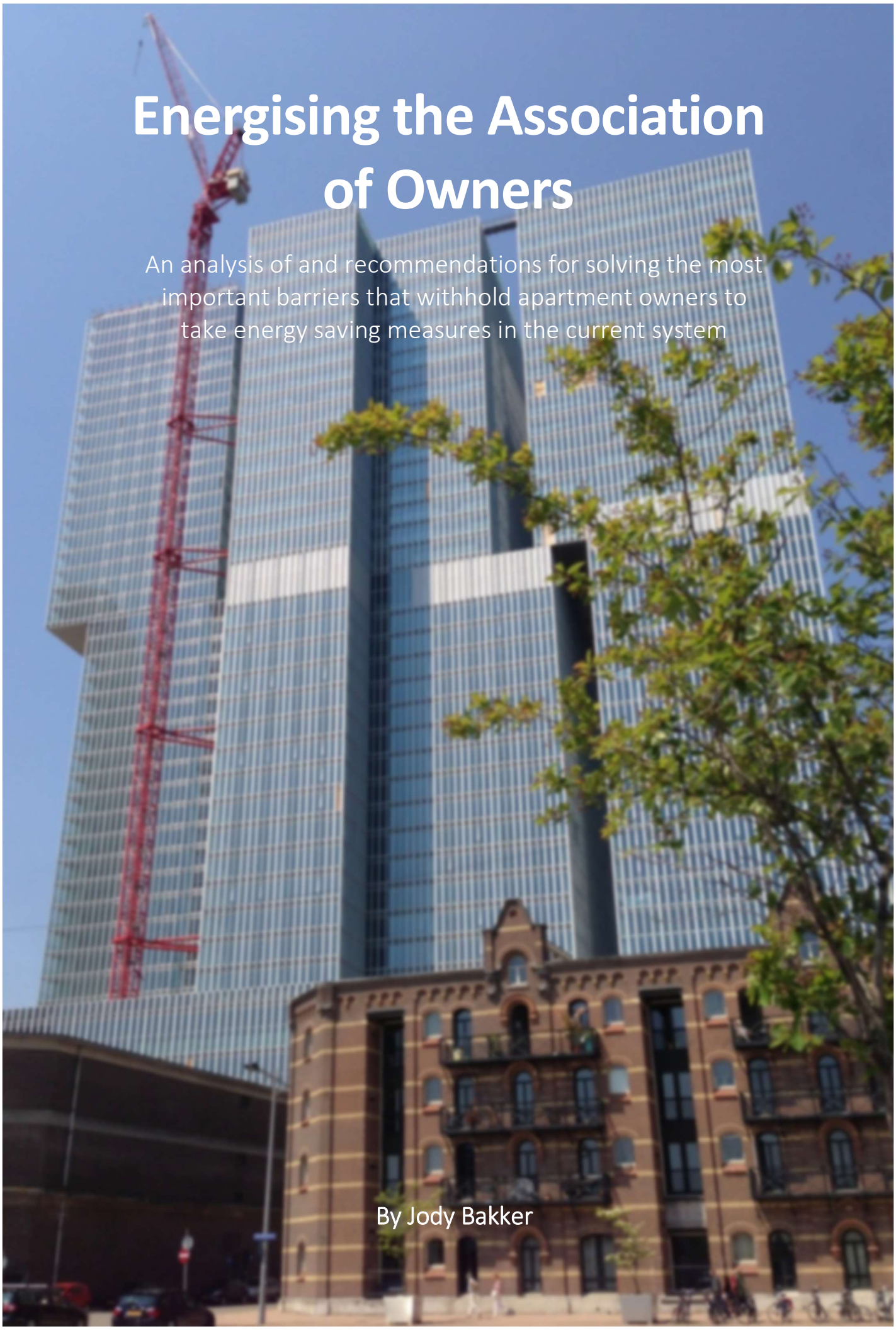

Energising the Association of Owners

An analysis of and recommendations for solving the most important barriers that withhold apartment owners to take energy saving measures in the current system

By Jody Bakker

Energising the Association of Owners

An analysis of and recommendations for solving the most important barriers that withhold apartment owners to take energy saving measures in the current system

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by

Jody Bakker

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ACKNOWLEDGEMENTS

Within this thesis for the master Complex Systems Engineering and Management[1], I have combined my acquired skills for analysing complex systems with my special interest in sustainability. Fortunately, this combination ensured that I enjoyed working on this research from start to finish. The start of this research was in February 2016 with an internship at the municipality of Rotterdam. This internship enabled me to analyse a complex system – of a municipality who wants to stimulate apartment owners to take energy saving measures – from both a scientific and a 'hands-on' perspective. For creating this opportunity, I want to thank my manager Lennaert Zinkhaan and my colleagues from the department *Bouw- en Woningtoezicht* and from the programme *Duurzaam* of the department *Ruimte en Wonen*. Especially, I want to thank my supervisors Farida Aghris and Fred Akerboom for sharing their network, for involving me in their daily work, and for their positive feedback.

In December 2016, with approximately 75% of my research completed, I accepted a fulltime job at Rho adviseurs voor leefruimte. In little less than a year, I have written the remaining chapters of this research. This period turned out to be more challenging than expected. But it makes me all the more grateful that I have completed this research and that I successfully started my professional career. I want to thank a number of people for helping me to accomplish these goals. I would like to express my gratitude to my first supervisor Herman de Wolff for his enthusiasm, his input for important decisions in this research, and for pushing me towards the completion of my thesis. I am also thankful to my second supervisor Mark de Bruijne and professor Henk Visscher for their constructive feedback that helped me to further improve the scientific relevance and readability of this research. Also, a special word for all respondents who were willing to take part in the interviews and who provided valuable input for this research. Last but certainly not least, I am very grateful to my family and friends for their unconditional support. In particular, I want to thank my mom and dad for encouraging me through thick and thin.

To conclude, I want to mention two positive developments that give cause for cautious optimism. These developments are recent and are therefore not included in this research. Firstly, an Association of Owners (*VvE Ellen in Assen*) received a loan that enables them to improve their apartment building to a Zero Energy Building. This is the first time that an AOO in The Netherlands received such a loan. Secondly, the new coalition agreement of Rutte III shows the ambition to meet the international climate goals from the Paris Agreement. This is certainly a positive development, even though this coalition agreement does not mention a sufficient number of policy instruments to actually meet these goals. Thus, as this research will show, there is still work to be done!

Jody Bakker

Oud-Beijerland, October 2017

[1] This master is previously known as Systems Engineering, Policy Analysis and Management (SEPAM)

EXECUTIVE SUMMARY

With the purchase of an apartment, the new apartment owner automatically becomes a member of the Association of Owners of that particular apartment building. This 'apartment owner' bought an apartment right and not the apartment itself. This apartment right allows the apartment owner to use the apartment. However, the apartment is owned by the Association of Owners (AOO), just like all other apartments in the apartment building. As all apartment owners are a member of this AOO, they share the joint ownership of the apartment building and they make joint decisions for this building. Arriving at these joint decisions turns out to be difficult. This is indicated by the large number of AOOs who are facing serious maintenance problems for their apartment buildings. These maintenance problems are the first challenge that many AOOs face in The Netherlands.

With the new energy saving ambitions from the Paris Agreement in 2015, the AOOs are faced with a second challenge: improving the energetic quality of their apartment buildings. These apartment buildings are part of the built environment, the sector with the largest share (34%) in the total Dutch energy consumption. To meet the Paris Agreement, The Netherlands must reduce its greenhouse gas emissions with 80% in 2050 compared to 1990. Given the magnitude of this task, it is inevitable that also the energy consumption of apartment buildings needs to be reduced. This requires an improvement of the energetic quality of an apartment building, for which a joint decision of the AOO is needed.

This need for a joint decision by a majority of the apartment owners is important for both the maintenance and energetic quality challenge that AOOs face. Difficulties with this required joint decision are, among others, the result of a lack of: financial resources, a long-term maintenance plan for the apartment building, competent board members, and commitment of apartment owners to the AOO. This illustrates that most AOOs will require some help to solve their complex puzzle, also known as the decision-making process. Some municipalities have recently started to help AOOs with the underlying problems of this difficult decision-making process. These municipalities have an interest in obtaining a basic maintenance level of apartments and have an interest in meeting the (inter)national energy reduction targets. In this research, the perspective of the municipality is used to analyse the challenges of the AOOs. To make this perspective more tangible, the municipality of Rotterdam, one of the forerunners, is used in this research as a continuing example. Rotterdam wants to stimulate AOOs to improve the energetic quality of their apartment buildings. But the municipality is struggling with the following problem statement:

In what way could the energetic quality of AOOs in Rotterdam be improved to a level that suits the national ambitions, given the available time and resources of the municipality?

It is not the intention of this research to identify the low-hanging fruits: the apartment buildings that are most suited for an energetic improvement, based on their energy labels, building period, financial means of the AOO, and so on. The aim of this research is to execute a thorough analysis of the issues – the problematic causal relations – that currently withhold all AOOs from improving the energetic quality of their apartment buildings. Subsequently, this research presents the contours of a municipal approach that changes the issues – problematic causal relations – with the largest impact on the decision-making processes of AOOs. This municipal approach is a set of alternatives – solutions – that can be implemented by the municipality to solve these problematic causal relations. This aim is accompanied by the following main research question:

Which type of municipal approach is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings?

This main research question is answered in four steps. The thorough analysis of the problematic causal relations is executed in research part A with a literature study and interviews. In the intermezzo, a selection from the list of problematic causal relations is made for the remainder of the research. Moreover, the intermezzo presents an assessment framework: a tool to identify promising alternatives – solutions – that are able to change the problematic causal relations. Research part B designs and assesses several alternatives, in order to arrive at a number of recommendations for a municipal approach in research part C. To answer the main research question, it is a prerequisite that these four steps are able to address the scientific problem of this research:

How to make a complete analysis of this complex multi-actor system and how to formulate alternatives for issues within this system from the perspective of only one actor?

Research part A: problematic causal relations

The literature study in research part A is used to describe the current situation: the situation in which many AOOs are struggling to take joint decisions for their apartment buildings. This description includes an actor analysis and a system analysis. From these analyses, several problematic causal relations – problems – are derived that currently withhold AOOs from improving the energetic quality of their apartment buildings.

In addition to the literature study, interviews are held with 32 respondents from 13 different types of organisations: from members of AOOs to the Ministry of the Interior and Kingdom Relations. All respondents are asked to identify problematic causal relations. The answers of the respondents are used to confirm the problematic causal relations that are found in the literature study. Moreover, some new problematic causal relations are identified during the interviews. Together, the literature study and the interviews result in a list of 24 relevant problematic causal relations. This list is presented in section §4.5. This executive summary presents the five problematic causal relations that are most often mentioned by the respondents:

1. A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on taking energy saving measures.

2. The effectiveness of the provision of information, advice, and support to AOOs to create a sense of urgency for the reduction of their energy consumption is uncertain.

3. Many companies from the building industry are not willing to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process.

4. An AOO may have insufficient spending power to pay for the total investment costs of the energy saving measures. In these cases, the AOO cannot decide to improve the energetic quality of their apartment building.

5. A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.

This top five of problematic causal relations illustrates the diversity of all 24 issues that are currently messing up the decision-making processes of AOOs. It is not feasible to design a municipal approach that is able to change all of these 24 issues. Therefore, a selection of the problematic causal relations is made in the intermezzo.

Intermezzo: selection of problematic causal relations

To structure the diversity of the 24 problematic causal relations, they are divided over six clusters. This clustering is based on common themes of the issues. These clusters of problematic causal relations are not completely independent from each other, as the relations in figure A show.

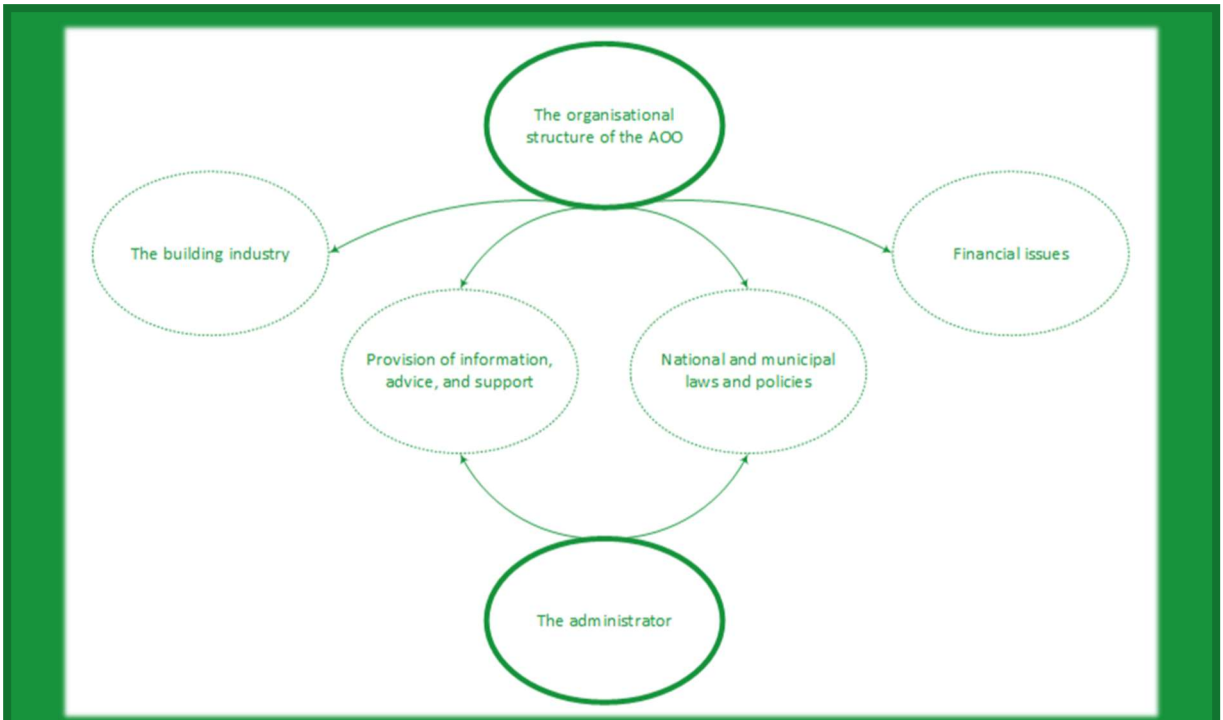


Figure A: the relations between the six clusters of problematic causal relations

The relations in figure A show that there are two clusters with a negative impact on the issues in the four other clusters. Firstly, the cluster of the organisational structure of the AOO. The essence of this cluster is that the Association of Owners is not well organised because some important elements in the organisational structure are missing. For example, if the AOO does not have a reserve fund – an account in which the AOO saves money for the maintenance of the building – it will become difficult to obtain a loan for an investment in the energetic quality of the apartment building. This illustrates the negative impact of this cluster on the cluster of financial issues.

Secondly, the cluster of the quality of the administrator. The administrator is an external organisation that can be contracted by an Association of Owners for the execution of several (administrative) tasks. These administrators may help AOOs to address their organisational issues. However, many administrators show little interest in the energetic quality of the apartment buildings. This is because the current system does not provide sufficient positive incentives for administrators to stimulate their AOOs to take energy saving measures. Any administrator who does not encourage its AOOs to improve the energetic quality of their apartment buildings, is classified as a poor-quality administrator. Due to the lack of positive incentives, these poor-quality administrators may brush off any actor, including the municipality, who wants to provide information, advice or support to their AOOs. This illustrates the negative impact of this cluster on the cluster of issues with the provision of information, advice, and support.

Based on their negative impact on the four other clusters of problematic causal relations, the clusters of the organisational structure of the AOO and the quality of the administrators are selected for the remainder of this research. The definitions of these two clusters are:

1. A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.

2. A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.

Intermezzo: the assessment framework

For these two clusters of problematic causal relations, an assessment framework is constructed. This assessment framework is a tool that is used to identify promising alternatives – solutions – for the selected problematic causal relations. With the assessment framework, alternatives that are designed in research part B, can be rated and ranked. The assessment framework consists of constraints, criteria and some assumptions. The constraints must be met by each alternative and they ensure that an alternative can be implemented in five to ten years and within the limits of the current system. In this research, the alternative meets the constraints if it does not change or exceed the current state of:

- the spending power of AOOs and individual apartment owners;
- the (financial) resources of the municipality;
- property rights;
- the (financial) resources of social housing associations and private landlords, and;
- the capacity of energy and process consultants and other companies from the building industry.

Subsequently, the criteria from the assessment framework are used to estimate whether an alternative – a solution – is able to successfully change the selected issues. Each alternative will receive four scores, one for each criterion. These scores indicate a negative or positive effect of the alternative on the criterion. The following four criteria are used to assess the alternatives:

- Total costs of the alternative for all actors in the system, including the transaction costs.
- The estimated quality of the administrators.
- The estimated number of AOOs with a good base and organisational structure.
- The estimated number of AOOs in which energy saving measures have been taken.

Research part B: design and selection of alternatives

The input for the alternatives is derived from the interviews with the respondents, from the literature study and from a subsequent brainstorm. This resulted in a list of 20 alternatives. These alternatives have been assessed with the assessment framework. Firstly, the compliance of the alternatives with the assumptions and constraints is checked. Alternatives that do not comply with all assumptions and constraints, are excluded from the selection process. Secondly, the remaining alternatives receive a score between -1 and +2 for the four criteria. These scores are based on the insights from research part A. The total scores of the alternatives – the sum of the four scores on the criteria – are used to select the most promising alternatives. This results in a list of nine promising alternatives.

These promising alternatives are combined into four different municipal approaches. These municipal approaches – the combinations of alternatives – are able to address both clusters of problematic causal relations at once. Moreover, due to smart combinations, the municipal approaches are more effective than the sum of their individual alternatives. These are the four municipal approaches:

1. A combination of education, collaboration and monitoring for administrators with a strong role for the municipality;
2. Creating supply and demand in a developing market for advice on energy saving measures that is provided by administrators to AOOs;

3. A measuring bar for the quality of administrators with a strong emphasis on monitoring the performance of the administrators;
4. And creating a joint long-term vision on the apartment building with the combined efforts of individual apartment owners, social and private landlords, and administrators.

Research part C: recommendations for a municipal approach

The strong and weak points of these municipal approaches have been pointed out by experts from the municipality of Rotterdam and VVE-010 in an expert validation. These strong and weak points are used to arrive at recommendations for a municipal approach. Also, the key insights from the analysis of the current situation in research part A and the results from the assessments of the alternatives in research part B are used for this purpose. The proposed municipal approach can change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings. By changing these problematic causal relations, it is less difficult for AOOs to go through the decision-making process and to improve the energetic quality of their apartment buildings.

The recommendations identify the most important elements that should be part of the municipal approach. Also, the recommendations mention aspects that should be taken into account, when designing such a municipal approach. Together, the recommendations provide the contours of a municipal approach that can be implemented by the municipality at short notice and, to a large extent, independent from other actors:

1. The municipal approach includes the collaboration of the municipality with administrators. With this collaboration, the municipality aims to improve the quality of the administrators and aims to reach a large group of AOOs through these administrators. The first year of the collaboration is intensive, with the municipality and the administrators working closely together. Thereafter, a covenant is signed with effort commitments for both the administrators and the municipality.

2. The second recommendation is to try to improve the quality of the base of the AOO from the inside and not from the outside. Firstly, the municipality will ensure that courses are provided to apartment owners. The aim of these courses is to inform and enthuse individual apartment owners to take the lead in their AOO. These apartment owners are stimulated to address any issues with the base of the AOO in the general meeting of owners and to start the discussion on energy saving measures. Secondly, the municipality will ask mortgage lenders to inform and warn potential apartment owners in case of a too low periodic deposit to the reserve fund or in case of an AOO with a poor base. This will stimulate apartment owners to improve the base of their AOO, in order to sell apartments in the future.

3. Thirdly, it is recommended to stimulate AOOs to develop a joint long-term vision on the future of their apartment buildings. This long-term vision will result in a shift from individual interests to collective interests, in a focus on (energetically) improving the apartment building instead of conservation and maintenance of the building. Moreover, this vision will structure the financial decisions in the AOO. The municipality can stimulate the development of such a vision via the courses for individual apartment owners, the effort commitments with administrators and optionally via a covenant with the social and private landlords.

A municipal approach that combines these three recommendations is able to change the crucial problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings. Some further research is needed for the implementation of this proposed municipal approach by the municipality of Rotterdam and by other municipalities. Firstly, it is recommended for the municipality of Rotterdam to research the new roles of administrators and mortgage lenders in the new system. With regard to the administrators, for example, it is valuable to perform some research on the current business cases of administrators and on the development of new financial incentives.

Secondly, the implementation of the proposed municipal approach will require some additional efforts from other municipalities, such as: updating their level of knowledge on AOOs, investing in dedicated staff capacity, and starting collaborations with other municipalities. Together, the recommendations from this research enable municipalities in the Netherlands to help Associations of Owners with their decision-making processes on the energetic quality of their apartment buildings.

TABLE OF CONTENTS

1. INTRODUCTION

1.1. Introduction

In the first chapter of this report, the Association of Owners is introduced as the subject of this research. The consecutive arguments that resulted in the selection of this subject have the character of a funnel. Starting from the context of international climate goals, the scope of this research is narrowed down to The Netherlands and more specifically the built environment in The Netherlands. Within the built environment of the Netherlands, one of the most complex issues is to reduce the energy consumption of privately-owned multifamily dwellings, also known as apartments. The ownership of such privately-owned multifamily dwellings is organised in an Association of Owners (AOO). The AOO is therefore selected as the primary subject of this research.

The subject of this research is approached from the perspective of the municipality. This is because the municipality, in contrast to other parties, has an interest in meeting the (inter)national climate goals and energy reduction targets. The aim of this research is to identify, describe and analyse the issues – problematic causal relations – that currently withhold all AOOs from improving the energetic quality of their apartment buildings. Subsequently, this research presents the contours of a municipal approach that changes the issues – problematic causal relations – with the largest impact on the decision-making processes of AOOs. This municipal approach is a set of alternatives – solutions – that can be implemented by the municipality to solve these problematic causal relations. This aim is accompanied by the following main research question:

Which type of municipal approach is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings?

However, this research is preceded by two chapters, in which the Association of Owners is introduced and the research design is described.

1.2. A context of international climate goals

Global warming has become an important topic over the past years. This is partly due to the increasing visibility of global warming, for instance the rising temperatures and extreme weather conditions. The other part is due to an increasing intensity of discussions on global warming in politics, science and the news. Frequently, this discussion has an alarming character as the problem of global warming is far from being under control.

Contrary to this trend of mainly negative news, 2015 brought a positive note to the discussion. “The growth in global CO_2 emissions from fossil-fuel use and cement productions stalled to -0,1% compared to 2014, after a decade of annual increases of 4%” (PBL, 2016a). In Europe (the EU28), “the CO_2 emissions were reduced in 2014 by 5.4%, mainly because of the decrease in fossil-fuel consumption for power generation and manufacturing, but also because of the 10% lower demand for space heating” (PBL, 2016a). Figure 1 shows both positive trends for global CO_2 emissions.

Despite the stabilisation of the global CO_2 emissions, there is still a considerable task to reduce these emissions to an acceptable level in order to restrict global warming. On the 12th of December 2015, 195 countries adopted the Paris Agreement under the framework of the United Nations Framework Convention on Climate Change (UNFCCC). The goal of the UNFCCC is to stabilise the greenhouse gas concentrations “at a level that would prevent dangerous human induced interference with the climate system” (United Nations Framework Convention on Climate Change, 2014). The specific goal of the Paris Agreement is to keep global warming below 2 °C and preferably below 1.5 °C relative to the pre-industrial level (Rijksoverheid, 12-12-2015). The observation that a global temperature rise of 2 °C might be

reached within 25 years highlights the urgency for taking action to stabilise the global CO_2 emissions (NOS, 24-02-2016).

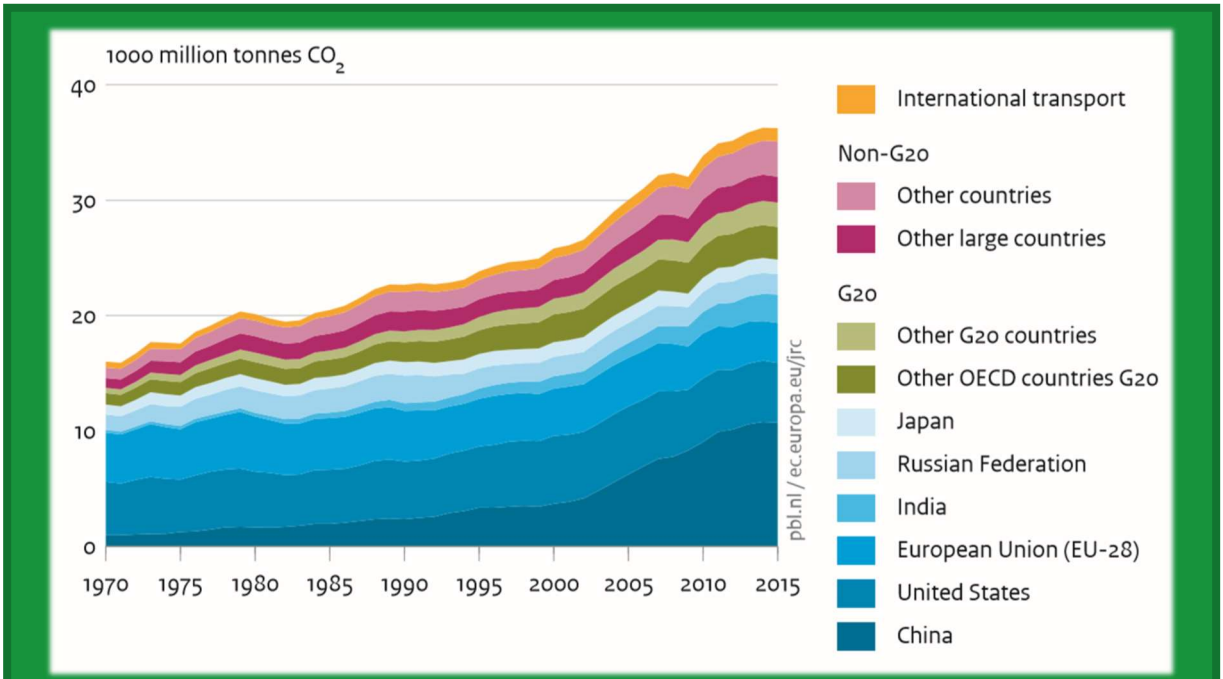


Figure 1: global CO_2 emissions per region from fossil-fuel use and cement production (PBL, 2016b)

1.3. The Dutch part in restricting global warming

In April 2016, The Netherlands signed the Paris Agreement and thereby committed to the international climate goals. Figure 2 illustrates that The Netherlands belongs to the top 30 countries with regard to CO_2-emissions and emits 0.46% of global greenhouse gases (International Energy Agency, 2014; Ministerie van Economische Zaken, 2016; Olonscheck, Walther, Lüdeke, & Kropp, 2015).

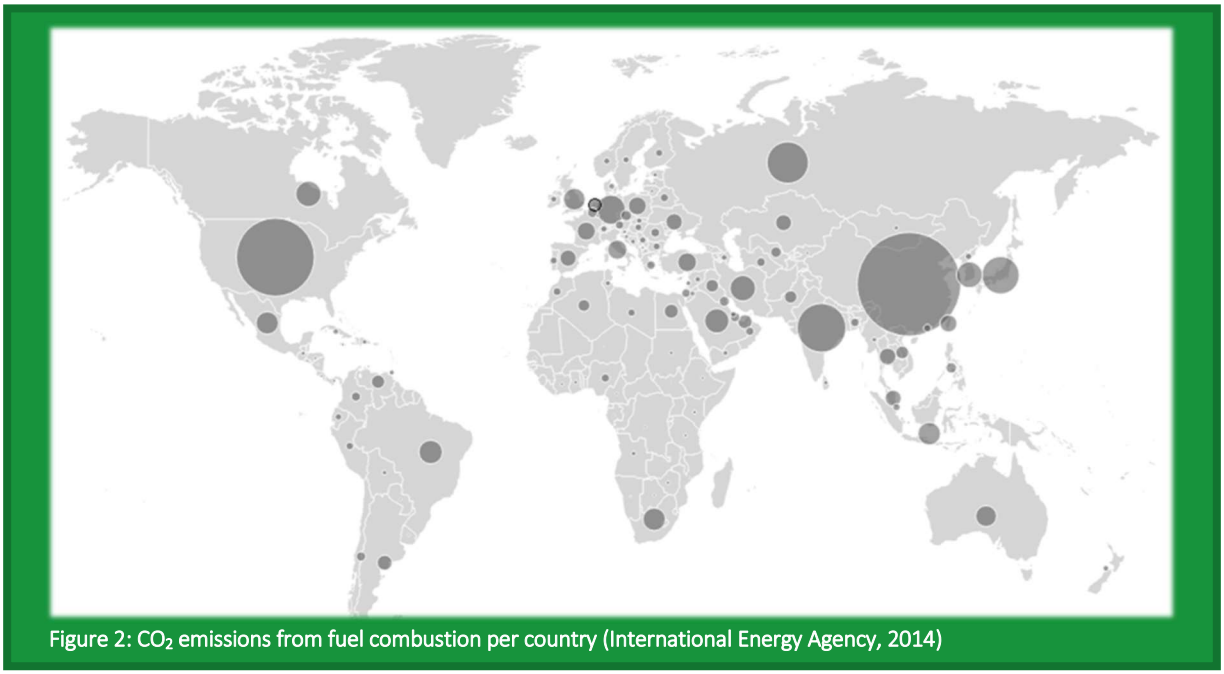


Figure 2: CO_2 emissions from fuel combustion per country (International Energy Agency, 2014)

As the Dutch share in the global climate problem is relatively high, the Paris Agreement requires far-reaching national action in the coming years (PBL, 2016a). The practical implication of the Paris Agreement for The Netherlands is an 80% reduction of greenhouse gas emissions in 2050 compared to 1990 (PBL, 2016a). Existing energy targets and energy policies at the European, national and local level aim to limit and reduce CO_2 emissions. However, additional energy policies are needed to meet this target. To prepare, a public debate on this subject (*Energiedialoog*) was held until July 2016, which will contribute to the formulation of a long-term energy policy.

