  The second process phase in which bottlenecks occur is the internal process within the housing association when the Program of Requirements is being created. One bottleneck in this process phase could be identified in theory (funding). This bottleneck is also identified by the experts. Furthermore, a second bottleneck in this process phase is identified (decision-making). None of these bottlenecks have been found back in this case study.

  The third process phase that deals with bottlenecks is the selection / tender process. Only two out of the five bottlenecks that were identified previously in this phase have been found back in this project. The bottlenecks in this process phase are:

  - **It is not allowed for the consortium to speak to the residents at the early stages of the project – *Speak to***
  It was not allowed to speak to the residents before plan actually starts. For the consortia in the tender phase this was hard to create a correct interpretation of the type of residents and the best way to convince them to commit to the project.

  - **Competition between market parties – *Competition***
  The tender process as it has been suggested by the Slim&Snel program included a transparent collaboration between the consortia before the projects has been granted to one of the parties. However, as it turned out this openness towards other parties was still quite hard for the consortia in project

After the selection process one consortium is chosen to elaborate and execute their plans. Both previously identified bottlenecks have been found back in this case. Being:

- **End-users are too little involved in the renovation project decision-making – *End-user involvement***
  The plan of the Wijkbedrijf included a lot of elements that had to do with the residents. Only in a later stage they found out that not all residents were cooperative with these plans. If they would have been engaged from an early stage of the project the decision could be made better.

- **New process asks for solving liveability problems by market parties – *Liveability problem-solving***
  This project had a strong focus on the liveability problem-solving in the neighbourhood. This is new for the market parties to work with. New ideas, like the ideas of the Wijkbedrijf, have to be thought of by market parties to make this possible.

  The next process phase in which bottlenecks are found is the 70% participation process. Two bottleneck were identified in this project. Being:

  - **Incorrectly substantiated assumptions by residents – *Assumptions***
  The residents do not see the same aspects as important as other stakeholders might do. This leads to wrong assumptions.

  - **Lack of interest in energy saving measures – *Interests***
  Money and comfort are more important issues for residents.

  The last phase in which bottlenecks have been identified in the theory and expert interview analyses is the use phase. None of these bottlenecks have been found back in this case.

As mentioned in the beginning of this paragraph only 11 out of the 22 bottlenecks have been verified by this case study. This does not necessarily mean that these bottlenecks are not possible to occur in another project. Since the project is part of the Energiesprong the focus of the project is on energetic sustainability, which explains the lack of the bottleneck regarding decision-making. None of the interviewees mentioned anything about the 70% participation process. This indicates
that no problems occurred in this process. This renovation had no large rent increase as a result, resulting no problems with the funding. In the same way all the bottlenecks that did not occur in this specific project can be explained. However, it is likely that these bottlenecks can occur in other projects since they have been found in theory and by means of expert interviews.

---

### 4.4.4 DATA USE

According to all the interviewees there was not much data use in the project. The most information used was derived from the knowledge that the people in the consortium had. However, they made use of a list of data on the residents that was provided by the housing association. Only the documents of the housing association were the physical data sources for this project.

---

### 4.5 CONCLUSIONS

In this chapter two renovation cases have been described. Both cases described in the previous sections had as main goal to make the dwellings more energetic sustainable. In the first case this was a rather basic energy saving, in the assignment the focus was on a B label for the dwellings. However, in the selection phase turned out to be rather easy to even reach an A label. In the second case the ideas were more extreme and the goal of the renovation was to renovate the dwellings towards energy neutral, which in the end was executed as an A label. In the next sections the first three research sub questions are addressed.

---

#### 4.5.1 THE RENOVATION PROCESS

1. **What are the key process steps in the initiation phase of the renovation process?**

   In both cases the focus on energetic sustainability led to a new type of assignment by the housing association. Due to the changing regulations regarding housing associations, they are obliged to outsource more of their tasks and focus on the core business. This led to the development part of the process to shift towards the constructors. Furthermore, in both cases a strong collaboration between the housing association and consortium in the elaboration phase was preferred. A chain collaboration was encouraged in both projects, yet in both cases it could also be notified that there were still struggles with this collaboration. The stakeholders all need to find their new role in the process, which takes time.

   The process steps that have been identified by theory and expert interviews have been found back in both cases. These process and the accompanying timelines are visualised in figure 4.6 (case I) and figure 4.11 (case II).

---

#### 4.5.2 STAKEHOLDERS

2. **What are the key involved stakeholders in the initiation phase of the renovation process?**

   As well as has been found in literature and expert interviews were in these cases the housing association, the consortium and the residents the key stakeholders.
3. What bottlenecks can be identified in the renovation process?

In the previous chapters a list of 22 bottlenecks has been created. In the case studies the bottlenecks were checked if they could be found back. In the first case thirteen bottlenecks have been identified, in the second case eleven. All the bottlenecks that were identified had already been identified in theory and/or expert interviews.

Eight bottlenecks were identified in both cases. These were:

- Communication
- Speak to
- Interests
- Changing roles
- Liveability problem-solving
- Collaboration
- Transition
- Time

Five bottlenecks were only identified in case I:

- Use
- 70%
- Funding
- Awareness
- Regulations

Three bottlenecks were only identified in case II:

- Assumptions
- End-user involvement
- Competition between market parties

Six bottlenecks were not found back in these cases:

- Decision-making
- Knowledge
- Trust
- Split incentive

- Techniques
- Net metering

These last six bottlenecks will be elaborated upon briefly. The first one (decision-making) is not identified in these cases since the projects selected are focusing on energetic sustainability. However, in the interview with Portaal, the housing association in the first case, the interviewee said that their decisions are based upon the financial, technical and social situation of a building. Yet, they do have energetic sustainability in mind, since they are currently renovating a lot of terraced houses since the techniques for those projects are easier. This does not entail that the bottleneck is not a general bottleneck in the Netherlands. It still might be possible that other housing associations in the Netherlands focus less on energy reduction.

The second bottleneck, lack of knowledge about the residents, seems to be obsolete in this project. There was information available up front, however it was briefly. That it was not much was indicated by the interviewees of both cases, however they did not see that as a problem in the initiation phase of the project. It was a bigger problem that they were not allowed to speak to the residents.

The third bottleneck, lack of trust in the new parties, seemed to be not occurring in these cases. However, again it might be possible that in other projects this could have been a bottleneck.

The fourth bottleneck, the split incentive, was irrelevant in these cases since to focus was not on energy neutral dwellings. However, the interviewee of Portaal did indicate that this is a problem for them in energy neutral renovation projects. Furthermore, they only charge 75% of the energy bill in the rent increase after renovation projects in which you can see that they are taking a loss in relation to the residents.

The fifth bottleneck, technical difficulties, was again with these cases not relevant. If these would have had the goal to renovate to energy neutral this bottleneck would have occurred.

The last bottleneck, net metering, does only entail projects that are generating energy as well. In the first case no solar panels were included. In the second case these were included yet not connected which makes this bottleneck obsolete.
5 – RESEARCH SYNTHESIS

In this chapter a synthesis of the research findings from theory, expert interviews and case studies is presented. The research into the possibilities of open data in the renovation process of post-war serial built dwellings has been based on an user need analysis. By means of theory, expert interviews and case studies a list of bottlenecks has been developed. In this chapter the link of these bottlenecks to data and the analysis on available open data sets is presented.

5.1 SUMMARY PREVIOUS FINDINGS

In this paragraph a comparison is presented of the outcomes of each of the previous research parts. As already has been mentioned in the concluding paragraphs of each chapter, the outcomes of the researches do not vary a lot and confirm each other. In the next subparagraphs this will be shortly addressed per topic.

5.1.1 THE RENOVATION PROCESS

Two types of the renovation process can be identified. Being the traditional process and the renewed process. These types have been found back in theory, expert interviews and in the case studies.

In the traditional process the housing association did send out a complete and detailed assignment for the renovation works. The constructor with the lowest offer to execute these works was selected for the project. Since this process leaves limited room for innovation and the implementation of energy saving measures this process is not sufficient anymore. That is why the renewed process has been introduced. In this renewed process the housing associations sends out a list of wishes and a budget. Constructors are asked to create consortia and to design a plan for the renovation project. This makes it possible to innovate in the process and concepts. Furthermore, it creates new types of assignments for the consortium such as collaboration, communication with the residents and gaining the 70% participation of the residents.

However, as can be derived from the expert interviews and the case studies, there is not merely a traditional process and a renewed process in their extreme forms. Both types of process can be identified in practise and all types of forms in between are possible. What can be concluded is to make energetic sustainable measure be implemented in the process new approaches are necessary. Due to the changing regulations regarding the energy efficiency of dwellings housing associations are obliged to experiment with new types of processes. As both case studies show, this has led to more energy improving measures in the dwellings, however this also led to struggles in the process regarding the changing stakeholder roles.

In figure 2.4 a process model of the process steps within the renovation process is presented. This process model has been confirmed by the expert interviews and case studies. The process steps stay the same for either the traditional process or the renewed process. The only change is the shift in responsibilities among stakeholders.

5.1.2 STAKEHOLDERS

A list of fourteen stakeholders has been identified in the inductive coding analysis19. Not all stakeholders are involved in each project and do have an important role in the process. The key stakeholders identified in theory, expert interviews and case studies are the housing association, the consortium and the residents.

The housing association is the client of the renovation project. In the Netherlands no other type of property owners (investors, owner-occupiers) seem to be working on a large scale improvement of their properties with the focus on energy reduction. In the Netherlands the system regarding housing associations is different compared to other countries in Europe. Due to the semi-public structure of the company they do not gain subsidies by the government, making it rather hard to invest large amounts of money at once.

The consortium consists of a constructor and the constructor could ask other parties to join the team to, together, have more knowledge. In theory another party could be in the lead for gathering the parties in a consortium, however from expert

19 The list can be found in appendix II
interviews and in the case studies could be concluded that the constructor is in the most case in the lead.

The resident is a stakeholder that has a specific role in renovation projects compared to other building projects. Most of the renovation projects are executed with the residents staying in their dwellings. This has a major impact on the lives of the residents. An example can be given from the project which was analysed in case I. The building works in the second flat started a few weeks before the summer of 2015 and have ended just before Christmas 2015. Even though the building works in the dwelling take ten workdays, the works in the rest of the gallery flat create nuisance as well. For half a year these people have to live in this project, which is intense. It is thus noticeable that a lot of the bottlenecks in the process have a link with the residents. Housing associations would like to engage the residents more closely with the decision-making regarding renovation of their dwellings, however at the same time they are hesitant to do so since it might lead to wrong expectations

5.1.3 BOTTLENECKS

Based upon theory, expert interviews and case studies a list of 22 bottlenecks has been created. An elaborated description of each bottleneck has been given in the previous chapters. However, not all bottlenecks are confirmed by each source. In figure 5.1 a matrix is presented in which is shown in what source which bottleneck has been identified by whom. The content of this figure can be found in the table in appendix VI as well.

The bottlenecks that were not found in theory all have to do with the changing process and accompanying stakeholder roles, with the exception of net metering. Not much literature could be found on the process and the stakeholder roles specifically for renovation projects with the focus on energy reduction. This could be the cause for not identifying these bottlenecks in theory. The net metering issue is important for the financial situation regarding the project, however it is more a context bottleneck than a process bottleneck. This could be the reason why it has not been found in theory. All the bottlenecks that were not identified in theory have been indicated by at least two other sources, which makes it likely that these bottlenecks will occur in practice.

The expert interviews did not all mention all bottlenecks. This could be caused by the fact that each stakeholder interviewed had its own expertise and perception regarding the process. No strange missing identification of bottlenecks can be found in the matrix.

Some of the bottlenecks could not be found back in the case studies. This has been analysed in the conclusion paragraph of the case studies chapter. Each of the bottlenecks which could not be found back in the case studies had a logical reason to not be found back in that specific case. This did not indicate that these bottlenecks could not be found back in other renovation projects.

What is interesting to see is that the bottlenecks regarding the communication between the housing association and residents, the incorrectly substantiated assumptions by residents, the 70% participation process, the lack of interest in energy saving measures, changing stakeholder roles, lack of funding and the process takes too much time have been mentioned by at least eight of the twelve sources. These bottlenecks seem to be the core issues regarding energetic sustainable renovation projects.

---

20 Personal communication with employees of housing association Ymere during a workshop of with all the co-makers of Ymere about the engagement of the resident in the process (8 December 2015).
<table>
<thead>
<tr>
<th>Bottleneck</th>
<th>Found in theory</th>
<th>Found in expert interviews; experts on sustainable housing transformation</th>
<th>Found in expert interviews; stakeholders - housing association</th>
<th>Found in expert interviews; contractor</th>
<th>Found in expert interviews; stakeholders - residents guidance</th>
<th>Found in expert interviews; stakeholders - not companies</th>
<th>Found in case I</th>
<th>Found in case II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication between housing association and residents</td>
<td>Van Hal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A transition in the process is needed</td>
<td>Sintvoet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing stakeholder roles needed</td>
<td>Van de Groep</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laws &amp; regulations hindering the renovation process</td>
<td>Loman</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication between stakeholders</td>
<td>Hetem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process takes too much time</td>
<td>Van den Weerd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic decisions of housing associations are not focused upon energetic sustainability</td>
<td>Karsenberg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of funding</td>
<td>Zijges</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge about residents</td>
<td>De Pater</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is not allowed for the consortium to speak to the residents at the early stages of the project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness of energy saving measures among professionals</td>
<td>Van den Weerd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical difficulties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competition between market parties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New process bars for enabling feasibility problems by market parties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End users are too little involved in the renovation project decision-making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70% participation of residents needed for renovation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incompletely substantiated assumptions by residents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of trust in non-residents in the neighbourhood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of interest in energy saving measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of energy efficient housing association</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split incentive housing association in residents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not modeling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 5.1: Matrix of bottlenecks and their sources (own illustration)*
5.1.4 OPEN DATA

Open data is a subject that has only gotten large scale attention by governments in the last five years. This makes it still a young subject that is in development. Which also indicated that there are still problems.

No proof has been found in either of the researches of the use of open data in the renovation process of residential real estate. Some advisors use open data sources in combination with data sources that are not freely available to give advice. However, still a modification and analysis of this data is necessary before it can be used in the process. As one of the interviewees of the first case study mentioned:

“The possibility of the use of data in the process did not gain much awareness with companies just yet. There is limited knowledge about the availability of these data sets and where to find them.” 21

Literature has shown that open data has to score positively on four levels before it could be properly re-used. First of all it should be known of, it should be attainable, it should be available and adequate governance regarding the implementation of open data should define the context. However, as research has soon the problems already entail with the first level. None of the interviewees did know of the existence of open data and its possibilities for the renovation process. Furthermore, as experts on open data have explained the attainability and availability of open data is still on a rather low level as well. The supply is fragmented and not always complete. Even though the transition towards an open government is occurring, still a lot of steps need to be taken. However, potential is seen by the experts on open data to re-use geographical data in processes regarding the built environment.

5.2 RELATION OF BOTTLENECKS TO DATA

Previously, 22 bottlenecks have been described that can be found in the renovation process. In the table in appendix III for each bottleneck their link to data, how they might be solved by means of open data input and to which data category they belong to is described. There is no bottleneck that has as original a lack of data. In the table the distinction has been made to data related, indirectly related to data and not related to data. This defines six bottlenecks to be directly relation to data, seven bottlenecks to be indirectly related to data and nine bottlenecks to be not related to data. In this case the relation to data has to do with the possibilities to diminish the bottleneck. For example the bottleneck regarding the communication between the housing association and residents could be diminished if better information supply towards the residents was given. This could be supplied with information of open data or a specific communication strategy could be design for specific residents’ groups. By means of open data more information about the residents could be available and these strategies could be designed. Similarly, for each bottleneck an explanation is provided in the table in the appendix. The relations of these bottlenecks to data have been classified by the interpretation of the author based upon the knowledge that has been gained by conducting the literature review, the expert interviews and the case studies.

Based upon these relations seven categories of possible data sets have been created. In table 5.1 each of these data sets, examples of what these data sets might entail and the bottlenecks to which they relate are elaborated. The examples in this table are examples thought of by the author to give an idea what the category is about these are not yet based upon availability in open data or on any other sources whatsoever. In the next sub sections each data category will be addressed briefly.

21 Vermerris & Van der Wal, interview, 16 November 2015
<table>
<thead>
<tr>
<th>Type of data</th>
<th>Examples</th>
<th>Related to bottleneck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data regarding residents</td>
<td>Types of households, income, household composition, education level, main language, interests</td>
<td>Communication, assumptions, speak to, knowledge, 70%, interests, changing roles, funding, trust, liveability problem-solving</td>
</tr>
<tr>
<td>Data regarding the neighbourhood</td>
<td>Amenities, physical structures, environmental situation</td>
<td>Speak to, changing roles, trust, liveability problem-solving</td>
</tr>
<tr>
<td>Data regarding the climate</td>
<td>Climate situation in a neighbourhood, general information on climate change and the consequences</td>
<td>Assumptions, interests, changing roles, awareness</td>
</tr>
<tr>
<td>Data regarding energy use</td>
<td>Current energy use of households</td>
<td>Assumptions, use, decision-making, interest, changing roles, funding, awareness, liveability problem-solving</td>
</tr>
<tr>
<td>Data regarding energy saving measures</td>
<td>Use manual of adjusted dwelling, availability of concepts with market parties for housing associations</td>
<td>Assumptions, use, decision-making, interests, funding, awareness</td>
</tr>
<tr>
<td>Data regarding subsidies</td>
<td>Available subsidies for energy saving measures</td>
<td>Funding</td>
</tr>
<tr>
<td>Data regarding companies</td>
<td>Chamber of commerce</td>
<td>Trust</td>
</tr>
</tbody>
</table>

Table 5.1: Typologies of data sets that could aid to diminish the bottlenecks (own work)

**Data regarding residents**

Most of the bottlenecks identified have to do with residents. The involvement of residents in a renovation project is different compared to other building projects. In most renovation projects the residents stay in their dwelling during the execution of the works. This has as a result that the residents is an important stakeholder which has to be dealt with during the whole project, attention should be paid to how to do this in the initiation phase of the project.

By means of more data about residents more knowledge can be gained about these residents before meetings with them are possible and appropriate. This can have two functions, it can be used to create a specific communication strategy that is aimed at a certain kind of target group which fits the residents the best. The second option is that it can be used to implement the information about the residents in the design. If more is known about the exact types of residents that do live in the building certain options might be interesting to include in the design.

**Data regarding the neighbourhood**

The second category of data that could be used in the renovation process of residential areas could be open data regarding the neighbourhood. With more knowledge on the neighbourhood and its structures this can be used in the initiation phase of the process. For example, information on existing amenities in the neighbourhood could be used to create a strategy to improve the level of social cohesion in the neighbourhood and this could aid to the residents being committed to the project. By means of more knowledge about the existing structures communication strategies could be specified and design decisions could be made more informed.

**Data regarding the climate**

A few of the bottlenecks have to do with a lack of knowledge regarding energetic sustainability. To make this bottlenecks diminish, more information about the climatic situation could be of a help. To make this possible two implementations of the data can be of help. The first one is more and better information supply about these climate issues to the residents and the professionals that are working in renovation projects. The second option could be using the information to make informed design decisions.
Data regarding energy use

Not much is known about the current state of a dwelling and its energy use. If residents would know more about the amount of energy their dwelling is using now it could create more awareness. The same goes for professionals in the field, much of them have limited knowledge about the energy use of dwellings and the consequences of this. With more and proper information supply this could be diminished. Furthermore, if more information could be available on the energy use of the dwellings, design decisions can be made more informed.