In 2013, The Netherlands achieved a 10% reduction in greenhouse gas emissions compared to the emission level in 1990 (PBL, 2016a). Although progress has been made to reduce greenhouse gas emissions, this reduction of 10% in the past 23 years is not in proportion to the required reduction of 80% in the coming 37 years. It is shown that existing energy policies result in insufficient overall progress relative to the 2050 targets. Moreover, even though total greenhouse gas emissions are decreasing, some sectors in The Netherlands still show an increase in greenhouse gas emissions from 1990 to 2013. This countertrend is observed in the sectors 'traffic' and 'built environment' (PBL, 2016a). The discrepancy between the ambitious new energy targets and the limited progress in meeting the existing energy targets emphasises the need for action.

Especially the built environment sector comprises a large portion of total Dutch energy consumption. Box 1 explains that the built environment consumed the largest share (34%) of Dutch gross final energy consumption in 2013 (ECN et al., 2015; Murphy, Meijer, & Visscher, 2012; Rijksdienst voor Ondernemend Nederland, 2015). The sector traffic is the third largest sector regarding energy consumption with a share of 24% (ECN et al, 2015). Within the sector traffic, the challenge of reducing greenhouse gas emissions is in replacing polluting fuels and vehicles by cleaner alternatives. As the lifespan of most vehicles is at its maximum 20-30 years, but often shorter, a lot of vehicles will be replaced by cleaner ones before 2050. The lifespan of buildings and especially dwellings significantly exceeds the lifespan of vehicles. An illustration of this statement is that 80% of the dwellings in the housing stock in 2050 will consist of dwellings in the present housing stock (ECN, 2015a). Reducing the greenhouse gas emissions of the built environment will thus also require an improvement of the energetic quality of existing buildings. Given this considerable challenge, the built environment is chosen as key sector in this report.

BOX 1: DISTRIBUTION OF DUTCH ENERGY CONSUMPTION

The total energy consumption in The Netherlands is composed of the consumption of several end users. These end users include the built environment, industry, agriculture and traffic. In figure 3, the shares of these four sectors are shown relative to total Dutch gross final energy consumption in 2013. In 2013, most energy was consumed in the built environment.

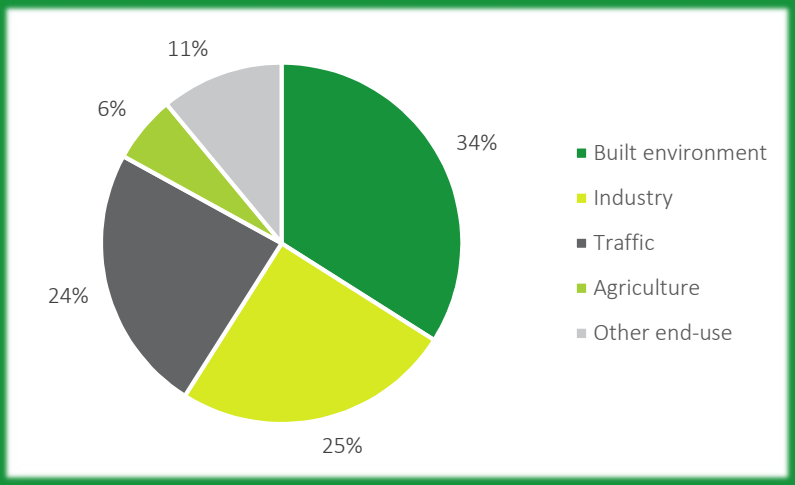


Figure 3: shares of end users in Dutch gross final consumption in 2013 (ECN et al, 2015)

1.4. The energetic quality of the built environment

The energy consumption within the built environment can be roughly distributed over two building types: dwellings and other real estate. Dwellings can be privately-owned or rented and other real estate may be used by commercial services or public services organisations. The energy consumption of privately-owned dwellings and rented dwellings comprises 65% of total energy consumption in the built environment. Figure 4 illustrates that privately-owned dwellings are most dominant in this share with 40% (PBL, 2014; Rijkswaterstaat, 2016).

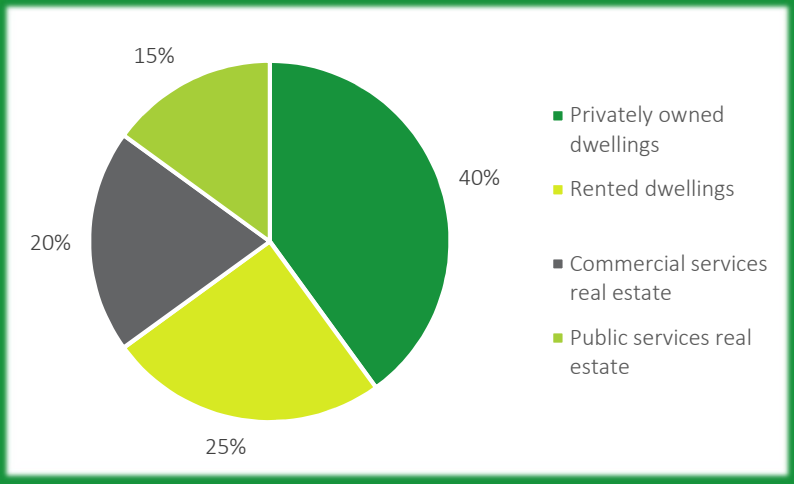


Figure 4: distribution of energy consumption within the built environment (Rijkswaterstaat, 2016)

This large share of privately-owned dwellings can be partly explained by the characteristics of the Dutch housing stock as described in box 2. As the Dutch housing stock consists of 60% privately-owned dwellings and 40% rented dwellings, it is reasonable that privately-owned dwellings have a larger share in the energy consumption of the built environment (Ministerie van BZK, 2016f).

BOX 2: THE DUTCH HOUSING STOCK IN A NUTSHELL

Within the Dutch housing stock, 60% of the dwellings are owner-occupied. The remaining 40% are dwellings that are rented out by social housing associations (32%) and private landlords (8%) (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016f). Over the last years, an increase in owner-occupied dwellings relative to rented dwellings can be observed (figure 5). The total number of dwellings in The Netherlands has increased from 5.9 million in 1990 to 7.6 million dwellings in 2015 (CBS, 2014; CBS, 2016b). Thus, the actual increase of privately-owned dwellings is stronger than indicated in figure 5.

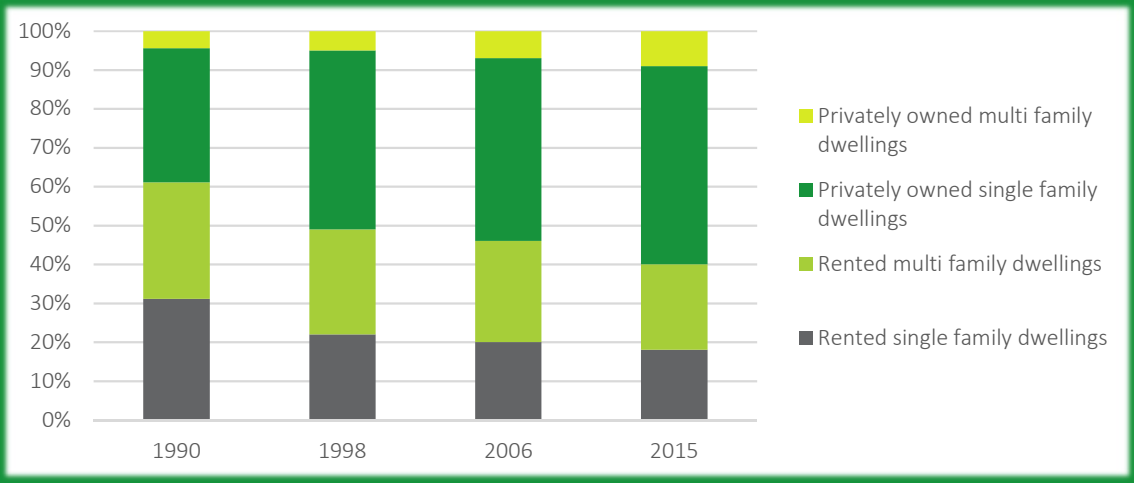


Figure 5: composition of Dutch housing stock by type of ownership and dwelling type (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016f)

In addition to the relatively large number of privately-owned dwellings, the energy use – in kWh (electricity) and m^3 (natural gas) – of an average privately-owned dwelling is higher than of a rented dwelling (Rijkswaterstaat, 2016). On the one hand, this is related to a difference in behaviour of residents in owner-occupied and in rented dwellings. On the other hand, box 3 shows that this is related to the large share of privately-owned single-family dwellings, which are generally larger and consume more energy than multifamily dwellings.

BOX 3: DWELLING TYPE AND ENERGY USE

In the Netherlands, there is a considerable difference in average energy consumption between rented and privately-owned dwellings. As figure 6 illustrates, privately-owned dwellings consume on average more energy – in terms of natural gas and electricity – than rented dwellings. Part of this difference may be due to a difference in behaviour between home-owners and renters. However, another part of this difference is due to the large share of single-family dwellings in the segment of privately-owned dwellings, as shown in figure 5. Single-family dwellings are larger and consume considerably more energy, especially natural gas, than multi-family dwellings. This can be deduced from differences in average energy costs of dwelling types in 2014: €1.000 for multi-family dwellings and €1.400-€2.330 for single-family dwellings (Rijkswaterstaat, 2016).

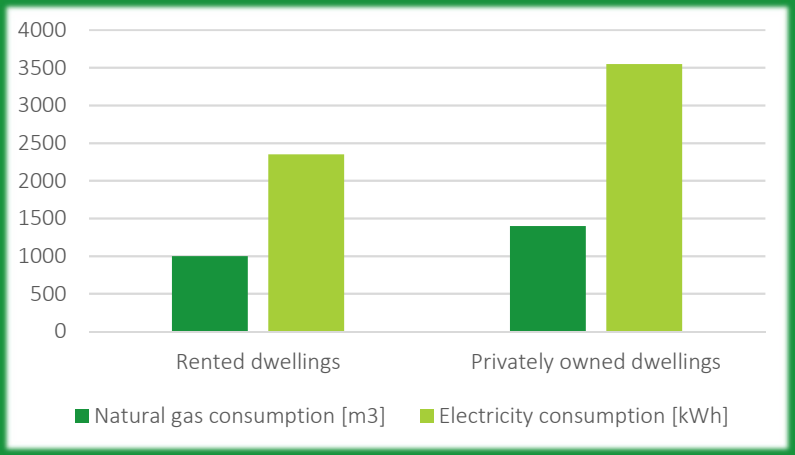


Figure 6: energy consumption of dwellings in 2014 (Rijkswaterstaat, 2016)

Due to the large number of dwellings and correspondingly the large number of individual owners, previous energy saving programmes in The Netherlands did not focus on this segment. Developing an energy saving programme for social housing associations is more transparent for the Dutch government. This is because there is an existing relation with the social housing associations and the number of associations is relatively small. However, the analysis of the energy consumption in the built environment suggests selecting the privately-owned dwellings as the subject of this research. This segment of the built environment is both large in total amount of energy consumed and in energy consumed per dwelling.

Within the segment of privately-owned dwellings, a distinction can be made between multifamily dwellings (17%) and single-family dwellings (83%) (Compendium voor de Leefomgeving, 2016). Box 2 indicates that the amount of privately-owned multifamily and single-family dwellings has increased over the years to approximately 4.5 million dwellings. Especially, the number of privately-owned multifamily dwellings increased strongly from approximately 235.000 dwellings in 1990 to 683.000 dwellings in 2015 (CBS, 2014, CBS, 2016b, Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016f). This can be explained by the large number of rented dwellings that were sold by the social housing associations. Given the large number of privately-owned dwellings, it is sensible to make another selection to arrive at a suitable and delineated subject of research.

Single-family dwellings are clearly overrepresented in the privately-owned housing stock. Furthermore, single-family dwellings consume on average more energy than multi-family dwellings. However, the difference in the pace of reducing this energy consumption among single-family and multi-family dwellings is noteworthy (Rijkswaterstaat, 2016). Figure 7 indicates that the pace of reducing the energy consumption of apartments – multifamily dwellings – is lagging in comparison to all types of single-family dwellings.

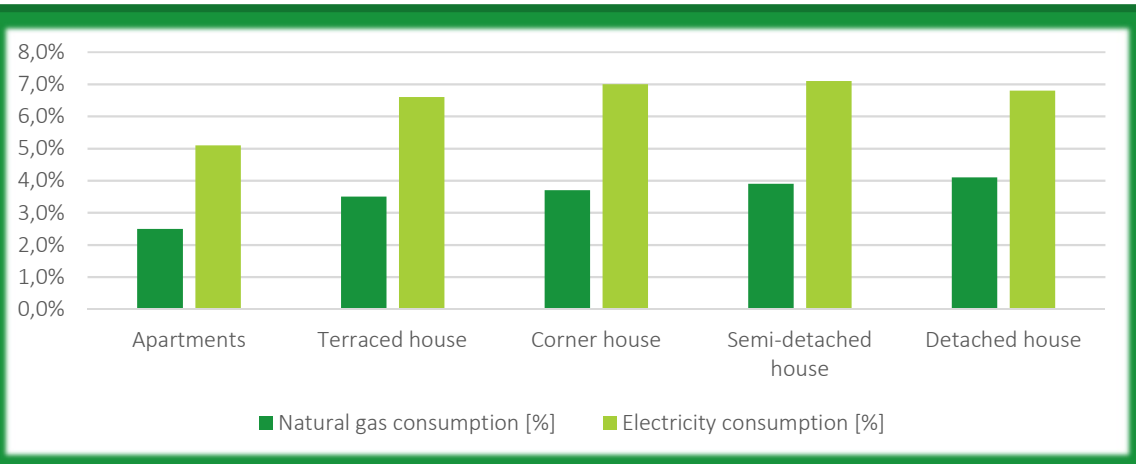


Figure 7: percentage of energy consumption reduction per dwelling type in 2014 (Rijkswaterstaat, 2016)

A potential line of reasoning for this difference is that the reduction rate of apartments is low, because the energetic quality of apartments is already high. However, this line of reasoning is contradicted by the fact that the average energetic quality of multifamily dwellings is lower than the energetic quality of single-family dwellings, as is explained in box 4.

Remarkably, efforts from companies and governmental organisations were mainly targeted at single-family dwellings over the past years. Improving the energetic quality of privately-owned apartments is still an uncharted territory. Thus, the conclusion is that, although multi-family dwellings have a high potential for reducing their energy consumption, their energy reduction rate is still relatively low. This contradiction is the main argument for delineating the subject of research from privately-owned dwellings to privately-owned multi-family dwellings, also known as privately-owned apartments.

BOX 4: ENERGETIC QUALITY OF SINGLE-FAMILY AND MULTI-FAMILY DWELLINGS

The energetic quality of dwellings in The Netherlands is measured in an energy index according to European guidelines. This energy index is often communicated using energy labels. In terms of energetic quality, label A/A+ indicates a high quality and label G indicates a poor quality. Figure 8 indicates that, with regard to energetic quality, multifamily dwellings underperform compared to single-family dwellings. To illustrate, multi-family dwellings received more energy labels in category G and less in category A+/A compared to single-family dwellings.

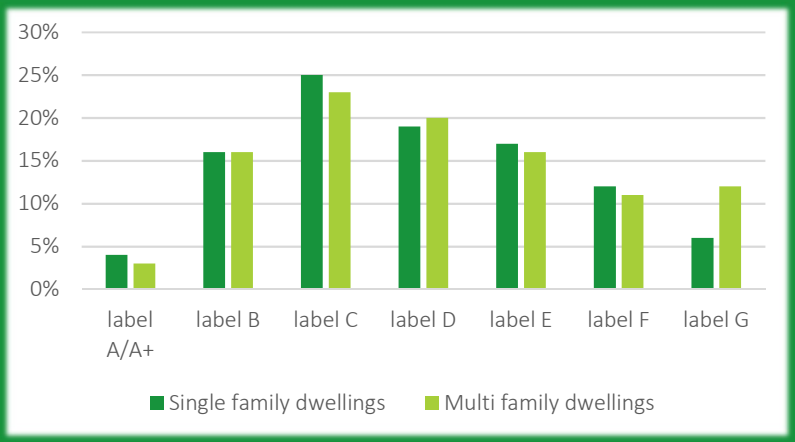


Figure 8: energetic quality per dwelling type in 2012 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012a)

1.5. Privately-owned apartments and the Association of Owners

An apartment is, in contrast to a single-family dwelling, not a separate object. Instead, apartments are clustered in a building block. One building block may contain several units, such as rented apartments,

privately-owned apartments, shops and offices (CBS, 2016a). This mix of units creates a complex ownership structure in the apartment building. Moreover, the ownership of an apartment does often not include the exterior walls, roof or ground floor of the building. From a legal perspective, the apartment owner does not own the physical apartment itself, but owns an apartment right. This apartment right is a license to use the apartment in accordance to the applicable rules of the specific building block. This means that all owners of one or more units in the apartment building jointly own the property.

BOX 5: THE BUILDING BLOCKS OF DUTCH ASSOCIATIONS OF OWNERS

In figure 9, a quick and simplified overview of Dutch Associations of Owners is provided. This overview is based on a recent study on Associations of Owners in The Netherlands (CBS, 2016a). The overview does not include units without an actual address, such as parking lots. Among others, figure 9 indicates that the majority of the privately-owned apartments are located in a mixed building block. A mixed building block is a building block that contains at least two unit types, with possible unit types being: privately-owned apartments, rented apartments, shops, offices, etc. In some cases, the number of units of the smaller building blocks do not match the number of units in the higher building block in figure 9. This is because there is a category 'unknown'.

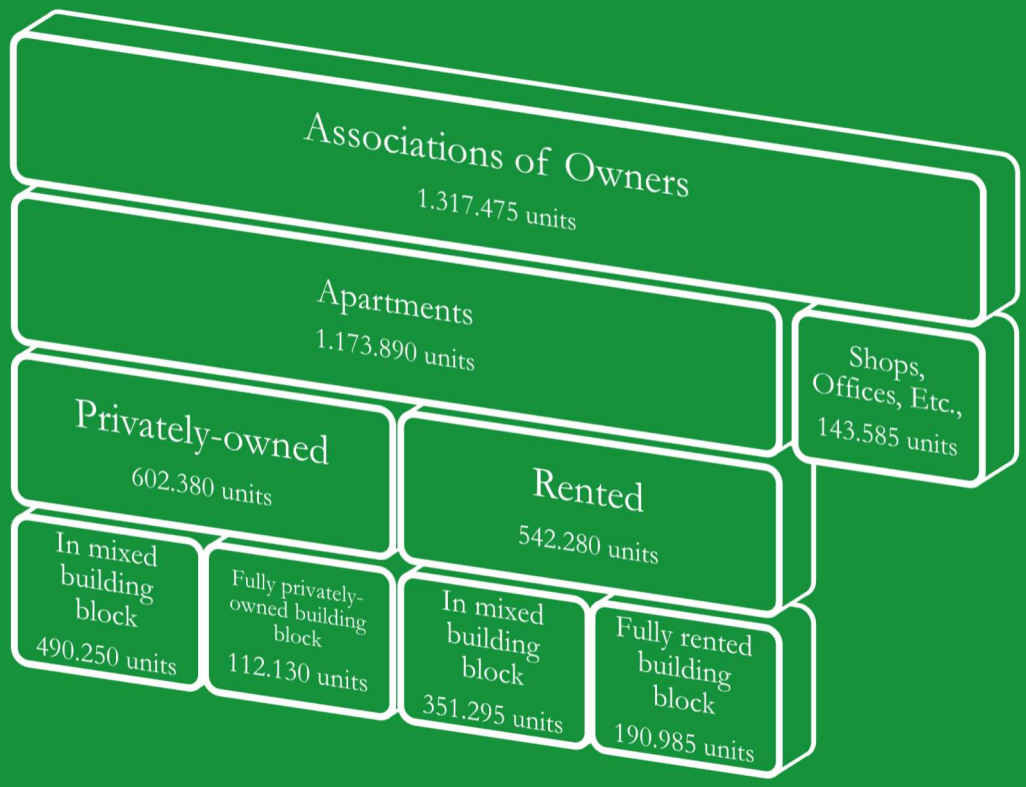


Figure 9: the general build-up of Associations of Owners based on units with an address (CBS, 2016a)

This joint ownership is organised in a Dutch variation to the Association of Owners (*Vereniging van Eigenaren*). In 1951, legislature to set up an Association of Owners (AOO) was introduced in the Netherlands. An AOO will come into existence after the construction of a new apartment building of which apartments are sold to more than one owner. Furthermore, an AOO can be initiated after the apartments of an existing apartment building are no longer owned by a single owner. The most important body of the AOO is the general meeting of owners (*vergadering van eigenaars*). In the general meeting of owners, every apartment owner has a vote in the decision-making process. This body limits the individual freedom of choice of an apartment owner. For example, decisions on making constructional changes to the apartment need to be taken by majority vote in the general meeting of owners according to the deed

of division. These constructional changes are often necessary for improving the energetic quality of privately-owned apartments. The insulation of walls or the replacement of windows are examples of constructional changes that often require a majority vote in the general meeting of owners. Thus, for the large scale reduction of the greenhouse gas emissions of privately-owned apartments, the AOO cannot be disregarded. The AOO is therefore selected as the primary subject of this research.

The reasons for selecting the AOO as the subject of this research are clear, as the decision-making process for considerably reducing the energy consumption of privately-owned apartments takes place in the Association of Owners. The downside of this choice is that, as stated in box 5, AOOs may consist of more units than merely privately-owned apartments. In fact, most privately-owned apartments (81%) are located in mixed building blocks. Due to this large number of mixed buildings, there seems to be a tension with the choice made in section §1.4 to focus merely on privately-owned apartments. To release this tension, both chosen subjects of research – privately-owned apartments and AOOs – are combined in a final subject of research: Associations of Owners with at least one privately-owned apartment.

1.6. The challenge and complexity of Associations of Owners

A collective decision of at least a majority of the owners is required for most high impact energy saving measures (the notion of energy saving measures is extensively discussed in sub section §3.3.1). From a legal perspective, an individual apartment owner is, for example, simply not allowed to apply insulation to the exterior walls, as these walls are joint property. For an Association of Owners to take energy saving measures, it is therefore crucial that the interests of the different owners are aligned to a certain extent. After all, the required investment in the energy saving measures must be in the interest of the majority of the apartment owners.

The large number of mixed building blocks with at least one privately-owned apartment, potentially increases the complexity of stimulating AOOs to take energy saving measures. This is because the owners vary from merely owner occupiers to private landlords, social housing associations, and owners of commercial real estate. This diversity brings new and additional interests to the decision-making table and might therefore complicate the challenge of finding a majority of owners in favour of energy saving measures. Nevertheless, the presence of an ambitious private landlord or social housing association might also provide an opportunity for taking energy saving measures.

Thus, it is important to evaluate the current decision-making processes of Dutch Associations of Owners. These decision-making processes focus on the core task of an AOO: the conservation of the apartment building. The conservation of the building turns out to be problematic for many AOOs (Meijer, 2013; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b; Vegter, 2012). Normal maintenance is problematic even though the decisions on this core task require a smaller majority than the decisions on energy saving measures. It is therefore likely that the decision-making processes on these energy saving measures will be even more troublesome for AOOs.

Common causes for problematic and lengthy decision-making processes on the conservation of the building are: insufficient savings for maintenance, a lack of long-term maintenance plans and owners who are simply not willing or able to act (Meijer, 2013; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b; Vegter, 2012). These causes are also relevant in the context of the energy reduction ambitions, as energy saving measures are often combined with necessary maintenance of the building. Additional complicating factors are limited financial resources, legal uncertainty with regard to the deed of division and a lack of adequate offers from the market (Hazel van den, Vaessen, & Wolff de, 2007; Meijer, Visscher, Kloosterman, & Guerra Santin, 2009; Ministerie van Binnenlandse Zaken en

Koninkrijksrelaties, 2012b; Vegter, 2012; Waals van der, 2015). Due to these barriers, many policy instruments of the Dutch government show a weak effect on the implementation of energy saving measures by AOOs (Murphy et al., 2012).

Even more, multiple intermediate reports conclude that the current set of policy instruments is not sufficient to meet the energy reduction goals formulated for 2030 and 2050 (Algemene Rekenkamer, 2015; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2015; Tigchelaar & Leidelmeijer, 2013). Various evaluations show that additional measures are required to meet the energy targets for the built environment in 2050 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2015; Olonscheck et al., 2015). The current mix of policies, laws and instruments is not sufficient to reach these goals (Algemene Rekenkamer, 2015). In this perspective, figure 10 provides some interesting insights, as it reports the number of dwellings (privately-owned, social rent and private rent) in which at least two energy saving measures were taken over the years. A clear descending line can be observed for at least two categories. This is alarming given that the number of dwellings in which at least two energy saving measures are taken must increase considerably to meet the climate goals. A remark is that the descending lines can be partly explained by the economic crisis in the corresponding years. Still, the drop in the number of privately-owned dwellings in which at least two energy saving measures are taken is remarkable. Also, this drop supports the statement that het current set of policy instruments is insufficient.

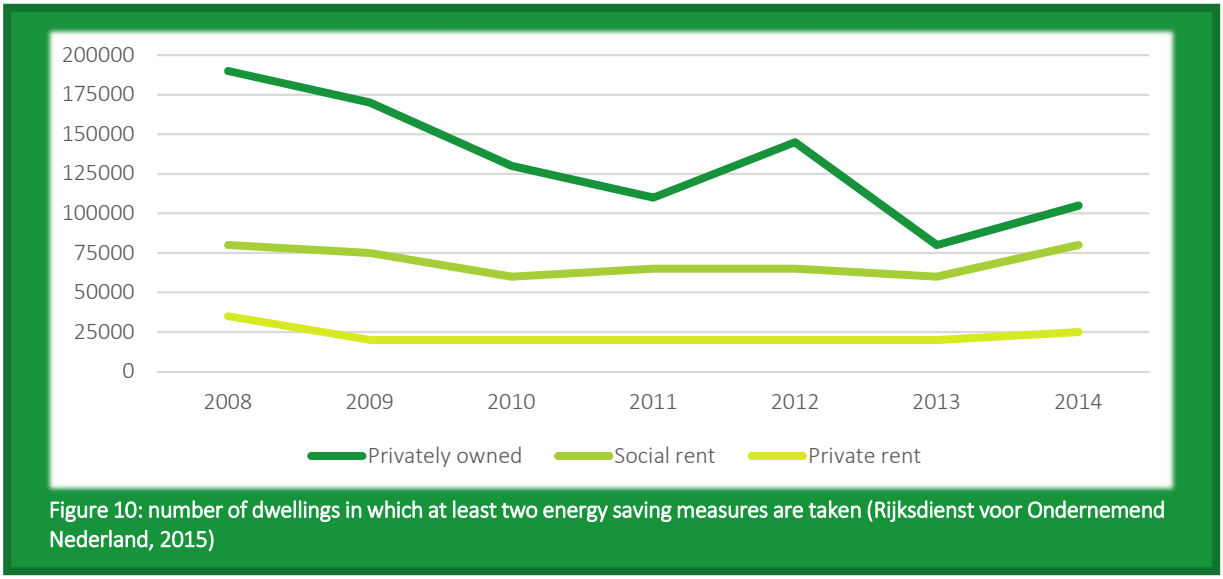


Figure 10: number of dwellings in which at least two energy saving measures are taken (Rijksdienst voor Ondernemend Nederland, 2015)

At first sight, it has become clear that stimulating AOOs to improve the energetic quality of their apartment buildings is a major challenge. However, selecting AOOs as the subject of this research does provide some opportunities, as the next section will show.

1.7. Opportunities regarding Associations of Owners

The selection of Associations of Owners with at least one privately-owned apartment as the subject of this research offers, aside from the described challenges, also several opportunities. Associations of Owners have, compared to single-family dwellings, the benefit of scale. AOOs consist, on average, of 9-10 apartments, possibly in combination with other types of units (CBS, 2016a). Due to their size, a decision to take energy saving measures in an AOO results in a larger effect on more dwellings than a similar decision in a single-family dwelling. Thus, despite the complex and time-consuming decision-making processes in AOOs, the obtained benefits of such collective decisions may offset these downsides.

The proposition that scale is an opportunity for AOOs, is illustrated by some recent numbers on the Dutch housing market and specifically on AOOs. In 2015, the Dutch housing market consisted of 7.6 million dwellings (CBS, 2016b). From this total amount of dwellings, 1.2 million dwellings are part of an Association of Owners (CBS, 2016a). More specifically, 0.95 million dwellings are part of an AOO with at least one privately-owned dwelling[2]. This corresponds to approximately 12.5% of the total Dutch housing stock (CBS, 2016a). It is striking that 60% of all dwellings in these AOOs are concentrated in only twenty large and medium municipalities in the Netherlands, as is shown in table 1. It is not surprising that the share of apartments in AOOs relative to the total housing stock of these municipalities is considerably higher than 12.5%. In Amsterdam, 's-Gravenhage, Leidschendam-Voorburg and Rijswijk, a share of 38% can be observed in figure 12 (CBS, 2016a; CBS, 2016b). In terms of scale, it becomes evident that AOOs with at least one privately-owned dwelling are a relatively large segment within the Dutch housing stock.