Data regarding energy saving measures

This has closely to do with the last data category described. However, it does not regard the energy use yet it entails the possible measures which might lead to saving energy. Not enough is known with professionals on which measures are possible and which ones are the easiest and cheapest to implement. This subject again entails two implementation methods. The first one is to make informed design decisions. The second one has to do with proper information supply about the dwelling and the measures that are going to be used in the renovation process.

Data regarding subsidies

Data on subsidies has only to do with the bottleneck regarding lack of funding. Since it is not profitable yet to renovate to energy neutral, housing associations prefer to have more knowledge on available subsidies. When an overview could be created this could help housing associations to make strategic decisions regarding the renovation of their housing stock.

Data regarding companies

One of the bottlenecks identified was that there is a lack of trust in new parties in the neighbourhood. This distrust is mainly with the residents. If more information on the companies is available and supplied to the residents this trust level could be increased.

5.3 AVAILABLE OPEN DATA SETS

In the previous paragraph a link has been made from the bottlenecks to categories of data. In this paragraph the analysis of available open data sets is described. The following steps are suggested by Bizer, Boncz, Brodie, and Erling (2012) for data integration. First the concern needs to be defined, which has been done by means of the user need analysis into the bottlenecks. Followed by a search for the data that could apply to this issue, which is presented in this chapter. After that, the data needs to be transformed into appropriate formats for processing, this step will not be executed in this research however will be mentioned in the recommendations. This data should than be verified if the information is unique, relevant and comprehensive. Lastly, it should answer to the concern mentioned in the first step.

Table 5.2 shows the keywords used in the search engine of data.overheid.nl, the amount of hits and the amount of useful hits when the hits were compared with the types of data that could be useful for the renovation process as has been described in the previous paragraphs. Since the open data portal of the Dutch government works in Dutch this analysis had to be conducted using Dutch keywords.

The generation of the keywords has been based upon the analysis of the needs from the bottlenecks and own interpretation of the author. The amount of hits were the number of hits that were generated by the open data search engine at the time of the analysis. The amount of useful hits is based upon the interpretation of the author of these hits. Each hit has been viewed by the author and analysed on its value for the renovation process based upon the knowledge that the author has gained regarding this process during the execution of this research project.

An overview with more details about the hits and URL-links to these sources can be found in appendix VII.
<table>
<thead>
<tr>
<th>Data category</th>
<th>Keyword Dutch</th>
<th>Keyword English</th>
<th>Amount of hits</th>
<th>Amount of useful hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data regarding residents</td>
<td>Type huishoudens</td>
<td>Type of household</td>
<td>41</td>
<td>8</td>
</tr>
<tr>
<td>Data regarding residents</td>
<td>Inkomen huishouden</td>
<td>Income household</td>
<td>149</td>
<td>15</td>
</tr>
<tr>
<td>Data regarding residents</td>
<td>Opleidingsniveau huishouden</td>
<td>Education level household</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Data regarding residents</td>
<td>Voertaal huishouden</td>
<td>Main language household</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data regarding the neighbourhood</td>
<td>Voorzieningen wijk</td>
<td>Amenities neighbourhood</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Data regarding the neighbourhood</td>
<td>Bebouwing</td>
<td>Built environment</td>
<td>35</td>
<td>9</td>
</tr>
<tr>
<td>Data regarding the climate</td>
<td>CO2 uitstoot</td>
<td>CO2 emission</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Data regarding the climate</td>
<td>Klimaatsituatie</td>
<td>Climate situation</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data regarding the climate</td>
<td>Omstandigheden milieu</td>
<td>Environmental situation</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Data regarding the climate</td>
<td>Klimaatverandering</td>
<td>Climate change</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Data regarding energy use</td>
<td>Energieverbruik</td>
<td>Energy use</td>
<td>37</td>
<td>7</td>
</tr>
</tbody>
</table>

Data category                  | Keyword Dutch                        | Keyword English                      | Amount of hits | Amount of useful hits |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data regarding energy use</td>
<td>Energieverbruik woningen</td>
<td>Energy use dwellings</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Data regarding energy saving measures</td>
<td>Energiebesparende maatregelen</td>
<td>Energy saving measures</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data regarding subsidies</td>
<td>Subsidies energie</td>
<td>Subsidies energy</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Data regarding subsidies</td>
<td>Subsidies renovatie</td>
<td>Subsidies renovation</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data regarding subsidies</td>
<td>Subsidies Energiebesparing</td>
<td>Subsidies energy saving</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data regarding companies</td>
<td>Kamer van koophandel</td>
<td>Chamber of commerce</td>
<td>54</td>
<td>5</td>
</tr>
<tr>
<td>Data regarding companies</td>
<td>Bedrijfsinformatie</td>
<td>Company related information</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5.2: Keywords and amount of hits of open data sources in the open data portal data.overheid.nl (own work)

22 The amount of hits has been last updated on December 6th. The amount of data sets available on data.overheid.nl was 7,256 at that moment.

23 The total amount of useful hits in this column does not add up to the amount of 57 that has been identified as useful, this is caused by the fact that some keywords led to the same data sets. There are doublings in this column.
It is chosen to only search in the engine offered by the open data website and not look at other places so the research can be retraceable. However, in literature a top 20 of data sets was found and not all of these data sets have been found back in this analysis, indicating the lack of attainability within the search engine which was also described in theory.

This analysis has led to 57 data sets that might be useful to implement in the renovation process. 50 of these data sets are only available for re-use in applications. These data sets cannot be directly downloaded but have to be implemented in a software program. Since most of the usable data sets have this characteristic is it necessary to build a tool before open data could be of an influence on the renovation process.

Furthermore, not all data sets found are available on a national level, since they are provided by specific provinces or municipalities. This fragmentation has as a result that the implementation of these data sets cannot be generalizable for projects throughout the whole country.

Lastly, not for all seven data categories could useful data sets be found. Figure 5.2 summarizes the amount of data sets found per category. What can be concluded is that the data regarding resident, data regarding the neighbourhood and data regarding energy use can be answered with information found in open data. Data regarding the climate, data regarding energy saving measures, and data regarding companies are less found in open data. For data regarding subsidies is only one data set available. However, this data sets is a complete overview on what subsidies there are available on energy saving measures on national, provincial and municipal scale and does thus answer perfectly to the quest for more information on available subsidies.

As can be concluded from the previous paragraphs, there are data sets available in the open data database which could facilitate the renovation process. However, since none of the bottlenecks that was identified by means of this research shows a direct link to data, the implementation of open data will not directly solve the bottlenecks. Moreover, as the four categories of bottlenecks indicate, the bottlenecks have not the lack of data (or information) as offspring. The bottlenecks have either to do with the collaboration between stakeholders, are caused by the institutional context, found its origin in funding problems or are caused by a low knowledge level. Yet, as the research synthesis shows there are possibilities. Figure 5.3 visualises the framework that can be used by stakeholders as an information source to see if there might be data sets that could aid them in the process and were they could find them. In the next subparagraph the framework is discussed. In the second subparagraph the steps that are necessary to make the use of open data in the renovation process possible are elaborated.

By means of this framework the main research question is answered. It gives a visualisation of the ‘how’ question regarding the implementation of open data in the process.

---

24 The keywords in the illustration are in English, however the search engine works in Dutch. Keywords with no results in the search engine have been left out of the framework.
Figure 5.3: Framework of possible implementation of open data to reduce bottlenecks in the renovation process (own illustration)
5.4.1 DISCUSSION OF FRAMEWORK

The first column of the framework that is presented in figure 5.3 defines the bottleneck categories. Each of the categories shows the bottlenecks that belong to that category below the box.

Based upon this framework it can be seen that the bottlenecks regarding context cannot be diminished or reduced by means of open data. For this bottlenecks no suggestions are given. For the other three bottleneck categories four possible solutions for the implementation of open data are offered, being communication strategies, design decisions, information supply and strategic decision-making.

If the arrows in the figure are followed this leads to the seven data categories as they have been identified in this research. For each of these category the keywords that led to useful hit is the open data portal of the Dutch government are written down as a guideline for the use. Lastly, the amount of useful data sets that were derived from this research by means of these keywords are presented. What can be seen is that not for each data category currently there are data sets available that can be useful.

Yet, since most of the data sets found are web based sources a tool should be developed to make these data sets readable. Furthermore, what should be kept in mind is that due to the fast development of available open data this framework has become obsolete the minute it has been finished. New data sets could be published at any moment of the day. However, it generates insights in what is possible and what is not at the time. The steps made in the research synthesis can be redone at any time to check if new data sets have become available in the meantime.

5.4.2 STEPS TO MAKE IMPLEMENTATION SUCCESSFUL

As has been mentioned before, the bottlenecks identified in this research are not directly related to data. Throughout the research the conclusion rose that the origins of the bottlenecks lay differently and the implementation of open data in the process cannot be done easily. This paragraph discusses the possible steps that are necessary to be taken in the renovation process before open data could be of an aid. This steps are based upon the knowledge gained by the author conducting this research and do not have an underlying academic source. The steps are a suggestion by the author for the practise of renovation projects. In the following sections the three suggestions are elaborated.

Awareness

The first suggestion would be to raise awareness regarding the possibility to re-use data in the renovation process. All of the interviewees were curious about the subject, however they did not know of the possibilities just yet. This could be done by means of newsletters and article and examples of how it could be used. For example, some of the bottlenecks identified in this research could be elaborated upon and a suggestion of how to solve these bottlenecks by means of open data could be explained.

Transparency

One of the motivations to open up the data is more transparency to the citizens. Furthermore, the same trend can be observed in the renovation process since most projects are executed in a ‘bouwteam’ or by means of co-makership. Transparency is a topic that has gained importance in policies nowadays. To make use of open data transparency is necessary as well. It should be transparent for all stakeholders involved what information is available and for what it is being used. The sharing of information is key in transparency strategies.

Transition

The building sector is known as being rather conservative. This has been notified by means of this research as well. To make a transition possible employees of the companies involved will have to be open to change. One of these changes can be the implementation of open data. However, to make proper use of this information from the open data, certain processes should have to change. The way the company works or how the collaboration with other stakeholders are will be influence and are in need of a transition.
5.5 CONCLUSIONS

In this chapter the outcomes from the literature review, expert interviews and case studies have been analysed. Based upon these researches a list of 22 bottlenecks is generated. For each of these bottlenecks the link to data is analysed. These links could be divided into seven data categories. Based upon these categories a list of keywords has been made. These keywords have been put in the search engine of the open data portal of the Dutch government. The outcomes have been analysed. Based upon this list of 57 data sets that might be interesting to re-use in the renovation process in the Netherlands has been generated. This is summarized in a framework that could aid stakeholders in the renovation process to search for open data sources that might be relevant. In the following sections answers will be given to the fourth and fifth sub questions.

5.5.1 OPEN DATA

4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?

Four data categories that could be effective for the renovation process and in which data sets have been found that are useable have been found by means of this analysis. These data categories are:

- Data regarding residents
- Data regarding the neighbourhood
- Data regarding energy use
- Data regarding subsidies

Together these categories include 57 data sets that can be used. Of these 57 data sets 50 are web based services, entailing that these data sets should be implemented in an application before they can be re-used.

The publication of open data sets can be done at each moment of the day, making the outcomes of this research become obsolete directly. It might be possible that in the near future more data sets become available that can be useful for the process. The steps in the research synthesis can be repeated at any moment to check if there are new data sets available.

Appendix VII shows a table with all the data sets that have been found in this research.

5.5.2 STEPS FOR IMPLEMENTATION

5. What steps are needed to implement open data in the renovation process?

The bottlenecks that are identified by means of this research do not have a lack of data as its origin. This entails that to implement data in the process, steps need to be taken. Furthermore, since both the renovation process with a focus on energy reduction and the re-use of open data are young subjects, both subjects need to go through some developments before they will be completely ready for the implementation of open data in the process. Three focus points have been suggested in this research to go through before the implementation of open data will be useful, being:

- Awareness
- Transparency
- Transition
CONCLUSIONS

In this chapter the conclusions of the research are presented. Firstly, a paragraph with the conclusions is given. In this paragraph answers are given to the research questions. Secondly, a brief discussion on the findings from the research is presented. Thirdly, the limitations of this research are elaborated. Fourthly, a paragraph with recommendations for further research and for practice is presented. Lastly, the chapter ends with a reflection on the subject, the process and the planning.

6.1 CONCLUSIONS

In this paragraph answers are given to the sub questions and main research questions. These research questions were presented in paragraph 1.3 and are:

How could open data be used to reduce bottlenecks in the initiation phase of a renovation project of residential real estate and neighbourhoods focusing on energetic sustainability in the Netherlands?

In order to were able to answer this main research question, a few sub questions needed to be answered. These sub questions are:

1. What are the key process steps in the initiation phase of the renovation process?
2. What are the key involved stakeholders in the initiation phase of the renovation process?
3. What bottlenecks can be identified in the renovation process?
4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?
5. What steps are needed to implement open data in the renovation process?

In the next sub paragraphs these questions are answered.

6.1.1 THE RENOVATION PROCESS

1. What are the key process steps in the initiation phase of the renovation process?

By means of literature review a process model has been generated. This process model has been evaluated with expert interviews and case studies. The model is shown again in figure 6.1. The process in the initiation phase can be sub divided into two parts. The first part of the initiation phase, the upper part of the model, is the internal process within the housing association. In this phase the project is put on the agenda and the content of the program of requirements is being made. After the assignment is clear the project is put in the market. This is the moment that the second process part starts, the external process steps, which are visualised in the middle part of the model. In this part the tender is send out to multiple market parties. The market parties form consortia and design a plan which meets the requirements set by the
housing association. After the tender process one consortium is granted with the assignment and the elaboration of the plan starts. Only at this point in the process are residents becoming included. By means of the 70% participation regulation housing associations are obliged to have at least 70% of the residents agree with the proposed plans before the renovation works can start. This gives the residents a large vote in the process.

Currently, a process transition can be noticed. This transition is necessary to make it possible to implement energy saving measures in the projects. The transition entails a more open program of requirements as starting point for the tender. The housing association defines a list of wishes and a budget and the consortia are free to design their plans. This leads to more innovative ideas. However, the process transition also entails changing roles which is still hard for some parties. With this transition the process steps, as described in figure 6.1, stay similar. Yet, the responsibilities in certain process steps shift from one stakeholder to another.

6.1.2 STAKEHOLDERS

2. What are the key involved stakeholders in the initiation phase of the renovation process?

The key involved stakeholders in the renovation process are the housing association, the consortium and the residents. This has been confirmed by theory, expert interviews and case studies. Figure 6.2 is a visualisation of a general stakeholder map for a renovation project.

The client of the project is the housing association. Housing associations in the Netherlands are different compared to other European countries. It are semi-public parties that do not have the use the official procurement law. This makes it possible to select consortia which they prefer to work with. Furthermore, housing associations do not get subsidies from the governments, which makes it important for them to have a good business case regarding renovation projects. Housing association in the Netherlands own a large part of the post-war serial built housing stock. There is a large assignment for these property owners to upgrade these dwellings. AEDES, the umbrella organisation for all housing associations in the Netherlands signed a covenant that commits to an average energy label B in 2021.

The consortium is the executing party of the project. It is a gathering of multiple parties that work together in realising the renovation project. The consortium needs at least a constructor to execute the building works. Furthermore, the other parties in the consortium may vary. Examples of possible other parties in the consortium are an architect or a residents guidance company.

The residents have a different role in renovation projects compared with other building projects. They stay in the dwellings during and after the renovation works. This makes it a social assignment. The residents have a large vote in the project due to the 70% participation regulation. However, in most cases the residents are only involved in the project when the plans are in a final stage already. In both the case studies the residents were represented in the process by a neighbourhood association.

The government has a small role in renovation projects, this goes for European, national and municipal governments. They mainly have influence on the projects by means of laws and regulations.
External advisors are hired by the consortium to give advice. This could for example be experts on energy reduction or climate design. In the traditional process these advisors were hired by the housing association to create a detailed program of requirements. Nowadays we can see shift of these advisors to the side of the consortium since less is known at the moment the consortium starts with the assignment.

Lastly, new types of parties enter the process. According to theory this is not specific for renovation projects yet it can be noticed in other types of urban redevelopment projects as well. In the second case study a new type of stakeholder that joined the process was the health insurance company. Since they had a lot of members in the flats they decided to do some project that could lead to prevention of health issues. Another new type of stakeholder that has been interviewed in the expert interviews was the net company. Since renovation have a lot of influence on the gas and electricity nets collaborations could lead to more efficient renovation of both the dwellings as these nets.

6.1.3 BOTTLENECKS

3. What bottlenecks can be identified in the renovation process?

By means of literature 15 bottlenecks have been identified in the renovation process. All these bottlenecks have been confirmed by the expert interviews. Furthermore, 7 extra bottlenecks have been added to the list. In the two case studies respectively 13 and 11 of these bottlenecks have been confirmed. The lack of the other bottlenecks in these cases was logical and explainable. Figure 6.3 shows the bottlenecks projected on the process scheme. Elaborate descriptions of the bottlenecks are given throughout the report. The bottlenecks can be divided into four categories, being:

- Stakeholder collaborations
- Knowledge level
- Context
- Funding

Figure 6.3: Identified bottlenecks projected on the process model (own illustration)
6.1.4 OPEN DATA

4. What open data is available in the Netherlands that could facilitate to reduce the bottlenecks in the renovation process?

By means of the list of bottlenecks a list of data categories has been generated in the research synthesis. 7 categories of possible data sets have been identified. Based on these categories a list of keywords has been made. These keywords have been put in the search engine of the open data portal of the Dutch government. 367 hits were generated based upon these keywords. All these hits have been analysed and it can be concluded that 57 data sets might be interesting for re-use in the renovation process. Of these 57 data sets 50 are web based services. This means that these data sets can only be re-used implemented in an application. So to make it possible to re-use these data sets applications should be developed. Figure 6.4 shows an overview of each data category and the usefulness of the data sets that have been found regarding this category.

| Data regarding resident         | 24 data sets | ✓  |
| Data regarding the neighbourhood | 15 data sets | ✓  |
| Data regarding climate          | 2 data sets  | X  |
| Data regarding energy use       | 12 data sets | ✓  |
| Data regarding energy saving measures | 0 data sets | X  |
| Data regarding subsidies        | 1 data set   | ✓  |
| Data regarding companies        | 3 data sets  | X  |

Figure 6.4: Categories of data sets and their availability (own illustration)

This overview shows that not all kind of bottlenecks might be reduced by the use of open data. None of the bottlenecks is directly caused by the lack of data or information, making it impossible to solve a bottleneck by means of open data completely. The bottlenecks that belong to the four categories in which a reasonable amount of data sets have been found might be diminished by means of open data. This means that for 13 of the 22 bottlenecks it might be possible to reduce these bottlenecks with more information input from open data. However, a few steps need to be taken before this implementation can be successful. The answer to the next sub question will address these steps. Appendix VII shows an overview of the 57 data sets that have been found regarding this subject.

6.1.5 STEPS FOR IMPLEMENTATION

5. What steps are needed to implement open data in the renovation process?

Currently, the level of data use in the process is quite low. Housing associations supply the information they have on a project to the consortia, which then make a proposal based upon this information. This has been the case in both projects studied in the case study section. Some market analyses are used, however not much. Most of the information that is used in the process is based upon knowledge of professionals. External data use, from for example open data sets, has not been identified in literature, expert interviews and the case studies. This will most likely have to do with the fact that little is known with market parties about open data. In all the interviews an extended explanation of open data and its re-use possibilities had to be given. The question on the level of data use currently in the process was in most cases misinterpreted and answers were given that had to do with information supply and knowledge. This complies with the concentric shell model for re-use (figure 6.5). In this model three levels are presented. Only if these three conditions are satisfied, a user will be able to re-use the information. However, as can be identified in this research in the building sector the problem is still with the outer shell, 'known'. Little is known with the professionals in the field of renovation about the possibilities of open data to improve the process.

Figure 6.5: Concentric shell model for re-use (Backx, 2003)

25 These bottlenecks are communication, changing roles, decision-making, funding, knowledge, speak to, awareness liveability problem-solving, 70%, assumptions, trust, interests and use.
Based upon this low level of knowledge about the possibilities to re-use open data and the transition in the process that is occurring to make energetic sustainable measures implemented in the projects, three steps are suggested to make the implementation possible:

- Make sure the amount of awareness rises
- Improve transparency in the process
- Make the transition towards implementation of open data possible

6.1.6 ANSWER TO THE MAIN RESEARCH QUESTION

In the previous paragraphs the sub questions of this research are answered. In this paragraph the main research question is answered. The main research question of this research is:

_How could open data be used to reduce bottlenecks in the initiation phase of a renovation project of residential real estate and neighbourhoods focusing on energetic sustainability in the Netherlands?_

No direct link between a bottleneck and a data source could be found. This makes it unlikely for a data set to solve a bottleneck directly. Most of the bottlenecks are part of the complex process regarding renovation of residential real estate. However, in the analysis data sets have been found which could help to diminish bottlenecks by means of more information supply in the process.

Before the data sets that are found can be implemented in the process a software tool should be developed. This is needed since 50 of the 57 data sources found are only attainable as a web service. This means that these data sets cannot be downloaded, however by means of a URL link can be implemented in a software system.

Yet, what needs to be kept in mind is that most of the bottlenecks identified are not directly related to data. Most of the bottlenecks have to do with the complex process and the transition which this process is going through with the focus on energetic sustainability. The implementation of open data could be of a small help for these bottlenecks, however will most likely not solve these bottlenecks completely. In chapter 5 a framework is presented which could be used by stakeholders to see if they could make use of data sets that are available in the open data portal of the Dutch government to diminish the bottlenecks they encounter.
6.2 DISCUSSION

This research had two objectives:

1. To research if it is possible to implement open data in the renovation process
2. To design a framework which could aid stakeholders in finding the right data sets

By means of the user needs analysis a list of 22 bottlenecks has been generated. None of these bottlenecks has a lack of data at its origin, thus making it unlikely to solve a bottleneck completely with the implementation of open data in the process. However, some of the bottlenecks do have a link to data or might be reduced by means of more information input in the process. For example the lack of knowledge about residents could be reduced if more information regarding the specific residents of the property would be available. This research shows that there are data sets available that could diminish some of the bottlenecks in the renovation process. However, as the research shows as well the current level of data use in the process is rather low. Merely information from the housing association and some external advisors is used in the process steps in the initiation phase. Making it unlikely that stakeholders will directly adopt data in the process when this would be implemented. First of all more awareness and transparency in the process should be created amongst stakeholders. Furthermore, the transition of the focus on energetic sustainability and the transition of a large amount of available data sets is necessary to be completed before open data could be implemented correctly in the process.

The second objective of this research was to design a framework which could aid stakeholder to find data sets that are useful for them at that moment in the process. In figure 5.3 a first set-up of this framework is made. However, since there are still steps that need to be taken before open data could be implemented in the process this framework is a set-up for a more developed framework which could be generated once the process is ready for this development. The framework is a suggestion of how it could be in the future and can be further developed in further research by another graduate student.

Another remark regarding the framework is that 50 out of the 57 data sets that have been identified as useful for the renovation process are web based services. This entails that these data sets need to be implemented in an application before being useful. This means that the stakeholders in the renovation process cannot directly make use of the data sets which could be found with the framework.

6.3 LIMITATIONS

The research has been limited by a number of factors. In the following bullet points these limitations are elaborated:

- **Time frame**: even though the graduation project took a whole year the empirical part of the research could only be conducted in three months, due to the deadlines from the university. It the period from September until the end of November the literature review needed to be finished, the expert interviews have been conducted and the case studies are made. Furthermore, the research synthesis had to be made as well as the report needed to be completed. This was a lot of work in a short amount of time. However, due to the pressure of this short amount of time the result came to a certain level which might not have been achieved when more time was taken and the project was executed more slowly.

- **Knowledge gap on the subject in theory and practice**: since a relatively young subject has been analysed, not much was known about this subject in practise and in theory. This created difficulties in the executing of the research. However, this could also have led to wrong statements by the interviewees since they are not experts on the whole research subject.

- **Limitations of research methods**: in this research multiple research methods being literature review, semi-structured interviews with experts and case studies including document analysis and semi-structured interviews have been used.

  - **Limitations literature review**: since the subject is new no direct sources in literature could be found that aided to answering the research questions. By means of sources on separate parts of the research subject these conclusions had to be made. It is possible that sources which could also have aided to these conclusions are not found and thus not used. Furthermore, there are limited sources describing a process in practise, which is a lack in the literature regarding this research.

  - **Limitations semi-structured interviews**: semi-structured interviews have as a general limitation that they can be bias due to poorly articulated questions and response bias (Yin, 2013). This can influence the outcomes of the research. Furthermore, the interviewer goes through a learning process during the conduction of the interviews. In this research 17 interviews have been conducted. The first interview was at the end of September and the last one was held in the beginning of December. In the meantime the interviewer did learn
more about the subject from other interviews and other parts of the research. This could have influenced the questions that have been asked and so the answers that were given.

- **Limitations case studies:** a limitation of case studies in general is that they are not generalizable. The sample size of the case studies in this research was two. This amount is too low to draw general conclusions. However, these cases give a tangible example of how renovation processes go in practice. Furthermore, the outcomes of case studies can be bias due to the subjective nature of the research method and the relationship of the researcher to the case. The outcomes of the case study depend mainly on the interpretations of the researcher (Yin, 2013).

The methods used for the case studies, semi-structured interviews and document analysis, have some limitations as well. One of the limitations of the interviews is that answers could be given incorrectly due to poor recall of the situation. For example in the interview with the process coach in case II she mentioned multiple times that she had problems with recalling specific process steps.

A limitation of document analysis is that these document can be misinterpreted by the researchers as well as have written down incorrectly by the author. This can create errors in the research.

- **Limitations regarding inductive coding:** in this research an inductive coding method has been used to analyse the outcomes from theory, expert interviews and the case studies. With this inductive coding the list of bottlenecks has been generated. Since this list was not available at the start of the first interviews, question could not have been asked which could have led to the interviewee identifying this bottleneck. Another limitation of inductive coding is that the essence of the quotation and its context can be lost in the analysis (Bryman, 2012).

- **Limitations in practise:** since the two topics researched are both rather young subjects, the context of these topics is not completely clear yet. In both cases laws and regulations are new or still in the making. This could in the future have a major influence on the context regarding these subjects.

- **Limitations regarding the availability of open data:** the government is working hard to open up more and more data sets. This makes it possible that the amount of available data sets can change each day. The analysis on the amount of open data sets available that fit the needs in the renovation process becomes outdated the minute new data sets are published. However, this analysis gives an image in what type of data sets could be used in the process.

- **Limitations in research field:** many of the interviewees have been involved with the Energiesprong program. This is logical since the focus of this program is on energetic sustainability and this research has the same focus. However, it could have influenced the answers given by the interviewees. This limitation has been made as minimal as possible to interview a housing association in the expert interviews that did not had to do anything with the Energiesprong as well as select one of the case that do not have to do with this program.

- **Possible miscommunication regarding terminology:** in the interviews it was noticed that most of the interviewees did not have much knowledge about open data. The interviewer gave an explanation about this subject, however it could not be guaranteed that the interviewee understand the subject completely. In the answers given by the interviewees it was multiple times noticed by the interviewer that they used the words ‘information’, ‘data’ and ‘knowledge’ interchangeable and as synonyms to open data. This is a misuse of terminology that has also been identified in studies on information needs by Wilson (1981).
6.4 RECOMMENDATIONS

In this paragraph recommendations regarding future research and recommendations for practise are given.

6.4.1 RECOMMENDATIONS FOR THEORY

This research has been set-up as an exploratory research. This entails that the subject researched is rather new. That leads to the following recommendations for theory:

- More research into the renewed renovation process with the focus on energetic sustainability is preferable. Not much could be found on this subject and the stakeholder roles within this process.
- More research into the re-use of open data can be done. Currently there is limited sight on how data sets are being re-used and the effects of these re-uses.
- The same methodology can be applied for the re-use of open data in other types of processes in the built environment.
- A method for analysing which data sets are interesting to re-use in the built environment which depends less on the observations of a researcher could be developed. In this research the analysis of which data sets were interesting is made by the researcher, this generates bias regarding the outcomes. Furthermore, it were now a bit over 300 data sets that needed to be analysed. This amount is still rather tangible, yet when the amount of data sets available will rise this will become impossible to do without a model or any other decision-making method.
- The framework regarding the search for useful data sets that has been presented in this research, could be upgraded and expended with more levels.

6.4.2 RECOMMENDATIONS FOR PRACTISE

- The conclusion of this research is that it might be possible to implement open data in the process, however a software tool is needed. The first recommendation for practise is to develop such a tool.
- The second recommendation regards the knowledge about open data among professionals in the building sector. None of the interviewees did know about the existence of open data, this shows that without this knowledge none of them would ever implement data in the process.
- All the bottlenecks identified in this research do not find their origin in a lack of data input. This means that these bottlenecks could be diminished by other methods. Most of the bottlenecks could be diminished with more transparency and openness among stakeholders.
- The steps that were presented in paragraph 5.4.2, awareness, transparency and transition, should be enacted upon to make it possible to re-use data in the renovation process.
6.5 REFLECTION

In this paragraph the reflection upon the researched subject, the process and the planning is described. This reflection is part of the graduation process and has as objective to learn from the graduation project and accompanying process.

6.5.1 REFLECTION ON SUBJECT

In this research the possibility for the implementation of open data in the renovation process of residential post-war serial built dwellings is investigated. The subject has been chosen based upon a personal opinion of the author that the input from open data could be interesting for the building process. In a first literature review no sources of this implementation of data could be found, because of this it was decided to investigate this subject and it has been chosen as the topic for this research. To analyse this subject it was chosen to design the research as an exploratory research.

Open data as well as renovation with a focus on energetic sustainability are rather young topics in practise and in theory. This makes the subjects rather hard to research. The findings from the research are thus not very specific and raise new questions. There are many bottlenecks in the process, however it is hard to link these specifically to a lack of any kind of data.

To research a topic in an explorative manner is hard for a graduation research. Since so many things are still unknown in theory and in practise, it is hard to analyse it in depth. In retrospect it might have been wished to choose a subject that is less innovative. However, that might as well not have been a challenge as this research has been now.

As the graduation research project progressed in time and the interviews as well as the literature review and the case studies were executed, more and more information on the process of renovation started to become clear. Generating new insights, yet also raising new questions. In retrospect the subject might have been chosen differently. When the research into both subjects, thus energy renovation and open data use, got more developed, bottlenecks that were not directly related to data were found. These bottlenecks do not have a direct link to data but are important for the process to succeed. Thus, it might have been better to look at a possible solution for these bottlenecks in a more general sense and not only focussing on open data. An example of this could be the bottleneck regarding the changing stakeholder roles. Furthermore, the same goes for the perspective of open data. A conclusion which can be drawn from this research is that the availability of open data is not known of amongst professionals in the building sector. This bottleneck first needs to be overcome before open data can be re-used in the renovation process, or any other kind of building project for that matter.

The outcomes of the research regarding the implementation of open data in a process in the built environment seem to be generalizable. The open data supply in the Netherlands still needs improvement before it can really be of an added value for a process in the built environment. However, there are already possibilities since a large amount of data sets is available nowadays. The results regarding the bottlenecks in the process seem to be bound to the renovation process, since the role of the residents is an important role in this process. In other building processes the role of the residents will be smaller since they do not have to stay in the dwellings during the building works in other processes.

Due to the qualitative approach of this research the outcomes of the interviews and the case studies might not be generalizable either. It could be that these specific interviews have influenced the findings regarding the bottlenecks in the process. However, since most bottlenecks have been confirmed by multiple sources and are triangulated by means of multiple research methods it will be most likely that these bottlenecks are correct.

The analysis of the open data sets is time bound, the minute this analysis has finished the outcomes have become obsolete. This is caused by the possibility for new data sets to become available at each moment of the day. Furthermore, the generation of the keywords and the analysis of the usefulness of the data sets that were derived from the analysis are done by the author. This analysis is done based upon the knowledge gained while executing this research, however it is not based upon literature sources or confirmed by any other source. This could be a limitation of the research.

The research has been conducted within the graduation lab ‘Urban Development Management’. This lab does focus on the interventions in the existing urban fabric. From an urban perspective the physical-spatial, economic and socio-cultural aspects are analysed. Furthermore, the lab focusses on multiple scale levels and multiple stakeholders in the processes regarding existing urban areas. This graduation research fits within this lab since multiple stakeholders and scale levels are analysed. A process within the existing urban fabric has been investigated in depth and an attempt is made to find its link to a new subject, in this case ‘open data’.
6.5.2 Reflection on Process

The research has been executed as an exploratory qualitative research which included a literature review, semi-structured interviews and case studies to conduct an user need analysis. Based upon this user need analysis a list of possible needed data sets is created. With this list the open data portal of the Dutch government has been consulted. This methodology has been chosen to answer the research questions. However, in retrospect some process steps might have needed to be conducted differently.

First of all, the literature review, expert interviews and case studies have been conducted fairly simultaneously. This could have led to certain questions not being asked to the first interviewees, since the knowledge of the author has been developing along the process as well.

Due to the qualitative set-up of the research it is still possible that not the right interviewees have been interviewed and the answers are thus not generalizable. It might be possible that employees of different housing associations or constructors give other answers and identify different bottlenecks.

Since not much has been written on either subject yet, being in this case the process of renovation projects focussing on energetic sustainability and the implementation of open data in process, it was hard to draw substantiated conclusions.

The research has been set-up as an exploratory research. This research methodology is difficult to execute, no expert can tell you exactly what the link is between the two subjects since this has not have been investigated in the past.

This research has been executed to achieve the Master of Science degree. In the graduation guide sixteen achievement levels for the integral curriculum of the MSc track of Real Estate & Housing are mentioned (Prins, 2015). In the next sub section each of these achievement levels are addressed shortly and its results in this research project are elaborated.

1. Academic contribution; the ability to make an inspiring and innovative contribution at an academic level. In this research project two new subjects has been combined to see if these two could add value to each other. This research has not been conducted up till now. Resulting in a contribution on academic level which was not there yet.

2. Academic methods and techniques; knowledge, understanding and skills in the field of academic research, methods and techniques. During the years at the university attention has been paid to literature review and other research methods. However, never have we had to execute these methods on such a large scale. Each interview went better than the previous one and I can definitely say that I have learn more on how to research and what kind of research method is appropriate to use.

3. Integrating disciplines; the ability to integrate varying disciplines. In this research multiple interviews were held with different kind of stakeholders. For example employees from housing associations as well as constructors. In the interviews different perspectives could be notified with these interviewees. The ability of putting the answers in perspective was something that has been learned during this research project.

4. Market, actors, processes and procedures; knowledge and understanding of the various roles, processes and events in the building sector. In this research one process has been investigated in depth, accompanying actors have been interviewed. Knowledge has been created about this specific type of project and its context and actors. However, it does not only give insights in this specific process, it makes it easier to understand other process in the building sector as well now.

5. History and relationship with other disciplines; knowledge and understanding of the history and the theory of the building sector and relating processes. The history on the part of the built environment which was the focus of this research has been elaborated in the literature review. Furthermore, a lot of attention has been paid to putting literature sources into context when looking at their publication dates. This is used to describe the traditional renovation process.

6. The future in an international context; knowledge and understanding of national and international developments in the real estate sector. The focus of this research has been on the Netherlands to demarcate the context of the subject. However, in both subject some attention was paid to the situation abroad. A recommendation of this research could be to look at the relationship between renovation and open data in other European countries as they had a similar rebuild assignment after WWII and are working on opening up their data as well.

7. Quality within requirements and preconditions; knowledge and understanding of the relationship between people and the built environment. In defining the bottlenecks a lot of attention has been paid to the perception of various stakeholders and their relationship with the dwellings.

8. Designs, processes and methods; knowledge, understanding and skills with respect to designing objects and processes in the area of building, renewing
and managing the built environment and the ability to integrate design methods and design results into decision-making process and evaluation processes in these areas. This knowledge has been attained by the qualitative in-depth analysis of the renovation process.

9. **Social developments;** knowledge and understanding of building projects as social processes. Since the perceptions of all stakeholders has been taken into account attention is paid to the social part of the processes.

10. **Economy and sustainability;** understanding of economic, technical, functional and social expected life of constructions and their components and its relation to the environment. The focus of this research is on energetic sustainability, thus a focus on the environment and the future. Furthermore, one of the reasons why energetic sustainability is an important subject is that the less affluent in our country live in the dwellings that have the lowest energy label. This makes it for this target group a financially important subject.

11. **Life cycle of real estate and management;** knowledge and understanding of the life cycle and the relating processes. The focus of this research is on renovating dwellings which are close to the end of their technical lifespan, and in some cases their financial and social lifespan as well. The focus of this research is renovating these dwellings into renewed dwellings with a new life. This has been done with the attention to all the building phases and with the focus on the initiation phase.

12. **Life cycle of real estate and relationship with other disciplines;** knowledge and understanding of other disciplines that have a relationship with building projects. In this research attention has been paid to the roles of different stakeholders such as architects, advisors, the context regarding laws and regulations and so on.

13. **Life cycle of real estate and various levels of scale;** knowledge and understanding on multiple scale levels. In this research the focus has been on different scale levels. In the analysis constantly zoom in and zooming out has been applied.

14. **Communication skills;** the ability explain the process by making use of pictures, texts, figures and the spoken word. The research has been written down as good as possibility and will be presented in a brief presentation that captures the essence of the research project and conclusions.

15. **Presentation skills, communication skills and computer skills;** knowledge, understanding and skills in these areas. To graduate the student must be able to explain the project properly.

16. **Professional practice;** the ability to work in practise. The research has been conducted within a graduation internship. During this internship a lot has been learned from the professionals at the graduation company.

### 6.5.3 REFLECTION ON PLANNING

The research project has started in February 2015. In the first weeks an exploration into possible research subjects was done. This was followed by a first presentation voor P1 in April. After this first presentation the literature research started. In this first period I lost myself in literature and had troubles finding the right information and staying on track. In June the first P2 attempt was made. Unfortunately, the work presented at that moment was not complete enough yet and another attempt was offered two weeks later in the beginning of July. In these weeks I have worked hard to get my story straight and the second attempt was successful. In the first period I was not sure what to research and had troubles with finding the right subject and research methods. I was not able to take a step back and think logically about the research subject. In the period up till the second P2 attempt this started to change and the subject got more concrete. In the last week a graduation internship had been arranged which made it easier to choose the cases to study and make the project fit into the real world and practise.

After the summer holiday the graduation internship started and the fulltime empirical research period could start. At the internship I mainly focussed on my own research, however due to conversations with professionals that work at the company and small assignment for selection projects that were done in renovation projects a lot of knowledge was created. This would have never been created without the internship and thus I am pleased with this opportunity and the guidance and freedom that I have gotten at the internship. For four and a half months I have worked fulltime, and in some weeks even more than that, on the research. When I started I did not expect that the research took this much time. However, preparing, conducting, transcribing and analysing interviews is a very time consuming job. This was something that I did not expect up front. Furthermore, I wanted to do a lot more during this period, like a test case, however due to the complexity of the process (of renovation) there was no time left to do this. This was a pity, however I learned a lot in the research and I do not see it as a shortcoming to the research in the end.

All together I can say that I am happy with the outcomes of the project and the process and planning that has led to this outcome.
REFERENCES

LITERATURE


Bregt, A. K., Grus, L., & Eertink, D. (2014). Wat zijn de effecten van een open basisregistratie topografie na twee jaar?