Table 1: ranking of municipalities based on number of apartments in AOOs with at least one private owned apartment (CBS, 2016a)

#	Municipality	#	Municipality
1	Amsterdam	11	Nijmegen
2	Rotterdam	12	Delft
3	Den Haag	13	Leiden
4	Utrecht	14	Breda
5	Groningen	15	Dordrecht
6	Haarlem	16	Zoetermeer
7	Eindhoven	17	's-Hertogenbosch
8	Leidschendam-Voorburg	18	Amersfoort
9	Arnhem	19	Rijswijk
10	Schiedam	20	Maastricht

Figure 11: bubble chart representation of number of Associations of Owners per municipality (based on CBS, 2016a).

Nevertheless, the presence of AOOs with at least one privately-owned dwelling is not limited to these twenty municipalities. The remaining 40% is evenly distributed over the other municipalities in The Netherlands (figure 11). Thus, this research may be of great interest for especially the large and medium municipalities in The Netherlands, but it is also relevant for other municipalities. To illustrate, only three municipalities – Ferwerderadiel, Loppersum and Rozendaal – do not have an AOO within their borders (CBS, 2016a).

A recent development is the increase in focus of the Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (*Ministry of the Interior and Kingdom Relations*) and several large municipalities on energy saving measures. These municipalities are, among others, Rotterdam and 's-Gravenhage. A suitable approach for stimulating AOOs to take energy saving measures is being sought both in collaboration and individually by the various governmental organisations, thereby recognizing the opportunities of such an approach.

[2] The total amount of dwellings in AOOs (1.2 million) and in AOOs with at least one privately-owned dwelling (0.95 million) may be somewhat higher in reality, as there are 26.000 addresses in AOOs with an unknown function (CBS, 2016a).

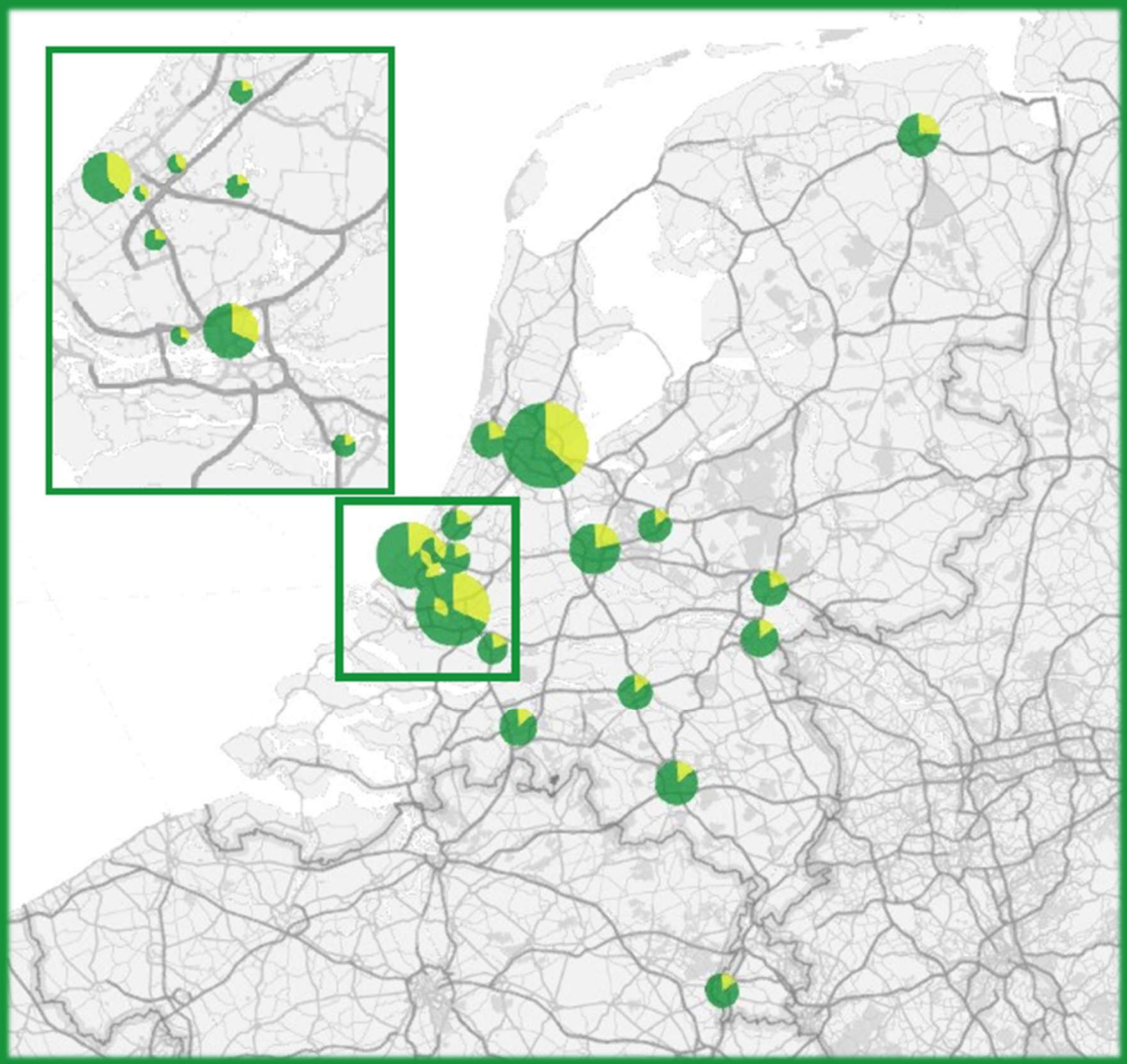


Figure 12: share of apartments in AOOs with at least one privately-owned dwelling – yellow – relative to the total municipal housing stock – green (based on CBS, 2016a; CBS, 2016b)

However, the 'national' discussion on this topic is still limited to a manageable number of interested parties. Most parties are located in the two provinces with most AOOs (Zuid-Holland and Noord-Holland), as figure 13 indicates. In many municipalities, a policy for stimulating AOOs to take energy saving measures still needs to be drafted. This research aims to add valuable information and insights to this discussion on suitable approaches and aims to provide this information to many parties.

Figure 13: number of Associations of Owners per province (based on CBS, 2016a)

1.8. Outline

To provide these insights, research part A continues with an extended problem exploration and the presentation of the research design and methodology in chapter 2. Subsequently, chapter 3 provides a description of the current system – the current situation – consisting

of an actor and systems analysis. These analyses are based on a literature study about stimulating AOOs to take energy saving measures. These analyses result in an overview of problematic causal relations – issues – within the current system. These problematic causal relations currently withhold AOOs from improving the energetic quality of their apartment buildings. In chapter 4, these problematic causal relations are compared to and supplemented with the problematic causal relations that are mentioned by respondents during several interviews. Finally, research part A ends with chapter 5, in which the impact of foreseeable changes and additions to the current system on the problematic causal relations are described.

The research continues with an Intermezzo in chapter 6, in which a selection is made from all problematic causal relations that are found in the literature study and interviews. This is because the number of problematic causal relations is too big and their diversity too large to address them all in one research. Subsequently, an assessment framework is made for assessing alternatives that aim to solve the selected problematic causal relations. With this assessment framework, promising alternatives can be identified.

In chapter 7 – the first chapter of research part B – several alternatives are designed for the selected problematic causal relations. These alternatives are assessed in chapter 8 with the assessment framework. The results from the assessments are used to combine and optimise a number of alternative approaches into four municipal approaches.

Finally, research part C presents the outcomes of this research. In chapter 10, strong and weak points of the four municipal approaches are indicated based on an expert validation. These insights are used to provide recommendations for a municipal approach that is able to change the selected problematic causal relations. Finally, chapter 11 and 12 provide the conclusions, some additional recommendations, and a reflection.

2. DESCRIPTION OF RESEARCH DESIGN

2.1. Introduction to the description of the research design

This second chapter offers a description of the research design. An important element of this design is the city of Rotterdam, which is used as an example throughout the research. With the city of Rotterdam in mind, a problem statement is formulated to provide some guidance for the research. In relation to this problem statement, the core of the design is described: the research questions, the objectives, and deliverables. Within a coherent structure these research questions relate to several consecutive chapters. This coherent structure is shaped by the research methodology, which consists of elements from the systems engineering approach and combines an extensive literature study with various interviews.

2.2. Extended problem exploration

2.2.1. Associations of Owners in Rotterdam

In the previous chapter, Associations of Owners with at least one privately-owned apartment are selected as the subject of this research. This selection will not be altered. Nevertheless, this selection has the disadvantage that it is rather general. It is difficult to create a clear picture on all Associations of Owners in The Netherlands with at least one privately-owned apartment. To add more focus to this picture, the city of Rotterdam will function as a continuing example in this research.

The city of Rotterdam is used as an example throughout the research for several reasons. Firstly, Rotterdam is the municipality with the second highest number of apartments in AOOs in The Netherlands, as is shown in table 1 in section §1.7 (CBS, 2016a). Also, the build-up of AOOs in Rotterdam in box 6 appears to be pretty similar to the overall build-up of AOOs in The Netherlands (box 5 in section §1.5). As a result, the city of Rotterdam seems to be a suitable example for this research.

Secondly, several other characteristics of AOOs in Rotterdam indicate the suitability of this example. For instance, the number of apartment rights per AOO in Rotterdam is equal to the national average of 14 apartment rights per AOO (CBS, 2016a). Furthermore, the percentage of 'mixed AOOs' – AOOs with both privately-owned and rented apartments – of 48% in Rotterdam is equal to the national percentage (CBS, 2016a).

Despite these similarities of Rotterdam and the national situation, at least two important differences have to be mentioned. Firstly, the 'WOZ value' of apartments in AOOs in Rotterdam is considerably lower than the national average (figure 15). The WOZ value is the appraisal value of property and is established by the relevant municipality under the Dutch Property Assessment Act (WOZ in Dutch). With 67%, Rotterdam has a relatively large share of apartments in AOOs with a WOZ value below €150.000 (CBS, 2016a). Thus, Rotterdam has a relatively large share of cheap apartments in AOOs. In contrast, Amsterdam stands out with a share of 35% for apartments in AOOs with a WOZ value above €300.000 (CBS, 2016a).

Secondly, the number of AOOs in Rotterdam per building period differs from the number of all AOOs in The Netherlands per building period. Figure 16 shows that more than 70% of AOOs in Rotterdam were built before 1945 (CBS, 2016a). Therefore, this part of the housings stock of Rotterdam can be called relatively old.

Both previously mentioned differences between Rotterdam and The Netherlands are indicators of the lower quality of the apartment buildings in Rotterdam. One way in which this lower quality expresses itself, is by means of deferred maintenance in certain neighbourhoods in Rotterdam (Gemeente Rotterdam, 2012). The municipality of Rotterdam states that, eventually, tens of thousands of dwellings –

including apartments in AOOs – need to be improved to arrive at an acceptable level of quality (Gemeente Rotterdam, 2012; Gemeente Rotterdam, 2016b).

BOX 6: THE BUILDING BLOCKS OF ASSOCIATIONS OF OWNERS IN ROTTERDAM

In accordance to figure 9, figure 14 provides a quick and simplified overview of the building blocks of Dutch Associations of Owners in Rotterdam. In this overview only units with an actual address are included. Among others, figure 14 indicates that the majority of the privately-owned apartments are located in a mixed building block. A mixed building block is a building block that contains at least two unit types, with possible unit types being: privately-owned apartments, rented apartments, shops, offices, other. A last note is that in some cases the number of units of the smaller building blocks do not match the number of units in the higher building block. This is because there is a category 'unknown'. Knowing that the total housing stock in Rotterdam consists of approximately 300.000 dwellings, the apartments in AOOs have a 39% share in the housing stock of Rotterdam (CBS, 2016a; CBS, 2016b).

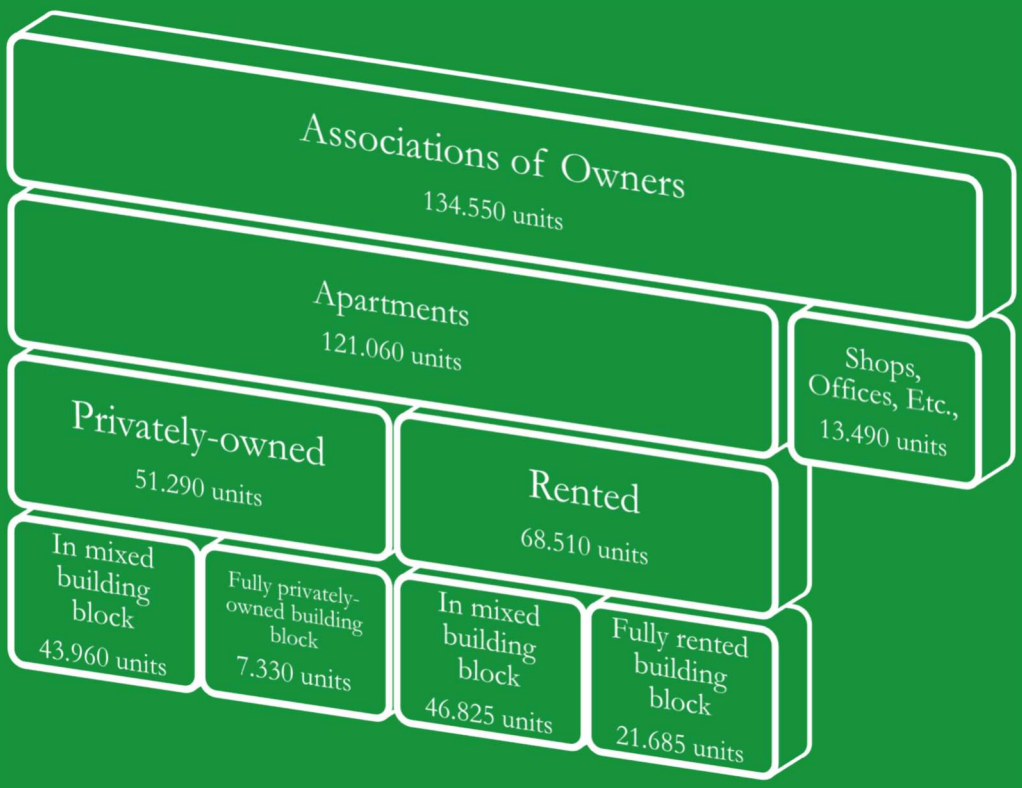


Figure 14: the general build-up of Associations of Owners in Rotterdam based on units with an address (CBS, 2016a)

Thus, in terms of quantity, the AOOs in Rotterdam are a good reflection of the AOOs in The Netherlands. However, the lagging quality of apartments in Rotterdam results in a challenging point of departure. This challenging point of departure may result in analyses and recommendations that can be applied – in a leaner form – to other municipalities in The Netherlands. Formulated differently, if a municipality with a strong point of departure (e.g. Amsterdam) would be selected as the continuing example for this research, an additional effort would be needed to apply the analyses and recommendations from this research in other municipalities.

Thirdly, Rotterdam is a suitable example because the municipality is already active in the field of AOOs for several years. In the first years, the focus of Rotterdam was on catching up with deferred maintenance. In the meantime, this focus has been expanded and currently includes energy saving measures (Gemeente Rotterdam, 2015e). The ambition of Rotterdam is to stimulate the implementation of energy saving measures in 1.500 apartments in AOOs by 2018 (Gemeente Rotterdam, 2015e).

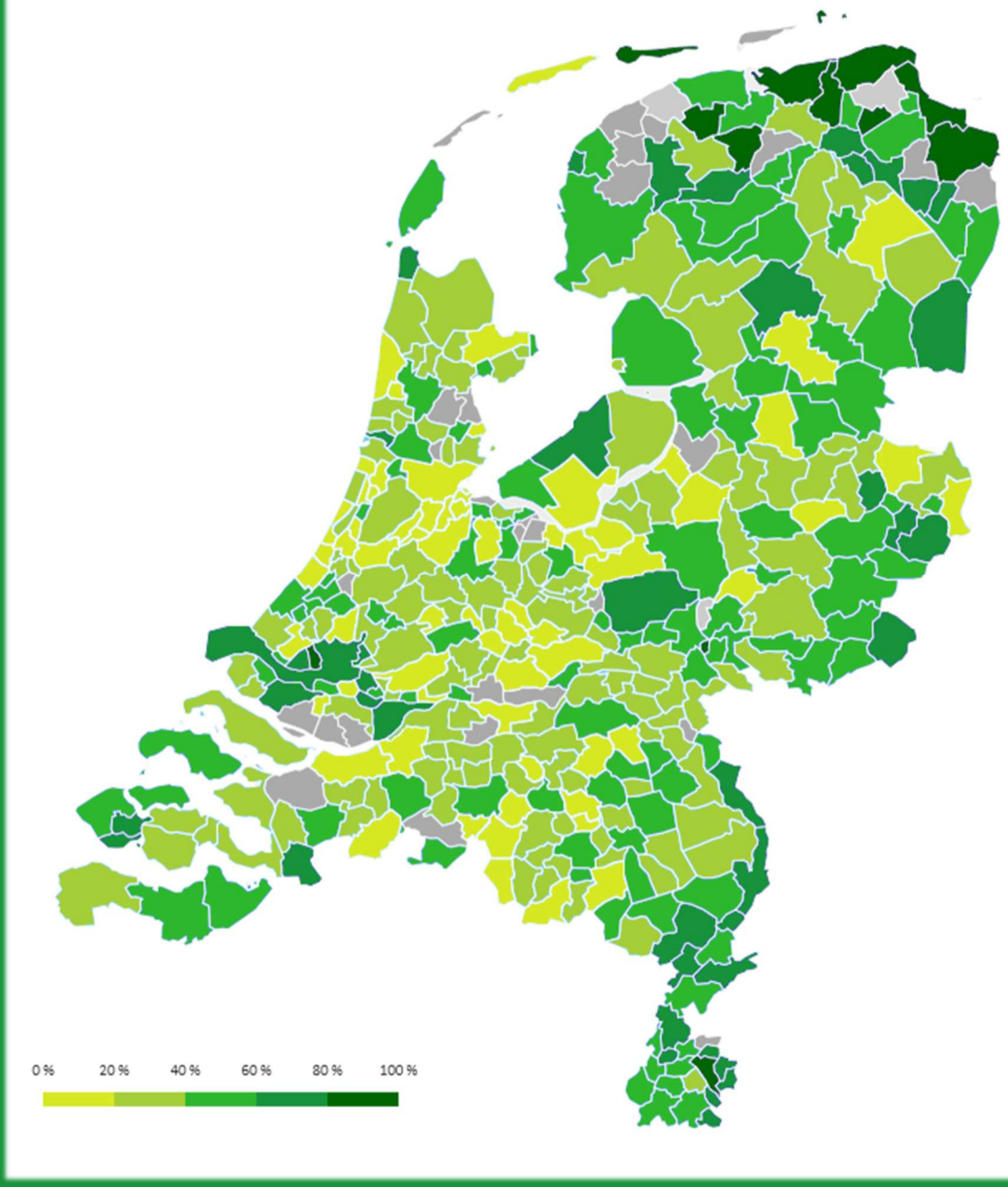


Figure 15: percentage of apartments in AOOs with a 'WOZ value' below €150.000 per municipality (based on interactive map of CBS, 2016a)

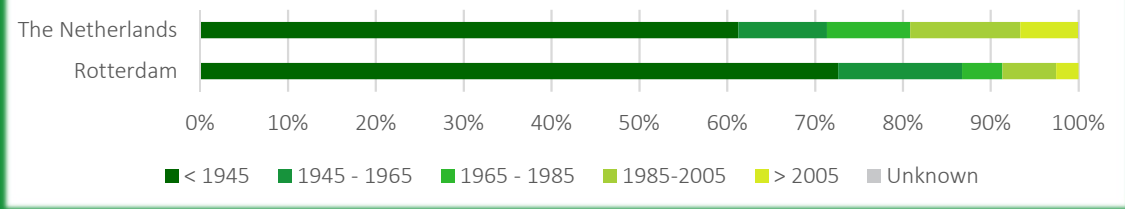


Figure 16: distribution of AOOs in Rotterdam and The Netherlands per building period (CBS, 2016a)

Several other examples of the active role of Rotterdam are available. In collaboration with a number of municipalities and the Ministry of the Interior and Kingdom Relations, Rotterdam is taking the lead in

clarifying and analysing the system of AOOs and in experimenting with promising approaches to stimulate the implementation of energy saving measures (De Haas & partners, 2016). Via this collaboration, Rotterdam is involved in the subsidy scheme – *subsidieregeling energiebesparing eigen huis* – of the Ministry, which aims to stimulate saving energy in existing owner-occupied dwellings (Staatscourant, 2016). In addition, Rotterdam participates in several pilots (e.g. *Renovatiesprong* and *Energiesprong*) to enhance the level of knowledge in this area. Furthermore, Rotterdam supports the regional energy counter – *WoonWijzerWinkel* – and founded VVE-010 in 2009, along with four large social housing associations, an organisation that assists and supports AOOs in Rotterdam (WoonWijzerWinkel, 2016; VVE-010, 2016b). Finally, Rotterdam has commissioned this research to improve the level of knowledge.

To summarise, Rotterdam is chosen as the continuing example in this research due to the large number of AOOs in the municipality, the similarities with the national build-up of AOOs, the challenging point of departure, and the active role of the municipality. The municipality of Rotterdam is a relevant example for other municipalities in The Netherlands. On the one hand, the active role of Rotterdam can serve as a positive example. While on the other hand, the challenging point of departure ensures that most municipalities can apply the recommendations of this report in a more limited form.

2.2.2. Problem statement

The example of the municipality of Rotterdam will be used in this sub section to work towards a problem statement. This problem statement will provide guidance to the research. This section will clarify the tension between the current state of Dutch AOOs and their ability to take energy saving measures and the desired future state.

The municipality of Rotterdam has formulated three milestones that represent the ambitions concerning energy reduction in the built environment (figure 17). The point of departure for Rotterdam is that dwellings on average have an energy label C (Energielabelatlas, 2016). In 2018, the last year of the period 2014-2018 of the current Mayor and Executive Board, the first milestone is set at 10.000 dwellings in which energy saving measures have been taken (Gemeente Rotterdam, 2015e). These energy saving measures should result in an improvement of the energy label with two steps to at least energy label C (Rotterdam, 2015c). These 10.000 dwellings include 1.500 dwellings in AOOs (Gemeente Rotterdam, 2015e). In reaction to the Paris Agreement being adopted by 195 countries on the 12th of December 2015, an additional set of measures was formulated by the municipality of Rotterdam (Gemeente Rotterdam, 2016a). With this additional set of measures the feasibility of taking energy saving measures in more than these 10.000 dwellings is investigated (Gemeente Rotterdam, 2016a).

For the year 2030, the ambition is to sustainably produce more energy than the amount of energy that is consumed in the city of Rotterdam (Gemeente Rotterdam, 2015c). With the milestone for 2050, the municipality wants to achieve that the buildings in the built environment can generate at least the amount of renewable energy that is consumed by all buildings (SER, 2013). This means that the built environment of Rotterdam will be energy neutral in 2050, in accordance to the national ambitions.

Although the ambitions of Rotterdam are clear, a critical remark is that these ambitions are not fully aligned with the national ambitions. In a period of four years (2014-2018), 10.000 dwellings will be energetically improved in Rotterdam. Considering the total housing stock of approximately 300.000 dwellings in Rotterdam, the yearly percentage of dwellings of the housing stock in which energy saving measures are taken, is 0,8% (CBS, 2016b). For apartments in AOOs, the yearly percentage does not exceed 0,4% as 1.500 apartments in Rotterdam will be energetically renovated over a period of four years. The national ambition is to energetically improve 300.000 dwellings per year with at least two label steps (SER, 2015). In the light of the national housing stock of 7.6 million dwellings, the yearly percentage of dwellings of the national housing stock, in which energy saving measures are taken, is

3,9% (CBS, 2016b). Although it is questionable whether the national ambition of 300.000 dwellings will be achieved, it is clear that the national ambition is more ambitious than the municipal ambition.

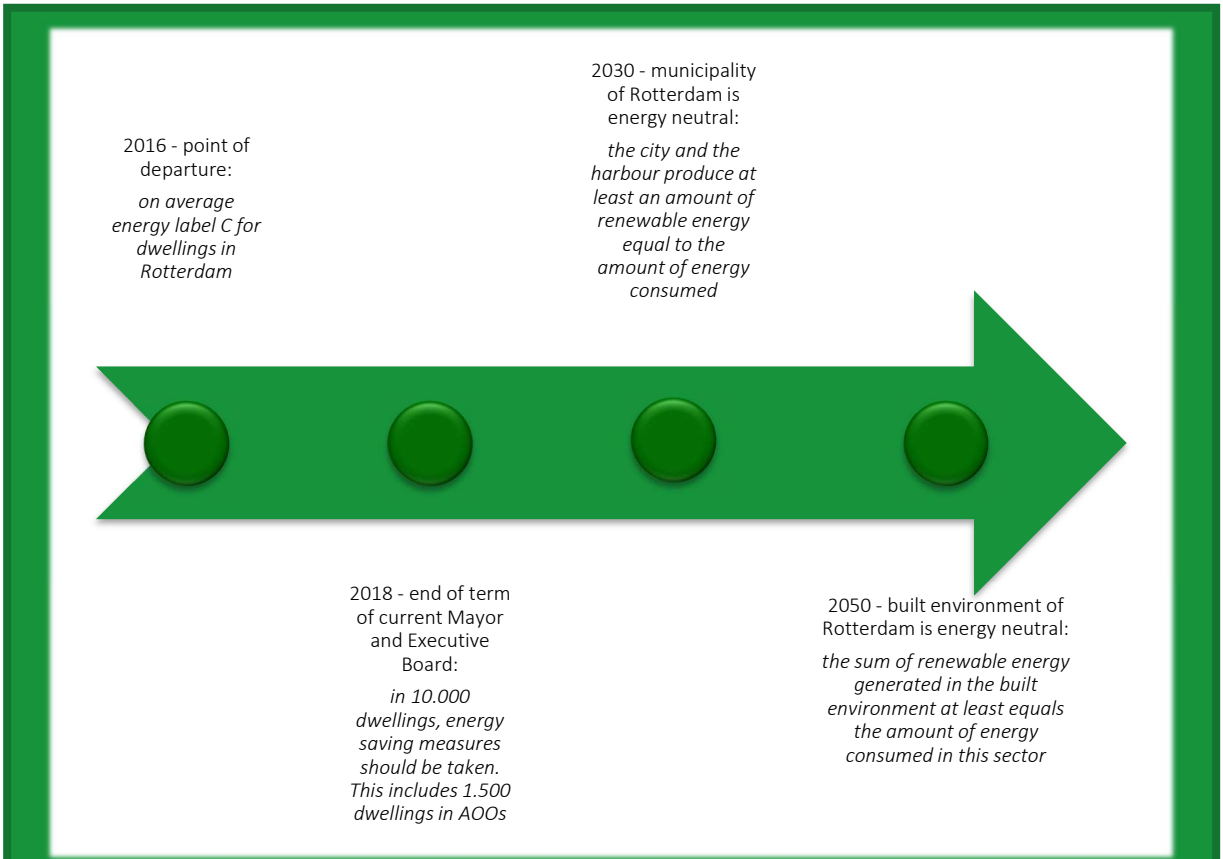


Figure 17: time line of energy reduction ambitions of the municipality of Rotterdam

This lower level of ambition cannot be explained by the progress that is already made in Rotterdam to meet the climate targets. One climate target is that the municipality has committed itself to reducing the CO_2 emissions in 2025 in the city and the port to half of the emissions in 1990 (DCMR Milieudienst Rijnmond, 2008). The CO_2 emissions in Rotterdam, as shown in figure 18, do not show a trendline towards this climate target (Milieumonitoring Stadsregio Rotterdam, 2016). Based on observations, another reason for the lower level of ambition in Rotterdam seems more likely. Both the limited amount of capacity (time) and resources (money) available for meeting the climate targets and the still ongoing search for an approach that can stimulate the uptake of energy saving measures in dwellings explain the cautious formulation of the municipal ambitions.

This search for an approach is not limited to the municipality of Rotterdam, on the contrary, most municipalities struggle to find an effective and efficient approach. A research of Twynstra Gudde and Atrivé on the municipalities of Amsterdam, Tilburg, Utrecht and Den Haag indicates that these municipalities observe various and mutually differing barriers in stimulating energy saving measures in dwellings. Because of these differing barriers, each municipality has adopted a distinct approach (Twynstra Gudde & Atrivé, 2016). According to the Social and Economic Council of the Netherlands (SER), the lack of cooperation between province, municipality, contractors, builders, and installers at the regional and local level is an example of these barriers (SER, 2015). Furthermore, the Council expresses the need to incorporate the national ambitions in the regional and local ambitions (SER, 2015). The lack of progress at the regional and local level is correlated to the lagging energy reduction in the built environment at a national level (PBL, 2014). Also, Vringer et al (2016) conclude that “it is not very likely that the energy

use will decline fast enough to achieve the Dutch policy targets for 2020" (p.23). Even though homeowners do make energetic improvements to their dwellings in small steps, "the policy instruments are too weak to stimulate energy saving measures on a larger scale" (p.9). The Ministry of the Interior and Kingdom Relations acknowledges these lagging results and has therefore proposed additional measures for, among others, privately-owned buildings (Algemene Rekenkamer, 2015; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016c).