INTERVIEWS


FIGURES

Figure 0.1: Visualisation of the problem statement (own illustration) | Figuur 0.1: Visualisatie van de probleemstelling (eigen illustratie)

Figure 0.2: Conceptual model based upon theory (own illustration) | Figuur 0.2: Conceptueel model gebaseerd op theorie (eigen illustratie)

Figure 0.3: Visualisation of the research design (own illustration) | Figuur 0.3: Visualisatie van de onderzoeksopzet (eigen illustratie)

Figure 0.4: Process steps in the initiation phase of a renovation process (own illustration) | Figuur 0.4: Processtappen in de initiatief fase van een renovatieproces (eigen illustratie)

Figure 0.5: Scheme of a traditional renovation assignment (own illustration) | Figuur 0.5: Schema van het traditionele proces (eigen illustratie)

Figure 0.6: Scheme of a renewed renovation assignment (own illustration) | Figuur 0.6: Schema van het vernieuwde proces (eigen illustratie)

Figure 0.7: Stakeholder map with involved actors in the renovation process and their interrelations (own illustration) | Figuur 0.7: Stakeholdermap met de betrokken actoren in het renovatieproces en de relaties tussen deze actoren (eigen illustratie)

Figure 0.8: Process steps with accompanying bottlenecks (own illustration) | Figuur 0.8: Processtappen met de bijbehorende knelpunten (eigen illustratie)

Figure 0.9: Categories of data sets and their availability (own illustration) | Figuur 0.9: Data set categorieën en hun beschikbaarheid (eigen illustratie)

Figure 0.10: Framework of possible implementation of open data to reduce bottlenecks in the renovation process (own illustration) | Figuur 0.10: Framework voor de mogelijke implementatie van open data om de knelpunten in het renovatieproces te verkleinen (eigen illustratie)

Figure 1.1: Example of gallery flat typology, flat is part of case II (KUUB, 2015)
Figure 1.2: Example of apartment block typology (Huislijn.nl, 2015)
Figure 1.3: Example of terraced house typology (QuaWonen, 2013)
Figure 1.4: The construction of a serial built gallery flat during the rebuilt period in the '60 and '70 (ERA Contour, 2009)
Figure 1.5: Visualisation of the problem statement (own illustration)
Figure 1.6: Visualisation of the research design (own illustration)
Figure 1.7: Timeline of research (own illustration)
Figure 2.1: Visualisation of provocations of research subjects (own illustration)
Figure 2.2: Development housing expenses. Expected rise of rent compared to the estimated gas price increase (Verbeme, 2011)
Figure 2.3: Energy prices in the last years and prospect for the coming years (ECN, 2015)
Figure 2.4: Process steps in the initiation phase of a renovation process according to theory (own illustration)
Figure 2.5: Decision-making process model by Simon (Zavadskas et al., 2008)
Figure 2.6: Scheme of a traditional renovation assignment (own illustration)
Figure 2.7: Scheme of a renewed renovation assignment (own illustration)
Figure 2.8: Stakeholder map with involved actors in the renovation process and their interrelations (own illustration)
Figure 2.9: Process steps with accompanying bottlenecks identified in theory (own illustration)
Figure 2.10: Concentric shell model for re-use (Backx, 2003)
Figure 2.11: Top20 Geographic information open data sets in the Netherlands in 2014 (Van Loenen & Donker, 2014)
Figure 2.12: Conceptual model based upon theory (own illustration)
Figure 3.1: Relation of interviews to the research project (own illustration)
Figure 3.2: Process model of stakeholders and the interviewees of this research (own illustration)
Figure 3.3: Process steps with accompanying bottlenecks identified in expert interviews (own illustration)
Figure 4.1: Location of cases within the Netherlands (own illustration)
Figure 4.2: Properties of housing association Portaal within the neighbourhood Smitsveen and their status (Portaal, 2013)
Figure 4.3: Picture of one of the gallery flats before the renovation (Portaal, 2013)
Figure 4.4: Picture of first gallery flat after the renovation, picture was made on 9 October 2015 (ERA Contour, 2015)
Figure 4.5: Picture during realisation second gallery flat, picture was made on 5 November 2015 (own picture)
Figure 4.6: Process phase and accompanying timeframes in the renovation project Smitsweg in Soest (own illustration)
Figure 4.7: Stakeholder map of the stakeholders involved in the renovation project in Smitsveen, Soest (own illustration)
Figure 4.8 Process steps with accompanying bottlenecks identified in case I (own illustration)
Figure 4.9: Location of the building blocks within the renovation project in Bilgaard, Leeuwarden (own illustration)
Figure 4.10: Renders of one of the gallery flats after the renovation project (Wijkbedrijf Bilgaard, 2015)
Figure 4.11: Process phase and accompanying timeframes in the renovation project Bilgaard in Leeuwarden (own illustration)
Figure 4.12: Stakeholder map of the stakeholders involved in the renovation project in Bilgaard, Leeuwarden (own illustration)
Figure 4.13 Process steps with accompanying bottlenecks identified in case II (own illustration)
Figure 5.1: Matrix of bottlenecks and their sources (own illustration)
Figure 5.2: Categories of data sets and their availability (own illustration)
Figure 5.3: Framework of possible implementation of open data to reduce bottlenecks in the renovation process (own illustration)
Figure 6.1: Process steps in the initiation phase of a renovation process (own illustration)

Figure 6.2: Stakeholder map with involved actors in the renovation process and their interrelations (own illustration)

Figure 6.3: Identified bottlenecks projected on the process model (own illustration)

Figure 6.4: Categories of data sets and their availability (own illustration)

Figure 6.5: Concentric shell model for re-use (Backx, 2003)

Figure II.1: Code families and their interrelationship in inductive coding analysis (own illustration)

**TABLES**

Table 0.1: Reader’s guide (own work)

Table 1.1: Matrix of research questions and accompanying paragraphs in which they are address (own work)

Table 5.1: Typologies of data sets that could aid to diminish the bottlenecks (own work)

Table 5.2: Keywords and amount of hits of open data sources in the open data portal data.overheid.nl (own work)

Table IV.1: Question category per interviewee (own work)
Appendix I – Overview of events which led to climate policies for the existing building sector in the Netherlands
Appendix II – Codes
Appendix III – Bottlenecks
Appendix IV – Interview protocol
Appendix V – Summaries interviews
Appendix VI – Matrix of bottlenecks and sources
Appendix VII – Available data sets analysis
Tabel 2.3 Overzicht van belangrijke gebeurtenissen voor de ontwikkeling en uitvoering van klimaatbeleid gericht op de bestaande woningvoorraad in Nederland

1968 Beleidsontwerp van Luchtvervuilingwet; voor de eerste keer wordt aandacht geschonken aan de concentraties van CO₂ in de lucht.


1973 Eerste Oliecrisis.

1974 Eerste Energinota (Ministerie van Economische Zaken). In deze nota bestaat veel aandacht voor het behoud van de natuurlijke aardgasreserves.

1978 Formeel van start gaan Nationaal isolatieprogramma (NIP).

1979 Tweede Oliecrisis; door de crisis wordt energiebesparing een expliciete beleidsdoelstelling.


1986 Scherpe daling van de olie- en daarmee gasprijs; dit ondermijnt de vraag naar energiebesparende maatregelen.

1987 Voorbije beëindiging van NIP; 72% van beleidsdoelstelling gerealiseerd.

1988 Publikatie van het rapport ‘Our Common Future’ van de Brundtland-commissie; in de rapportage wordt een wereldwijde aandacht gevraagd voor het klimaatprobleem veroorzaakt door de uitstoot van broeikasgassen.

1989 Van start gaan van het programma’s ‘E-novatie’ (bestaande woningen) en ‘Energie Effectief’ (voortlichtingscampagne).

1990 Publicatie van NMP+, een uitbreiding van de NMP, waarin speciale aandacht wordt gegeven aan het thema ‘duurzaam bouwen’.


1993 NMP-3 (Ministerie van VROM); de ontkoppeling van economische groei en broeikasgasuitstoot wordt opgenomen in rationeel beleid.


1996 Introduktie van energieprestatie-indicator voor bestaande woningen (E.I.). In tegenstelling tot EPC betreft het geen wettelijke norm. De indicatie van de indicator is in ‘zichzelf gelijk’ communicatie instrument (eerst op adviesbasis en later als certificaat) te introduceren met als doelstelling een loofvrij tijd te worden omgeset in normering.

1996 Introduktie van regulierende energiebelasting (RED) gericht op energieverbruiksgedrag van de doelgroep bewoners.

1996 Ondertekening van het convenant Duurzaam Bouwen door de rijksoverheid en de branchevereniging van woningscorporaties, Aedes.
1997 Ontwerp Kyoto-protocol: wereldwijde aandacht voor het klimaatprobleem.

Ontwikkeling van een indicator voor energieprestatie van klokken (ENE) in Nederland.

1998 Zestien EU-lidstaten, waaronder Nederland, ondertekenen het Kyoto-protocol en committeren zich aan CO₂-emissiereductie van 8% over de periode 1990-2010. Voor Nederland is de doelstelling 6%.

Uitvoeringsnota klimaatbeleid (Ministerie van VROM); vertaling van Kyoto-doelstellingen naar landelijk beleid, ondersteund door maatstaven voor de gebouwde omgeving.

Energiebesparingsnota (Ministerie van Economische Zaken). Het berekenen van energiebesparing in de gebouwde omgeving wordt in navolging van de Uitvoeringsnota klimaatbeleid als belangrijke doelstelling gezien. De nota benadrukt de inzet van manierconforme beleidsinstrumenten.

2000 Introductie energiepremie-regeling (EPR; subsidiesregeling) en energiepremieactiviteiten (EPA).

2001 NMP-4 (Ministerie van VROM); de strategische visie van het milieubeleid wordt gekoppeld aan transmissie/management. De problematiek van klimaatverandering krijgt een belangrijk deel van de toekomstig milieubeleid.

Ministerie van VROM verantwoordelijk gemaakt voor de uitvoering van klimaatbeleid gebouwde omgeving.

Van start gaan met ‘Kompas, energiebeleven wonen en werken’, programma van communicatieve beleidsinstrumenten.

2002 Eerste Evaluatienota nationaal klimaatbeleid.

2004 Bijstand van emissieloos broeikasgas; dit leidt aanpassingen in beleidsmaatregelpakket: voortvloeiende bekendmaking energiepremie-regeling.

Introductie BAND-energiecomponent, stimulans voor gemeenten om locaal klimaatbeleid uit te voeren, met een belangrijke taakstelling in de woningbouw.

2006 Beoogde introductie ‘energielement’ uitgesteld door Minister van VROM.

Van start gaan transmissieplatform ‘PuGo’; maatschappelijk samenwerkingsplatform op initiatief van het programma ‘Energistrategie’ (Ministerie van Economische Zaken). Planontwikkeling programma ‘Moer met minder’ gaat van start.

Wereldwijde aandacht voor klimaatproblematiek door vertoning van de film ‘An inconvenient trust’ van de Amerikaanse ex-presidentskandidaat Al Gore.

2007 Aantreking kabinet Balkenende IV, met separate Minister voor milieuzaken. Nota ‘Schoon en Zing’ (Ministerie van VROM); 30% energiebesparing en 20% duurzame energie in gebouwde omgeving te bereiken in 2020.

2008 Verifieerde invloed energiecertificaat voor woningen (‘energielement’).

Ondertekening Conventant energiebesparing bestaande gebouwen. Vertaling van ‘Moer met minder’-doelstellingen naar de beleidsagenda. De branchevereniging van de woningcorporaties, Aedes, is geven ondertekenaar en formuleert een eigen (minder ambitieuze) doelstelling die wordt opgenomen in een eigen strategische nota voor de eigen sector, het ‘Antwoord aan de samenleving’.


2012 Eind van de eerste Kyoto-evaluatieperiode (1990-2010); landelijke doelstellingen broeikasgasuitstoot moeten zijn gerealiseerd.

APPENDIX II - CODES

Boundary conditions:
1. Financing
2. Laws & Regulations

Renovation process:
1. Traditional approach
2. Renewed approach

Scale level:
1. Building part
2. Dwelling
3. Building
4. Block
5. Neighbourhood
6. City
7. National

Stakeholders:
1. Advisor
2. Architect
3. Consortium of multiple market parties
4. Constructor
5. Energy company
6. Entrepreneurs in the neighbourhood
7. Health insurance company
8. Housing association
9. Municipality
10. National government
11. Neighbourhood association
12. Net companies
13. Residents owners-occupiers
14. Residents rental

Bottlenecks:
1. Communication between the housing association and residents
2. Incorrectly substantiated assumptions by residents
3. Use of energetic sustainable dwelling
4. It is not allowed for the consortium to speak to the residents at the early stages of the project
5. Strategic decisions of housing associations are not focussed upon energetic sustainability
6. Lack of knowledge about residents
7. 70% participation of residents needed for renovation
8. Lack of interest in energy saving measures
9. Changing stakeholder roles needed
10. Lack of funding
11. Awareness of energy saving measures among professionals
12. Lack of trust new parties in the neighbourhood
13. New process asks for solving liveability problems by market parties
14. Laws & regulations backlog the renovation process
15. Split incentive housing association vs residents
16. Collaboration between stakeholders
17. A transition in the process is needed
18. Process takes too much time
19. End-users are too little involved in the renovation project decision-making
20. Technical difficulties
21. Competition between market parties
22. Net metering
## APPENDIX III – BOTTLENECKS

<table>
<thead>
<tr>
<th>Category</th>
<th>Keyword</th>
<th>Bottleneck</th>
<th>Process phase</th>
<th>Related stakeholders</th>
<th>Data related?</th>
<th>Indirectly related to data?</th>
<th>How to possibly solve by means of open data?</th>
<th>Data category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder collaborations</td>
<td>Communication</td>
<td>Communication between housing association and residents</td>
<td>Before the initiation starts, during whole process</td>
<td>Housing associations / residents</td>
<td>Yes</td>
<td>-</td>
<td>Better information supply towards residents from the housing association up front. If more precise information on the residents is known it might be easier to write the residents in a certain way that suits this specific group of households.</td>
<td>Data about residents</td>
</tr>
<tr>
<td>Context</td>
<td>Transition</td>
<td>A transition in the process is needed</td>
<td>Whole process</td>
<td>Government / housing association / consortium / suppliers</td>
<td>No</td>
<td>No</td>
<td>Environment related. To change a process steps need to be made within a company and within the sector.</td>
<td>-</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>Changing roles</td>
<td>Changing stakeholder roles needed</td>
<td>Whole process</td>
<td>Housing association / consortium</td>
<td>No</td>
<td>Yes</td>
<td>Related to process changes. However, since the stakeholder roles are changing certain information should be with different stakeholders than in the traditional process. Open data might be a source of the right information for this.</td>
<td>Data about residents, data about the neighbourhood, data about climate, data about energy use</td>
</tr>
<tr>
<td>Context</td>
<td>Regulations</td>
<td>Laws &amp; regulations backlog the renovation process</td>
<td>Whole process</td>
<td>Government / housing association / consortium</td>
<td>No</td>
<td>No</td>
<td>Laws &amp; regulations related. Institutional context of a project.</td>
<td>-</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>Collaboration</td>
<td>Collaboration between stakeholders</td>
<td>Whole process</td>
<td>Government / housing association / consortium / residents</td>
<td>No</td>
<td>No</td>
<td>A lack of trust between stakeholders can backlog the decision-making process.</td>
<td>-</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>Time</td>
<td>Process takes too much time</td>
<td>Whole process</td>
<td>Government / housing association / consortium / residents</td>
<td>No</td>
<td>No</td>
<td>Environment related. This causes discontent and distrust with residents.</td>
<td>-</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Decision-making</td>
<td>Strategic decisions of housing associations are not focussed upon energetic sustainability</td>
<td>Creating Program of Requirements</td>
<td>Housing association</td>
<td>Yes</td>
<td>-</td>
<td>When more data on energy use would be used in the decision-making process at housing associations, better grounded decisions could be made.</td>
<td>Data about energy use, data on energy saving measures</td>
</tr>
<tr>
<td>Category</td>
<td>Keyword</td>
<td>Bottleneck</td>
<td>Process phase</td>
<td>Related stakeholders</td>
<td>Data related?</td>
<td>Indirectly related to data?</td>
<td>How to possibly solve by means of open data?</td>
<td>Data category</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>----------------------------------------</td>
<td>--------------</td>
<td>----------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Funding</td>
<td>Funding</td>
<td>Lack of funding</td>
<td>HA: creating Program of Requirements R: 70% participation process</td>
<td>Housing association / resident</td>
<td>No</td>
<td>Yes</td>
<td>Money related. However, an overview of all subsidies available might give valuable information. Furthermore, if the financial benefits are more clearly to residents they might obey faster.</td>
<td>Data about residents, data about energy use, data on energy saving measures, data on subsidies</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Knowledge</td>
<td>Lack of knowledge about residents</td>
<td>Selection / tender process</td>
<td>Housing association / consortium</td>
<td>Yes</td>
<td>-</td>
<td>Look for more data which could give a clear visualisation of what is the specific residents group.</td>
<td>Data about residents</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>Speak to</td>
<td>It is not allowed for the consortium to speak to the residents at the early stages of the project</td>
<td>Selection / tender process</td>
<td>Consortium / residents</td>
<td>Yes</td>
<td>-</td>
<td>Without being able to speak to the residents specific information about them could be missing. This could be avoided with more information from data about these residents.</td>
<td>Data about residents, data about the neighbourhood</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Awareness</td>
<td>Awareness of energy saving measures among professionals</td>
<td>Selection / tender process</td>
<td>Housing association / consortium</td>
<td>No</td>
<td>Yes</td>
<td>If the situation within a company like a housing association is not supportive enough, it might be hard to implement a new type of process. By means of more information employees can be made aware of the need for energy saving measures.</td>
<td>Data about climate, data about energy use, data on energy saving measures</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Techniques</td>
<td>Technical difficulties</td>
<td>Selection / tender process</td>
<td>Consortium / suppliers</td>
<td>No</td>
<td>No</td>
<td>Research &amp; development related. Development of renovation concepts by constructors, R&amp;D projects by technical companies etc.</td>
<td>-</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>Competition</td>
<td>Competition between market parties</td>
<td>Selection / tender process</td>
<td>Multiple consortia</td>
<td>No</td>
<td>No</td>
<td>Process related.</td>
<td>-</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>Liveability problem-solving</td>
<td>New process asks for solving liveability problems by market parties</td>
<td>Elaboration phase</td>
<td>Consortium</td>
<td>No</td>
<td>Yes</td>
<td>The bottleneck has to do with changing stakeholder roles and trust of residents. However, if market parties would have more information about these problems it might be easier to solve them, since they do not have the long history in the process.</td>
<td>Data about residents, Data about the neighbourhoods, data about energy use</td>
</tr>
<tr>
<td>Category</td>
<td>Keyword</td>
<td>Bottleneck</td>
<td>Process phase</td>
<td>Related stakeholders</td>
<td>Data related?</td>
<td>Indirectly related to data?</td>
<td>How to possibly solve by means of open data?</td>
<td>Data category</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------------------------------</td>
<td>---------------</td>
<td>----------------------------</td>
<td>---------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>End-user involvement</td>
<td>End-users are too little involved in the renovation project decision-making</td>
<td>Elaboration phase</td>
<td>Housing associations / consortium / residents</td>
<td>No</td>
<td>No</td>
<td>Process related.</td>
<td>-</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>70%</td>
<td>70% participation of residents needed for renovation</td>
<td>70% participation process</td>
<td>Housing association / consortium / residents</td>
<td>No</td>
<td>Yes</td>
<td>Directly related to the decision-making of residents. Indirectly it might be influenced if more is known about the residents. A better plan could be made and the residents could be persuaded to participate. With more information supply towards the residents they will know more about the needs of the renovation and will go along easier.</td>
<td>Data about residents</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Assumptions</td>
<td>Incorrectly substantiated assumptions by residents</td>
<td>70% participation process</td>
<td>Residents</td>
<td>Yes</td>
<td>-</td>
<td>More information supply towards residents could make them understand the necessity of the renovation better. If more is known about the exact residents, specific communication strategies can be made.</td>
<td>Data about residents, data about climate, data on energy saving measures</td>
</tr>
<tr>
<td>Stakeholder collaborations</td>
<td>Trust</td>
<td>Lack of trust in new parties in the neighbourhood</td>
<td>70% participation process</td>
<td>Consortium / residents</td>
<td>No</td>
<td>Yes</td>
<td>Related to the decision-making of residents. However, with better information supply towards residents it might be possible that the trust level would rise.</td>
<td>Data about residents, data about the neighbourhood, data on companies</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Interests</td>
<td>Lack of interest in energy saving measures</td>
<td>70% participation process</td>
<td>Residents</td>
<td>No</td>
<td>Yes</td>
<td>Directly related to the decision-making of residents. Thus not directly data related, however with an estimation of types of residents better strategies could be made to persuade them to cooperate. Furthermore, more information supply towards residents could make them more interested.</td>
<td>Data about residents, data about climate, data on energy use, data on energy saving measures</td>
</tr>
<tr>
<td>Category</td>
<td>Keyword</td>
<td>Bottleneck</td>
<td>Process phase</td>
<td>Related stakeholders</td>
<td>Data related?</td>
<td>Indirectly related to data?</td>
<td>How to possibly solve by means of open data?</td>
<td>Data category</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------</td>
<td>----------------------------------------------------</td>
<td>---------------</td>
<td>----------------------------</td>
<td>---------------</td>
<td>-----------------------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Use</td>
<td>Use of energetic sustainable dwelling</td>
<td>Use phase</td>
<td>Housing association / residents</td>
<td>Yes</td>
<td>-</td>
<td>Proper information supply on how to use the dwelling after the renovation project is needed.</td>
<td>Data about energy use, data on energy saving measures</td>
</tr>
<tr>
<td>Funding</td>
<td>Split incentive</td>
<td>Split incentive housing association vs residents</td>
<td>Use phase</td>
<td>Housing association / residents</td>
<td>No</td>
<td>No</td>
<td>Laws &amp; Regulations related. Institutional context of a project. This law will most likely be adjusted at the start of 2016.</td>
<td>-</td>
</tr>
<tr>
<td>Context</td>
<td>Net metering</td>
<td>Net metering</td>
<td>Use phase</td>
<td>Government / housing association / residents</td>
<td>No</td>
<td>No</td>
<td>Laws &amp; regulations related.</td>
<td>-</td>
</tr>
</tbody>
</table>
APPENDIX IV – INTERVIEW PROTOCOL