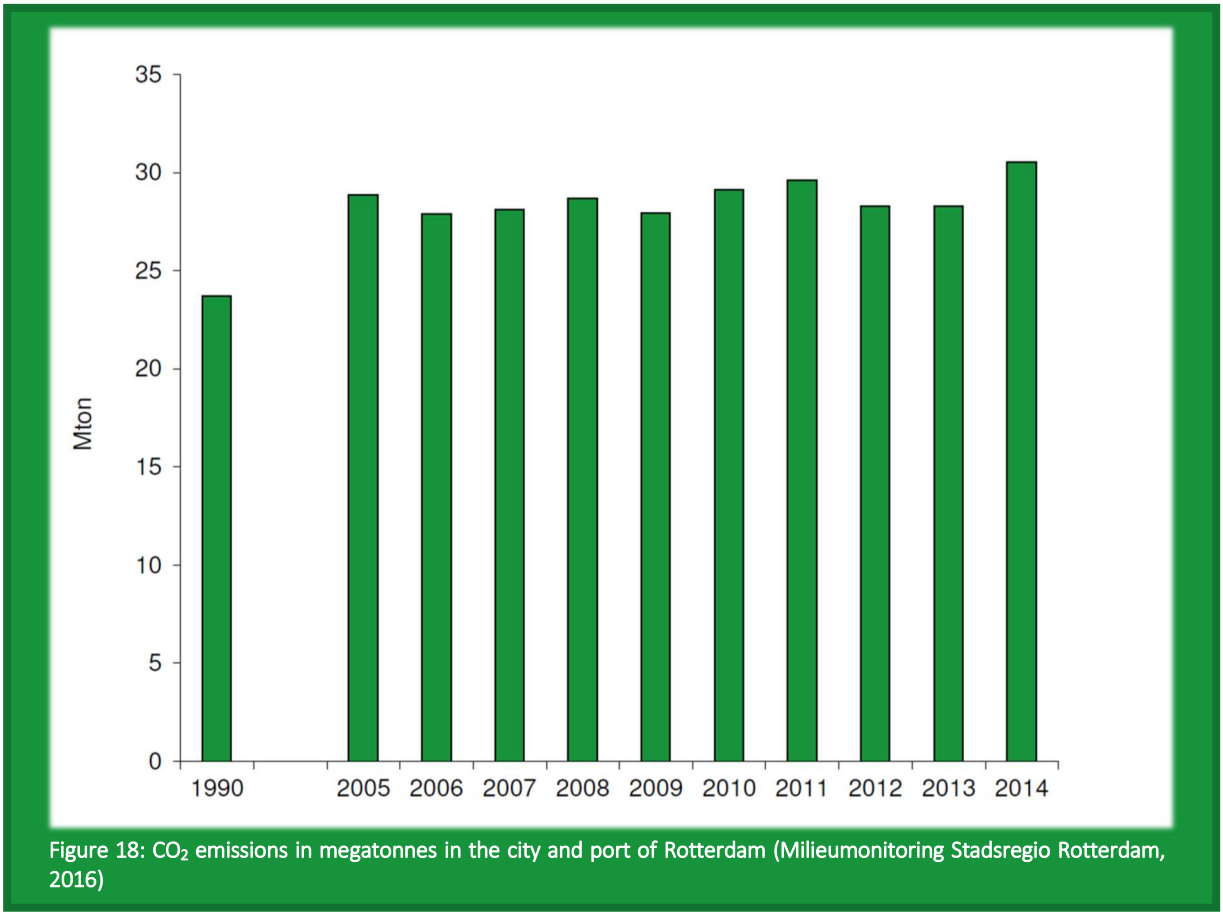


Figure 18: CO_2 emissions in megatonnes in the city and port of Rotterdam (Milieumonitoring Stadsregio Rotterdam, 2016)

In comparison to all buildings in the built environment, the AOOs are a difficult target group to stimulate to take energy saving measures. The lack of progress of AOOs can be attributed to a set of specific barriers (Waals van der, 2015). The following barriers, among others, complicate the implementation of energy saving measures: limited financial resources, laborious internal decision-making processes, and badly informed or not concerned residents with a short length of residence (Hazel van den, Vaessen, & Wolff de, 2007; Meijer, Visscher, Kloosterman, & Guerra Santin, 2009; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b; Vegter, 2012; Waals van der, 2015). Due to these barriers, some key energy saving policy instruments show a weak impact on especially AOOs (Murphy et al., 2012). The limited effect of these policy instruments is also observed in Rotterdam. Two evaluations of the current approach in Rotterdam show that most homeowners in AOOs are simply not interested in energy saving measures (Lammers & König, 2016; W&I Group, 2016).

Based on the previous confrontation between ambitions and obtained results, the problem statement for the municipality of Rotterdam can be formulated:

In what way could the energetic quality of AOOs in Rotterdam be improved to a level that suits the national ambitions, given the available time and resources of the municipality?

This problem statement indicates the tension between the current situation and the desired situation (Haan de, 2009). The problem statement is formulated for the municipality of Rotterdam. Therefore, the last part of the problem statement, regarding the available time and resources, describes an important tension from the viewpoint of the municipality of Rotterdam. The formulation of this problem statement does not exclude that other tensions may be present. On the contrary, other tensions are for example a possibly strong infringement of property rights to force apartment owners to improve the energetic quality, the disbalance between the financial resources of AOOs and the required future investments in energetic quality or the issue of sufficient resources of market parties to assist AOOs in their decision-making processes. But it is not practical to include this set of tensions in the problem statement.

However, the combined effect of these various tensions is that an effective and efficient approach to stimulate AOOs to improve the energetic quality of their apartment buildings has not been found yet. This indicates the existence of a knowledge gap. The causes for the inadequate results of the current approaches are unclear. Hence, the research starts with an analysis of these causes. It is after this analysis that the problem will be sufficiently clear to formulate recommendations to improve the current approach. These recommendations will be partially based on the analysis of Rotterdam, but are preferably also valuable for other municipalities in The Netherlands.

2.3. Research design: questions, objectives, and deliverables

Based on the problem statement and the identified knowledge gap, the following main research question can be formulated:

Which type of municipal approach is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings?

This main research question indicates that the research design and method need to result in an analysis of this complex multi-actor system from the perspective of just one actor: the municipality. To answer this main research question, it is crucial to address the following scientific problem:

How to make a complete analysis of this complex multi-actor system and how to formulate alternatives for issues within this system from the perspective of only one actor?

The research design results in a research that is a combination of two parts. In the first part, the current system is described and the problematic causal relations are analysed. More specifically, the barriers that currently withhold AOOs from improving the energetic quality of their apartment buildings will be clarified. In the second part, the results of the preceding analysis are used to design a suitable municipal approach to change some of these problematic causal relations, such that AOOs are more likely to take energy saving measures.

Therefore, part A and part B of the research each have a central research question and several sub questions. The combined results from both central research questions will provide an answer to the main research question. The intermezzo will provide an assessment framework which is based on research part A and is used in research part B.

Part A: what are the problematic causal relations that limit the effect of national and municipal approaches for stimulating AOOs to take energy saving measures?

A.1. Which problematic causal relations for stimulating AOOs to take energy saving measures are described in literature?
A.2. To what extent does the set of problematic causal relations from the literature study correspond to the problematic causal relations that are mentioned in interviews on the AOO practice?
A.3. What is the effect of planned/foreseeable changes of the current national and municipal approaches on the identified problematic causal relations?

Research part A starts with an extensive literature study on stimulating AOOs in the Netherlands to take energy saving measures. The results of this literature study are structured with an actor analysis and a system analysis. Subsequently, the insights from the literature study are confronted with the experience and observations that are shared by various actors from the AOO practice in interviews. The combined result of the literature study and the interviews is a list of numerous problematic causal relations that withhold AOOs from taking energy saving measures. The robustness of this list is tested with an analysis of the effects of planned or foreseeable changes of the current approaches on the causal relations.

I.1. Which criteria and constraints result from research part A and assist in finding a municipal approach that is able to breach the problematic causal relations that restrict AOOs in taking energy saving measures?

From this list, a selection of problematic causal relations is made based on a substantiated procedure. Especially for the short-term, these are the most important problematic causal relations that must be changed. In an intermezzo between part A and part B, an assessment framework is made to find a municipal approach that can change these problematic causal relations.

Part B: which types of municipal approach are, according to the assessment framework, suitable to change the problematic causal relations?

B.1. Which alternatives are suggested in literature and in the interviews for changing the problematic causal relations?
B.2. Which municipal approaches are, given the overall result in the assessments, able to change the problematic causal relations?

In research part B, several alternatives are designed that are to a large extent based on suggestions from the literature study and the interviews. Each alternative addresses at least one of the selected problematic causal relations. To find the best combinations of alternatives – the municipal approaches that can change the problematic causal relations – three assessments are carried out. Based on a validation of these combinations by several experts, recommendations are given for a type of municipal approach that can change the problematic causal relations that withhold the AOOs from improving the energetic quality of their apartment buildings.

The answers to above questions are followed by a concluding part C in which the final selection of the municipal approach is made and the conclusions and recommendations from this research are presented. The different parts of the research are integrated in the following objective statement:

The objective of this research is to describe a municipal approach to stimulate AOOs in Rotterdam and preferably other Dutch municipalities to take more energy saving measures, based on an extensive analysis of the current system and in compliance with the assessment framework consisting of criteria and constraints.

From the objective statement, three deliverables that will result from this research can be identified:

1. System analysis and description, including the identification of problematic causal relations, for the issue of stimulating AOOs in Rotterdam and preferably other municipalities to take more energy saving measures;
2. Assessment framework consisting of criteria and constraints to assess alternative approaches on their suitability to stimulate AOOs to improve the energetic quality of their apartment building;
3. Recommendations for a municipal approach that is able to stimulate AOOs in Rotterdam and preferably other Dutch municipalities to take more energy saving measures.

2.4. Research methodology

2.4.1. Coherence of the research

The preceding research questions should be answered according to a sound research methodology. This section describes the research methodology, the scientific design of this research. Each of the six sub questions formulated in the previous section will be answered in one or two corresponding chapters. For an overview, the chapters corresponding to the six sub questions are indicated in table 2.

Table 2: sub questions and corresponding chapters

PART A			
#	Sub question	#	Chapter
A.1.	*Which problematic causal relations for stimulating AOOs to take energy saving measures are described in literature?*	3	System description
A.2.	*To what extent does the set of problematic causal relations from the literature study correspond to the problematic causal relations that are mentioned in interviews on the AOO practice?*	4	Evaluation of current system
A.3.	*What is the effect of planned/foreseeable changes of the current national and municipal approaches on the identified problematic causal relations?*	5	Evaluation of system in near future
#	Sub question	#	Chapter
I.1.	*Which criteria and constraints result from research part A and assist in finding a municipal approach that is able to breach the problematic causal relations that restrict AOOs in taking energy saving measures?*	6	Assessment framework
#	Sub question	#	Chapter
B.1.	*Which alternatives are suggested in literature and in the interviews for changing the problematic causal relations?*	7	Design of alternatives
B.2.	*Which municipal approaches are, given the overall result in the assessments, able to change the problematic causal relations?*	8 9	Assessment of alternatives Optimising (combinations of) promising alternatives

So, which research methods and techniques are used to answer this set of six sub questions? This is the essence of the research methodology discussed in this section. As the character of the six sub questions varies, answering these questions requires different research methods and techniques. Thus, for each research sub question, suitable research methods and techniques are selected. Six combinations of a research sub question with often a combination of research methods and techniques may sound confusing. Therefore, a research flow diagram is composed to visualise these six combinations in figure 19[3]. The research flow diagram shows the three parts – part A, B, and C – of the research and the intermezzo. In part A, part B and the intermezzo, the corresponding research sub questions are answered, as is

[3] In Appendix I a bigger version of the research flow diagram in figure 19 is included, as the readability may be problematic.

shown in detail in table 2. In part C, the main research question is answered and the conclusions, recommendations and reflection are presented.

Every part of the research consists of two research phases. The current phase of conceptualisation is completed with the system description in chapter 3. Subsequently, the core of the evaluation phase is to evaluate, supplement and improve the system description based on contributions of various actors from the AOO practice in interviews. The insights gained from research part A are used to make an assessment framework. Part B starts with the formulation phase in which the alternatives are designed based on the suggestions from the literature study, interviews and a brainstorm. Thereafter, the analysis phase continues by assessing the alternative approaches based on the assessment framework. Moreover, opportunities to optimise (combinations of) the alternative approaches are sought in the analysis phase. The interpretation phase of part C includes the final selection of a suitable approach. The last phase, the recommendations phase, concludes the research and provides recommendations and a reflection. The loop in the research flow diagram illustrates the iterative character of the process to improve a system. Within this research one iteration will be completed. The research flow diagram is partly based on the systems engineering approach (Sage & Armstrong, 2000). This systems engineering approach is a suitable approach to address the scientific problem of this research: *how to make a complete analysis of the complex multi-actor system and how to formulate alternatives for issues within this system from the perspective of only one actor?*

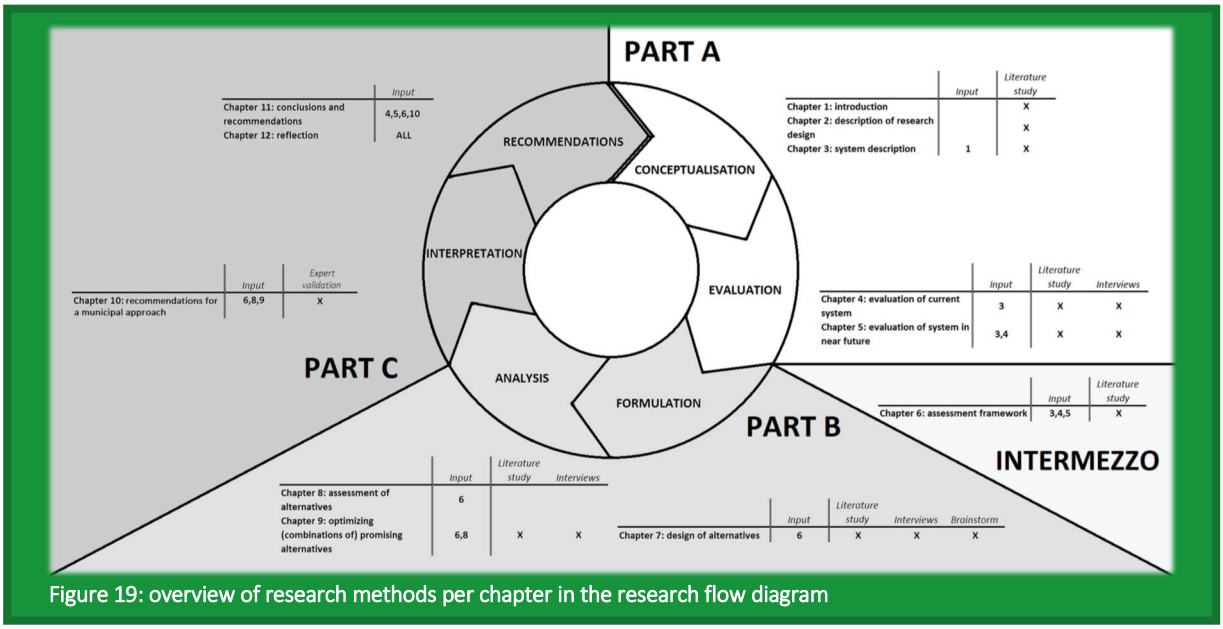


Figure 19: overview of research methods per chapter in the research flow diagram

Finally, the research flow diagram shows per research phase the corresponding chapters of the research. For each chapter, the required input from previous chapters and the research methods that will be applied are indicated.

2.4.2. Research methods and techniques

To conclude this section, a closer look is given at the research methods and techniques. Four different research methods are applied: literature study, interviews, a brainstorm, and an expert validation. The research methods and techniques are briefly introduced in this section and are described in detail in the corresponding chapters.

The literature study is used to provide input to most of the chapters in this research, as is shown in the research flow diagram. However, the most important input of the literature study for this research is in

the system description of chapter 3. The literature study is comprehensive and includes many sources on AOOs in the Netherlands, often in combination with search results for subjects such as '(national) policy on energy saving', 'positive examples of energy saving measures taken', 'financial, legal and process aspects' and 'improving the quality of maintenance of apartment buildings'. The amount of published scientific research on the subject of research is limited, but in addition valuable reports from reliable (Dutch) research institutes can be used. Moreover, some pilot projects and experiences from a couple of organisations are documented. The number of sources was significantly increased by using key terms and bibliographies in literature for new searches, also known as the snowball effect (Baarda & De Goede, 2006). In the system description, the information from the literature study is combined and structured by means of two research techniques: the system analysis and the actor analysis.

To supplement the system description of chapter 3, the research method of interviews is used to identify additional and (partly) contradicting information from various actors from the AOO practice. Over the course of two months, 28 interviews with 32 respondents were held. As the questions in the interviews have an open character, oral interviews are considered most suitable (Baarda & De Goede, 2006). Based on the actor analysis, relevant organisations were selected after which contact details of potential respondents were retrieved. In addition, each respondent was asked for suggestions for other respondents. Each interview has the same structure and contains six discussion topics. However, the formulation and content of the questions are slightly adapted to the specific expertise of every respondent. The structure of an interview consists of the following six discussion topics: 1) relation of respondent to the subject of research (incl. description of context and level of knowledge); 2) experience with energy saving measures in AOOs; 3) naming obstacles in the current system (problematic causal relations); 4) naming potential alternative approaches to improve the current system; 5) pilot projects, experiments and other respondents; 6) effect of foreseeable changes and additions to the current system. From this it follows that the interviews provide more input for the research than just a supplement to the system description. For example, results from the interviews are also used for designing and optimising alternative approaches.

In the remainder of the research, the research phases are largely based on input from previous phases and the input from research methods becomes slightly less prominent. An example is the assessment framework consisting of criteria and constraints in chapter 6 as it is largely based on the problematic causal relations found in the system analysis of chapter 3 and on the insights, that are derived from the interviews. For the design of the alternatives, the suggestions made by the respondents form the basis. These suggestions are elaborated and adjusted based on literature and a brainstorm. In chapter 10, the results from an expert validation are used, in combination with the key insights from research part A and B, to arrive at recommendations for a municipal approach. At this point of the research, it goes too far to discuss the details of the research methods and techniques. Therefore, the general description of methods and techniques in this section will be elaborated in detail at the start of each chapter.

3. SYSTEM DESCRIPTION

3.1. Introduction to the system description

This chapter is part of the conceptualisation phase and contributes to the answering of the central research question of research part A: *what are the problematic causal relations that limit the effect of national and municipal approaches for stimulating AOOs to take energy saving measures?* Specifically, the system description in this chapter aims to answer the first research sub question:

A.1. Which problematic causal relations for stimulating AOOs to take energy saving measures are described in literature?

As is indicated in the research sub question itself, a literature study is used as the research method. This literature study forms the basis for the description of the system of stimulating energy saving measures in AOOs in the Netherlands. During the literature study, the choice was made to select only literature on Dutch AOOs. As the legal structure of AOOs in other countries differs from the Dutch AOOs, the comparison with AOOs abroad is difficult (Vegter, 2012). Moreover, the amount of literature on AOOs in other countries is often not available in English.

The literature study aims to collect a set of sources that provide a complete description of the system. Therefore, several databases were used, such as Scopus, the repository of the TU Delft, databases for reports from the municipality of Rotterdam, the Ministry of the Interior and Kingdom Relations and several Dutch (research) institutes. In addition, searches via Google were conducted to find sources from the AOO practice. Most searches were carried out in Dutch, with Scopus being the English exception. The basic search term is 'Association of Owners' – *Vereniging van Eigenaren (VvE)* – but combinations were made with subjects such as '(national) policy on energy saving', 'positive examples of implemented energy saving measures', 'financial, legal and process aspects', or 'improving the quality of maintenance level of apartment buildings'. The bibliographies of the sources, that were initially found, were used to find additional relevant sources (snowball effect).

The sources that resulted from the literature study are structured and analysed with two research techniques: actor analysis and systems analysis. The actor analysis in section §3.2, also known as stakeholder analysis, describes and classifies actors based on their interests and objectives. The actor analysis shows which actors are involved in the problem and in what way (Enserink et al., 2010). In the systems analysis of section §3.3, the causal relations of the system are mapped and analysed. The analysis helps to put some structure to the complex problem of stimulating AOOs to improve the energetic quality of their apartment buildings. By combining the results of both analyses, the problematic causal relations in this system, according to literature, will become clear in section §3.4.

3.2. Actor analysis

The actor analysis in this section consists of several steps to arrive at a description and classification of the actors involved. The first step of this description is largely based on the interests, objectives and available resources of each actor. This illustrates the extent to which an actor is involved in the challenge of stimulating energy saving measures in AOOs. Secondly, the formal relations between the actors are described and included in a formal chart. This chart may indicate problematic, redundant or missing relations. Thirdly, the actors are classified and positioned on a power/interest grid. This power/interest grid is, among others, used to select relevant respondents for the interviews.

3.2.1. Interests, objectives and available resources

This sub section consists of an enumeration of relevant actors and includes their interests, objectives and available resources as known in literature. Preceding this enumeration, definitions for the terms

'interests, objectives and available resources' are provided. "Interests are the issues that matter most to an actor", but "are not directly linked to the concrete problem situation" of stimulating AOOs to take energy saving measures (Enserink et al., 2010, p.92). 'Objectives indicate what actors wish to achieve in this concrete problem situation' (Enserink et al., 2010). "The resources of actors are het formal and informal means that are available to the actors to realise their objectives" (Enserink et al., 2010, p.96).

The Association of Owners

As an actor, the Association of Owners can be described as multiform. As figure 20 indicates, the organisational structure of the AOO includes several components, e.g. the board of the AOO (*bestuur*), the audit committee (*kascommissie*) and the general meeting of owners (*vergadering van eigenaars*). This general meeting of owners may consist of owner occupants, social housing associations and private landlords (*particuliere verhuurders*). In addition, the AOO may have a relation with tenants – via social housing associations and/or private landlords – and an administrator (*beheerder*). Lastly, the AOO may contain some non-residential units with a retail or office function. Before examining the interests, objectives and available means of this multiform actor, it is sensible to describe the AOO in more detail.

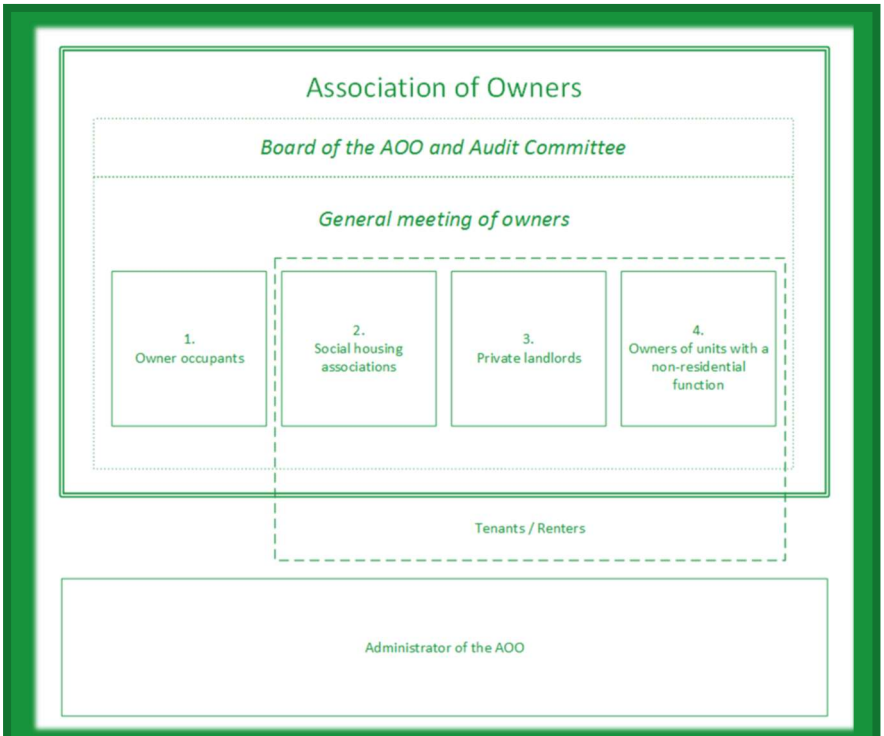


Figure 20: organisational structure of the AOO

To start, the AOO is a legal entity (Vegter, 2012). In the general meeting of owners of the AOO decisions can be made on the management, maintenance and the use of joint properties and the complex (Vegter, 2012). These decisions are taken by absolute majority, unless otherwise specified in the articles of the Association of Owners (Vegter, 2012). In addition, many regulations include a provision that the owners of at least 50% of the apartment rights should be present during the first assembly of the general meeting of owners to take a decision (Waals van der, 2015). The board of the AOO is responsible for the execution of the decisions made by the general meeting and for the management of the financial resources of the AOO. The audit committee is the component of the AOO that checks the execution of the tasks of the board (Vegter, 2012). Decisions on the maintenance (and energetic quality) of the complex are preferably included in the multi-year maintenance plan (*meerjarenonderhoudsplanning, MJOP in Dutch*).

Topics for the assembly of the general meeting of owners, such as the implementation of energy saving measures, can be proposed by both the board of the AOO and by individual owners (Waals van der, 2015). The general meeting of owners may consist of three types of owners: owner occupants, social housing associations and private landlords. Thus, the specific composition of the general meeting of owners in an AOO varies based on the number of owners and their distribution over one or more owner types. For the correct and complete formulation of the interests, objectives and available resources of the AOO, the interests and objectives of the three types of owners should be considered separately.

The owner occupants, in general, have an interest in an apartment with an appropriate value for money given their personal situation. On the long term, preserving or increasing the property value of the apartment is an additional interest (Gruis & Budde, 2012). Within the preconditions of sufficient financial means, limited nuisance, and significant benefits in terms of the reduction of the housing expenses[4] or the increase in comfort, the objective of the owner occupant may be to invest in energy saving measures in the AOO (Gruis & Budde, 2012).

Social housing associations, in their core, have an interest in providing good and affordable housing to the target group of low-income households, e.g. families with an income below €29,000 per year (Aedes, 2016). Regarding energy saving measures in AOOs, social housing associations have an objective to meet national targets for the social housing stock and additional performance agreements with municipalities (Aedes et al., 2016). At a national level, social housing associations aim to improve the average energy label of the social housing stock to label B in 2025 and label A in 2030 (Aedes et al., 2016). The commitment of social housing associations to meet the national targets and especially the additional performance agreements with municipalities is not very high (Milieudefensie, 2016). Stimulating energy saving measures in AOOs is certainly no business as usual for social housing associations (Nieboer et al., 2011). Part of this has to do with the fact that social housing associations should take the interests of their tenants into account, especially if a renovation or a rent increase is required to improve the energetic quality (Gruis & Budde, 2012; Stroomversnelling Nederland, 2015).

The private landlords have an interest in a profitable exploitation of their real estate. Within the preconditions of improving the rentability of the apartments, a sound business case, and limited risks, the objective of the private landlords is to invest in energy saving measures in AOOs. Private landlords who are a member of Vastgoed Belang, an association that is committed to the interests of private landlords, aim at 80% of their housing stock having at least energy label C in 2020 (Rijksdienst voor Ondernemend Nederland, 2016a). As well as social housing associations, private landlords need to take the interests of tenants into account during the decision-making process on energy saving measures in AOOs (Stroomversnelling Nederland, 2015).

The number of owners of units with a non-residential function, mostly a retail or office function, in AOOs is limited in Rotterdam. In Rotterdam, there are approximately 120.000 apartments and 4.000 units with a retail or office function in AOOs (CBS, 2016a). Like the owner occupants, the owners of units with a retail or office function have an interest in a profitable exploitation and in preserving or increasing the property value. Within the preconditions of sufficient financial means, limited nuisance, little lost revenue, and significant benefits in terms of the reduction of energy expenses, the owner is willing to invest in energy saving measures in the AOO.

The combined available resources of the three types of owners are both formal and informal. Financial resources such as the reserve fund of the AOO[5], a single deposit to the reserve fund or a loan, are the most important formal resources (Vegter, 2012). The right to propose topics for the general meeting of owners is another formal resource. Informal resources of an AOO may be the contribution of expertise, information and time of an apartment owner to inform other owners on the topic of energy saving measures (Gruis & Budde, 2012). Besides, on a national level the interest group *VvE Belang* stands up for the interests of AOOs and apartment owners (VvE Belang, 2016c).

[4] Housing expenses, in this context, are the sum of energy consumption expenses and mortgage repayments (Gruis & Budde, 2012)

[5] Normally, the general meeting of owners has decided that each owner has to pay a monthly contribution to the AOO. These contributions together form the reserve fund of the AOO, which is used to pay for maintenance and unexpected expenses.

Lastly, AOOs may contract an administrator, an external organisation, to take over a number of tasks of the board of the AOO (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). Most administrators do not feel the urgency to take a leading role regarding energy saving measures (Waals van der, 2015). However, recently a few administrators have started to advise AOOs to include a couple of energy saving measures in their multi-year maintenance plan (Atrivé, 2015).