Case selection

In the empirical phase of this research are interviews conducted with multiple different interviewees. Five categories of interviewees were selected, being:

- Experts on the field of sustainable housing transformation
- Experts that are stakeholders in the renovation process
- Experts on open data
- Stakeholders in case I
- Stakeholders in case II

By means of these categories are all parts of the research addressed.

Interviewee selection

In this sector are the interviewees elaborated for each category. Furthermore, attention is paid to how much of the research field these interviewees cover.

Experts on the field of sustainable housing transformation

These interviews are held to analyse what the status quo on the field of sustainable housing transformation is and how experts on this subject observe the process and what bottlenecks they see in this process. Three interviews in this category are held:

- Anke van Hal, Professor of Sustainable Building & Development at Nyenrode Business University and Professor of Sustainable Housing Transformation at the faculty of Architecture of the Delft University of Technology.
- Eefje Stutvoet, researcher Sustainable Housing Transformation at the faculty of Architecture of the Delft University of Technology. She is also working on a PhD research into the transition process towards a sustainable housing stock in the Netherlands. She conducted this research at the Energiesprong program up till September 2014.
- Jan Willem van de Groep, program director at the Energiesprong.

By means of these interviews a complete overview on the perspective of academia and the perspective of practise regarding sustainable housing transformation is given. Since all of the interviewees have a link to the Energiesprong program this might have influenced the outcomes of the research in some way. However, since this program is the only large scale program that is focussing on energy reduction in the existing housing stock, this is inevitable.

Experts that are stakeholders in the renovation process

These interviews are held to analyse what the various stakeholders’ perspectives are in the process and which bottlenecks they encounter in the process.

- Richard Loman, project leader at the housing association Rochdale. It has been chosen to interview this specific housing association since they are not directly related to the Energiesprong program, compared to some of the other interviewees. Furthermore, Rochdale is a large housing association in Noord-Holland and working hard on the renovation of their housing stock.
- Rick Hetem, process manager renovation at ERA Contour, a developer/construction company.
- Saskia van der Weerd and Timo Stoopman, both concept coordinator existing buildings at ERA Contour. They mainly work on tender competitions for renovation projects.
- Menno Karsenbarg, consultant at Centrum voor Woononderzoek, a company that gauges residents’ satisfaction during the renovation process. This interviewee is representing the residents in the process.
- Harma Zijgers, an independent entrepreneur who does resident communication in renovation project commissioned by a constructor or housing association. This interview does also represent the residents in the process.
- Danny de Pater, program manager at Netbeheer Nederland, an overarching organisation for all energy companies in the Netherlands which has a focus on the transition towards sustainable energy supply. This interview does represent the new types of stakeholders in the process.
Since the qualitative set-up of this research it is not possible to generalize the outcomes regarding the stakeholders’ perspectives. More different companies per stakeholder category should be interviewed to make these findings generalizable. However, these interviews do give insights into the perceptions of certain stakeholder types. Secondly, there have not been interviews with residents that had to deal with renovation projects, instead it is chosen to interview two professionals that represent these residents in the process. An interview with a resident will most likely generate useless data. The focus of this research is on the initiation phase and since the residents are only involved at the end of this stage their perception will not give a correct view on the process.

Experts on open data

These interviews were held with multiple experts on the field of open data to generate insight into the status quo regarding open data and the possibilities of re-use. The interviews were held with:

- Paul Suijkerbuijk, open data expert at Leer- en Expertisepunt Open Overheid. They encourage and support governmental parties to open up their data for public re-use.
- Bastiaan van Loenen, senior researcher at the Kenniscentrum Open Data of the research institute OTB.
- Peeter Windt, a market analyst who makes use of data sets to give advice on residents in building projects.

By means of these three interviews the perspective of the government as well as the perspectives of the academic world and practice are presented.

Stakeholders in case I

- Marien Vermerris and Peter van der Wal, employees of ERA Contour, one of the parties in the consortium
- Rob van de Werken, project leader at the housing association Portaal

Stakeholders in case II

- Irma van Herwaarden, process coach
- Jan Kruijer, director at housing association WoonFriesland
- Tijmen Hordijk, project leader at KAW Architects, one of the parties in the consortium

Interview questions

In the following section are all interview questions that have been asked to the interviewees presented. Table IV.1 gives an overview on which interviewee has been asked which question category. Not all exact questions have been asked to each interviewee. For each interview an interview guide has been made with a selection of the questions for that specific interviewee. The interviews have been set-up in a semi-structured manner, which entails that other questions that were not in the interview guide could also have been asked during the conversation. Answers to these questions have been integrated into the interview summaries (appendix V).

The interviews have all been conducted with Dutch as the spoken language. A short introduction into each subject is given in English, the interview questions are written down in Dutch.

The interviews have all started with an introduction by the interviewer. This is followed by a question in which the interviewee could explain a bit more about its company and own role. The interviews have ended with an open question in which the interviewee was able to make some last remarks and suggestions for the rest of the research could be given.

After the interview was finished a summary has been made (appendix V). The summaries have been send to the interviewee and the possibility has been given to the interviewees to react upon this summary or change small things. No direct changes were made to the interviews after the response of the interviewees, however new valuable suggestions have been given which have been implemented in the research.
### Process

These questions are about the renovation process.

- Zou je me stapsgewijs kunnen vertellen hoe het proces bij jullie verloopt in de initiatief fase?
- Zien jullie een procesverandering over het algemeen?
- In hoeverre is de vraag vanuit de opdrachtgevers gericht op energiebesparing?
- Het proces van renoveren op grotere schaal, dus op wijkniveau, wordt vaak ingezet door woningcorporaties. Echter zien we ook dat deze corporaties steeds meer terug gaan naar hun kerntaken en zich puur op de woningen focussen. Ziet u mogelijkheden tot energietische verbeteringen op een grotere schaal?
- Ben je bekend met de werkwijze van de Energiesprong? Zo ja, in hoeverre werken jullie ook op die manier?
- In het initiatief van de Energiesprong, Slim & Snel, wordt een procesverbetering geïnitieerd. In hoeverre is dit proces verschillend van de traditionele aanpak die daarvoor plaatsvond?

### Table IV.1: Question category per interviewee (own work)

<table>
<thead>
<tr>
<th>EXPERTS ON SUSTAINABLE HOUSING TRANSFORMATION</th>
<th>PROCESS</th>
<th>STAKEHOLDERS</th>
<th>BOTTLENECKS</th>
<th>DATA USE</th>
<th>OPEN DATA</th>
<th>CASE I</th>
<th>CASE II</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAKEHOLDERS IN THE PROCESS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPERTS ON OPEN DATA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAKEHOLDERS CASE I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>STAKEHOLDERS CASE II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

- Er zijn behoorlijk wat initiatieven die proberen om het proces van woningrenovatie te innoveren, zoals die van de Energiesprong, in hoeverre zie je deze initiatieven succesvol worden in de praktijk?
- Wanneer initiatieven niet succesvol worden, wat zijn dat de hoofdzakelijke knelpunten die kunnen worden opgemerkt?
- Hoe is vanuit je rol als proces coach het verschil in het renovatieproces in de traditionele zin en de innovatieve zin te omschrijven?
- Heb je aan meer renovatieprojecten meegewerkt? Zo ja, welke en wat zijn daaruit de belangrijkste lessen geweest?
- Op de website van platform31 staat de volgende zin: Het vertrekpunt is dat er met name een verandering in het proces en de werkwijze in de bouw nodig is: andere uitvraag, beter aanbod, meer financiële mogelijkheden, aangepaste wet- en regelgeving, én een andere kijkwijze.

- Wat is de veranderende uitvraag die er nu kan worden opgemerkt?
- Is het aanbod inderdaad beter geworden?
- Zijn er nieuwe financiële mogelijkheden ontstaan?
- Welke wet- en regelgevingen zijn gewijzigd?
- Zien jullie een veranderende kijkwijze?
- Zijn ingrepen gericht op energiebesparing technisch gezien lastig?
**Stakeholders**

These questions entail the various stakeholder roles in the process.

- In hoeverre zijn de rollen van andere stakeholders veranderd?
- Zijn er veranderingen zichtbaar in de betrokken stakeholders bij processen? Zo ja, welke?
- In hoeverre zijn partijen bereid om een nieuwe aanpak toe te passen?
- Zijn er voor jullie bepaalde samenwerkingen met andere stakeholders interessant?
- Hoe denken woningcorporaties over het toepassen van energetische besparingen in renovatieprojecten?
- Hoe is de houding van energie en netbedrijven ten opzichte van de energietransitie?
- Hoe is de houding van energie en netbedrijven ten opzichte van renovatieprojecten?
- Hoe kunnen bewoners beter worden geïnformeerd over energiebesparing?
- Is er zicht op het gebruik van woningen na een nul-op-de-meter renovatie?
- Hoe staan bewoners tegenover energetische woningverbetering?
- In hoeverre denk je dat partijen, bijvoorbeeld bouwers, open staan voor aanpassingen in het proces?
- In hoeverre zijn woningcorporaties bereid om te renoveren gericht op energieverbruik?
- In hoeverre is de rol van de bouwer veranderd in de afgelopen jaren met het oog op renovatieprojecten?

**Bottlenecks**

These questions are about the identification of bottlenecks in the process.

- Wat zijn in uw ogen de grootste knelpunten in het bereiken van meer energetische duurzaamheid?
- Wat zijn in jouw optiek de grootste knelpunten die er in het proces aanwezig zijn?
- Kan je aan de hand van voorbeelden een aantal knelpunten benoemen die je in projecten bent tegengekomen?
- Zijn er bepaalde knelpunten die jullie vaker in renovatieprojecten terug zien komen?
- In hoeverre kom je knelpunten tegen die te maken hebben met informatievoorziening? En zo ja, welke knelpunten zijn dit?

**Data use**

These questions are about the level of data use in the process.

- Kun je mij vertellen welke informatiebronnen er normaliter worden gebruikt in een proces?
- Waar ziet u mogelijkheden om door middel van meer informatie in het proces een beter proces te kunnen hebben?
- Zijn er knelpunten die gerelateerd zijn aan informatievoorziening en datagebruik of juist het te kort hiervan?
- Zoals ik al eerder gezegd had ik kijk ik naar de mogelijkheid om open data te gebruiken in het proces. Wat vind je hiervan en denk je dat het een mogelijkheid is?

**Open data**

These questions are about the availability and re-use of open data.

- Wat is de motivatie achter het openbaar maken van de data van onze overheid?
- Wat voor data is er beschikbaar over de gebouwde omgeving?
- Hoe ver is data over woningen en bewoners openbaar in Nederland?
- Wat zijn toepassingen van de datasets die u succesvol vindt?
- Hoe denkt u dat datasets kunnen worden gebruikt in de bouwsector?
Wat zijn issues die er nu spelen omtrent open data?
Hoe ver zijn jullie in het proces met het vinden van zo veel mogelijk datasets?
Hoe ver is data over woningen en bewoners openbaar in Nederland?
Wat voor type data sets zijn nog niet openbaar beschikbaar die u graag openbaar beschikbaar zou zien om uw advies te optimaliseren?

Case I
These questions are all about the first case study.

Kunt u mij eerst een algemene introductie geven over de aanleiding van het project? Wie heeft het geïnitieerd? Welke stakeholders zijn er vanaf het begin bij betrokken geweest en welke stakeholders zijn pas later in het proces erbij gekomen?
Wat is jullie rol binnen het project?
Wat is de rol van de overige stakeholders binnen het project?
Zou je stap voor stap kunnen vertellen hoe het proces eruit heeft gezien?
Wat waren de grootste knelpunten in het proces?
Hoe was de houding van de verschillende stakeholders ten opzichte van proces veranderingen?
In de wijk staan ook een aantal koopwoningen. Waren de eigenaren van deze woningen vroeg betrokken bij het project? Zo ja, hoe was hun houding tegenover de wijkvernieuwing?
Hoe heeft het proces er stap voor stap uitgezien?
Wat waren de grootste knelpunten in het proces?
Hoe zou naar uw mening het proces eruit kunnen hebben verlopen?
Welke informatiebronnen zijn gebruikt tijdens de initiatief fase?
Uit de informatie op de website blijkt dat energie een belangrijk thema is in de herontwikkeling. Hoe is de focus hierop geweest?
Wat was de mening van de verschillende stakeholders ten opzichte van energetische verbeteringen?
In welke fase van het proces zijn de bewoners bij de renovatie betrokken?
Zou je stap voor stap kunnen vertellen hoe het proces eruit heeft gezien?
Hoe was de houding van de verschillende stakeholders ten opzichte van proces veranderingen?
Hoe verloopt voor jullie de samenwerking met andere partijen?
Hoe staan bewoners tegenover energetische woningverbetering?

Case II
These questions are all about the second case study.

Kunt u mij eerst een algemene introductie geven over de aanleiding van het project? Wie heeft het geïnitieerd? Welke stakeholders zijn er vanaf het begin bij betrokken geweest en welke stakeholders zijn pas later in het proces erbij gekomen?
Wat is jullie rol binnen het project?
Wat is de rol van de overige stakeholders binnen het project?
Hoe was de houding van de verschillende stakeholders ten opzichte van proces veranderingen?
In de wijk staan ook een aantal koopwoningen. Waren de eigenaren van deze woningen vroeg betrokken bij het project? Zo ja, hoe was hun houding tegenover de wijkvernieuwing?
Hoe heeft het proces er stap voor stap uitgezien?
Wat waren de grootste knelpunten in het proces?
Hoe zou naar uw mening het proces eruit kunnen hebben verlopen?
Welke informatiebronnen zijn gebruikt tijdens de initiatief fase?
Uit de informatie op de website blijkt dat energie een belangrijk thema is in de herontwikkeling. Hoe is de focus hierop geweest?
Wat was de mening van de verschillende stakeholders ten opzichte van energetische verbeteringen?
In welke fase van het proces zijn de bewoners bij de renovatie betrokken?
Zou je stap voor stap kunnen vertellen hoe het proces eruit heeft gezien?
Hoe was de houding van de verschillende stakeholders ten opzichte van proces veranderingen?
Hoe verloopt voor jullie de samenwerking met andere partijen?
Hoe staan bewoners tegenover energetische woningverbetering?
APPENDIX V – SUMMARIES INTERVIEWS

Interviews experts sustainable housing transformation

This paragraph includes interviews with Anke van Hal, Eefje Stutvoet and Jan Willem van de Groep.

Van Hal, interview, 22 September 2015

According to van Hal is the process of sustainable housing transformation changing from demand driven towards supply driven. The projects should not be tailor made anymore but change into the way car factories work. Since a large part of the housing stock is developed in a serial way, the renovation of these dwellings could be serial as well. This results in a supply of measures that could be applied to the dwellings. The traditional process could be identified as housing associations giving the market a detailed description of their requirements and asking for the lowest price to execute these plans. In the renewed process which is occurring nowadays the process is changing. The housing association gives a minimal list of wishes to the market parties and asks them to come up with a solution that still fits within the given budget. This causes a shift in the design and development of the projects from the housing associations towards market parties. Market parties are reacting on this by offering multiple concepts which could be applied to the renovation of these dwellings.

A bottleneck in the process could still be technical difficulties, however many companies are developing new technologies for the renovation of dwellings. This bottleneck is not directly data related yet more research and development related.

Another bottleneck that van Hal notices in renovation projects is the lack of knowledge about residents. In many projects there is not much known about the residents that do live in the dwellings. If more knowledge was available up front, certain design decision can be made more substantiated. Most barriers in the renovation process are now approached in a rather technical manner. However, many of the residents do not have knowledge or interests regarding the subject of energetic sustainability. If the parties would know more about the residents up front they could include the measures that are technically important into a design which includes more tailor made ideas for the residents as well.

Related to the knowledge about the residents is the communication between the housing association and residents. Due to the economic crisis and changing regulations many projects were delayed, which caused miscommunications regarding expectations of residents. This has created a lack of trust amongst residents. This is a bottleneck that has to be overcome by market parties when the renovation project does start.

Before a renovation project, or any other project that has a major impact on the dwelling or rent levels, can start, 70% of the residents should agree upon the set plans. To gain this participation, the trust of the residents towards the housing associations and the executing market parties should be increased. However, as mentioned before this trust level is most of the times quite low. Gaining this 70% is a bottleneck in many projects and takes up a lot of time.

Besides these resident related bottlenecks which were identified in the interview with van Hal, some regulations bounded bottlenecks were identified as well. Being the process of net metering and other laws and regulations that backlog the process. However, these are more boundaries conditions and out of the scope of this research.

It might be assumed that renovation projects are focussing on the dwelling scale level. However, according to van Hal in many cases the scale is larger and on block or neighbourhood level as well. Local entrepreneurs could be included in the project or large scale solar panel projects which could supply other home owners in the neighbourhood as well.

Stutvoet, interview, 23 September 2015

Stutvoet is researching the process of transition needed for the renovation of dwellings. In this research the cases of the program Slim&Snel of the Energiesprong were analysed. According to the Energiesprong, to make the renovation process better new forms of collaboration needed to be found. This asks for more innovation in the building sector. According the program the best way to achieve this innovation is by asking market parties to actively collaborate in the process. Market parties are asked to think along and work together in an early stage of the project (Slim&Snel, 2015a).

In the new approach towards renovation projects, as Stutvoet noticed, is process innovation hard. The roles of the stakeholders need to change and new ways of dealing with information and asking questions need to be found. In this new approach the housing association, the client, gives a set of wishes to the market parties together with a budget. The market parties are then asked to come up with a plan of approach on how to fulfil these wishes and even more within this budget. Since the
market parties are in the lead of the design they need to learn to ask new kind of questions and not ask the housing association what they want. In the projects monitored by Stutvoet this proved to be complicated for most of the consortia in the running for the tender. Another bottleneck in these processes was the collaboration between the various consortia. It was intended that they would share their ideas and plans to all have a better end result and help each other in the initiation process. However, it turned out to be hard for these parties to be completely open and transparent towards each other. They still felt the competition since only one of them would be granted with the project.

Another new step in this process was that the selection criteria were not created up front. These were created along the way in collaboration with all the consortia and the housing association. On the one hand this created an environment in which the creativity of the consortia is not slowed done by the selection criteria. However, on the other hand this made it complicated to choose for innovative and new designs and techniques, since not all parties would chose the same applications and this creates difficulties with the rating.

To make a process innovation possible it is often mentioned that there are pioneers needed. This happens in renovation projects as well. The parties that are currently working in these new processes are enthusiastic up front, however not all employees might share the same innovative mind-set. This creates problems and wrong assumptions within the companies. As Stutvoet mentioned it is still really dependent on individuals to make a difference in the process.

Since the process is changing the type of work of the market parties is changing as well. In the past this was based on exact wishes of the housing association and the constructors only had to execute these renovation works. In the new process this is changing towards projects on more levels, in many projects solving liveability problems is part of the assignment as well. Which is new for the market parties and the best approach still needs to be found.

Housing associations have difficulties with this new way of working as well. They still have struggles to relinquish the project towards the market parties. Furthermore, all employees and layers of the organisation should be on board. Which is hard for some employees, mainly on the operational level, since they are losing some of their tasks. This might even lead to them being superfluous to the organisation and the fear of losing their jobs.

Another issue for the housing association has to do with the financial means for the renovation project. The housing association has to pay a lot of money to make these properties less energy consuming. However, the direct benefits of these measures are with the residents. This split incentive causes problems in financing the projects by the housing associations. However, a new law is being prepared in which the housing association will be able to ask an extra amount of money from the tenant for the energy saving measures.

The process is changing for other stakeholders as well. According to Stutvoet the municipalities are withdrawing in most of the projects. They leave it to the housing association and the market parties. This happens because of the reorganisation of the municipalities in the Netherlands and in which they have less capacity to work on certain projects. However, they are cooperative and are trying to not backlog the process as good as possible.

A stakeholder that can be identified as new in these types of projects are the energy companies. Their business model will change when dwellings use less energy and even generate energy. Furthermore, net companies might join the project to include maintenance on their cables at the same time as the renovation project occurs.

Certain laws and regulation backlog the process of renovation as well. First of all, the Verhuurdersheffing. This caused housing association to be less affluent. Furthermore, European regulation and nation al regulations caused a larger focus on the core business of the housing associations, which backlogs them in creativity and innovation. If we zoom in to renovation projects, net metering can be seen as an issue. However, the laws and regulations regarding this subject are about the change.

Van de Groep, interview, 13 October 2015

Van de Groep is program manager at the Energiesprong. The Energiesprong is working on creating conditions which will support large developments in the field of making the built environment more sustainable. The sustainability focus within this program is mainly on energy.

One of the changes the Energiesprong wants to make is to shift from a demand driven market towards a supply driven market. Housing associations should look more into the concepts that are already available with constructors instead of asking for a tailor made solution. This creates a faster, cheaper and better process and gives the possibility to further develop the concepts. According to van de Groep are more and more concepts being offered by constructors regarding renovation. However, the mind-set shift within housing associations to make the process transition
possible is still lacking behind. Furthermore, constructors should be more pro-active in bringing their concepts to the market.

To make renovation more financially profitable, the Energiesprong focused on lowering the costs of these measures. With the re-use and redevelopment of the concepts provided by the constructors it will be less expensive to renovate. Furthermore, the Energieprestatievergoeding (EPV) will make it easier for the housing association to gain income. According to Van de Groep it is expected that this law will be effective as of January 2016.

A thing that makes the process innovation hard is the structure of housing associations which has been developed over the years. A mindset shift within these companies is necessary to make the process change successful. Due to the structure and changing roles within the company and in the process it has occurred that at the beginning of the project the housing association was very enthusiastic about a new approach, yet during the process it turned out the be hard to execute and arrange within the company and the process failed.

Another issue regarding housing associations is that they could be more strategical in their portfolio management. There is, in many cases, not a long term vision and project occur just because someone has put it on the renovation agenda. However, upfront these decisions could be based upon more information and so strategic choices could be made. For example, first renovate a flat with the most collaborative inhabitants. Furthermore, if you know what solutions are available through concepts of market parties, it might be interesting to make certain decisions. For example, the renovation of terraced dwellings seems to be easier regarding the techniques that are available at this time. So it might be more interesting to execute these projects first before other project on which less concepts are available.

Residents are in most of the cases that Van de Groep has seen cooperative. However, in many projects the project has been in the initiation phase for a while. Which caused discontent with the residents. To start a renovation project 70% of the residents should agree with the measures. The communication from the housing association towards the residents on these types of projects could be improved.

Most renovation projects are mainly focusing on interventions in the dwellings and not yet on a large scale. According to Van de Groep new innovations are being developed to reduce energy use and increase energy generation on neighbourhood level. Smart grids, micro grids, sharing solar panels and neighbourhood batteries are possible implementations. However, the assignments by the housing associations are most of the times still focused on dwelling level.

The role of the tenant needs to change as well. In the ideal situation is according to Van de Groep the tenant process owner. Which means that the tenant is included in the process as much as possible. He knows the process and the project and if certain things change, for example the planning, he will be able to reflect this change and accept it easier.

A bottleneck in the process is that the residents are only involved when the consortium already has been granted with the project. The project starts then with ‘warme opnames’, meetings in which the constructor visits all households and checks the conditions of the dwelling. Furthermore, this is the first contact moment to speak to the residents and ask them about their wishes and needs. Due to this meetings the whole project might be starting over if these wishes and needs and the conditions of the dwellings do not comply with the information given up front by the housing association.

A bottleneck directly related to data use is that the information systems of housing associations are quite complicated. It is hard to gain the right information from it. Due to this is it hard to give the right information to the consortia to create proper concepts.

According to Van de Groep benefits can be achieved if more information was available about the specific residents in the neighbourhood up front. If the meetings with the residents are done in a more informed way it will be easier to address certain problems of residents. Information from for example liveability researches and CBS might offer solutions here.

Interviews stakeholders in the renovation process

In this paragraph the expert interviews with multiple parties from different perspectives in the renovation process are elaborated.

Loman, interview, 2 November 2015

Loman is project leader at the housing association Rochdale. He works on renewal and renovation assignments that the housing association has.

In the first years of this century housing associations dealt with a large scale housing assignment. This resulted mainly in demolition and new build. Furthermore, the liveability in some neighbourhoods was considered to be low. Which asked for assignments on that level. This resulted in a certain manner of working for
housing associations until 2010. As of that moment the crisis hit and the individual sale of properties was not successful anymore. This caused a change in business models. Furthermore, some scandals in the real estate sector led to new working methods. For Rochdale this resulted in more focus on existing properties and the renovation of these buildings. The government had influence on this transition as well. Due to regulations housing associations should focus on their core business and are not allowed to develop homes for sale, non-social rental dwellings and other properties anymore (DAEB vs non-DAEB). The mind-set shifted, demolishment and new build is no longer the solution for liveability problems anymore. Moreover, focussing on the existing building stock and the redevelopment and renovation of these properties is less risky compared to strategies that were applied in the past.

The housing association works with a five year investment agenda as Loman explained. Each year the department leaders together decide which projects should be added to this agenda. Based upon physical, financial and social analysis of a building or neighbourhood it is decided which projects should be put on the agenda. Feasibility studies are done and multiple solutions are analysed. Furthermore, the external factors like the market have influence on which development path is the best choice.

Recently the manner of tendering has changed. They are no longer sending out an exact assignment and asking for the lowest price. This has changed into a set of conditions combined in a program of requirements with the quest for the highest qualitative solution. This shift is caused by four trends. Firstly, this focus has shifted from budget towards results. The lowest offer is no longer the best solution, higher quality is more important since liveability problems have to be solved in a new manner. Secondly, large scale reorganisations within housing associations led to a lower amount of capacity within the companies. This has as a result that more work should be outsources to the market. Thirdly, it is caused by new forms of trust towards market parties. Forthly, with the economy at this moment it is financially profitable to buy now and not in a few months or years. Loman noticed that due to this last fact their way of tendering might change in the future again due to costs of materials. Currently, they prefer this manner of assigning market parties to their projects because it saves a lot of time to not go through all the tender process steps and not having to create a detailed program of requirements and accompanying specifications. Furthermore, it generates an added value in the projects since new ideas emerge from the market.

These four trends have led to a change in the content of the tender. Next to the physical adjustments to the neighbourhood, social interventions become part of the assignment. Which creates a new type of approach for market parties. They suddenly have to think more about the residents, about how to approach them and how to communicate to them. In the past these things were arranged by the housing association.

The process steps which can be identified in renovation projects at this housing association are:

1. Identification of a physical, social or financial problem
2. Project leader assigned to the project
3. Study into the problem by project leader
4. Feasibility study of the redevelopment of the property by project leader. This also entails the possibility to make ambitions possible.
5. Decision made by board of directors on what type of redevelopment should be applied (demolishment, renovation, transformation, do nothing etc.)
6. Elaboration of conditions for the project
7. Pre-selection process with multiple market parties
8. Tender process with a few market parties
9. Granting of project to one market party
10. Preparation phase in which the project will be designed in detail and the residents will be included in the process

These process steps are consistent with the process steps identified by Hasselaar (2012) in the literature review which was presented in the previous chapter.

Due to the social responsibility of housing associations they see the rising energy prices as a threat for their tenants. Affordability of housing is thus a subject that is important for them in the renovation projects. This issue is more important to the housing association and its tenants compared to sustainability issues. However, since this year the housing associations started to recover from the financial crisis and Loman is glad to see that more money is available to invest in sustainability measures. Regarding these sustainability measures the energetic sustainability and thus lowering the energy bill for their tenants is seen as the most important subject regarding sustainability.

In the past liveability problems were addressed by changing the neighbourhood composition by means of demolishment and new build. Nowadays the housing association does not see this as the one solution anymore. If possible they like to keep their properties intact. Demolishment and new build is a form of destructing your own property and capital in the end. They will only chose for demolishment if no other solution is suitable anymore. The focus is now on renovating the existing building...
stock and next to that developing new build dwellings in other areas. The key thought on solving liveability problems is now by changing the combinations of types of households within an area.

For the housing association the focus is still on neighbourhood level, even though the renovation projects are mainly focused on building or dwelling level. To still keep the bigger picture the liveability problems and attractiveness of the neighbourhood keep on being important. This is being kept in mind during the initiation phase of the renovation project, however financial means will always be leading in the decision-making regarding these neighbourhood related subjects.

Loman would like to have more and better information supply regarding the different techniques and concepts that are available for sustainable housing renovation. Furthermore, he would like to have more information on the multiple subsidies that are available to renovate in an energetically sustainable manner. He now finds it difficult to have an overview in what measures and what subsidies are available for them to use.

Loman did not mention bottlenecks regarding residents by himself, only when asked about these residents the conversation on this subject started. Residents do have other priorities, saving energy is not directly one of their main concerns. Their basic needs, like avoidable rent and no drafts or humidity problems, do have a higher priority. This might at the same time be a bottleneck, since there is not much interest in energy saving measures it can be difficult to gain enough participation for the project. For renovation project it is legally required to achieve participation of 70% of the households before a project can start. Loman said that until now this 70% was always achieved in their renovation projects. However, there are always households that do not want to cooperated and cause problems. In the new tender process the responsibility of gaining this 70% participation has shifted towards the market parties. The housing association sees this as a positive change in the process. Since they have a long term relationship with the residents, which is not in all cases positive, it is being expected that a new party in the process in most of the cases will be trusted more easily. Furthermore, due to negative media exposure the attitude for residents towards housing associations can be bias, which makes it hard for the housing association to do positive things in the eyes of the tenants. Furthermore, due to the crisis some projects got delayed which caused distrust and discontent with the residents towards the housing associations. Loman notifies this as a focus point for housing associations, more attention should be paid to communication towards residents as well as the management of expectations.

One of the bottlenecks identified earlier on in this research, ‘lack of trust in new parties in the neighbourhood’, has been identified as an opportunity by Loman. He says that by bringing a new party to the project this party will be trusted easier in comparison to the housing association.

Hetem, Interview, 3 November 2015

Hetem is process manager at construction company ERA Contour. He works on the co-makership project for Ymere in which a large part of their renovation works are included. Furthermore, he is focussing on innovation in the housing sector, developments regarding BIM and system engineering.

Hetem has seen the role of the constructor change in the renovation process. Previously, the tender process went straight forward. This has changed into the responsibility regarding the contact with the residents shifting towards the constructor instead of the housing association. Furthermore, the development of concepts for renovation is a new trend amongst constructors. With these concepts they go actively to possible clients and the market.

This process changes has led to a new role for the housing association as well. They are less acting as a developer and have to focus more on their social tasks. The attitude of housing associations towards this changing role differs. Many are looking for a new image after the cases of fraud which occurred in the past. However, housing associations that did not had to deal with these issues do have a smaller urge to change.

These process changes have led to new stakeholder roles for all stakeholders involved. Hetem sees the roles of the housing association and the constructor changing a lot. However as he argues the role of advisors should change as well, yet this is not happening that much. To make innovation possible this should start with the advisors, they should have a more active role in creating innovative concepts for renovation and supplying new types of products. The same goes for suppliers, they are currently working based upon the demand. According to Hetem a mind-set shift could occur and suppliers could innovate with the products that they offer to the market. The role of the municipality has not changed that much. Due to financial structures within the municipality it is hard for civil servants to join a building process, mostly in the starting phase when not all hours put in the project are accounted for.

ERA Contour strives towards more inclusion of the residents in the project. By making them part of the project they can function as ambassadors towards other
households in the block which might be hesitant towards the project. In the past the communication towards the residents in renovation projects was done by the housing associations, this has shifted towards the consortium. Residents are not really interested in energy saving measures. In most cases for them there are not much changes, the rent stays approximately the same, so why bother and execute the renovation project? That might be a thought to not participate in the project. Furthermore, many projects have had a long history in different information supply towards the residents about its purposes. This has cause residents to distrust the housing association. Which makes them hard to believe in the new plans. This is a bottleneck that has to be overcome by the consortium.

What Hetem sees is that the stakeholders that are directly involved in the process are the same as in the past. However, the roles of these stakeholders have changed. In some cases new stakeholders get involved, yet this differs per case.

The process steps regarding a renovation project which Hetem identifies are:

1. Quest is put in the market
2. Pre-selection by means of a short pitch, not directly case related
3. Tender is send out by the housing association to a few market parties
4. Consortium is being created, project plan is made
5. Selection process
6. Tender is granted to one consortium
7. Consortium meets with the housing association to define the plan and make some adjustments when needed
8. Creation of plan. Together with evaluation moments in which the consortium starts talking to the residents about their needs
9. Housing association has final say in the project
10. Start of renovation works

A shift in process which can be identified, not only in renovation projects yet in other building projects as well, is more collaboration between stakeholders. This co-makership leads to teams that are closer and can complement each other better.

In the new process constructors are involved earlier on in process. This makes them able to have more influence on the end result of the project. However, since the constructor was not involved in the projects in the years before the project started like housing associations are, certain important information is missing. Hetem would like to have more information on for example, lifestyles, target groups, physical conditions of the dwellings, energy use and so on.

A question which is often asked in tenders in a process speed increase. This is hard to achieve, since the process is mainly bound to the time frames which laws and regulations give. For example, residents have to be given a certain amount of time to react on a plan.

Technically renovation to an energy label B is relatively easy to execute. However, renovations to an A label are still hard, especially in high rise buildings. Furthermore, innovations on neighbourhood level such as sharing solar panels with multiple blocks or new heating systems are still hard to implement. Innovations and developments on this fields are necessary to makes these measures financially and technically feasible.

Long term commitment of housing associations to a renovation project in combination with maintenance is still lacking. According to Hetem this is caused by the structure of housing associations. Since the responsibilities of these separate phases in the life cycle of a building lie with multiple departments, housing associations still struggle with the implementation of a total cost of ownership (TCO) approach.

Furthermore, strategical decision of housing associations could be made different according to Hetem. Since the past and regulations do prohibit housing associations to execute demolishment and new build project or develop outside of their sector to make their project profitable, they are bound to renovation. However, not in all cases renovation might be the best choice. Hetem puts question marks with some renovation projects and does wonder if this money could not have been spend better.

Van der Weerd & Stoopman, Interview, 27 November 2015

Van der Weerd and Stoopman are end-user and concept coordinators for existing buildings at ERA Contour, a construction company. ERA Contour has always done new build as well as renovation projects of existing buildings. However, this is not commonly known and thus are Van der Weerd and Stoopman working on gaining more awareness of renovation projects done by the company in the market. Furthermore, they are working as process leaders with the acquisition and selection projects for renovation of existing dwellings. Most projects executed by ERA Contour are renovations of gallery flats.
Van der Weerd and Stoopman notice a process shift, which partly created their jobs. In the past renovation projects were delivered to the market with a clear description of what needed to be done and the company who offered the lowest price would be granted with the assignment. However, nowadays this has shifted towards a wish list combined with a budget given to the constructors by housing associations. This leads to a changing job for the constructor, since they have to think of more things than before. They, for example, have to look at which energy label will be the target, will this be B, like the housing association asked for? Or will it be easy to upgrade to an A label without many more investments? Yet, selection projects are not only occurring in this renewed style. Projects in a more traditional set-up are still put in the market as well. As well as all types of quests that lie in between these two options.

This also leads to a change in how to deal with residents. As a constructor you need to do more with residents in the renewed process style than in the traditional process style. In the past the housing associations were responsible for gaining the 70% participation of the residents for the project. Nowadays they outsource this more and more to the constructors. This puts new types of works with the constructor and asks for a different approach.

The changing quest of the housing association does have an impact on the role of the constructor. Furthermore, it has an influence on the roles of the other stakeholders as well. The roles of subcontractors change in the same way as the main contractor, since they are now asked to think along as well. The same goes for advisors, their assignment is getting bigger since more things have to be thought of by the constructor. An architect is an advisor as well, the role of the architect is changing since in the past they were hired by the housing association to design the renovation. After this design was finished it was send to constructors and they were asked for which price they could develop the proposed design. However, since the housing associations are less defining the boundaries for the renovation project the design will only be made in the selection phase. This creates a difficult situation, since the constructors are not paying the architects before the project has been granted to them. However, in contrast to new build, the design phase has already been mostly finished at the time of granting. This creates only a small amount of work left over for the architect after the project has been won. Which then again raises the question when to pay the architect. Furthermore, new types of advisors are joining the consortium or are advising the consortium. These can for example be advisors on the field of energy or advisors on the field of subsidies. According to Van der Weerd and Stoopman are most parties more than willing to change, since it generates new jobs for them. In the past most of these advisors were more on the side of the housing association. Due to the changing question by the housing associations these are shifting towards the side of the constructor.