Municipality of Rotterdam

Before describing the interests, objectives and available resources of the municipality of Rotterdam, a description of the context of AOOs in Rotterdam is given. In the municipality of Rotterdam, 11.500 AOOs are present with at least one apartment (CBS, 2016a). These AOOs contain in total approximately 120.000 apartments, both privately-owned and rented (CBS, 2016a). The average number of apartments per AOO (10,5 apartments) indicates that Rotterdam contains many small AOOs. However, a fair number of large AOOs with over 100 apartments are also located in Rotterdam (CBS, 2016a). The residents of AOOs in Rotterdam tend to be situated more often in a difficult socio-economic situation compared to the national average (CBS, 2016a). The social housing associations in Rotterdam[6] are situated in a challenging financial situation as well (Woonbond, 2016). On top of that, the municipality is working on fraudulent private landlords (Gemeente Rotterdam, 2012).

Within this challenging context, the leading role of the municipality in stimulating AOOs has changed to a facilitative role (Gemeente Rotterdam, 2015e). This facilitative role implies that the municipality of Rotterdam wants to collaborate with a wide range of actors on this issue (Gemeente Rotterdam, 2015e). The financial resources (subsidies) to tempt AOOs are reduced and for a large part used to create an efficient and effective collaboration with other actors. Behind this shifting role and reduced deployment of financial resources a fundamental question is hidden: "why should a municipality invest public money in the maintenance" or energetic improvement "of private dwellings?" (Meijer & Visscher, 2015).

Firstly, the municipality of Rotterdam has an interest in improving the maintenance level of dwellings, as a lack of maintenance results in a reduced quality of the housing stock and affects the perceived quality of the living environment (Waals van der, 2014). The municipality of Rotterdam has set the ambition to create an attractive living environment to retain residents with a favourable social-economic situation, especially in the southern part of Rotterdam (Gemeente Rotterdam, 2015d). Secondly, the municipality of Rotterdam has an interest in improving the energetic quality of dwellings, as this improvement is an essential step to meet the national agreements on energy reduction and the municipal ambition to become energy neutral in 2030 (Gemeente Rotterdam, 2015c).

Within the municipality of Rotterdam, the department of Building Control and Housing Inspection (*afdeling Bouw- en Woningtoezicht*) is responsible for improving the level of maintenance, while the department of Public space and Housing (*afdeling Ruimte en Wonen*) and more specifically the programme '*Duurzaam*' are responsible for an improvement of the energetic quality of the privately-owned housing stock in Rotterdam. These two departments collaborate on the issue of stimulating AOOs to take energy saving measures, but for the sake of clarity, the objectives and available resources are discussed separately.

The *afdeling Bouw- en Woningtoezicht* wants to improve the maintenance quality of houses in Rotterdam within twenty years to the average maintenance quality level of the housing stock in the four large cities of The Netherlands (Gemeente Rotterdam, 2015d). In addition, they want to avoid a situation in which the maintenance quality of improved dwellings will decline once again to an unacceptable level

[6] In Rotterdam, four large social housing associations are located (Havensteder, Vestia, Woonbron and Woonstad Rotterdam) and a few smaller social housing associations

(Gemeente Rotterdam, 2012). To prevent this for AOOs, effort is needed during the process of improving the maintenance quality to activate the general meeting of owners and the board of the AOO, to stimulate good management, and to draft or update the multi-year maintenance plan (Gemeente Rotterdam, 2012).

In case of deferred maintenance in violation with the *Woningwet* (Housing Act), the available legal resource for the *afdeling Bouw- en Woningtoezicht* is that it may summon the AOO to solve this maintenance problem. The improvement of the deferred maintenance by the AOO can be enforced or the costs for the improvement can be recovered from the AOO by the municipality. In case of deferred maintenance that is not yet in violation with the *Woningwet* and an AOO that is not active (box 7), the municipality may use the *Machtigingswet* (Enabling Act). The *Machtigingswet* enables the municipality to request the *kantonrechter* (judge) for authorisation to convene the general meeting of owners (Vegter, 2012). In addition, the municipality can be present at and to speak during the assembly. However, the decisions are still taken by the general meeting of owners (Vegter, 2012). Under certain conditions, the municipality may even enforce to draft a multi-year maintenance plan, to get a professional administrator, and to implement the measures from the multi-year maintenance plan (Vegter, 2012). The threat of using the *Machtigingswet* may be a sufficient trigger for an AOO to solve the maintenance problem (Hof et al., 2015). Additional resources of the *afdeling Bouw- en Woningtoezicht* to stimulate energy saving measures in AOOs are the provision of information (i.e. VVE-010), professional advice from building inspectors, and in exceptional cases a subsidy to improve the maintenance level of the AOO (Gemeente Rotterdam, 2015a).

BOX 7: ACTIVE AND FUNCTIONING ASSOCIATIONS OF OWNERS

AOOs in The Netherlands can be split into two categories. On the one hand, there is a category of active (e.g. functioning) AOOs and on the other hand, there is a problematic group of non-active (e.g. sleeping) AOOs. Sleeping AOOs are problematic as there is no yearly assembly of the general meeting of owners, no official decision-making process and no deposits to the reserve fund of the AOO (Vegter, 2012). In contrast, an active AOO is formally functioning if it has: a yearly assembly of the general meeting of owners, a periodic deposit of the owners to the AOO, a multi-year maintenance plan, a reserve fund, a collective insurance and the presence of a board (Vegter, 2012). The most favourable situation is a formally functioning AOO that does carry out major maintenance works. Unfortunately, the reality is that not many AOOs have reached this most favourable situation yet. This results in maintenance problems and a lack of AOOs who take energy saving measures. The cause is that a sound basis of AOOs is lacking. In 2012, for example, 51% of Dutch AOOs had insufficient financial resources in the reserve fund and even 65% did not have a multi-year maintenance plan (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b).

The *afdeling Ruimte en Wonen* has a leading role in the *'Duurzaam'* programme and '*Versnelling010'*. *Versnelling010* is a network of organisations[7] with the objective to reduce the energy consumption of the housing stock of Rotterdam (Gemeente Rotterdam, 2015e). The ambition of *Versnelling010* is to achieve at least two energy label steps to at least energy label A, B, or C for 1.500 apartments in AOOs before 2018 (Gemeente Rotterdam, 2015e). In response to the adoption of the Paris Agreement, the option to increase the number of apartments in AOOs in the ambition is being explored by the municipality of Rotterdam (Gemeente Rotterdam, 2016a). In contrast to the *afdeling Bouw- en Woningtoezicht*, the *afdeling Ruimte en Wonen* and the *Versnelling010* programme do not have coercive resources available to enforce the uptake of energy saving measures by AOOs. *Versnelling010* is trying to achieve the objective with resources such as: the provision of information (special website,

[7] The network of actors of *Versnelling010* consists of the municipality of Rotterdam (*afdeling Ruimte en Wonen*), constructors, social housing associations, Rabobank Rotterdam, NUON, Eneco, Stedin, VVE-010 and NRG031 (Gemeente Rotterdam, 2015e).

letters to residents and via special attachments in local newspapers), the establishment and support of (physical) information desks (e.g. VVE-010 and WoonWijzerWinkel), and enabling AOOs to take part in a special course on energy saving measures (Gemeente Rotterdam, 2015e). To inspire AOOs, the municipality aims to support a fast decision-making and implementation process by collecting and presenting information on inspiring pilot AOOs (BIQ, 2015). Lastly, *Versnelling010* has initiated the Rotterdam Renovation Fund (RRF). The Rotterdam Renovation Fund has the ambition to use European funding to support an efficient decision-making process of AOOs on energy saving measures and to create a financial arrangement to grant loans to small AOOs (less than 10 apartments) for this purpose (Atrivé, 2015).

VVE-010

VVE-010 is an independent foundation with an interest in supporting AOOs in Rotterdam. They assist with everything that comes with an AOO (VVE-010, 2016a). Both the municipality and the four large social housing associations in Rotterdam participate in VVE-010 (Gemeente Rotterdam, 2015d). The objective of VVE-010 is to achieve a minimum level of quality of the apartments, to have an active AOO, and to energetically improve 1.500 apartments with at least two energy label steps to a minimum of energy label A, B, or C before 2018 (Gemeente Rotterdam, 2015a). This objective is directly related to one of the objectives of the municipality of Rotterdam. VVE-010 is commissioned by the municipality to provide basic services and to offer support on the topic of energy saving measures to AOOs from 2015 to 2018 (Atrivé, 2015).

The available resources of VVE-010 to support AOOs vary, because some AOOs in Rotterdam are designated to receive a special approach to solve (repeating) maintenance problems (Gemeente Rotterdam, 2015b). Normally, VVE-010 provides information, advice and support with all sorts of practical matters to AOOs (VVE-010, 2016a). Moreover, VVE-010 assists apartment owners to start up an active AOO (VVE-010, 2016c). For the designated AOOs that require a special approach, VVE-010 drafts a multi-year maintenance plan and operates as the administrator of the AOO for a limited period (VVE-010, 2016c).

WoonWijzerWinkel

The WoonWijzerWinkel is the official energy information desk for Rotterdam and other municipalities in the region (WoonWijzerWinkel, 2016). The WoonWijzerWinkel, a trademark of a charitable foundation, has an interest in the promotion of energy saving measures in the built environment and the continuation of the organisation (WoonWijzerWinkel, 2016). To date, the WoonWijzerWinkel is partly relying on subsidies and contracts for specific projects from municipalities, including Rotterdam. The objective of the WoonWijzerWinkel is to stimulate as many AOOs as possible to consider the implementation of energy saving measures. To this end, the WoonWijzerWinkel brings numerous energy saving measures together in a showroom in Rotterdam (WoonWijzerWinkel, 2016). This showroom can be visited by apartment owners, thereby enabling a meeting between supply and demand. Other resources of the WoonWijzerWinkel are professional advice, obligation free quotes (*vrijblijvende offerte*), special offers in selected neighbourhoods, information on the website and in a mobile portacabin (*WoonWijzerWagen*) (WoonWijzerWinkel, 2016).

European Union

The European Union has an interest in ensuring a secure, affordable and climate-friendly energy provision for EU citizens and businesses (European Union, 2016). Regarding climate-friendly energy, the EU has set itself the objective to cut 80-95% in greenhouse gas emissions by 2050 compared to 1990 (European Union, 2016). The available resource to the EU is that this objective, with the consent of the Member States, is included in national policy. The Member States, including The Netherlands, decide on the specific form of implementation of the national policy.

Ministry of the Interior and Kingdom Relations

The Ministry of the Interior and Kingdom Relations (*Ministerie van Binnenlandse Zaken en Koninkrijksrelaties*) has an interest in contributing to affordable, safe, and energy-efficient dwellings for citizens in

pleasant neighbourhoods (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016d). The objective of the Ministry is to stimulate AOOs to pay attention to sustainability, in order to contribute to the reduction of greenhouse gas emissions (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016a). The Ministry knows the achievement of this objective is lagging and that additional measures are needed (Algemene Rekenkamer, 2015; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016c). For AOOs, the Ministry has three available resources: 1) a subsidy on insulation of the AOO and optionally on an energy advice, a sustainable multi-year maintenance plan and professional guidance during the decision-making process[8], 2) a loan on favourable terms to finance the implementation of energy saving measures (NEF), 3) and a three-year campaign to inform owner occupiers who consider taking energy saving measures (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016e).

Province of South-Holland

The Province of South-Holland (*Provincie Zuid-Holland*) has an interest in being a leading province in which citizens live, work and recreate with pleasure (Provincie Zuid-Holland, 2016a). The transition to a clean, future-proof and affordable energy system is considered an opportunity to innovate, to stay competitive, to protect the environment and by doing so, to maintain the current welfare and prosperity (Provincie Zuid-Holland, 2016a). The objective of the Province is to make the energy supply to the built environment CO_2-neutral by 2035 (Provincie Zuid-Holland, 2016b). However, the Province does not focus on stimulating home owners to take energy saving measures as this is perceived a task for the municipalities.

VNG region Rijnmond en Goeree Overflakkee

The *Vereniging van Nederlandse Gemeenten* (VNG) – the association of Dutch municipalities – has divided The Netherlands in 29 regions. The municipality of Rotterdam is in the region *Rijnmond en Goeree Overflakkee* (figure 21). The VNG has an interest in supporting municipalities to achieve the objectives from the national Energy Agreement for Sustainable Growth (VNG, 2016). The objective of the VNG is to develop stable alliances and partnerships and to work towards profitable and repeatable business cases (VNG, 2014). The VNG has received a financial resource, a €15 million subsidy, from the Ministry of the Interior and Kingdom Relations (VNG, 2014). VNG regions may apply for a share of this financial resource to support regional alliances of companies, civil society, and government,

Figure 21: location of VNG region Rijnmond en Goeree Overflakkee

[8] The subsidy is roughly equal to 20% of the insulation costs. The subsidy can only be applied for if at least two different types (e.g. insulation of the roof, façade, floor, cavity wall or high efficiency glass) of insulation are implemented of sufficient size.

and to contribute to the achievement of the objectives from the Energy Agreement (VNG, 2014). In addition, the VNG deploys coordinators who help in expanding smart and innovative partnerships and in specific projects (VNG, 2014). Lastly, the VNG strongly stimulates each region to set up a regional energy information desk, such as the WoonWijzerWinkel in Rotterdam for the region Rijnmond and Goeree Overflakkee (VNG, 2014).

Platform Duurzaam VVE Beheer

In addition to the co-operation with the other municipalities in the VNG region, Rotterdam takes part in the *Platform Duurzaam VVE Beheer* (i.e. Platform Sustainable Management of AOOs) (Gemeente Rotterdam, 2015d). A few municipalities (e.g. Amsterdam, Apeldoorn, and Den Haag) and experts on the AOO practice participate in this platform. The participants noted that the increase in energetic quality of AOOs is lagging compared to the modest increase in energetic quality in the remaining Dutch housing stock (De Haas & partners, 2016). It is in the interest of this platform to stimulate and support the uptake of energy saving measures by AOOs (De Haas & partners, 2016). The objective of the platform is to find effective approaches and tools to this end (De Haas & partners, 2016). The available resources of the platform are limited to sharing experiences and exchanging knowledge (De Haas & partners).

Construction, maintenance and renovation companies

Naturally, there is a mix of companies from the building industry involved in the implementation of energy saving measures in AOOs. Currently, the share of such measures in the order books of companies that operate in the market of privately-owned dwellings is 25% (Bouwend Nederland, 2016b). *Bouwend Nederland* is the largest association and business organisation of construction companies and represents the interests of the Dutch building industry (Bouwend Nederland, 2016c). *Bouwend Nederland* has an interest in a vital building industry that works on a sustainable regeneration of the living environment (Bouwend Nederland, 2016c). In addition, it is in the interest of the companies in the building industry to be among the first companies that can make the transition, as they may well be 'the winners of the future' (De Nederlandsche Bank, 2016). Given the commercial character of the companies, their primary objective is to generate both turnover and profit. Subordinate is the objective to contribute to an energy neutral built environment in 2050. *Bouwend Nederland* points out that the simply developing interesting offers for home owners is not sufficient to meet this objective in 2050. In addition, the demand side, the home owners, should be stimulated (Bouwend Nederland, 2016a).

One of the available resources of *Bouwend Nederland* is to lobby for this purpose (Bouwend Nederland, 2016c). In the lobby, a greater consistency between the policy instruments for stimulating a sustainable built environment has priority (Bouwend Nederland, 2015). Currently, the building industry senses that the energy policy of the various government levels is uncertain given the lagging results (De Nederlandsche Bank, 2016). Timely and predictable energy policies are essential for the building industry to fully contribute to the national objectives on energy reduction (De Nederlandsche Bank, 2016). Another resource is providing customized information to home owners. For this purpose, new technologies are used, such as tools that illustrate the implications of energy saving measures in a 3D model of the specific dwelling (e.g. WoonConnect) (WoonConnect, 2016). Besides, the building industry wants to design repeatable renovation concepts, that will reduce the purchase costs for individual home owners. A last resource of the building industry is to convince indecisive home owners by offering a guarantee on the energy performance of the dwelling after renovation up to 10 years (BouwGarant, 2016).

Energy and process consultants

In contrast to the companies of the building industry, the energy and process consultant are not directly involved in the implementation of energy saving measures. Energy consultants inform AOOs on the most efficient energy saving measures for their specific building and on the impact of the measures on the housing expenses and comfort of the apartments (FEDEC, 2016). Process consultants assist (the boards of) AOOs during the decision-making process and aim to create a support base among the vari-

ous apartment owners for the implementation of energy saving measures (Platform31, 2015). The energy and process consultants have an interest in expanding the market for advice to AOOs. They see this as an opportunity to increase both turnover and profits. The objective of energy and process consultants is to increase the quality of their customized advices to AOOs, such that more AOOs may take decisions on energy saving measures based on a correct and reliable advice (FEDEC, 2016). Independent advice from energy and process consultants who have no direct interest in the implementation of measures – in contrast to advice from companies from the building industry itself – may result in less obstacles in the decision-making process (Waals van der, 2015). The recent subsidy from the Ministry of the Interior and Kingdom Relations is an available resource to the consultants, as the subsidy covers a part of the costs for their energy advice or professional guidance during the decision-making process (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016e). In addition, consultants may clarify their written advice during a presentation at the general meeting of owners and may pay attention to the comprehensibility of the advice, in order to enhance the opportunity of a positive decision of energy reduction.

Banks and the SVn

AOOs should preferably save a sufficient amount of money in their reserve fund for major maintenance and energy saving measures (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2015). However, this is currently not the case for a considerable number of AOOs for numerous reasons. Another option for AOOs to finance these measures is to apply for a loan. These loans are only incidentally provided by one Dutch bank (e.g. Rabobank) and some small credit providers. This is because the AOO cannot provide a collateral (*onderpand*) in return (Agentschap NL, 2012; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). The national government has, therefore, opened the existing *Nationaal Energiebespaarfonds* (i.e. a national fund for saving energy) for AOOs in 2015 (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2015).

The *Nationaal Energiebespaarfonds* (NEF) stems from the *Woonakkoord* (i.e. Housing Agreement) of 2013 (Rijksoverheid, 2016e). The original objective of the NEF was to increase the investment capacity in the building industry by providing landlords and individual home owners access to this fund (Rijksoverheid, 2016e). In 2015, the national government opened the NEF also for AOOs with the objective of providing them access to financial resources for the implementation of energy saving measures (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2015). The objective of the NEF is to contribute to the uptake of energy saving measures by AOOs and ultimately to the achievement of the national energy saving targets. A secondary objective is to demonstrate to banks and other credit providers that the risks of loans to AOOs are limited (Platform31, 2013). In other words, the national government wants to tempt more banks and other credit providers to develop financial products for AOOs.

The NEF is managed by the *Stimuleringsfonds Volkshuisvesting Nederlandse Gemeenten* (SVn) (NEF, 2016b). In total, €300 million is available. The interest and repayment revolve into the fund (NEF, 2016b). The available resources to the SVn are the loan conditions. For example, the NEF is open for AOOs with at least 10 apartments (NEF, 2016b). The loan can only be used for selected (energy saving) measures by the SVn (NEF, 2016b). A last example of the loan conditions is that the size of the total loan for an AOO may vary between €25.000 and €5.000.000 (NEF, 2016b).

The above enumeration of interests, objectives and available resources for the relevant actors is summarised in table 3.

Table 3: overview of interests, objectives and available resources of relevant actors

#	Actors	Interests	Objectives	Available resources
1	Association of Owners			
1.1	*Owner occupants*	Appropriate housing expenses and favourable property value.	Invest in energy saving measures, within certain preconditions and in case of sufficient benefits.	a. The reserve fund; b. a single deposit to the reserve fund; c. a loan; d. right to propose discussion topics for the general meeting of owners; e. contribution of expertise, information and time by owners and f. a contract with an administrator.
1.2	*Social housing associations*	Provide good and affordable housing to the target group	Average energy label of social housing stock is label B in 2025 and label A in 2030. Meet additional performance agreements.	
1.3	*Private landlords*	Profitable exploitation through rental of the real estate.	Invest in energy saving measures within financial preconditions and in case of limited risk.	
1.4	*Owners of units with a non-residential function*	Appropriate establishment costs and favourable property value	Invest in energy saving measures, within certain preconditions and in case of sufficient benefits.	
2	Municipality of Rotterdam			
2.1	*Afdeling Bouw- en Woningtoezicht*	Improve maintenance level of dwellings and quality of living environment	Maintenance quality of the housing stock in Rotterdam needs to be improved to the average level of quality in the four large cities in The Netherlands.	a. Summon AOOs based on the Woningwet; b. Machtigingswet; c. provision of information and d. subsidy to improve maintenance level.
2.2	*Afdeling Ruimte en Wonen*	Improve energetic quality of dwellings to meet national and municipal ambitions.	Achieve at least two steps in energy label to at least label A, B, or C in 1.500 apartments in AOOs before 2018.	a. Provision of information; b. information desks; c. course on energy saving measures; d. inspiring pilots and e. RRF.
3	VVE-010	Supporting AOOs with everything that comes with an AOO.	Achieve minimum level of quality of apartments. Activate AOOs. Energetically improve 1.500 apartments with at least two energy label steps to at least label A, B or C in 2018.	a. Information, advice and support; b. activate AOOs and c. in special cases, multi-year maintenance plan and administrator.
4	WoonWijzerWinkel	Promotion of energy saving measures in the built environment and the continuation of the organisation.	Stimulate as many AOOs as possible to consider the implementation of energy saving measures.	a. Showroom with energy saving measures; b. professional advice; c. obligation free quotes; d. special offers and e. information provision.
5	European Union	Ensuring a secure, affordable, and climate-friendly energy provision for EU citizens and businesses.	Cut 80-95% in greenhouse gas emissions by 2050 compared to 1990.	a. Objectives are included in the national policy of Member States.
6	Ministry of the Interior and Kingdom Relations	Contributing to affordable, safe and energy-efficient dwellings for citizens in pleasant neighbourhoods.	Stimulate AOOs to pay attention to sustainability, in order to contribute to the reduction of greenhouse gas emissions.	a. Subsidy on insulation and advice; b. a loan from the NEF; c. a three-year information campaign.
7	Province of South-Holland	Leading province in which citizens live, work and recreate with pleasure.	Energy supply to the built environment is CO_2-neutral by 2035.	
8	VNG region Rijnmond and Goerree Overflakkee	Supporting municipalities to achieve the objectives from the national Energy Agreement	Continue to develop stable alliances and partnerships and to work towards profitable and repeatable business cases.	a. €15 million subsidy for support of regional alliances, b. coordinators and c. regional energy information desks.
9	Platform Duurzaam VVE Beheer	Stimulate and support the uptake and energy saving measures by AOOs.	Find effective approaches and tools to stimulate and support the uptake of energy saving measures.	a. Sharing experiences and b. exchanging knowledge.
10	Construction, maintenance and renovation companies	Vital building industry that works on a sustainable regeneration of the living environment. Be among the first companies that make the transition.	Generate turnover and profits. Contribute to an energy neutral built environment in 2050.	a. Lobby; b. Customized information; c. design repeatable renovation concepts; d. guarantee on the energy performance.
11	Energy and process consultants	Expanding the market for advice to AOOs to increase both turnover and profits.	Increase the quality of customized advices to AOOs, to stimulate the uptake of more energy saving measures.	a. Subsidy on advice from the Ministry; b. nice presentation and comprehensibility of advice.
12	Banks and SVn	Providing AOOs access to financial resources for the implementation of energy saving measures.	Contribute to the uptake of energy saving measures of AOOs and the achievement of national energy saving targets.	a. Fund of €300 million and b. loan conditions.

3.2.2. Formal relations between actors

The extensive discussion on the interests, objectives and available resources of the relevant actors in sub section §3.2.1 is used in this sub section to map the formal relations between actors. Formal relations between actors may be based on laws, contracts and agreements. These formal relations can be mapped in a formal relations chart to visualise the interdependencies between actors. The formal relations chart is used in this sub section to analyse which formal relations may need to be enhanced or even created to potentially solve problematic causal relations. The analysis of the formal relations focusses on the AOO, thereby disregarding some natural relations between for example various levels of government.

Given the large number of formal relations, the choice was made to construct two complementary versions of the formal relations chart. The first version maps the internal relations within the AOO. This formal relations chart shows the AOO as a multiform actor, in line with the previous sub section. The second version maps the external relations of the AOO with other actors. To focus on the external relations, the AOO is mapped in this formal relations chart as one uniform actor. Both formal relations charts are based on the literature study.

Internal formal relations

The first formal relations chart focusses on the internal formal relations of an AOO and is included in figure 22. The formal relations that have not previously been referred to in this research, are discussed in short in box 8. For the specific layout of this formal relations chart, the following assumptions were made: the AOO has a board and an audit committee [9] and the AOO is registered at the Chamber of Commerce (i.e. *Kamer van Koophandel*). Due to the registration at the Chamber of Commerce, the board of the AOO and those authorized to sign contracts on behalf of the AOO are known to other actors (Kamer van Koophandel, 2016). The problematic formal relations from the first version of the formal relations chart are briefly discussed before continuing the analysis with the second version of the chart.

BOX 8: INTRODUCING NEW FORMAL RELATIONS I

In the first formal relations chart, a number of formal relations require an introduction. Firstly, the general meeting of owners appoints, by majority vote, the audit committee and the board (VvE Belang, 2016a; VvE Belang, 2016b). The audit committee checks the financial documents of the AOO (VvE Belang, 2016b). The board consists of at least one member. A member of the board can be both an owner in the AOO or an external professional (VvE Belang, 2016a). The board executes the decisions made by the general meeting of owners. For example, the board concludes contracts with various market parties (VvE Belang, 2016a). In addition, the board monitors the monthly financial contributions of the owners to the reserve fund (VvE Belang, 2016a). The deed of division and the corresponding model regulation determine the number of votes each owner has in the general meeting of owners (VvE Belang, 2016d). These votes are mostly based on the surface areas of the apartments. Lastly, the *Boek 7 BW Huur* (i.a. the Seventh Book of the Civil Code on Rent) regulates the relation between lessor and tenant (Rijksoverheid, 2016b).

The first problematic formal relation is related to one of the assumptions that underpin the formal relations chart in figure 22. Despite the growing number of active and functioning AOOs, still 30% of the AOOs[10] did not comply with the mandatory registration at the Chamber of Commerce in 2015 (CBS, 2016a). The absence of this registration causes uncertainty for companies that want to do business with AOOs. For these companies, it is essential to know who is authorized to sign contracts to ensure that the contract is legally binding (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b).

[9] An AOO has the obligation to have an audit committee, unless there is a supervisory board (i.a. *Raad van Commissarissen*) or a supervisory accountant appointed based on the deed of division (VvE Belang, 2016b).
[10] From the 144.000 AOOs in the dataset of the cadastre (i.a. *Kadaster*), 100.000 AOOs were registered at the Chamber of Commerce in 2015. In these figures, also AOOs without residential apartments are included (CBS, 2016a).

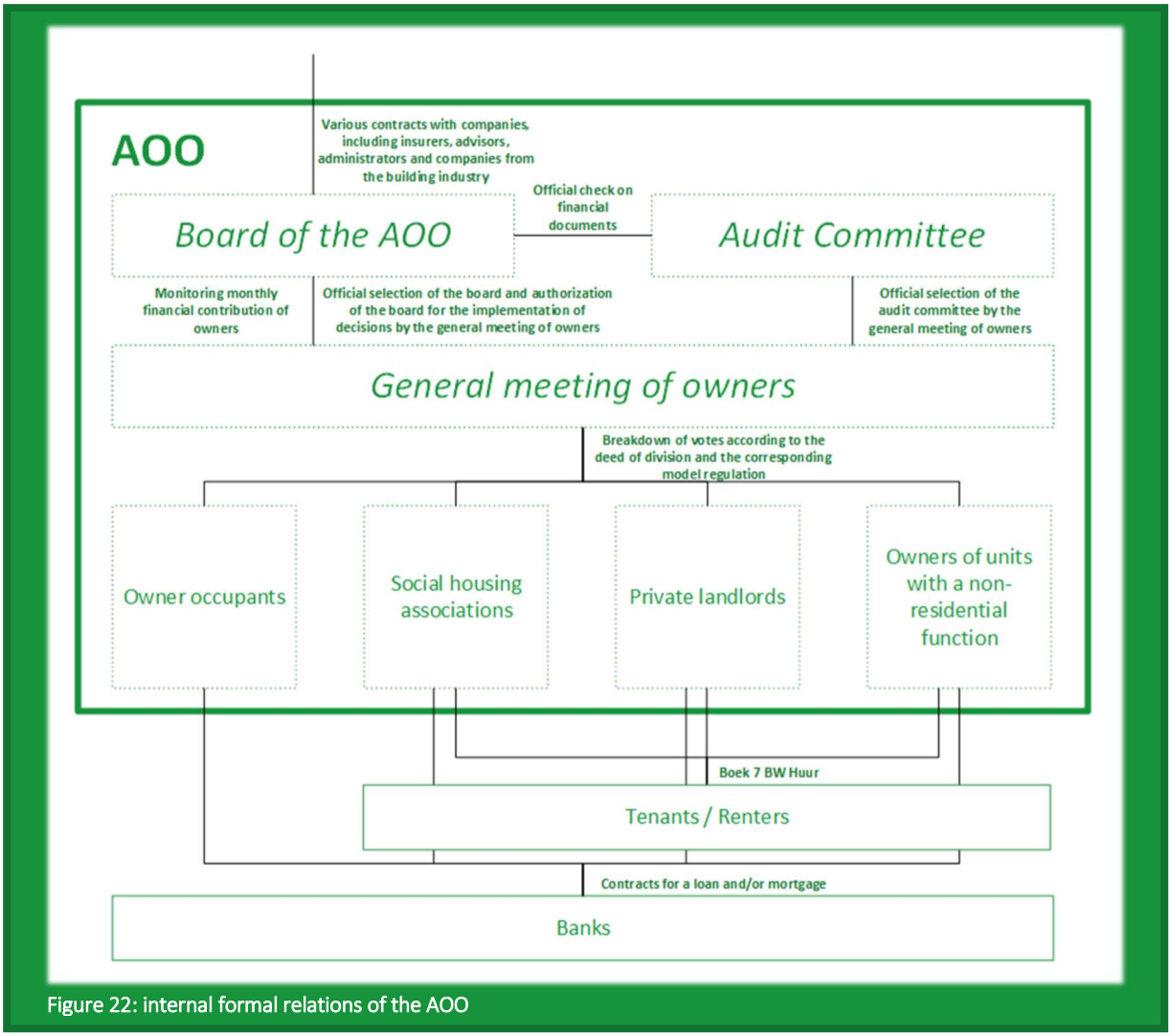


Figure 22: internal formal relations of the AOO

A second observation is that the professionalism of the board of the AOO varies with the size of the AOO (Vegter, 2012). This holds for both types of boards: a board consisting of members of the general meeting of owners and a board consisting of external members. In larger AOOs, boards do more often consist of professional members with the required skills (Budde & Gruis, 2012). A lesser quality of the board limits the opportunities for an AOO to execute major maintenance works, let alone the execution of energy saving measures.

Thirdly, the ownership structure in the AOO and the breakdown of votes, according to the deed of division (i.e. *splitsingsakte*) result in numerous AOOs in which one large owner owns most of the apartments. This owner has a major impact on the decision-making process as his number of votes is sufficient to take or to obstruct a decision in the general meeting of owners (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016b). For the uptake of energy saving measures, this situation can be either an opportunity or an obstacle, depending on the motivation of this large owner to invest in such measures.

Lastly, the social housing associations, private landlords and lessors of units with a non-residential function are bound by the Boek 7 BW Huur (i.e. *Seventh Book of the Civil Code on Rent*) (Rijksoverheid, 2016b). The essence is that lessors should take the interests of their tenants/renters into account during the decision-making process in the AOO. In addition, lessors often need to have the consent of 70% of the tenants for an (energetic) renovation of the apartments (Rijksoverheid, 2016b). If an increase of the rent is needed for this renovation, a lack of consent from the tenants may obstruct the process.

External formal relations

The second version of the formal relations chart is included in figure 23. Most of the external formal relations have been mentioned as available resources to actors in the previous sub section. The formal relations that have not previously been referred to in this research, are discussed in short in box 9. During the analysis of the available literature on formal relations between the actors introduced in the previous sub section, a number of problematic formal relations are identified.

BOX 9: INTRODUCING NEW FORMAL RELATIONS II

In the formal relations chart of figure 23, three formal relations are shown that have not been introduced before. Firstly, the Boek 5 BW Appartementsrechten (i.a. Fifth Book of the Civil Code on apartment rights) is a national law that coordinates the initiation and existence of AOOs (Rijksoverheid, 2016a). This law, among others, regulates the obligations for AOOs to have a reserve fund and a collective insurance (Rijksoverheid, 2016a). The Ministry of the Interior and Kingdom Relations has been the origin of most of the content of this law, given the policy domain of this ministry. Secondly, the formal relations chart shows that AOOs may have a pre-existing relation with banks when they apply for a loan to finance energy saving measures. Various owners within an AOO may have taken out an individual mortgage to finance the purchase of the apartment. Thirdly, the WoonWijzerWinkel has, in addition to the financial support from the municipality of Rotterdam and the VNG region, a financial formal relation with numerous companies from the building industry. These companies purchase a subscription at the WoonWijzerWinkel, allowing the demonstration of their products in the showroom of the WoonWijzerWinkel.

The first observation is that the legal embedding of the international (and European) climate goals in Dutch national policy is limited. The Agreement on Energy for Sustainable Growth from 2013, signed by 40 Dutch organisations, comes closest to any form of legal embedding (SER, 2013). However, this agreement does not result in any direct obligations for the ordinary energy consumer. As a result, the municipality is lacking an obligatory instrument – similar to the instruments available for deferred maintenance (Woningwet and Machtigingswet) – to force the uptake of energy saving measures in AOOs (PBL, 2014). Notable is that approximately 50% of home owners in The Netherlands would find new regulations on the energetic quality of existing dwellings acceptable (PBL, 2014).

Secondly, the national government – the Ministry of the Interior and Kingdom Relations – has included several obligations for AOOs in the Fifth Book of the Civil Code on apartment rights. These obligations are included with the objective to have active and functioning AOOs in The Netherlands with preferably a yearly assembly of the general meeting of owners, a periodic deposit of the owners to the AOO, a multi-year maintenance plan, a reserve fund, a collective insurance and the presence of a board (Vegter, 2012). In practice, it turns out that a significant number of AOOs does not abide by the rules on apartment rights (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). It seems that these AOOs do not experience the negative consequences of disregarding these obligations as no enforcement is taking place.

Thirdly, AOOs consisting of at least 10 apartments may apply for a loan from the *Nationaal Energiebespaarfonds* for the implementation of energy saving measures (NEF, 2016b). The number of commercial banks that provide similar loans to AOOs is limited (Agentschap NL, 2012; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). AOOs consisting of less than 10 apartments and with insufficient financial resources to finance the energy saving measures themselves, have no other options to apply for a loan for the AOO. Instead, the apartment owners of these AOOs need to individually apply for a loan (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). In that case, existing mortgages need to be considered and may cause that the loan is not being granted (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b).

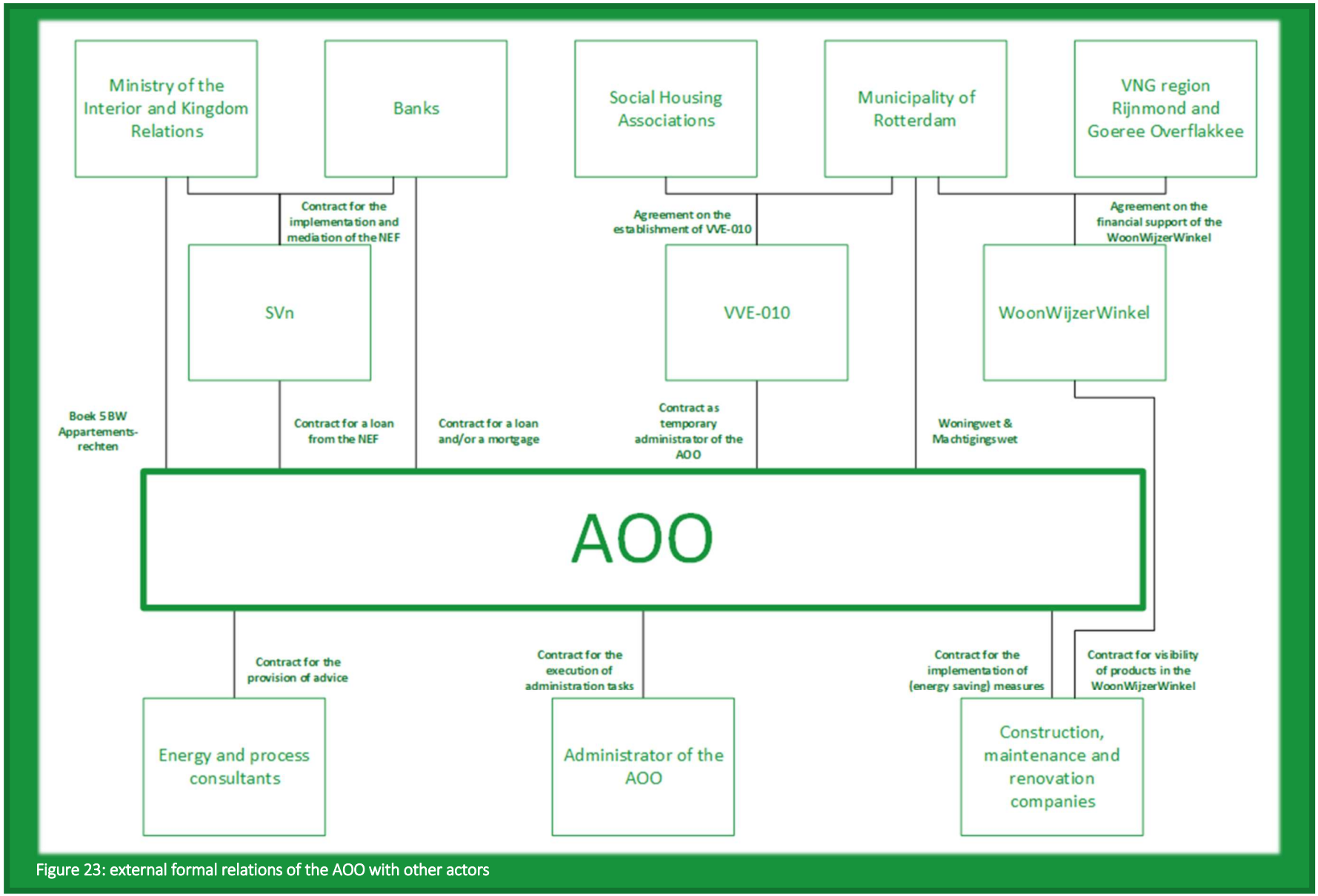


Figure 23: external formal relations of the AOO with other actors

In addition to this conflict between an existing mortgage and a new loan for energy saving measures, AOOs with high energy saving ambitions are obstructed by the limited timespan of the loans (Platform31, 2016). This limited duration of loans hampers AOOs to spread the costs of a major energetic improvement over an extended period, in such a way that the yearly costs of the loan equal the yearly savings on energy costs.

Lastly, the second version of the formal relations chart indicates that the Province of South-Holland does not play a significant formal role in stimulating AOOs to take energy saving measures. Also, the *Platform Duurzaam VVE Beheer* is not included in the formal relations chart as the platform is an informal collaboration between a few municipalities and experts on the AOO practice.

3.2.3. Power and interest grid

In the previous sub section, the formal relations between actors were identified and analysed. The formal positions and interdependencies of actors relative to other actors are indicated in the formal relations charts. From these, a number of problematic formal relations have been identified. In addition to the formal position of actors, another position or role can be attributed to actors based on their power (e.g. the available resources at their disposal) and their interests (e.g. the intrinsic motivation or a formally defined objective) (Enserink et al., 2010). These positions can be visualised in a power-interest grid, as is done in figure 24.

The power-interest grid positions actors along the extremes of two axes: high or low power and high or low interest. The origin of the grid, at the intersection of the two axes, symbolises an actor with average power and average interest regarding the uptake of energy saving measures by AOOs. An actor can be positioned in one of the four quadrants. Each quadrant stands for a different type or role of the actor in the current problem situation.

In the first quadrant (high power and high interest), the 'key players' are located. The interests of these actors are driven by the formally defined objectives on saving energy in the built environment, and more specifically in AOOs. The power of the municipality, the Ministry and VVE-010 is based on available formal resources, while the social housing associations, in their role of large owner in an AOO, have a lot of power in the decision-making processes of these AOO. The power of VvE Belang is related to the lobby activities on the national level and the provision of objective information to AOOs. The key players are crucial to improve the current problem situation.

The second quadrant (high power and low interest) contains the 'context setters'. The financial actors, the banks and the SVn, have the power to provide AOOs with or the deprive AOOs from the financial opportunity to invest in energy saving measures. These actors thus have significant power in the current situation. The administrators and the three types of owners in an AOO, the owner occupants, the private landlords and the owners of non-residential units, are not bound to any formally defined objectives like the social housing associations. These owners set a number of preconditions for an investment in energy saving measures. Overall they have a lower interest in improving the energetic quality of AOOs if compared to the 'key players'. The power of the private landlords, as a large owner, is similar to the power of the social housing associations in AOOs. The power of the other owners is a little less. The administrators have the power to put energy saving measures on the agenda of the AOO. The context setters should be kept satisfied during the process of analysing and improving the current situation. Possibly, some 'context setters' may be turned into 'key players' with a municipal approach if their interest in taking energy saving measures is increased.

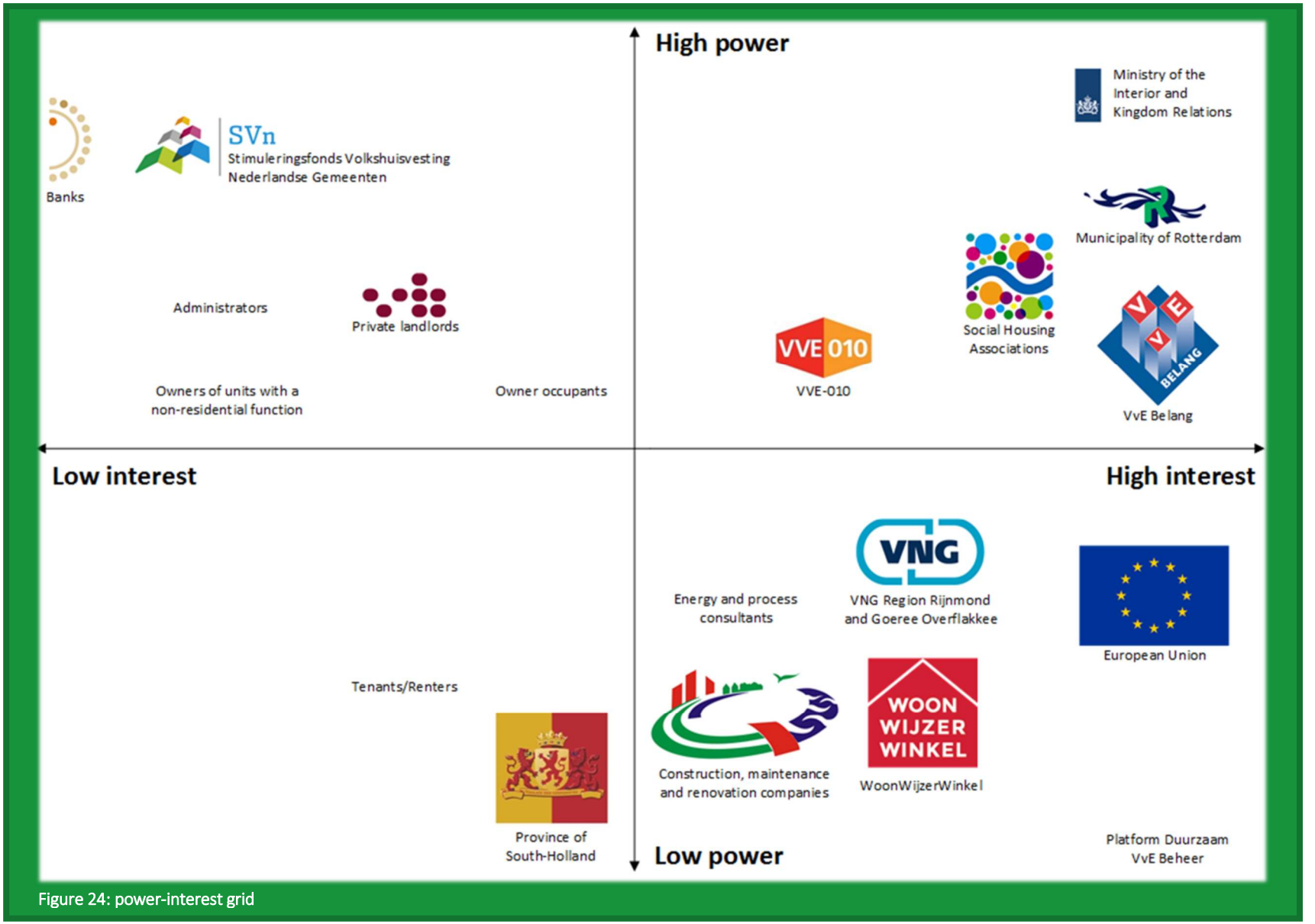


Figure 24: power-interest grid

The ‘crowd’ is in the third quadrant (low power and low interest). The ambition of the Province of South Holland is not directly related to stimulating the uptake of energy saving measures in AOOs. Moreover, the Province does not have any resources for this purpose. The tenants/renters have an interest in a comfortable and affordable apartment and set, like the owner occupants, preconditions for energetically renovating the apartment building. Only in some cases, the tenants/renters have a blocking power in the decision-making process. Therefore, the crowd will have a minimal role in the process.

Lastly, the ‘subjects’ are in the fourth quadrant (low power and high interest). The (semi-) governmental subjects – Europe, the VNG region, and the *Platform Duurzaam VvE Beheer* – have a high interest due to the formally defined objectives on energy saving in the built environment, but lack the resources to directly stimulate the AOOs. The market parties – the WoonWijzerWinkel, the consultants and the construction, maintenance and renovation companies – have a direct financial interest in stimulating AOOs to take energy saving measures, but lack the resources to sufficiently facilitate this themselves. The ‘subjects’ need to be informed during the process.

As indicated in sub section §2.4.2, a significant part of this research is based on interviews with experts from the AOO practice. An essential step in preparing these interviews is selecting the relevant experts from the AOO practice. The power-interest grid supports this selection process and has resulted in the list of preferred organisations to take part in the interviews in table 4. For various reasons, a few actors from the power-interest grid are not included in this selection. The actors that are classified as crowd in the power-interest grid, the tenants/renters and the Province of South Holland, are excluded as respondents from the interviews as they have a minimal role in the process of stimulating AOOs to take energy saving measures. The European Union is not included in the selection for practical reasons and a lack of direct involvement in the subject of stimulating AOOs to save energy. The owners of units with a non-residential function in the AOO are disregarded as they are few in numbers in AOOs, as indicated in sub section §3.2.1. Lastly, from the financial sector only the SVn is included as preferred respondent for the interviews as the involvement of banks with AOOs is currently limited.

Table 4: preferred organisations for the interviews

Organisations
Administrators in AOOs
Construction, maintenance and renovation companies
Energy and process consultants
Ministry of the Interior and Kingdom Relations
Municipality of Rotterdam
Owner occupants in AOOs / Board of the AOO
Platform Duurzaam VvE Beheer
Social Housing Associations in AOOs
SVn
VNG region Rijnmond and Goeree Overflakkee
VvE Belang
VVE-010
WoonWijzerWinkel

3.3. Systems analysis

The second research technique to identify problematic causal relations for stimulating AOOs to take energy saving measures is the systems analysis. The systems analysis uses some of the insights from the actor analysis, such as the available resources of the actors, but is largely independent from the previous analysis. Therefore, the findings of both analyses will be discussed in conjunction in section §3.4. The systems analysis aims to map and analyse the causal relations of the system. For this, a few preceding steps need to be taken. Firstly, the term ‘energy saving measures’ will be clarified, as there are numerous measures available to save energy in an apartment. This clarification includes a delineation of measures that are included in this research. Secondly, the ‘journey’ of an AOO from the first contact of the notion ‘energy saving measures’ until after the implementation of these measures is described. This description includes the role of other actors in this journey and several possible bumps on the road for the AOO. Thirdly, a few external factors that may affect the system are discussed. These external factors may play a role in the existence of problematic causal relations, as the relevant actors are not able to

influence these external factors. Lastly, the system diagram combines the causal relations, the external factors (§3.3.3), the available resources (§3.2.1) and criteria to map and analyse the system.

3.3.1. Energy saving measures

Energy saving measures is a term that has already been frequently used in the previous chapters of this research. At the start of the systems analysis, it is sensible to finally define and explain this notion and to discuss the various types of energy saving measures that may be taken in an apartment or an apartment building. An energy saving measure, for now, is any social, legal, technical or physical measure that is taken with the purpose of reducing the amount of primary CO_2-emissions from the energy consumption of an apartment or an apartment building. The definition of energy saving measures will be delineated at the end of this sub section.

The trias energetica is a frequently used perspective to look at different types of energy saving measures (Bueren van, 2012; Hasselaar, 2009; Korbee et al. 1979). According to the trias energetica, the reduction of CO_2-emissions from energy consumption should be established in three consecutive steps (figure 25). Firstly, the energy demand of an apartment (building) should be reduced by improving the current energetic quality and by changing the behaviour of user(s) in a positive way. Secondly, the remaining energy demand should be fulfilled with renewable energy sources as much as possible. Thirdly, any energy demand that cannot be fulfilled with renewable energy needs to use fossil fuels as efficient as possible. The various energy saving measures can be classified, as in table 5, based on these three steps of the trias energetica and based on the question whether the measure requires either the autonomous decision of the individual apartment user or the collective decision of the AOO.

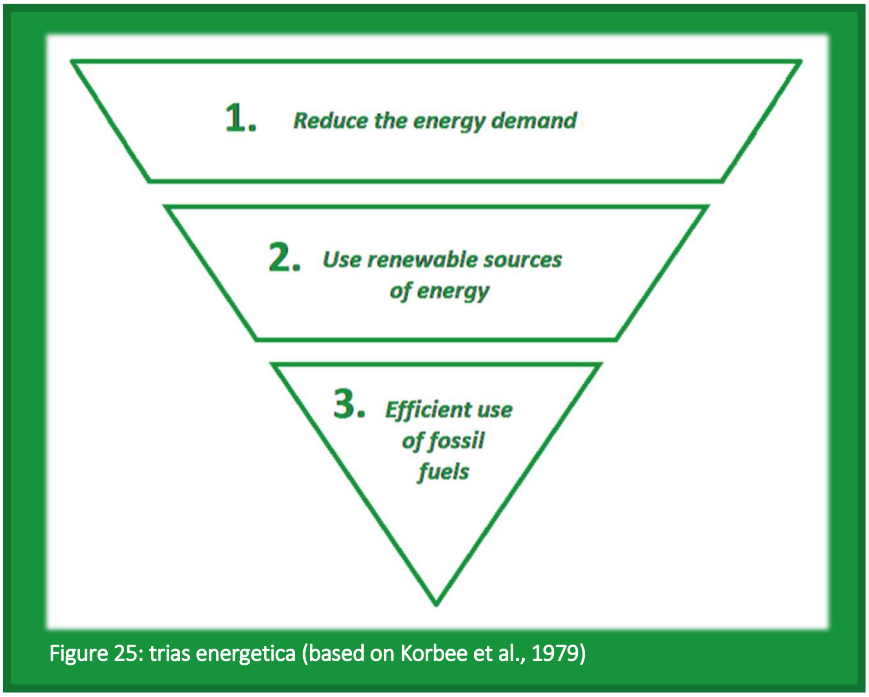


Figure 25: trias energetica (based on Korbee et al., 1979)

For energy saving measures that have an effect on the joint property of the AOO, a collective decision by the general meeting of owners is needed according to the rules in the deed of division. In this situation, also a landlord/tenant dilemma may occur as “the landlord provides the tenant with the housing, appliances and installations while the tenant pays the energy bills” (Ástmarsson et al., 2013, p.357). As the landlord does not pay for the energy consumption, the landlord has few incentives to support proposals for energy saving measures in the general meeting of owners.

In this context, it is important to note that some energy saving measures may be taken by the user of the apartment and do not require the approval of the owner of the apartment. The user of the apartment (e.g. the owner occupier or the tenant/renter) can take energy saving measures in the apartment as long as the measures have no effect on the joint property of the AOO. In addition, for tenants and

renters it is important that these energy saving measures can be removed after the termination of the rental contract.

Table 5: types of energy saving measures

Type of energy saving measure	Reduces the energy demand	Uses renewable sources of energy	Efficiently uses fossil fuels
Requires autonomous decision of the individual apartment occupier	- Behavioural change - Temporary insulation within the apartment	- Contract for the supply of renewable energy	- Upgrade to energy efficient appliances - Monitor functioning of measures
Requires collective decision of the Association of Owners	- Insulation of the apartment buildings - Calibrating existing energy systems	- Production of sustainable energy - Contract for the supply of renewable energy	- Upgrade to energy efficient appliances - Monitor functioning of measures

The types of energy saving measures in table 5 are discussed in the next paragraphs following the sequence of the three steps of the trias energetica. Energy saving measures that require either an autonomous decision of the individual apartment user or the collective decision of the AOO are discussed jointly.

Reduce the energy demand

Individual apartment users may reduce the energy demand of their apartment by changing their behaviour. The behaviour of apartment users is an important factor in the total energy demand (Majcen, 2016; Tigchelaar & Leidelmeijer, 2013). Small changes in the behaviour of the apartment user – such as closing interior doors, reducing the shower time, turning of the lights when leaving the room and heating a limited number of rooms in the house – have a visible impact on the energy consumption. The recently introduced smart meters and related apps assist in this behavioural change. Related to a positive behavioural change is the 'rebound effect', which may occur after the implementation of physical energy saving measures. On the one hand, the perceived reduction of the energy demand, that is expected from these measures, makes that some apartment users become careless and are more likely to waste energy. On the other hand, economical apartment users, who are prior to taking energy saving measures already aware of their energy consumption, will also profit less than expected from these measures. Therefore, the rebound effect makes that the calculated reduction of energy demand of an energy saving measure is not realised in practice (Majcen, 2016).

In addition, the apartment user may take measures that temporarily improve the insulation of their apartment. The most common examples of these temporary insulation measures are applying weather stripping at doors and windows (*i.e. tochtstrips*) and placing a letterbox draught excluder in the letterbox (*i.e. brievenbusborstel*) to limit transmission losses. Applying radiator foil is a similar type of measure that reflects heat of a domestic heating radiator into the centre of the room, although it is technically not an insulation measure.

For the insulation of the façades, floors and the roof of the apartment building a collective decision of the AOO is required, as these structural elements are in most cases part of the joint property of the AOO. Different techniques may be used for the insulation of these parts of the building, however discussing these techniques goes too far for this research. Replacing the windows, exterior doors and their frames by ones with a higher thermal resistance (Rc-value) is another way to improve the insulation of the apartments. Lastly, the remedy of thermal bridges requires attention, as these thermal bridges not only cause transmission losses but may also damage the construction of the apartment building (Bueren van, 2012).

Lastly, the energy demand can be reduced by calibrating the existing energy systems of the apartment building. Hydronic balancing of the central heating system of the AOO ensures that the correct amount of hot water is distributed to the individual apartments and domestic heating radiators, such that the waste of thermal energy is limited (NEF, 2016c). For AOOs with one or more elevators, an interesting measure is to check and update the elevator(s) to a better energy label (NEF, 2016a). Thus, without replacing the current energy sources a reduction of the energy demand can be achieved.

Use renewable sources of energy

For the electricity use, both the individual apartment user and the AOO can switch to a contract with a supplier of renewable electricity. The contract of the AOO is for the electricity use in common areas in the apartment building, such as lighting at the entrance and in the corridors. For the gas consumption, such a simple measure as switching from supplier does not offer a solution.

Therefore, AOOs have the option to decide to (partly) generate electricity and heat themselves. This electricity can be generated with solar panels and small wind turbines. Heat can be produced with solar boilers, heat pumps and geothermal power. It is important for AOOs that the apartment building (structurally) allows the required additions to the structure and that these additions are allowed within the local regulations. For example, some roofs of AOOs cannot hold the additional weight of solar panels, solar boilers, wind turbines and heat pumps may not always be allowed in local regulations.

Efficient use of fossil fuels

If some of the energy demand still needs to be met by fossil fuels, it is important to use these fossil fuels as efficient as possible. In general, there are two types of energy saving measures that allow for an efficient use of fossil fuels. Firstly, individual apartment users and the general meeting of the AOO may decide to upgrade the current appliances to appliances with a higher energy efficiency. For individual apartment users, this includes among others individual central heating boilers, light bulbs and household appliances. For the AOO this includes for example shared central heating boilers, light bulbs, elevators and the intercom system. Secondly, the individual apartment owner or the AOO may decide to manage and monitor the long-term effect of energy saving measures taken in the apartment (building) (Nieboer et al., 2011). Monitoring these effects helps in the early detection of mistakes during the installation or implementation of the measure and of energy loss due to behavioural changes or the expired lifespan of a measure.

Delineating the definition of energy saving measures

At the start of this sub section an energy saving measure was defined as any social, legal, technical or physical measure that is taken with the purpose to reduce the amount of primary CO_2-emissions of the energy consumption of an apartment or an apartment building. Some energy saving measures can be taken by the individual apartment user, while other energy saving measures can only be taken with a joint decision of the general meeting of the AOO. As the subject of research, the AOO, does not have a role in the first category of energy saving measures, the second category of measures is selected for the remainder of this research. Besides, the scope has been delineated to building-related energy saving measures, which excludes the legal measure of switching to a contract for the supply of renewable energy. This results in the following definition of energy saving measures:

An energy saving measure is any building-related measure that is taken with the purpose to reduce the amount of primary CO_2-emissions of the energy consumption of the apartments and the common areas of the apartment building and is based on a valid decision of the general meeting of owners of the AOO

Within this definition the possibility for the AOO to take sets of energy saving measures, such as packages of measures that improve the energetic quality of the apartment building to a (nearly) Zero Energy Building is also included (Gvozdenović, 2014; Stroomversnelling Nederland,2015).

3.3.2. The customer journey of the AOO

The essence of the trias energetica, as discussed in the previous sub section, is that a reduction of the energy demand makes that less energy from (renewable) sources has to be generated. With this rule, the trias energetica aims to prevent too much production of costly renewable energy (CE Delft & Instituut voor Milieuvraagstukken, 2013). It is typical that, according to the *trias psychologica*, the order of preference for energy saving measures of consumers is opposite to the sequence of the trias energetica (5plus1, 2015). Surveys show that consumers are more willing to invest in, for example, solar panels than in insulation of the building. This insight is one of the reasons for the description and analysis of the customer journey of the AOO in this sub section. The customer journey of the AOO in figure 26 describes which ten stages an AOO, in general, will go through before taking energy saving measures.