The process steps for a renovation project for a construction company are:

1. Through the network of the company the selection project is put on the agenda of the company
2. The company is invited to join a pre-selection round (average of 10 parties are invited)
3. Pre-selection: a pitch is given to the housing association about the company, not yet project related
4. Three or four parties are selected to continue in the selection round. The project assignment is communicated to the parties who are still in the running.
5. Internally a team will be created. The team consists of a board member, process leader, cost expert, logistical expert, building work preparer and a manager.
6. The internal team decides on a strategy for the project.
7. External parties are asked to work along in a consortium. It depends on the type of assignment which parties are asked. Most of the times these are advisors, engineers and subcontractors.
8. With the complete consortium the project is being designed.
9. Together with the competitors there is a moment to visit the building site, get the last information and ask questions.
10. The project design is being finalized, together with a price proposition. Furthermore, the technical as well as social and commercial perspectives are weighted in the project design.
11. A presentation round is held in which all parties present their proposal.
12. The project is being granted to one of the consortia.
13. Plan is further developed.
14. Executing of the project.

A plan can still change a lot after the project has been granted to one of the consortia. After the awarding moment the housing association and the constructor have a meeting to discuss the proposal. The contract phase starts. In this meeting the housing association might want to change certain parts of the project. Feasibility studies are being conducted in this phase as well. Afterwards the 70% participation of
the residents needs to be gained as well. The residents thus also have a say in the project. Furthermore, other departments within a housing association are getting involved, and might have different wishes as well. In most cases this process and changes in the project lead to a delay in the starting moment of the renovation project.

Regarding sustainability two types can be recognized in renovation projects. This can be the technical side and the social side of the project. Both have to do with energetic sustainability. Since housing associations agreed upon becoming more energetic sustainable, they put in most cases a label improvement in the assignment. Technically there are still some difficulties. It is important to have a good team within the consortium to make this possible. The right collaborations with advisors and engineers need to be found. In most of the case the aim is for a B label after the renovation project has finished. The technique to upgrade to an A label or energy neutral building is in most of the cases not yet developed far enough. The cost benefits ratio is out of balance. It mainly depends on the building typology if it is possible to reach an A label or energy neutral. Terraced dwellings are in most of the cases easier to upgrade to an A label. Gallery flats and apartment blocks will currently in most case only reach a B label. However, as Van der Weerd and Stoopman notice, most assignments for renovation which they receive are focused on gallery flats. Due to the programs of the Energiesprong a changing approach by constructors can be notified as well. They are more focussing on developing concepts which can be bought as a complete package by housing associations. Two concepts that ERA Contour has developed in collaboration with other constructors are ‘het renovatiekompas’26 and the ‘beter-op-de-meter woningen’27.

The other part of sustainability mentioned was social sustainability. In most cases the post-war serial built dwellings are situated in neighbourhoods with an average of households with a low social class and a low income. This asks a specific approach during the execution of the renovation works, which again has to be thought of during the initiation phase. It is important to have good contact with the residents, have enough information sessions and take your time to deal and work with them. A renovation project can also be seen as an opportunity for a housing association to do something on the social situation in the neighbourhood. Since the renovation has a lot of impact on the daily life of the residents, the constructor offers many options for them to flee the working activities in their dwellings. For example ERA Contour supplies a temporary building near the building site in which the residents can relax; a temporary living room so to say. In this living room neighbours can meet up and talk with each other. This creates a new type of social cohesion. A perfect opportunity for the housing association to meet with the residents and have a chat with them.

As mentioned before, the residents of these typologies of dwellings do most of the time have a limited amount of money to spend. Which makes money the key subject for them in renovation projects. They are afraid to pay more for their housing after the renovation project is finished. They know for sure that the rent will rise, however, the decreased energy bill is something that is promised to them, but cannot be proven before the project has been finished. Housing associations want constructors to give security of the success of the lower energy bill. However, this is hard for constructors to do since it is depending on external factors how it will turn out. The use of the dwelling in a proper manner by the residents is needed. Furthermore, the climatic circumstances have a lot of influence as well. For example a very cold winter could influence the height of the energy bill. Residents have problems with this insecurity regarding their energy bill and thus housing expenses. To persuade the resident to go along with the project and trust the housing association and the constructor on the proposed project, energy information sessions are held. If more information would be available on the current energy use of the dwellings the design can be made more fitting to the situation as well as these information sessions can be started more informed and better substantiated for the residents.

A bottleneck identified by Van der Weerd and Stoopman is that for them it is not always clear what the housing association wants. This has to do with the new type of questions asked. Since this is less defined it occurs that housing associations change their mind during the process.

The information offered to the market parties by housing associations is moderate. It even occurs that information within the supplied documents is contradictory. With renovation projects you always need to check at the location if information is correct. Information on asbestos for example is always just a sample of one or two dwellings. A plan has to be created based upon an estimation of the current situation. More information up front will improve the process. In some cases it is not allowed to speak to the residents up front. If limited information is available about these residents it can cause problems to make the right estimation and make a proper process design.

26 http://www.renovatie-kompas.nl/

27 http://www.eracontour.nl/specialismen/beter-op-de-meter
Furthermore, to make innovation happen it is still leaning much on individuals in a company. A certain mind-set is necessary.

A process improvement can be found in with more collaboration between the housing association and constructors according to Van der Weerd and Stoopman.

Karsenbarg, Interview, 5 October 2015

Karsenbarg works at the Centrum voor Woononderzoek. A small company that measures residents’ satisfaction during renovation projects. They are commissioned by housing associations or construction companies. They have contact with the residents through telephone calls on multiple moments in the process. By means of the analysis on the residents’ satisfaction they give advice to the commissioner on how to work more customer friendly during the renovation works. This can lead to improvements of the execution process even during the project.

In most of the cases is the Centrum voor Woononderzoek being incorporated in the project when the execution phase starts. In some cases they are involved in the process towards achieving the 70% participation. According to Karsenbarg it is in some cases hard to attain this participation level. They are asked to measure the situation and help the housing association and the constructor to reach the 70% participation by analysing the situation and find out what the reasoning behind not participating is.

Since they monitor the whole process, from start to delivery, bottlenecks can be identified in the process. What Karsenbarg notices is that in almost all projects residents are more than satisfied with the end result of the renovation of their dwelling. They do not have problems with the work man and construction company either. The problems are mostly with the process leading up to the renovated dwelling. In many cases there are problems with the housing association which have been built up over a period of time. For many residents this is hard to let go and does cause a certain attitude towards the renovation project.

Not all housing associations have a good name due to problems in the past. For these housing associations purification of their names is of utmost importance. Be knowing more about the residents and their needs a project can be approached in a manner which fits these needs in the best way. According to Karsenbarg preventing for coming in the media in a negative way is an important topic for these housing associations.

Communication towards the residents for the housing association and the constructing company as well could be executed better. Since the renovation is in many cases in inhabited circumstances it is for residents important to know what they can expect. Changes in schedules are experienced as bothersome and need to be either prevented or communicated clearly.

A bottlenecks which Karsenbarg identifies as well is wrong assumption by residents. They have certain ideas of the measures that will be applied to their dwellings that may not be the truth. This perception of the residents can backlog the project, since they might decide to not participate and thus the 70% participation level will not be achieved. An example can be that the residents do not have sufficient knowledge about the energetic measures which will be applied to their dwellings and do have prejudices about these measures. To prevent these misunderstandings to occur it is key to communicate properly. According to Karsenbarg in many case the communication towards the residents about a renovation project can be rather technical which might be not understandable for certain residents.

Lastly, the process of renovation takes a lot of time. This leads to circumstances which might change and the project to change due to that. Which in communication towards residents can be experienced as unpleasant.

Zijgers, interview, 5 October 2015

Zijgers is an independent entrepreneur who works on residents’ communication within building projects. Currently she is working at a renovation project in Utrecht. In this project 350 terraced dwellings are being renovated. The dwellings had deferred maintenance and needed to become more energetic sustainable.

Correct information supply is something which is of utmost importance for the execution of the project. Zijgers notices that this still costs a lot of time to find the sufficient information and documents for all stakeholders. Since each dwelling has its own characteristics, for example when residents did remove a wall or replace the kitchen, it will be good to process this information in a clear way in which it is coupled to the addresses. This is currently happening, however according to Zijgers this process can be improved.

The project Zijgers currently works on has been in the initiation phase for many years. This has caused irritation to pill up with residents. When they called for small maintenance projects they were told that this will not be executed since a large scale renovation project was coming up. However, since the project backlogged it took a while and thus the dwellings had deferred maintenance. Due to this backlogs the
relationship between the housing association and the residents has not always been good. This causes problems in convincing the residents of the plans and achieving the 70% participation which is needed to start the project. This also occurred in this project.

Furthermore, in most of the cases residents do not have a lot of knowledge about energy saving measures. They understand the effect of replacing single glass with double glass, however insulation in the walls and other energy saving measures are hard to understand and to find support for among the residents. Without the knowledge on these measures residents might hesitate on supporting the project. This leads to wrong assumptions regarding the renovation works.

The last problem Zijgers indicates regarding the residents is the way of funding. Most of the households inhabiting social rental dwellings are not affluent. The measures do have influence on the rent levels and energy bills. However, for the residents this still entails a lot of insecurities. This, in combination with the build-up distrust towards the housing association regarding the renovation project, makes it hard for them to believe in the project and be able to trust the word of the housing association that their financial situation will not decline. Proper communication and information supply is necessary to overcome these bottlenecks.

De Pater, Interview, 9 November 2015

De Pater is program manager at Netbeheer Nederland. The overarching organisation for all net companies in the Netherlands. The organisation includes two types of companies, being the gas net companies and the electricity net companies. From his position he works on sustainability projects and is connected to the Stroomversnelling, one of the initiatives that founds its origin in de Energiesprong. Two types of net companies are existing in the Netherlands, being on the one hand the companies that have a national focus and on the other hand the companies that are working regionally.

In most of the building projects the net companies are only included in the process in a late stage. They strive towards being included more earlier on in the process, preferable at the very early stages when the housing association is making strategic decisions on which projects they would renovate first. By joining the Stroomversnelling program they are trying to make this possible, however this is not happening in the manner that they are envisioning it at this day.

Netbeheer Nederland is one of the founding fathers of the initiative ‘De brede stroomversnelling’, the program which is an off spin of the Stroomversnelling project.

In this program more stakeholders are getting involved, like other housing associations and constructors. By having a place at the steering wheel they try to get their role in the process more clear for other stakeholders. Furthermore, they are encouraging more energetic concepts to be developed by market parties. The Stroomversnelling is focussing on all-electric, which has a large influence on the existing networks. To execute these concepts properly alignments should be found between constructors and net companies. This means that the stakeholder roles need to change to make the transition possible. It is important to speak the same language. Housing associations are talking about different things than net companies are. However, they do have the same long term vision, which constructors lack. According to De Pater this creates a playing field in which each stakeholder has to find its own new role. The role net companies prefer is to be at the clients’ side and together with housing associations and the municipality defined which neighbourhoods should be renovation and how these sustainability goals can be achieved. However, this place in the process has not been conquered yet. How it is often occurring nowadays is that a constructor is calling the net company only at the start of the project. It is an announcement that they are starting and not a collaboration to achieve the best results.

The renovation of dwellings to more energetic sustainable dwellings has a large impact on the nets. In the Netherlands we have an excellent gas and electricity net. However, certain changes like excluding the gas network and changing towards an all-electric net have a major impact on these nets. This will lead to the gas network being obsolete and the electricity network to have to bear with the transport of a large amount of electricity. Furthermore, because the generation of electricity is shifting from one local point towards decentral through solar panels for example, the net should be able to transport electricity in two ways instead of one. According to de Pater the current nets are most of the times capable of doing this, however they may wear down faster. When net companies are closer related to building projects they can make certain decision for their net more strategical. It now sometimes happens that a net company just did a large maintenance project on their gas net in a neighbourhood and just a short time after the housing association starts a large scale renovation project in which the block will change the heating system from gas to all-electric. This is a waste of societal money.

For net companies it is interesting if renovation projects would scale up to neighbourhood level. Nowadays these projects are focussing mainly on dwelling and block level. For a network it has a large impact if a housing association decides that it is going to renovated some blocks in a neighbourhood, yet in the neighbourhood are also a few dwellings owned by private owners who did not execute a renovation project.
yet. On strategical level a lot of innovation are possible on neighbourhood scale for the net company.

Another stakeholder which could join the playing field if this would upgrade to neighbourhood scale are water distribution companies. They have a lot of pipes which need to be renovated as well. If all parties would collaborate in renovation projects and strategical decisions on these renovations would be made on neighbourhood level, these projects could be joined and executed more efficiently.

Furthermore, according to de Pater it will be good to incorporate residents more in the process of making their dwelling sustainable. Many residents do not understand what certain changes to the dwellings do have for influence. They should change their behaviour. Some of the net companies in the Netherlands are working on the guidance of the residents after their houses have been renovated to make them use their dwellings in a better way and thus putting less load on the nets. In this way less energy use is more beneficial for the resident as well as the net company. The same goes for dwellings which produce energy and want to return the surplus to the grid. This ask for knowledge about and correct use of energy. It is necessary to balance supply and demand in this case. Awareness amongst residents regarding energy saving measures should be created and increased.

The financing of renovation projects needs to be improved as well. Profitable business cases need to be developed for all stakeholders in the process. Furthermore, the way housing associations can earn their investment back, through the EPV, should be explained to the residents in a clear manner. How could you convince them that the measures you are going to take will indeed lead to an energy bill of zero Euros at the end of the year? How could you make them aware of the impact their own behaviour has on this bill? Without a proper explanation of these consequences it will be hard to achieve the 70% participation amongst the residents and it might cause problems after the renovation project has been finished and the energy bills turn out to be different than expected. To make this all possibility it is good to communicate properly towards the residents.

This new manner of financing does ask for a new role for the investor as well. The investment is recouped in a different way compared to normal investment projects. Furthermore, new start-ups, mainly tech related, will enter the process. However, as De Pater notices in the Stroomversnelling projects, large industrial companies, which would first only be included through the constructor, are bringing concepts to the market as well.

To make the energy transition possible, laws and regulations are important. The EU is setting goals for the member states and each country is in the lead to develop their own rules regarding this subject. According to De Pater the current laws and regulations are supportive and do not necessarily backlog the process.

To summarize, due to the transition towards an energetic sustainable built environment new stakeholders enter the process. One type of these new stakeholders are the net companies. Since the renovation projects on dwelling do have a large impact on their networks they want to be involved in the early stages of the project.

Interviews with experts on Open data use

In this paragraph the three interviews with experts on open data are summarized.

Suijkerbuijk, Interview, 24 September 2015

Suijkerbuijk works for the Leer- en Expertisepunt Open Overheid, the organisation that works on realising the Open Data goals of the Dutch national government. They give briefings within governmental organisation and share their knowledge with as many persons as possible. They strive towards getting data opened by all types of governmental bodies. The first focus is on opening up this data, secondarily the re-use by others to lead to societal and economic benefits is being promoted. The goals of the national government on opening up their data are based upon three pillars, being: transparency, internal efficiency and external re-use.

Open data finds its foundation in two laws, being ‘de wet openbaarheid van bestuur’ (law open government) and the second one is ‘de wet hergebruik van overheidsinformatie’ (law re-use of governmental information). The first one has as a result that data should be available as open data. The second one means that this data should be in a re-usable format, readable for a computer, reusable for a computer, without restrictions or with only a small fee when being used. These two laws form the legal framework for open data.

According to Suijkerbuijk are not the laws and regulations backlogging the process of more available data, yet is it more related to cultural aspects. For example, opening certain data sets may bring risks with it, it could be interpreted in the wrong way or it could simply cost a lot of money.
Each governmental body is responsible for its own open data. They have to show own initiative in opening up their data. All data is collected in one central spot, being data.overheid.nl. Currently this website included around 7,000 references to data sets. According to Suijkerbuijk not much organisations, governmental and non-governmental, do exactly know what data they have in their organisation. This is caused because hardly any organisation has an open by default or open design process. However, a trend can be noticed which leads towards more and more data being open and available for re-use. Due to this the amount of open data sets will keep on growing and furthermore it causes that it is hard to estimate how many data sets could become available.

Data sets that are currently openly available and that are related to the built environment are for example dwelling related, this is data available at the Kadaster about WOZ values, ownership, vacancy etc. Furthermore, data sets relating topographical information is available in the BRT (Basis Registratie grootschalige Topografie). This includes information on the spatial planning in the Netherlands. Other data sets that Suijkerbuijk suggests for this research are related to the quality of the environment. For example air quality, traffic information, amenities in the neighbourhood and permits that are given out. Furthermore, the housing research WoON gives a lot of longitudinal quantitative data on housing in the Netherlands. Resident related is a lot of information available within the data of the CBS (Centraal Bureau voor de Statistiek)28.

Suijkerbuijk notices that many renovation projects are mainly based on what the government or the housing association wants. Certain decisions are made from a top-down point of view. However, maybe residents do not have the same need for renovation, or do prefer a renovation that has not been put on the agenda yet. He suggested that it might be interesting to develop a tool which could support these kinds of developments.

Van Loenen, Interview, 6 November 2015

Van Loenen is one of the researchers of the Kenniscentrum Open Data of OTB. The Kenniscentrum works with many business partners and gives advice to parties on opening their data and how to deal with it. They work on issues regarding governance, privacy, laws and regulations, impact analyses and how to design business models.

Since 2010 the hype of open data has started due to political commitment by means of the digital agenda of Neelie Kroes, European Commissioner 2010-2014. As of that moment European and national laws have been created to make the publication of governmental data possible. The Netherlands are currently world leading in the sharing of geographical data.

Due to open data being a rather young subject it still finds its foundation with pioneers. These pioneers within the governmental body are important for the success of the data sharing of that specific body. Van Loenen mentioned a few examples of governmental parties in which the pioneer left the process and as a result the open data projects diminished.

An important distinction that Van Loenen makes is the difference between open and publicly accessible data. Publicly accessible data is available data which can be analysed and used, however it is not available for commercial re-use. Open data is data that is open for analysis, use and re-use. This distinction is not always clear and important to keep in mind when data would be re-used.

The publication of open data by governmental bodies has made a lot of progress in the last years. However, this sharing is still occurring in a fragmented manner. Data sets are being published on national, provincial and municipal levels. Which makes it hard to find specific data sets when you do not know where to look for it. Van Loenen identifies this as a bottleneck in the process towards good re-use of data. He places a critical remark with the open data website of the Dutch national government. This website is a gathering point of all data sets available in the Netherlands. However, there are also municipalities and provinces who do prefer to public their data sets on their own website without a link to the national website. It is being encouraged to all public bodies to publish their data sets also on the portal of the government, however this is not being regulated.

Another point which backlogs possible re-use is that not all municipalities can provide the same level of quality on their data. An example Van Loenen mentioned is the thermographic recording in cities. Scans are being made of all rooftops and exterior walls of the buildings in a city to show the heat emission of these buildings.

28 These suggestions are used in the research into the available data sets to answer to the bottlenecks in the process.
This can be an interesting data set to re-use in the renovation process of dwellings, however since the responsibility of this analysis lies with the municipality not all cities do conduct this research, the research is not being done in one general manner and not all cities do supply this data set as open data.

These difficulties – availability for re-use, scatterings of the sources and different quality levels – cause it to be hard to re-use the data sets in the most profitable manner and for people or companies who want to make use of these data sets hard to start this process.

Another struggle regarding open data is privacy. It is hard to find the balance between privacy and open data, since with the combination of multiple data sets it can be quite easy to trace the aggregation level back to one household or person.

The struggles on the path towards an ideal supply of open data are not unique to the Netherlands. Across to globe all countries are dealing with the same struggles and are working on this process. The question is how this supply can be presented in the best manner so every user is able to find the right information and use it to their best abilities. One of Van Loenen’s colleagues at the Kenniscentrum Open Data has done research into the re-use of open data and concluded that this is not only the task of the governmental bodies in how to supply the open data, there is also a large responsibility with the user. Users can take a more active attitude towards asking for the right information. According to this research the users are now too passive and waiting for the right information to come their way.

For this analysis Windt uses open data sources, like CBS and Kadaster, however he also makes use of sources that are not directly open and need to be gotten by paying a fee.

According to Windt, an opportunity could be if data from IP-addresses would be openly accessible. This data will give a lot of information on the residents and their interests. However, this is closely linked to privacy issues. A bottleneck that Windt mentions for the use of data is those privacy issues as well. People may not like the amount of data that is available on them. They get the ‘Big Brother is watching you feeling’. Windt experienced this in previous projects by comments of residents associations.

To gain participation of the residents in a renovation project it does not have to do that much with the techniques or budget available, it has to do with the circumstances and needs of the residents. By having more information on these residents up front this could be done more grounded and successful. According to Windt this is not done enough at the moment, the constructors are mainly talking about techniques and not enough about the soft sides of the renovation project, thus the wellbeing of the residents.

More profit could be made if not only residents’ data yet also data about energy use would be used to prove that certain concepts are profitable. If both would be combined a new type of information would be available which could be really fruitful for the end result of the project.

**Interviews case I & II**

The interviews regarding the case studies have not been summarized. The interviews have been recorded and during a playback of these interviews the information has directly been processed in the case description. The complete case description has been send to all interviewees for confirmation after this has been finished. The recordings of the interviews are available upon request at the author.

---

29 This interview has been conducted through email, not face to face.
<table>
<thead>
<tr>
<th>Bottleneck</th>
<th>Found in theory</th>
<th>Found in expert interviews; experts on sustainable housing transformation</th>
<th>Found in expert interviews; stakeholders - housing associations</th>
<th>Found in expert interviews; stakeholders - constructor</th>
<th>Found in expert interviews; stakeholders - residents guidance</th>
<th>Found in expert interviews; stakeholders - net companies</th>
<th>Found in case I</th>
<th>Found in case II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication between housing association and residents</td>
<td></td>
<td>Van Hal</td>
<td>Stutvoet</td>
<td>Van de Groep</td>
<td>Loman</td>
<td>Hetem</td>
<td>Van der Weerd &amp; Stoopman</td>
<td>Karsenbarg</td>
</tr>
<tr>
<td>A transition in the process is needed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing stakeholder roles needed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laws &amp; regulations backlog the renovation process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication between stakeholders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process takes too much time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic decisions of housing associations are not focussed upon energetic sustainability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of funding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge about residents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is not allowed for the consortium to speak to the residents at the early stages of the project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness of energy saving measures among professionals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical difficulties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competition between market parties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New process asks for solving liveability problems by market parties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End-users are too little involved in the renovation project decision-making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottleneck</td>
<td>Found in theory</td>
<td>Found in expert interviews; experts on sustainable housing transformation</td>
<td>Found in expert interviews; stakeholders - housing associations</td>
<td>Found in expert interviews; stakeholders - constructor</td>
<td>Found in expert interviews; stakeholders - residents guidance</td>
<td>Found in expert interviews; stakeholders - net companies</td>
<td>Found in case I</td>
<td>Found in case II</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-----------------</td>
<td>--------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td>------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>70% participation of residents needed for renovation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorrectly substantiated assumptions by residents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of trust in new parties in the neighbourhood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of interest in energy saving measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of energetic sustainable dwelling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split incentive housing association vs residents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net metering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data category</td>
<td>Data set category</td>
<td>Title data set</td>
<td>Source</td>
<td>Scale level</td>
<td>Aggregation level</td>
<td>Treatment of raw data?</td>
<td>Further notes</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>--------------------------------</td>
<td>-----------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-------------</td>
<td>--------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Data regarding residents</td>
<td>Types of households</td>
<td>Koopkracht; overgang van type huishouden</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/groups/koopkracht-overgang-van-type-huishouden">https://data.overheid.nl/data/dataset/groups/koopkracht-overgang-van-type-huishouden</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prognose huishoudens naar type; leeftijd; herkomstgroepering 2013-2060</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/prognose-huishoudens-naar-type-leeftijd-herkomstgroepering-2013-2060">https://data.overheid.nl/data/dataset/prognose-huishoudens-naar-type-leeftijd-herkomstgroepering-2013-2060</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td>Gemiddeld inkomen; huishoudens</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/gemiddeld-inkomen-huishoudens">https://data.overheid.nl/data/dataset/gemiddeld-inkomen-huishoudens</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laag inkomen; huishoudens</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/laag-inkomen-huishoudens">https://data.overheid.nl/data/dataset/laag-inkomen-huishoudens</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Samenstelling inkomen; huishoudens</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/samenstelling-inkomen-huishoudens">https://data.overheid.nl/data/dataset/samenstelling-inkomen-huishoudens</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bewoonde woningen; inkomen bewoners</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/bewoonde-woningen-inkomen-bewoners">https://data.overheid.nl/data/dataset/bewoonde-woningen-inkomen-bewoners</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gemiddeld inkomen; personen</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/gemiddeld-inkomen-persone">https://data.overheid.nl/data/dataset/gemiddeld-inkomen-persone</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inkomen; personen naar kenmerken</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/inkomen-persone-naar-kenmerken">https://data.overheid.nl/data/dataset/inkomen-persone-naar-kenmerken</a></td>
<td>Municipal</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gemiddeld inkomen; personen naar regio</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/gemiddeld-inkomen-persone-naar-regio">https://data.overheid.nl/data/dataset/gemiddeld-inkomen-persone-naar-regio</a></td>
<td>Municipal</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inkomensklasse; particuliere huishoudens naar diverse kenmerken</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/inkomensklassen-particuliere-huishoudens-naar-diverse-kenmerken">https://data.overheid.nl/data/dataset/inkomensklassen-particuliere-huishoudens-naar-diverse-kenmerken</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uitkeringsafhankelijkheid; personen</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/uitkeringsafhankelijkheid-persone">https://data.overheid.nl/data/dataset/uitkeringsafhankelijkheid-persone</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inkomensongelijkheid; personen</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/inkomensongelijkheid-persone">https://data.overheid.nl/data/dataset/inkomensongelijkheid-persone</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data category</td>
<td>Data set category</td>
<td>Title data set</td>
<td>Source</td>
<td>Scale level</td>
<td>Aggregation level</td>
<td>Treatment of raw data?</td>
<td>Further notes</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------</td>
<td>----------------</td>
<td>--------</td>
<td>-------------</td>
<td>-------------------</td>
<td>------------------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>Data category</td>
<td>Data set category</td>
<td>Title data set</td>
<td>Source</td>
<td>Scale level</td>
<td>Aggregation level</td>
<td>Treatment of raw data?</td>
<td>Further notes</td>
<td></td>
</tr>
<tr>
<td>Welzijn in combinatie met financiën</td>
<td>Household composition</td>
<td>Huishoudens; kindertal, regio</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/welzijn-in-relatie-met-financi%C3%ABn">https://data.overheid.nl/data/dataset/welzijn-in-relatie-met-financiën</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algemene bijstand; WWB-uitkeringen</td>
<td>Household composition</td>
<td>Huishoudens; personen</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/algemene-bijstand-wwb-uitkeringen">https://data.overheid.nl/data/dataset/algemene-bijstand-wwb-uitkeringen</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algemene bijstand; WJ-uitkeringen</td>
<td>Household composition</td>
<td>Huishoudens; grootte</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/algemene-bijstand-wj-uitkeringen">https://data.overheid.nl/data/dataset/algemene-bijstand-wj-uitkeringen</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woningen; hoofdbewoner/huishouden</td>
<td>Household composition</td>
<td>Woningen; hoofdbewoner/huishouden</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/woningen-hoofdbewonerhuishouden">https://data.overheid.nl/data/dataset/woningen-hoofdbewonerhuishouden</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>Education level</td>
<td>Score eindtoets Cito; gezinskenmerken</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/score-eindtoets-cito-gezinskenmerken">https://data.overheid.nl/data/dataset/score-eindtoets-cito-gezinskenmerken</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main language</td>
<td>Interests</td>
<td>ICT gebruik; huishoudens</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/ict-gebruik-huishoudens">https://data.overheid.nl/data/dataset/ict-gebruik-huishoudens</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leefstijl; persoonskenmerken</td>
<td>Interests</td>
<td>Leefstijl; persoonskenmerken</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/leefstijl-persoonskenmerken">https://data.overheid.nl/data/dataset/leefstijl-persoonskenmerken</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mutation level</td>
<td>Amenities</td>
<td>Gewenste verhuizingen</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/gwenste-verhuizingen">https://data.overheid.nl/data/dataset/gwenste-verhuizingen</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data regarding the neighbourhood</td>
<td>Amenities</td>
<td>Nabijheid voorzieningen; buurt 2014</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/nabijheid-voorzieningen-buurt-2014">https://data.overheid.nl/data/dataset/nabijheid-voorzieningen-buurt-2014</a></td>
<td>Municipal / Neighbourhood</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data category</td>
<td>Data set category</td>
<td>Title data set</td>
<td>Source</td>
<td>Scale level</td>
<td>Aggregation level</td>
<td>Treatment of raw data?</td>
<td>Further notes</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------</td>
<td>----------------</td>
<td>--------</td>
<td>-------------</td>
<td>------------------</td>
<td>------------------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bestand bodemgebruik 2012 ZOW</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/bestand-bodemgebruik-2012-zow">https://data.overheid.nl/data/dataset/bestand-bodemgebruik-2012-zow</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Direct download geodata</td>
<td>This data is only available for the South, East and West of the Netherlands</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ontwikkeling bebouwing 1000 - 2002</td>
<td>Provincie Utrecht, <a href="https://data.overheid.nl/data/dataset/ontwikkeling-bebouwing-1000-2002">https://data.overheid.nl/data/dataset/ontwikkeling-bebouwing-1000-2002</a></td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Utrecht</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cultuurhistorie - DNA-kaart, grenzen en bebouwing, provincie Gelderland</td>
<td>Provincie Gelderland, <a href="https://data.overheid.nl/data/dataset/cultuurhistorie-dna-kaart-grenzen-en-bebouwing-provincie-gelderland">https://data.overheid.nl/data/dataset/cultuurhistorie-dna-kaart-grenzen-en-bebouwing-provincie-gelderland</a></td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Gelderland</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Milieu energie - kansen potentie zonne-energie, provincie Gelderland</td>
<td>Provincie Gelderland, <a href="https://data.overheid.nl/data/dataset/milieu-energie-kansen-potentie-zonne-energie-provincie-gelderland">https://data.overheid.nl/data/dataset/milieu-energie-kansen-potentie-zonne-energie-provincie-gelderland</a></td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Gelderland</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Milieu - bodem asbestkansen in de bodem, provincie Gelderland</td>
<td>Provincie Gelderland, <a href="https://data.overheid.nl/data/dataset/milieu-bodem-asbestkansen-in-de-bodem-provincie-gelderland">https://data.overheid.nl/data/dataset/milieu-bodem-asbestkansen-in-de-bodem-provincie-gelderland</a></td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Gelderland</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CBS gebiedsindelingen</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/cbs-gebiedsindelingen">https://data.overheid.nl/data/dataset/cbs-gebiedsindelingen</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Environmental situation</td>
<td>Emissies naar lucht</td>
<td>Provincie Noord-Brabant, <a href="https://data.overheid.nl/data/dataset/embr">https://data.overheid.nl/data/dataset/embr</a> )[dt ]na r-lucht</td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Noord-Brabant</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Luchtkwaliteit wegen - GES kaarten NO2</td>
<td>Provincie Noord-Brabant, <a href="https://data.overheid.nl/data/dataset/luchtkwaliteit-wegen-ges-kaart-no2">https://data.overheid.nl/data/dataset/luchtkwaliteit-wegen-ges-kaart-no2</a></td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Noord-Brabant</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Luchtkwaliteit wegen - GES kaarten PM10</td>
<td>Provincie Noord-Brabant, <a href="https://data.overheid.nl/data/dataset/luchtkwaliteit-wegen-ges-kaart-pm10">https://data.overheid.nl/data/dataset/luchtkwaliteit-wegen-ges-kaart-pm10</a></td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Noord-Brabant</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRS kaart 3 klimaat, gezondheid en veiligheid</td>
<td>Provincie Utrecht, <a href="https://data.overheid.nl/data/dataset/prs-kaart-3-klimaat-gezondheid-en-veiligheid">https://data.overheid.nl/data/dataset/prs-kaart-3-klimaat-gezondheid-en-veiligheid</a></td>
<td>Provincie</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td>This data is only available for the province Utrecht</td>
<td></td>
</tr>
<tr>
<td>Data category</td>
<td>Data set category</td>
<td>Title data set</td>
<td>Source</td>
<td>Scale level</td>
<td>Aggregation level</td>
<td>Treatment of raw data?</td>
<td>Further notes</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Data regarding climate</td>
<td>Climate situation</td>
<td>Bijdrage van de toplaag van de bodem aan klimaatregulatie</td>
<td>Onderzoeksinstituties, <a href="https://data.overheid.nl/data/dataset/bijdragen-van-de-toplaag-van-de-bodem-aan-klimaatregulatie-relatief">https://data.overheid.nl/data/dataset/bijdragen-van-de-toplaag-van-de-bodem-aan-klimaatregulatie-relatief</a></td>
<td>National</td>
<td>?</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Climate change</td>
<td>IMAGE scenario’s ecologisch-milieu-modelraamwerk - PBL</td>
<td>Ministerie van Infrastructuur en Milieu, <a href="https://data.overheid.nl/data/dataset/image-scenario-s-ecologisch-milieu-modelraamwerk---pbl">https://data.overheid.nl/data/dataset/image-scenario-s-ecologisch-milieu-modelraamwerk---pbl</a></td>
<td>National</td>
<td>?</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data regarding energy use</td>
<td>Energy use</td>
<td>Energieverbruik woningen; wijkbuurt 2014</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/energieverbruik-woningen-wijkbuurt-2014">https://data.overheid.nl/data/dataset/energieverbruik-woningen-wijkbuurt-2014</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energieverbruik particuliere woningen</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/energieverbruik-particuliere-woningen">https://data.overheid.nl/data/dataset/energieverbruik-particuliere-woningen</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energieverbruik particuliere huishoudens</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/energieverbruik-particuliere-huishoudens">https://data.overheid.nl/data/dataset/energieverbruik-particuliere-huishoudens</a></td>
<td>National</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energieverbruik bedrijven en huishoudens</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/energieverbruik-bedrijven-en-huishoudens">https://data.overheid.nl/data/dataset/energieverbruik-bedrijven-en-huishoudens</a></td>
<td>National</td>
<td>?</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warmtegebruik huishoudens per buurt (GJ/ha/jaar)</td>
<td>Ministere van Economische zaken, <a href="https://data.overheid.nl/data/dataset/warmtegebruik-huishoudens-per-buurt-gj-ha-jaar">https://data.overheid.nl/data/dataset/warmtegebruik-huishoudens-per-buurt-gj-ha-jaar</a></td>
<td>National</td>
<td>Block</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warmtenetten</td>
<td>Ministere van Economische zaken, <a href="https://data.overheid.nl/data/dataset/warmtenetten">https://data.overheid.nl/data/dataset/warmtenetten</a></td>
<td>National</td>
<td>Block</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warmtevraag huishoudens per gemeente (GJ/ha/jaar)</td>
<td>Ministere van Economische zaken, <a href="https://data.overheid.nl/data/dataset/warmtevraag-huishoudens-per-gemeente-gj-ha-jaar">https://data.overheid.nl/data/dataset/warmtevraag-huishoudens-per-gemeente-gj-ha-jaar</a></td>
<td>Municipal</td>
<td>Municip al</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energie verbruik en producentenprijs</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/energieverbruik-en-producentenprijs">https://data.overheid.nl/data/dataset/energieverbruik-en-producentenprijs</a></td>
<td>National</td>
<td>?</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liander verbruikdata 2 onder 1 kap</td>
<td>Liander, <a href="https://data.overheid.nl/data/dataset/liander-verbruikdata-2-onder-1-kap">https://data.overheid.nl/data/dataset/liander-verbruikdata-2-onder-1-kap</a></td>
<td>Municipal</td>
<td>Six digit postal code</td>
<td>Direct download as .csv file</td>
<td>This data is only available for the municipality Apeldoorn</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liander verbruikdata flat/appartement</td>
<td>Liander, <a href="https://data.overheid.nl/data/dataset/liander-verbruikdata-flat-appartement">https://data.overheid.nl/data/dataset/liander-verbruikdata-flat-appartement</a></td>
<td>Municipal</td>
<td>Six digit postal code</td>
<td>Direct download as .csv file</td>
<td>This data is only available for the municipality Apeldoorn</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Liander verbruikdata vrijstaande woning</td>
<td>Liander, <a href="https://data.overheid.nl/data/dataset/liander-verbruikdata-vrijstaande-woning">https://data.overheid.nl/data/dataset/liander-verbruikdata-vrijstaande-woning</a></td>
<td>Municipal</td>
<td>Six digit postal code</td>
<td>Direct download as .csv file</td>
<td>This data is only available for the municipality Apeldoorn</td>
<td></td>
</tr>
<tr>
<td>Data category</td>
<td>Data set category</td>
<td>Title data set</td>
<td>Source</td>
<td>Scale level</td>
<td>Aggregation level</td>
<td>Treatment of raw data?</td>
<td>Further notes</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
<td>----------------</td>
<td>--------</td>
<td>-------------</td>
<td>------------------</td>
<td>------------------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>Data regarding energy saving measures</td>
<td>Available concepts for energy saving measures</td>
<td>Liander verbruiksdatalijtjeshuis</td>
<td>Liander, <a href="https://data.overheid.nl/data/dataset/liander-verbruiksdatalijtjeshuis">https://data.overheid.nl/data/dataset/liander-verbruiksdatalijtjeshuis</a></td>
<td>Municipal</td>
<td>Six digit postal code</td>
<td>Direct download as .csv file</td>
<td>This data is only available for the municipality Apeldoorn</td>
<td></td>
</tr>
<tr>
<td>Data regarding subsidies</td>
<td>Available subsidies</td>
<td>Energiesubsidiewijzer</td>
<td>Ministerie van Economische zaken, <a href="https://data.overheid.nl/data/dataset/energiesubsidiewijzer">https://data.overheid.nl/data/dataset/energiesubsidiewijzer</a></td>
<td>National / provincial / municipal</td>
<td>Six digit postal code</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data regarding companies</td>
<td>Chamber of commerce</td>
<td>Vestigingen van bedrijven; grootte, rechtsvorm, bedrijfstak, regio's</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/vestigingen-van-bedrijven-grootte-rechtsvorm-bedrijfstak-regios">https://data.overheid.nl/data/dataset/vestigingen-van-bedrijven-grootte-rechtsvorm-bedrijfstak-regios</a></td>
<td>Municipal</td>
<td>?</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kamer van koophandel, handelsregister</td>
<td>Kamer van Koophandel, <a href="https://data.overheid.nl/data/dataset/administratieve-en-sociale-overheidsdiensten">https://data.overheid.nl/data/dataset/administratieve-en-sociale-overheidsdiensten</a></td>
<td>National</td>
<td>?</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bedrijven; grootte en rechtsvorm</td>
<td>CBS, <a href="https://data.overheid.nl/data/dataset/bedrijven-grootte-en-rechtsvorm">https://data.overheid.nl/data/dataset/bedrijven-grootte-en-rechtsvorm</a></td>
<td>National</td>
<td>?</td>
<td>Webservice, only available to re-use in application</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>