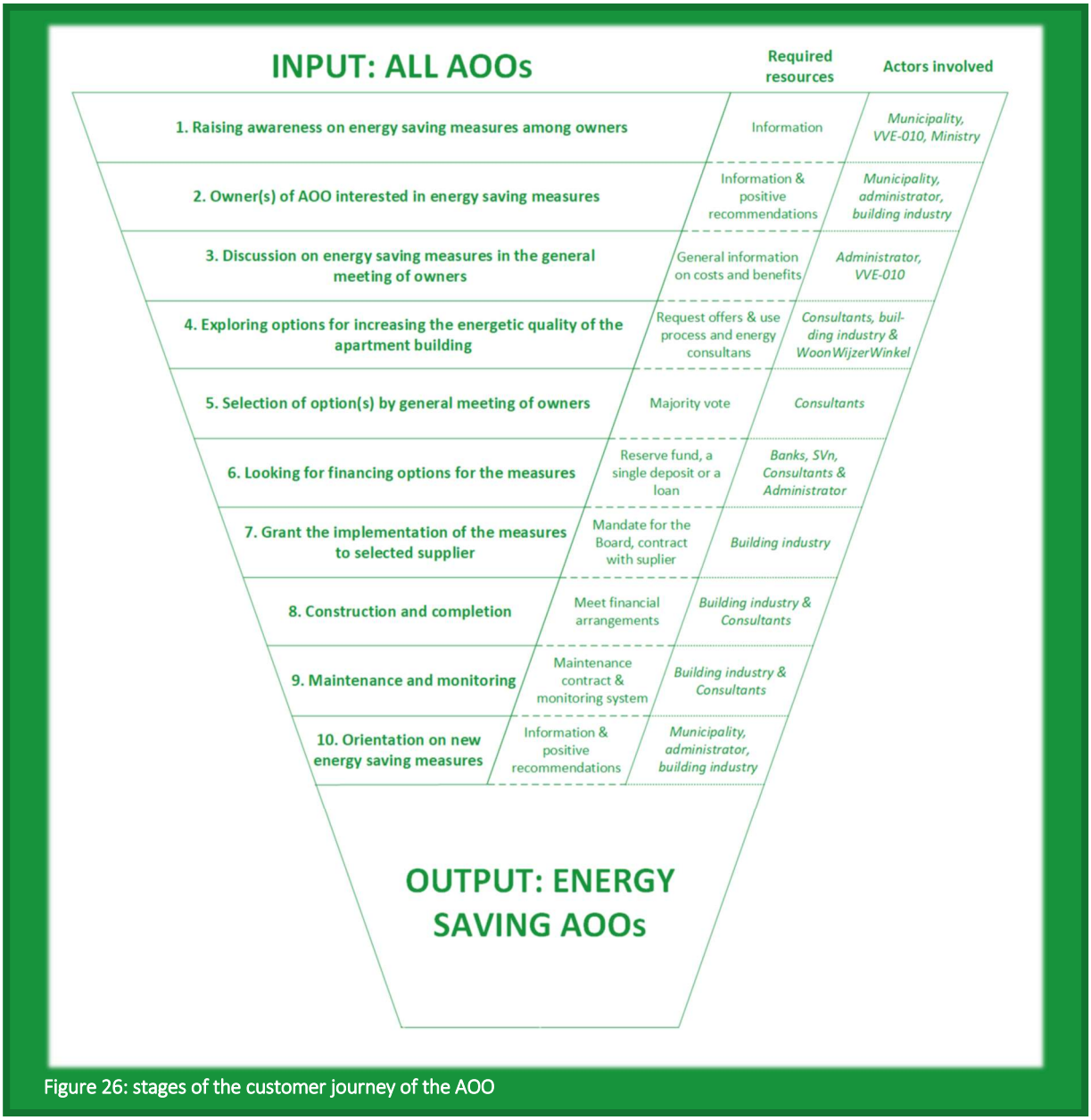


Figure 26: stages of the customer journey of the AOO

After each stage, several AOOs will decide not to proceed to the following stage for various reasons. This is indicated with the funnel shape of the customer journey. These reasons include a lack of required resources or a lack of support from involved actors. The potential obstacles, or problematic causal relations, in the customer journey are identified based on the literature study and will be discussed in this sub section.

Both the number of AOOs that start the first stage of the customer journey and certainly the number of AOOs that (largely) complete the customer journey is limited. The problematic causal relations that underlie those limited numbers are discussed below for every stage of the customer journey. However, in general, the problematic causal relations can be found in time-consuming and legally defined decision-making processes, in insufficient means in the reserve fund, in the difficulty of self-financing the measures for several owners, and in the lack of financial organisations willing to provide a loan to AOOs (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b).

Raising awareness on energy saving measures among owners

To raise the awareness of apartment owners on the topic of energy saving measures, information is provided by the municipality of Rotterdam, VVE-010, and the Ministry of the Interior and Kingdom Relations. However, the effectiveness of providing information to reduce the energy consumption is uncertain for several reasons (Murphy et al., 2012). Firstly, 'a significant number of owners are not concerned with their complexes and are badly informed on the AOO' (Ploeger & Groetelaers, 2014). This might be related to the way owners, in especially small AOOs, are approached. A research shows that they want to be addressed as individual homeowners and not as a member of the AOO (W&I Group BV, 2016). Secondly, members of the general meeting of owners need time to grasp the complex matter of energy saving measures and to get a sense of urgency (Vleuten van der, 2014). Thirdly, the length of residence in an AOO is relatively short (e.g. five years), causing a permanent need for the provision of information to new owners (Vegter, 2012). Lastly, it turns out to be difficult for information providers to connect to relevant changes and opportunities in the lives of apartment owners (ECN, 2015b; Meijer et al., 2009).

Owner(s) of AOOs that are interested in energy saving measures

A challenging stage for the municipality, the administrator and the building industry is to make owners of AOOs interested in energy saving measures. The two main barriers for owners to become interested in energy saving measures are a lack of knowledge on and no priority for these measures (Meijer & Visscher, 2015; Meijer et al., 2009). As to a lack of knowledge, many apartment owners are insufficiently aware of the financial benefits of energy saving measures (PBL, 2014). Regarding priority, a boundary condition for becoming interested in saving energy is a functioning AOO (Atrivé, 2015). The priority of a significant number of AOOs will be mainly on establishing this functioning AOO in the coming years.

Discussion on energy saving measures in the general meeting of owners

The next stage starts with the issuing the general meeting of owners and by adding the topic of energy saving measures to the agenda. Preferably, one or more owners take the lead in introducing this new topic to the other owners of the AOO. In this stage, potential resistance of these other owners may arise based on expectations regarding the hassle and nuisance of the proposed measures (Meijer et al., 2009). In addition, owners may not be willing to pay for a research on suitable energy saving measures if the costs and benefits of the investment cannot be quantified in advance (Budde & Gruis, 2012). In both instances, it may be difficult to convince a sufficient number of owners to continue with the customer journey. Especially in small AOOs, one owner or a small number of owners may block the plans to save energy for the entire AOO (Stichting Verbouw Rustenburg-Oostbroek, 2010; Waals van der, 2014).

Exploring options for saving energy for the specific apartment building

In small AOOs, exploring the options for energy saving measures is mostly done by the owners themselves. Hereto, the measures need to be simple, direct, and clear so as not to discourage the interested owners (Meijer et al., 2009). The information on the various options should preferably come from independent parties, but in practice often originates from the building industry or semi-commercial organisations such as the WoonWijzerWinkel (Hoogland & Slauerhoff, 2014). For larger AOOs it is more feasible to hire consultants for advice on the technical, financial and process aspects (Hoogland & Slauerhoff, 2014). Thus, this stage may prove to be particularly challenging for small AOOs.

Selection of option(s) by the general meeting of owners

For the selection of energy saving measures by the general meeting of owners, a new meeting will be issued. The potential barriers in this stage are mostly related to financial issues. Firstly, the conditions for some AOOs may be such that the investment in energy saving measures is not profitable (PBL, 2014; Versnelling010, 2014). Secondly, several energy saving measures, such as insulation of the roof, may result in varying profits (split-incentives) among the owners of the AOO (Meijer et al, 2009; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). For owners who receive little benefits from the measure(s), while the costs are divided equally, a sense of unfairness may evoke. This often results in a vote against the proposed measure(s) (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). Thirdly, in some AOOs there is some disagreement whether improving the energetic quality of the apartment building is part of the regular tasks of the AOO (Vleuten van der, 2014). An example of this disagreement is the question whether AOOs, as an association, are allowed to commercially resupply electricity to the grid (Vleuten van der, 2014). A last barrier is that non-financial costs and benefits are not included in the decision on energy saving measures (PBL, 2014).

Looking for financing options for the measures

The largest barrier in the customer journey, the financial barrier, is found in this stage (Meijer & Visscher, 2015; Tigchelaar & Leidelmeijer, 2013). To start, the decision-making process on suitable financial options requires at least a qualified majority and in other cases a majority of two-thirds or three-fourths of the votes, which may be difficult to achieve (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b; Vleuten van der, 2014). In general, the AOO has three financing options: the reserve fund, a single deposit of each owner, and a loan. In case of limited financial resources of the apartment owners and an insufficient filled reserve fund, the only financial option for an AOO is to obtain a loan. For AOOs that consist of at least 10 apartments, it is possible to obtain a loan as an AOO. Still, the AOO must meet the (financial) loan conditions that are used by the SVn, banks, and other credit providers. For smaller AOOs, each owner need to individually obtain a loan, but this is often not an option for every owner (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012b). Thus, in some cases the conclusion in this stage is that no financing is possible and that the AOO needs to first save money for the investment (PBL, 2014).

Grant the implementation of the measures to selected supplier

Just before granting the contract for the implementation of the energy saving measures to the selected supplier, some unexpected barriers may arise. Firstly, in case of a loan, the total costs (including the financing costs) of the energy saving measures have become clear in the previous stage. To arrive at a positive decision, it is important that the financial benefits of the energy saving measures are in line with these total costs for the AOO (Waals van der, 2015). Secondly, the position of an owner of a large number of apartments may become relevant in this stage (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016c). As the moment of the actual investment is nearing, this owner may only now start to oversee the (financial) consequences of the decision, thereby possibly delaying or obstructing the decision-making process.

Remaining stages

In the remaining stages, the internal decision-making process of the AOO is largely completed. The limited number of barriers in the last three stages include disappointing results regarding the reduction of the energy consumption, due to construction and installation errors in the construction and completion stage. Secondly, the amount of energy saved may shrink over the years in the maintenance and monitoring stage. If no long-term contracts are concluded for periodic maintenance and monitoring of the measures and if no further action is taken by the AOO, these shrinking energy savings are another disappointing result for the AOO. Lastly, these disappointing results may discourage AOOs to enter the orientation stage for the implementation of additional energy saving measures. In that case, the implementation of energy saving measures is limited to a one-time project (Budde & Gruis, 2012).

3.3.3. External factors

In this last sub section, prior to the construction of the system diagram in sub section §3.3.4, the external factors are discussed. 'An external factor is an element that cannot be directly influenced by the relevant actors or by the factors inside the system, but that does put important limitations to or constraints on the behaviour and outcome of the system' (Enserink et al., 2010). For reasons of clarity, only the most important external factors with a large effect on the system will be included in the system diagram. Therefore, this sub section is used to describe the various external factors in order of importance and to select the external factors that need to be included in the diagram:

- Energy price: the energy price – for electricity and natural gas – is a determining factor for the uptake of energy saving measures by AOOs (CE Delft, 2013; De Nederlandsche Bank, 2016). The payback time of the investment in energy saving measures, and thus the business case of the investment, is largely determined by the energy price (BIQ, 2015). Prolonged high energy prices increase the benefits of taking energy saving measures, but uncertain energy prices may discourage investing in these measures (De Nederlandsche Bank, 2016; Nieboer et al., 2011).

- Cost development of energy saving measures: the costs of energy saving measures is an important factor in the investment decision of the AOO (CE Delft, 2013). Due to ongoing innovation and increasing competition between suppliers, the costs of energy saving measures may drop slightly in the short-term. Moreover, the costs of a renovation to a (nearly) Zero Energy Building are expected to drop significantly in the coming years (Stroomversnelling Nederland, 2015).

- Economic development: the economic development in The Netherlands is a rather general factor, but is of importance for achieving the energy saving ambitions for AOOs (CE Delft, 2013). To illustrate, before the economic crisis of 2008, the investments in (energetically) improving and maintaining apartments could be earned back significantly faster than is currently the case (Gemeente Den Haag, 2015). The economic development influences the spending power of apartment owners, on the value development of apartments in AOOs and indirectly on the level of deferred maintenance (Gruis & Budde, 2012; Meijer, 2013).

- Access to capital: the access to capital (e.g. the access to a loan) is a factor with a moderate effect on the investment decision of AOOs, as some AOOs depend on a loan for the implementation of energy saving measures (Nieboer et al., 2011). In addition to the regulations that define the access of AOOs to capital, the basic interest rate as determined by the European Central Bank influences the access to capital. This rate is related to the interest rate of the loans for AOOs provided by banks and the SVn and thus determines the financing costs and indirectly the total investment costs of energy saving measures (CE Delft, 2013).

- Market demand for apartments with a high energetic quality: the market demand for apartments with a high energetic quality could stimulate the uptake of energetic renovations of apartments in AOOs. However, the energetic quality of a dwelling currently is only for 2% of the buyers an important selection criterion (Bouwend Nederland, 2016b). As the market demand for apartments with a high energetic quality turns out to be marginal, this external factor is not included in the system diagram.

- Breakthrough innovations for energy saving measures: there is an ongoing development to arrive at breakthrough innovations for energy saving measures. However, the development of these innovations will be such that a substantial contribution to the energy saving ambitions is not to be expected before 2040 (CE Delft, 2013). Therefore, these innovations are not included in the system diagram.

Thus, these are the external factors selected for the system diagram in the following sub section: energy price, cost development of energy saving measures, economic development and access to capital.

3.3.4. System diagram

The extensive analysis of the system and its problematic causal relations is summarised in this sub section with a system diagram. This system diagram is not composed based on solely the perspective of the municipality of Rotterdam, but is a general representation of the system to stimulate AOOs to take energy saving measures. Furthermore, the causal relations depicted in the diagram apply for the total 'population' of AOOs and not just for any individual AOO.

The system diagram includes the means (e.g. a relevant selection of the various types of available resources from sub section §3.2.1) on the left side of figure 27. The external factors from the previous sub section are placed at the top of the diagram. Given the general and multi-actor character of the diagram, one widely supported criterion is selected for the system (e.g. the energetic quality of the AOOs). The means, external factors and the criterion are located on the boundaries of the system.

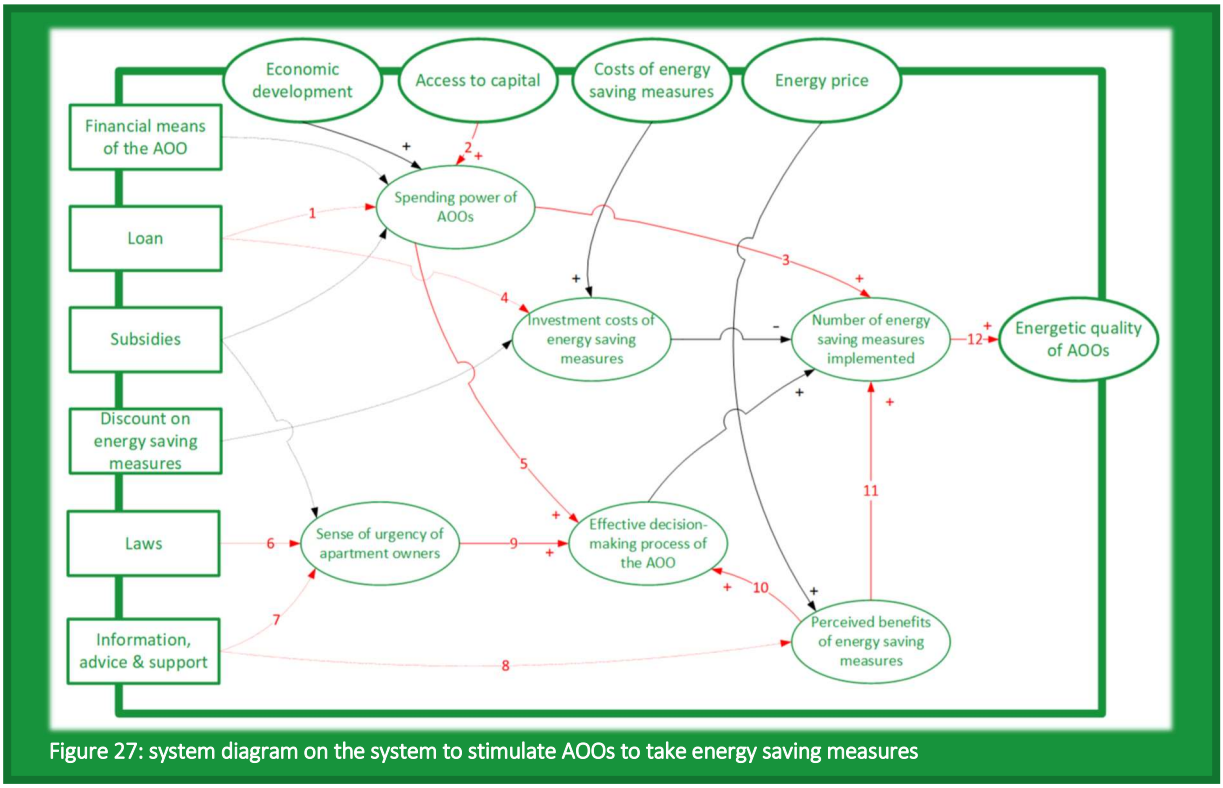


Figure 27: system diagram on the system to stimulate AOOs to take energy saving measures

The causal relations between means, external factors, internal factors and the criterion are indicated with arrows. A positive causal relation is indicated with a plus sign (+) and a negative causal relation with a minus sign (-). An example of a positive causal relation is that the number of energy saving measures taken increases if the spending power of AOOs increases. The relation that the number of energy saving measures decreases if the investment costs for these measures increases, is an example of a negative causal relation. The dotted arrows indicate the effect of the means on the internal factors of the system.

The red arrows in the system diagram indicate a large number of problematic causal relations that have been mentioned in this chapter and are derived from the literature study. The numbers of the twelve red arrows that indicate the problematic causal relations correspond to the numbers in table 6. In table 6, each problematic causal relation is only briefly described as these relations have already been discussed in the various analyses in the previous sections.

Table 6: problematic causal relations based on the system diagram

#	Description of problematic causal relation
1	The specific loan conditions of a loan from the SVn limit the increase of the spending power of certain types of AOOs. For example, small AOOs with less than 10 apartments do not qualify for this loan. Moreover, the loan conditions do not allow for a loan that enables an energetic renovation to a (nearly) Zero Energy Building as the duration of the loan is too short.
2	The spending power of AOOs is suboptimal as there are hardly any commercial banks or other commercial organisations that are willing to provide a loan to AOOs (e.g. access to capital).
3	An AOO may have, for several reasons including problematic causal relation 1 and 2, insufficient spending power to pay for the total investment costs of the energy saving measures. In these cases, the AOO cannot decide to conduct any measures to save energy.
4	The costs of the loan as a financing instrument may disturb the delicate balance between financial costs and benefits of the investment in energy saving measures.
5	For AOOs with limited spending power, due to the size or financial position of the AOO, it is difficult to hire expertise from professional board members or other consultants to ensure an effective decision-making process within the AOO.
6	Several existing laws have a limited effect on creating a sense of urgency among apartment owners to invest in energy saving measures. The (inter)national energy saving ambitions are insufficiently embedded in national law to trigger investments in the reduction of the energy consumption in apartments. Moreover, the regulations to improve the functioning of the AOO are not met by a relatively large share of the AOOs, as no enforcement is taking place.
7	The effectiveness of the provision of information, advice, and support to AOOs to create a sense of urgency for the reduction of the energy consumption is uncertain for various reasons as discussed in sub section §3.3.2.
8	Especially for small AOOs, due to a lack of expertise, it is often difficult to structure and to value information, advice and support provided by various objective and subjective actors in order to identify and perceive the benefits of the energy saving measures.
9	The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as either the owner of a large number of rented dwellings or the tenants/renters, if less than 70% agrees with the plans for the energetic renovation, may block the decision-making process.
10	Unclear or uncertain financial benefits of the energy saving measures often withhold AOOs to continue their decision-making process with an investment of time and money in the specific analysis of suitable energy saving measures for the apartment building.
11	The perceived benefits of the energy saving measures in some cases may be such that the costs of the energy saving measures exceed the benefits, even in the rare cases that non-financial benefits are included in the consideration. Therefore, the investment in energy saving measures is not an attractive option for some AOOs.
12	During the construction and maintenance of energy saving measures, construction or installation errors or a lack of maintenance may decrease the actual amount of energy saved by the measures. The energetic quality of the AOO may thus be less than expected.

As the problematic causal relations from table 6 do not include all the problematic causal relations in literature, a brief overview of these relations will be provided in the next section.

3.4. Conclusion

The aim of this chapter is to describe and analyse the system that intends to stimulate AOOs to take energy saving measures, in order to answer the first research sub question:

A.1. Which problematic causal relations for stimulating AOOs to take energy saving measures are described in literature?

The first research technique, the actor analysis, showed in line with Nieboer et al. (2011) that the system consists of "mutually dependent actors with none of them being dominant" (p.10). Another important outcome is that it is essential that the AOOs' base is in order, to stimulate AOOs to take energy saving measures. A poor quality of the base of the AOO initiates several problematic causal relations. For AOOs to improve their base, they should preferably meet all or at least most of the characteristics of a properly functioning AOO as described in table 7.

Table 7: characteristics of a properly functioning AOO

Characteristics of a properly functioning AOO
The presence of a Board of the AOO
The presence of an Audit Committee or a Supervisory Board
At least once a year the assembly of the general meeting of owners
A periodic deposit of the owners to the AOO
The presence of a reserve fund, preferably of sufficient size
To have a multi-year maintenance plan
To have a collective insurance
To carry out major maintenance works in time
To have a high attendance to or commitment among the general meeting of owners
A registration of the AOO at the Chamber of Commerce
To keep records of the decisions and the financial status of the AOO
To have a qualified daily management of the AOO, eventually by an administrator

The poor base of an AOO and its effect on the decision-making process is, based on the results of the literature study, a problematic causal relation that is of great importance. Based on the two research techniques – the actor and system analysis – applied in this chapter, several other problematic causal relations are found in literature. All problematic causal relations are presented in table 8.

Table 8: set of problematic causal relations derived from the literature study

#	Description of problematic causal relation
A	If the quality of the base of the AOO is poor, the AOO will not be able to have an effective decision-making process as they will not get through the previous stages. The quality of the base of the AOO is defined poor if the AOO does not meet most of the characteristics of a properly functioning AOO in table 7.
B	The specific loan conditions of a loan from the SVn limit the increase of the spending power of certain types of AOOs. For example, small AOOs with less than 10 apartments do not qualify for this loan. Moreover, the loan conditions do not allow for a loan that enables an energetic renovation to a (nearly) Zero Energy Building as the duration of the loan is too short.
C	The spending power of AOOs is suboptimal as there are hardly any commercial banks or other commercial organisations that are willing to provide a loan to AOOs (e.g. access to capital).
D	An AOO may have, for several reasons including problematic causal relation B and C, insufficient spending power to pay for the total investment costs of the energy saving measures. In these cases, the AOO cannot decide to conduct any measures to save energy.
E	The costs of the loan as a financing instrument may disturb the delicate balance between financial costs and benefits of the investment in energy saving measures.
F	For AOOs with limited spending power, due to the size or financial position of the AOO, it is difficult to hire expertise from professional board members or other consultants to ensure an effective decision-making process within the AOO.

G	Several existing laws have a limited effect on creating a sense of urgency among apartment owners to invest in energy saving measures. The (inter)national energy saving ambitions are insufficiently embedded in national law to trigger investments in the reduction of the energy consumption in apartments. Moreover, the regulations to improve the functioning of the AOO are not met by a relatively large share of the AOOs, as no enforcement is taking place.
H	A lack of knowledge among apartment owners in AOOs on energy saving measures limits AOOs to become interested in collectively saving energy in the apartment building.
I	The effectiveness of the provision of information, advice, and support to AOOs to create a sense of urgency for the reduction of the energy consumption is uncertain for various reasons as discussed in sub section §3.3.2.
J	Especially for small AOOs, due to a lack of expertise, it is often difficult to structure and to value information, advice and support provided by various objective and subjective actors in order to identify and perceive the benefits of the energy saving measures.
K	The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as either the owner of a large number of rented dwellings or the tenants/renters, if less than 70% agrees with the plans for the energetic renovation, may block the decision-making process.
L	In addition, the transition from a sense of urgency to an effective decision-making process may be hampered by split-incentives of certain energy saving measures among apartment owners. Apartment owners who receive little benefits from the measure(s), but need to pay an equal share of the costs, are likely to vote against the implementation of these measures.
M	Unclear or uncertain financial benefits of the energy saving measures often withhold AOOs to continue their decision-making process with an investment of time and money in the specific analysis of suitable energy saving measures for the apartment building.
N	The perceived benefits of the energy saving measures in some cases may be such that the costs of the energy saving measures exceed the benefits, even in the rare cases that non-financial benefits are included in the consideration. Therefore, the investment in energy saving measures is not an attractive option for some AOOs.
O	Companies from the building industry may be less willing to do business with AOOs in case of uncertainty with regard to who is authorized to sign a contract with a company on behalf of the AOO.
P	During the construction and maintenance of energy saving measures, construction or installation errors or a lack of maintenance may decrease the actual amount of energy saved by the measures. The energetic quality of the AOO may thus be less than expected.
Q	The energetic performance of the building after the renovation, in terms of energy consumption, can be less than expected due to the rebound effect.

This set of problematic causal relations, derived from the literature study, will be compared with the problematic causal relations mentioned by various actors from the AOO practice in the next chapter.

4. EVALUATION OF CURRENT SYSTEM

4.1. Introduction to the evaluation of the current system

The set of problematic causal relations, that is derived from the literature study and is presented in table 8 in the previous chapter, is the product of the conceptualisation phase. This chapter is the start of the evaluation phase. In this phase, the aim is to evaluate the functioning of the current system (chapter 4) and the system in the near future (chapter 5). For this evaluation, interviews are held with various actors from the AOO practice. The result of this phase will be a complete set of problematic causal relations in which the results from the literature study and the interviews are combined. Thus, this chapter addresses the second research sub question of research part A:

A.2. To what extent does the set of problematic causal relations from the literature study correspond to the problematic causal relations that are mentioned in interviews on the AOO practice?

For several reasons, the input from various actors from the AOO practice is needed to arrive at a complete set of problematic causal relations regarding the system of stimulating AOOs to take energy saving measures. Firstly, the set of problematic causal relations found in the literature study may be incomplete. It is possible that not every problematic causal relation is recorded in the limited body of literature on this topic. Secondly, there might be a time-lag between the identification of problematic causal relations in practice and the documentation of these relations in literature. Thirdly, some problematic causal relations may not have been included in literature as these relations were not deemed relevant from a theoretical perspective. Hence, the input of various actors from the AOO practice is needed to ensure that the set of problematic causal relations is complete.

The input of the various actors from the AOO practice is collected during interviews. The specifics of this research method, of which the results are used in this and other chapters, are described in section §4.2. Subsequently, whether and how each problematic causal relation from table 8 in section §3.4 is mentioned during the interviews, is discussed in section §4.3. This section indicates the compliance of the results from the various interviews with the results from the literature study. Thereafter, in section §4.4, several additional problematic causal relations are introduced. These additional problematic causal relations result from the interviews, but did not emerge from the literature study. Lastly, the conclusion in section §4.5 indicates to what extent the set of problematic causal relations, which was found in literature, corresponds to the problematic causal relations mentioned during the interviews. Any supplements and additions to the set of problematic causal relations from the previous chapter are made clear in this concluding section.

4.2. Description of interview research method

As announced in sub section §2.4.2, the detailed description of the research method for the interviews is included in this section. The overall intention of the interviews is to supplement and improve the insights that are derived from the literature study. For this purpose, each interview consists of six discussion topics (e.g. themes), which are relevant for different parts of the research. The first two discussion topics – the relation of the respondent to the subject of research and the experience of the respondent with energy saving measures is AOOs – are used to sketch the level of knowledge of the respondent and the context in which the respondent operates. This chapter is about the third theme: the problematic causal relations mentioned by the respondents. The fourth discussion topic, the potential alternative approaches to improve the current system as suggested by the respondents, is input for chapter 7 and 9. In these chapters, the alternative approaches are designed and optimised. Furthermore, the fifth discussion topic covers suggestions of respondents for other relevant respondents for

the interviews. Lastly, the sixth theme is about the effect of planned and foreseeable changes and additions to the current system according to the respondents and is discussed in chapter 5. This theme is deliberately placed at the end of the interviews to not affect the other answers of respondents.

Based on the actor analysis, a list of preferred organisations to take part in the interviews was composed in sub section §3.2.3. Each organisation was approached by email and/or phone to take part in the series of interviews. In some cases, specific contacts within these organisations were directly invited to participate in the research based on recommendations from other respondents, whereas in other cases the organisation was invited to propose a relevant respondent. In total, 28 interviews were held with 32 respondents over the course of two months. Given the diversity of some groups of respondents, multiple respondents were interviewed for the following groups: the owner occupants in AOOs, the energy and process consultants, the construction, maintenance and renovation companies, the social housing associations with property in AOOs, and the *Platform Duurzaam VvE Beheer*. In most of these groups, a mix of respondents living or working in Rotterdam or other municipalities are found, as it proved to be difficult to find sufficient respondents in Rotterdam who are willing to participate in the interviews, especially for the owner occupants in AOOs.

Table 9: respondents in the interviews

Respondents	#
Administrators in AOOs	I
Construction, maintenance and renovation companies	III
Energy and process consultants	VI
Ministry of the Interior and Kingdom Relations	I
Municipality of Rotterdam	I
Owner occupants in AOOs / Board of the AOO	VI
Platform Duurzaam VvE Beheer	III
Social Housing Associations in AOOs	III
SVn	I
VNG region Rijnmond and Goeree Overflakkee	I
VvE Belang	I
VVE-010	I
WoonWijzerWinkel	I

Given the six discussion topics, the questions in the interviews have an open character and therefore oral interviews are considered most suitable (Baarda & De Goede, 2006). The formulation and content of the questions were slightly adjusted for each respondent, as the fields of expertise vary among the respondents (table 9). Furthermore, it is important to mention that both the questions and answers from the respondent were originally formulated in Dutch and were translated to English based on the transcripts of the interviews. In general, the interviews took place at a location of choice of the respondent, mostly at the office or at the apartment. Five interviews were conducted over the phone. With the permission of the respondent(s), most interviews were recorded to ensure proper reporting of the interviews. In consultation with the respondent(s), these reports could be viewed and revised to make sure that the reports correctly represent the arguments of the respondent. Lastly, an arrangement was made with all respondents that citations will not be accompanied with names of the respondents but only with the type of organisation.

4.3. Compliance with the set of problematic causal relations

In this section, the compliance of the set of problematic causal relations of table 8 (§3.4) with the problematic causal relations mentioned by the various actors from the AOO practice is discussed. This table consists of 17 problematic causal relations and, based on the interviews, more will be added to the list. To add some structure to this list of problematic causal relations, the relations are assembled in clusters based on similar topics. The following five clusters are used to structure this section:

1. The organisational structure of the AOO;
2. Financial issues;
3. National and municipal laws and policies;
4. Provision of information, advice and support;
5. The building industry

4.3.1. Organisational structure of the AOO

Two problematic causal relations were found in the literature study regarding the organisational structure of the AOO. The first relation is between the quality of the base of the AOO and the effectiveness of the decision-making process. As sub section §4.3.1.1 will show, meeting several characteristics is an indicator for a good quality of the base of the AOO. The importance of especially one indicator, to have a high-quality administrator, is stressed by the respondents. The effect of the quality of the administrator on the effectiveness of the decision-making process is therefore treated as a separate problematic causal relation in the upcoming chapters. Secondly, the effect of being a mixed AOO with both privately-owned and rented apartments on the decision-making process is also discussed in this sub section.

4.3.1.1. Quality of the base of the AOO

According to the literature study, a poor quality of the base of an AOO significantly obstructs the decision-making process for the implementation of energy saving measures. This problematic causal relation was confirmed by several respondents. To illustrate, an energy and process consultant state that 'most of the AOOs, who are already active in the field of energy saving measures, are AOOs with a good base'. Moreover, respondents from the *Platform Duurzaam VvE Beheer* claim that apartment owners in AOOs with a good base have an advantage over other homeowners regarding energy saving measures, despite the long duration of the decision-making process. 'Apartment owners in AOOs with a good base are, in contrast to individual homeowners, used to making a multi-year plan for maintenance works and corresponding savings'. 'Therefore, apartment owners are more susceptible to notions such as "invest now and earn back later"'. 'An additional advantage of a properly functioning AOO is, in terms of scale, that an entire apartment building can be energetically improved with the active involvement of only a few apartment owners and the approval of the remaining owners'. In contrast, every individual homeowner needs to become active to energetically improve his dwelling.

In table 7 (§3.4), the characteristics of a properly functioning AOO are presented based on the literature study. A number of these characteristics are also mentioned during the interviews as important missing features of AOOs. These missing features often result in a problematic decision-making process on energy saving measures. Table 10 shows for each missing feature the number of respondents that mentioned it during the interviews. Based on the input from the respondents, two important missing features were added to the list in table 10 in italics. Firstly, it is important that the Board of the AOO receives a mandate from the general meeting of owners to legally execute the decisions of this meeting. Secondly, an active Board of the AOO regarding energy saving measures is an important feature for an AOO to have an effective decision-making process on this topic. The three most important missing features of an AOO according to the respondents can be derived from table 10:

Table 10: importance of missing features of AOOs according to respondents

Missing features of AOOs	#
To have a qualified daily management of the AOO, eventually by an administrator	XVI
To have a high attendance to or commitment among the general meeting of owners	VIII
A periodic deposit of the owners to the AOO	V
To have an active Board of the AOO with regard to energy saving measures	*III*
The presence of a reserve fund, preferably of sufficient size	III
To have a multi-year maintenance plan	II
To issue a mandate for the Board of the AOO to execute specific decisions	*I*
To carry out major maintenance works in time	I
To keep records of the decisions and the financial status of the AOO	-
To have a collective insurance	-
The presence of an Audit Committee or a Supervisory Board	-
The presence of a Board of the AOO	-
At least once a year the assembly of the general meeting of owners	-
A registration of the AOO at the Chamber of Commerce	-

- In the third place of missing features is the lack of a periodic deposit of the owners to the AOO. The respondents, in addition to the literature study, indicate that 'the height of this periodic deposit should be in line with the multi-year maintenance plan'. Furthermore, this missing feature is strongly related to another feature, the presence of a reserve fund, as the height of the periodic deposit determines the height of the reserve fund. A member of the *Platform Duurzaam VvE Beheer* and a consultant confirm this relation by stating that 'the size of the reserve fund is often insufficient, as AOOs tend to set a too low level for the periodic deposit'. In addition, various actors from the AOO practice warn against 'lowering the level of the periodic deposit, as the short-term financial benefits of the owners are outweighed by the long-term negative effects on the financial position of the AOO (reserve fund) and the quality of the apartment building'. It follows from the answers of the respondents that it is sensible to consider these two missing features as one coherent missing feature: the presence and sufficient size of a reserve fund and a periodic deposit of the owners to the AOO.

- Secondly, eight respondents indicated that a high attendance to or commitment among the general meeting owners is an important missing feature that causes a problematic decision-making process. The observed participation of owners in AOOs by respondents is low, whilst this participation in and commitment to the AOO is necessary for an effective decision-making process on energy saving measures. Improving the energetic quality of the apartment building is not one of the core tasks of the AOO. For decisions by the general meeting owners on this topic need to be taken by qualified majority and not by strict majority. Thus, the attendance to meetings and the commitment among owners is needed to arrive at decisions on this voluntary topic. For example, an owner occupant of the AOO states that 'a lack of commitment to the AOO, results in a too low attendance of owners at the general meeting of owners to take valid decisions, thereby slowing down the decision-making process as a second general meeting of owners needs to be organised'. Moreover, 'a support base among the owners is needed to accommodate the possible loss of a leader within the AOO on the topic of energy saving measures'. Lastly, 'the absence of a support base among the owners can also be challenging for construction, maintenance and renovation companies as experience shows that criticism and resistance may arise during the execution of the energy saving measures'.

- The most important missing feature of AOOs, based on 16 out of 28 interviews, is the absence of a qualified daily management of the AOO or eventually a good administrator. The respondents especially experience a variable quality of administrators of AOOs. "The presence of an administrator turns out to provide no guarantees for a good organisation of the AOO in practice". Partly, 'this is due to a lack of knowledge on the topic of energy saving measures among administrators of AOOs'. However, for the most part this is due to an insufficient interest of administrators in raising the awareness of AOOs on the topic of energy saving measures. Firstly, 'administrator have an insufficient interest in the topic of saving energy as this topic is missing as a specific task for which the administrator can charge the AOO'. 'Thus, as administrators do not receive a compensation for advice on saving energy, most administrators and especially large administrators are not willing to spend time on this topic'. However, respondents do see a way out of this situation and argue "that administrators can provide AOOs with advice on energy saving measures based on a more extensive contract with the AOO". Secondly, 'providing advice on energy saving measures to AOOs may still cause a conflict with the business model of the administrator'. "Some administrators receive a fee for every kilowatt-hour and m^3 natural gas consumed by the AOO from energy suppliers or middlemen". 'Any advice from administrators on energy saving measures may decrease their revenues". 'Moreover, respondents observe that several administrators have a financial interest in specific construction, maintenance and renovation companies, causing administrators to provide subjective advice on energy saving measures'.

Given the wide recognition among respondents of the problematic causal relation between a poor quality of an administrator and an effective decision-making process in the AOO, there are sufficient grounds to include this as a separate problematic causal relation: a poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures. This problematic causal relation coexists with the previously defined problematic causal relation: a poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process. This quality of the base of an AOO can be determined based on the number of characteristics that an AOO from the list in table 10. These two problematic causal relations are in principle separate from each other, but may negatively reinforce one another.

4.3.1.2. Blocking power of tenants and large owners

Another problematic causal relation that is derived from the literature study has to do with the potential blocking power of tenants/renters or owners of many apartments in an AOO. This blocking power may affect the effective decision-making process on investing in energy saving measures in AOOs that consist of a mix of privately-owned and rented apartments. In these AOOs, an owner with many apartments may block the decision-making process by voting against the energetic improvement of the apartment building or the tenants/renters may block the decision if at least 70% disagrees with the plans. In the interviews, the respondents focused mainly on social housing associations as owners of many apartments in an AOO. Thus, the results presented in this sub section should be viewed from this perspective.

In general, social housing associations tend to have a majority stake in many AOOs. 'This is because social housing associations originally planned to sell all apartments in an apartment building to private owners, but for some reasons this transition was not fully completed', explains a member of the *Platform Duurzaam VvE Beheer*. 'Currently, the social housing associations do not intend to sell the remaining apartments as they need these apartments to rent them to their target group of low-income households', as discussed in sub section §3.2.1. The magnitude of the influence of an owner of many apartments on the decision-making process of the AOO depends on the size of the majority stake of this owner. An example of this mechanism is that a few years ago, the social housing association *Woonbron*, from a social point of view, bought several apartments in AOOs 'to obtain a stake in these apartment buildings'. 'With this majority stake *Woonbron* was able to steer these AOOs towards the execution of necessary maintenance works and sufficient savings for the future'.

Woonbron states that they want to 'maintain their majority stakes in apartment buildings that are important for their position as a landlord'. 'Even though *Woonbron* wants to have a large influence on these apartment buildings, they claim to be open to the interests of other apartment owners'. Furthermore, '*Woonbron* has a policy that apartments are repurchased from individual apartment owners in AOOs in which only a few apartments were sold'. With this policy *Woonbron* wants to undo the inconvenient ownership situation for both the social housing association and the other owners in the AOO. Also, *Woonstad Rotterdam*, another social housing association, confirms that they have 'a majority stake in over 90% of the AOOs in which they have possessions'. Lastly, the social housing association *Havensteder* states that in their case, 'the number of AOOs in which they have a majority stake is decreasing'.

AOOs that contain a mix of privately-owned and rented apartments, can be characterised by conflicting interests of the social housing association (with a majority stake) and other owners. 'Both sides blame each other that they do nothing but pursue their own interests'. According to a member of the *Platform Duurzaam VvE Beheer*, 'these conflicting interests make that the social housing association and the other owners in the AOO want to invest in the apartment building at different moments in time'. 'Ultimately, this results in a mismatch in communication between and in expectations of the various owners in the AOO'.

During the interviews, the respondents have indicated that in this context of conflicting interests, the social housing association is most often the actor that is non-cooperative regarding improving the energetic quality of the apartment building. 'Only in a few AOOs, there is a blocking minority of other owners that obstruct any plans to take energy saving measures as they are not willing to invest', says a company from the building industry. Social housing associations are blamed by the respondents for their 'wait and see attitude', their 'lack of willingness to invest in the AOO', their 'obstruction of initiatives from other owners in the AOO', and their 'rigid compliance to their own (maintenance) planning for their possessions'. This attitude of social housing associations towards AOOs, in combination with their majority stake, makes that they are tempted to block the decision-making process by voting against the energetic improvement of the apartment building. This attitude of social housing associations is, according to the respondents, related to 'their focus on renting out dwellings in combination with a lack of knowledge on ownership in an AOO'. Moreover, 'as little priority is given to the energetic quality of the apartment building by other owners in AOOs, social housing associations are not stimulated to pay attention to this issue'.

An additional complicating factor for the involvement of social housing associations with the energetic quality of AOOs is that social housing associations may have several functions within the AOO: owner, landlord, member of the board, and possibly administrator of the AOO. 'Especially the combination of the social housing association being the owner with a majority stake in the AOO and the administrator of the AOO is problematic' according to the respondents, as this increases the influence of the social housing association on the AOO even more.

From the foregoing, it seems that respondents observe little blocking power from tenants/renters in the AOO practice. It is only *Havensteder* that points out that 'plans for the (energetic) renovation of an AOO, that require the consent of 70% of the tenants/renters, may be slightly delayed by this additional step in the process'. This observation results in the following refinement of the formulation of the problematic causal relation: the transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process. Even though the respondents strongly focused on social housing associations as owners with a majority stake in AOOs, this problematic causal relation also includes other owners with a majority stake in an AOO, such as private landlords.

4.3.2. Financial issues

Secondly, several problematic causal relations are related to the financial issues of investment for improving the energetic quality of AOOs. In total, eight problematic causal relations will be discussed in this sub section, among others: the access to capital, the spending power of the AOO, the split-incentives of an investment, and the insufficient or uncertain size of the financial benefits of an investment.

4.3.2.1. Loan conditions of the SVn

The literature study indicated that the specific loan conditions of the SVn for energy saving measures are problematic for certain types of AOOs. The loan conditions are such that some AOOs are not eligible for this loan. This eliminates one of the opportunities for these AOOs to increase their spending power for energy saving measures. According to literature, the loan conditions on especially the minimum size of the AOO and the maximum duration of the loan are excluding AOOs from obtaining a loan. In an interview, the SVn confirmed that indeed 'an AOO needs to meet several requirements, such as: obtain an energy advice from an independent energy consultant, have a multi-year maintenance plan for maintenance works and energy saving measures for a period of 15 years, and present a financial overview of the revenues and financial obligations of the AOO'. However, the SVn does observe 'a clear

increase in the number of applications for loans from the *Nationaal Energiebespaarfonds* since the opening of the fund for AOOs in the summer of 2015'.

During the interviews, various respondents mentioned restrictive loan conditions that limit the number of AOOs that are eligible for a loan from the SVn. These restrictive loan conditions are included in table 11. Firstly, the maximum duration of a loan of 15 years is mentioned the most by the respondents. 'The respondents agree that this duration is sufficient for energetic improvements of the apartment building with a limited ambition level'. However, "this duration of 15 years is inadequate for large scale energetic improvements such as a renovation to a (nearly) Zero Energy Building". 'The current projects with this ambition level are delayed due to the absence of a loan with a duration of approximately 30 years'. According to the SVn, "a fixed interest rate for a loan with a duration of 30 years, results in large risks for the financer", in this case the SVn itself. 'A solution to mitigate these risks is currently being sought as the urgency to structurally provide a loan with a longer duration is high'. A critical remark on this duration is made by a social housing association, as they find it 'questionable for an AOO to enter an obligation with a duration of 30 years and with significant consequences for future apartment owners'.

Table 11: restrictive loan conditions according to respondents

Restrictive loan conditions for a loan from the SVn for AOOs	#
The maximum duration of the loan of 15 years	VI
The minimum size of the AOO of at least 10 apartment rights	V
Cumbersome and time-consuming application process for a loan	*II*
The requirements on creditworthiness of an AOO	*I*
The rise in interest rate of the loan compared to a few years ago	*I*

Secondly, the minimum size of the AOO of at least 10 apartment rights is pointed out as a restrictive loan condition by several respondents. 'This minimum size of an AOO has to do with the requirements on creditworthiness by the SVn: the maximum of 5% of the apartment owners with payment arrears is quickly reached in a small AOO'. This distinction between small AOOs and larger AOOs is understood by VvE Belang, the SVn as provides an alternative with individual loan applications for each apartment owner in an AOO. In contrast, the Ministry of the Interior and Kingdom Relations is in favour of opening the *Nationaal Energiebespaarfonds* for small AOOs. Finally, a company from the building industry indicates that "the SVn should not keep a strict limit of 10 apartment rights, but should take the functioning of the AOO as a criterion for providing a loan, as was previously done by the SVn".

Another restricting factor, according to an administrator, is the cumbersome and time-consuming application process for a loan. This is caused by the total set of loan conditions. For example, the exhaustive list of (energy saving) measures determines which measures are eligible for a loan from the *Nationaal Energiebespaarfonds*, thereby complicating the application process for an improvement of the energetic quality of an apartment building in combination with large maintenance works. Furthermore, an energy consultant states that the interest rates for a loan from the SVn used to be lower and was thus more attractive in previous years.

To conclude, the respondents observe the same problematic causal relation between the loan conditions of the SVn and the required spending power to invest in energy saving measures. Three types of AOOs – small AOOs, AOOs with high energy saving ambitions, and AOOs with payment arrears – are currently not eligible for a loan from the *Nationaal Energiebespaarfonds*. Apart from the two restrictive loan conditions derived from the literature study – the minimum size of the AOO and the maximum duration of the loan – three restrictive loan conditions of lesser importance are mentioned by the respondents, as shown in table 11 in italics.

4.3.2.2. Access to commercial capital

Based on the literature study, the limited access of AOOs to commercial capital from banks and other credit providers is detected and identified as a problematic causal relation. This limited access to commercial capital is a problematic causal relation as it deprives AOOs of a financial resource and results in

suboptimal spending power. According to the literature study, commercial loans are only incidentally provided by one Dutch bank (e.g. Rabobank) and some small credit providers, as AOOs cannot provide a collateral (*onderpand*) in return (Agentschap NL, 2012; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012). During the interviews, six respondents confirmed the existence of this problematic causal relation in the AOO practice and, more importantly, elaborated on the underlying reasons for the restraint of banks and other credit provides to provide commercial loans to AOOs.

The absence of a financial collateral that the AOO can provide in return for the commercial loan is confirmed by the respondents as one of the underlying reasons for this restraint (table 12). This underlying reason includes the point of view of banks that the investment in the energetic quality of the apartment building is not fully reflected in the property value of the apartment building and/or the property value of the individual apartments.

Table 12: underlying reasons for the limited access to commercial capital according to respondents

Underlying reason for the limited access to commercial capital	#
Miscalculation of the risks of providing a commercial loan to AOOs	*V*
The absence of a financial collateral (*onderpand*) for the loan	II
The AOO as a customer does not fit into the system of banks	*I*
Other commercial organisations require a bundle of multiple loans	*I*
Other commercial organisations require a compensation for inflation	*I*

However, the most important underlying reason for the limited access to commercial capital is, according to the respondents, a miscalculation of the risks of providing a loan to an AOO. The Ministry of the Interior and Kingdom Relations and the SVn claim that AOOs have a good track record in meeting their financial obligations for loans from the *Nationaal Energiebespaarfonds*. Nevertheless, they observe that banks unjustly view AOOs as a difficult and risky customer group. Banks are therefore reluctant in providing loans to this group. In contrast, an administrator states that 'some apartment owners in an AOO', under his management, 'refused to repay a loan for energy saving measures due to unclear information and incorrect expectations'. This results in a dubious image among banks and other commercial organisations of the payment default risks of AOOs. Given this image, 'banks are often only willing to provide a commercial loan to an AOO if the government provides a guarantee for the payment default risks'. According to a consultant with expertise in the financial field, "this demand for guarantees from the government indicates a market failure". As a result, the perceived financial risks of the AOO as a customer make that the maximum duration of a commercial loan is limited to 15 years, like the loans from the *Nationaal Energiebespaarfonds*.

Finally, three other underlying reasons for the limited access to commercial capital for AOOs are mentioned by the respondents. Firstly, a consultant with expertise in the financial field notes that "the AOO is difficult to categorise as either a private or a business customer for banks". 'This is because financial products that are specifically designed for AOOs are often not available in the shrinking product mix of banks'. Secondly, the financial expert points out that 'other commercial organisations, such as pension funds, are not interested in individual projects'. 'These organisations are only in a large bundle of loans for various AOO projects with a total value of approximately €300 million'. This size cannot be met in the near future as the total sum of recent applications for loans from the *Nationaal Energiebespaarfonds* by AOOs is far smaller. Lastly, pension funds require, in addition to a large bundle of loans, a compensation for the inflation rate on top of the interest rate. This compensation for the inflation rate significantly increases the costs of the loan for AOOs, which again will make the spending power of the AOOs suboptimal.

4.3.2.3. Insufficient spending power for the investment

The literature study shows that an AOO may have insufficient spending power to pay for the total investment costs of the energy saving measures. In that case, an AOO cannot help but decide to postpone or to reject the implementation of energy saving measures. Also from practice in Rotterdam, it appears that "many AOOs get stuck in the financial stage" of the customer journey.

The spending power of an AOO is determined by (a combination of) four types of financial resources:

- The reserve fund of the AOO that is being filled by the periodic deposits of apartment owners to the AOO;
- A loan from the SVn, a bank, or a commercial organisation for the AOO;
- A single deposit to the reserve fund of the AOO by each individual apartment owner;
- A subsidy for the implementation of energy saving measures provided by the government.

Problems with the spending power of the AOO only occur with the first three types of financial resources. In the following paragraphs, the comments of the respondents on each of these three types of financial resources are discussed.

Firstly, sub section §4.3.1.1 showed that the quality of the base of the AOO includes an important financial feature of a functioning AOO: the presence and sufficient size of a reserve fund and a periodic deposit of the owners to the AOO. The failure of an AOO to comply with this financial feature has a negative effect on its spending power. Respondents state that the "financial situation of an AOO is often problematic as the AOO has only saved for the maintenance of the apartment building and not for the (energetic) improvement". A board member of the AOO explains that "it proved to be difficult to increase the periodic deposits of apartment owners to the AOO, due to the effect of the past financial crisis on the individual financial situation of these owners". In addition, the Ministry of the Interior and Kingdom Relations indicates that 'several to-be apartment owners are insufficiently aware of the real monthly costs for maintaining and improving the apartment and the apartment building'. Consequently, a significant number of apartment owners cannot afford the necessary increase of the periodic deposit for the (energetic) improvement of the building. In addition, 'apartment owners who expect to own the apartment only for a short time, are often not willing to increase the periodic deposit for an (energetic) improvement of the building in the long run, as they want to sell their apartment on the short term'.

Secondly, sub sections §4.3.2.1 and §4.3.2.2 illustrate the difficulties for various types of AOOs to obtain a loan from either the SVn or from a bank or another commercial organisation. "Small AOOs with a limited size of the reserve fund are often not eligible for a loan to replenish the financial resources to a sufficient level". From another perspective, the SVn adds that AOOs should be informed in an early stage of the customer journey on the funding opportunities that are created by a loan from the *Nationaal Energiebespaarfonds*. This prevents AOOs from assuming that investing in energy saving measures is not a realistic option for them as they the lack the financial resources to pay for these measures.

Thirdly, an AOO may decide in the general meeting of owners on the payment of a single deposit to the reserve fund by each apartment owner in order to increase the spending power of the AOO to a sufficient level. This single deposit may, depending on the size, allow the investment in a single energy saving measure or even a large scale energetic improvement to a (nearly) Zero Energy Building. However, a consultant with expertise in the financial field points out that 'this single deposit may prove to be a real problem for a number of individual apartment owners in the AOO given their personal situation'. "Especially for large scale energetic improvements to a (nearly) Zero Energy Building, the investment costs are high: approximately €55.000-€40.000 per apartment". 'Practice has shown that the single deposit is not really accepted by apartment owners as a financial resource to increase the spending power of the AOO and to allow for the improvement of the building'. 'Unless the single deposit is needed for real necessity, such as balconies with a risk of collapsing or problems with the foundation of the building, the use of the single deposit as a financial resource is a total no-go for AOOs'.

The previous sub sections and the discussion on the three types of financial resources indicate that having enough spending power for an investment in energy saving measures is a real challenge for an AOO. However, even if the spending power is sufficient, the AOO may decide not to invest in the reduction of energy use. Instead, an apartment owner points out that "an AOO may use its spending power

for expenses that are more urgent than energy saving measures". Apart from the urgency of other expenses, an AOO may decide to refrain from any investment and to save for maintenance expenses in the future. 'This is because the willingness to invest in energy saving measures in general is rather low for AOOs'. Thus, as a financial consultant noted, 'sufficient spending power of an AOO does contribute to, but is no guarantee for, an investment in energy saving measures'. 'In this respect, 'investments in energy saving measures that result in no additional costs for the apartment owners in the short or medium term (e.g. maximum five to seven years) are most likely to be implemented by an AOO with sufficient spending power'.

4.3.2.4. The financing costs of a loan

In the literature study, the following problematic causal relation was found: the costs of the loan as a financing instrument may disturb the delicate balance between financial costs and benefits of the investment in energy saving measures. This problematic causal relation focusses on the financing costs of a loan, which include the interest on the loan and in some cases also a compensation for the inflation rate. The financing costs are part of the total investment costs of energy saving measures. Regarding the financing costs, it was found that it is important that the financial benefits of the reduction of the energy consumption are in line with the total investment costs for an AOO to be able to make a positive decision (Waals van der, 2015). However, no respondent mentioned the financing costs for a loan as a potential threat for the delicate balance between the costs and benefits of an investment in energy saving measures. Presumably, this is because the financing costs are indirectly included in the balance of the spending power of the AOO on the one hand and the total investment costs on the other hand. Therefore, it is decided that, as this problematic causal relation is insignificant in itself, but does have an influence on the costs and benefits, the problematic causal relation in the previous sub section explicitly includes this influence.

4.3.2.5. Limited spending power for hiring expertise

From the literature study, a problematic causal relation was derived between the limited spending power of the AOO, due to its size or its financial situation, and the ability of an AOO to hire expertise. Hiring expertise can be in the form of a professional board member or an advice from a consultant. This expertise may help towards an effective decision-making process within the AOO. The importance of the ability of an AOO to hire expertise is confirmed by eight respondents in the interviews. *VVE-010* adds 'that AOOs require a special approach including the support of professionals, as most AOOs are not able to work on the maintenance issues and on the improvement of the apartment building by themselves'. A consultant understands that 'apartment owners give little priority to the issues of the AOO as their spare time is limited and valuable'. Hiring expertise helps with this priority problem as it enables an effective decision-making process with less effort needed from the apartment owners.

The support for hiring expertise increases among the apartment owners after the completion of the first stages of the customer journey, in which the technical possibilities and the wishes of the owners have been identified. According to a process consultant, 'AOOs are willing to pay for advice in this stage, if they are sure that they will receive a high-quality advice'. Although AOOs are willing to pay for good advice, the ability to pay for this advice varies widely among AOOs. Obviously, this ability to pay for advice depends on the spending power of an AOO. However, an energy consultant points out 'that good advice is relatively more expensive for small AOOs'. This is because the costs of an advice for a small AOO are only slightly less than those for a large AOO, making the costs per apartment relatively high. An administrator who charges a fixed fee per apartment for the daily management, regardless of the size of the AOO, confirms that "small AOOs of two or three apartments are not profitable for the administrator". 'Moreover, a member of the *Platform Duurzaam VvE Beheer* notes that the costs for sup-

port and advice during the decision-making process and implementation of large scale energetic improvements to (nearly) Zero Energy Buildings will remain high, approximately €30.000 per AOO, in the coming years'. A board member points out that 'the best way for AOOs to reduce the costs for advice and support is to figure out as much as possible themselves and to only hire expertise for the complex issues in the process'. An example of such a complex issue is the application for a loan from the SVn.

Notable is that the respondents fully focused on the expertise of energy, financial, and process consultants and disregarded the possibility to hire professional board members to improve the decision-making process. From practice no indication is derived that AOOs, who need professional board members, experience any financial barriers in hiring this expertise. Hiring professional board members may perhaps be seen as a need that only exists among AOOs with sufficient spending power. This luxury need is not included in the new formulation of the problematic causal relation: for AOOs with limited spending power or a limited number of apartments, it is difficult to hire expertise from consultants to ensure an effective decision-making process within the AOO.

4.3.2.6. Split-incentives of single energy saving measures

Conflicting interests between owners do exclusively occur in mixed AOO with both privately-owned and rented dwellings. Potentially, this is something that may occur in every AOO and especially in an AOO that is considering taking energy saving measures. This is found in the literature study and is identified as a problematic causal relation as the transition from a sense of urgency to an effective decision-making process may be hampered by split-incentives of certain energy saving measures among apartment owners. Apartment owners who receive little benefits from the measure(s), but need to pay an equal share of the costs, are likely to vote against the implementation of these measures.

Process consultants confirm that 'it is cumbersome to try to align the varying interests of all apartment owners within the AOO'. Moreover, 'the underlying arguments for these interests prove to be difficult to determine'. Through this, potential solutions for aligning the interests of the owners remain out of sight. Also for companies from the building industry 'it turns out to be difficult to differentiate between individual interests of apartment owners and the collective interests of the AOO'.

The conflicting interests, in the form of split-incentives, become clearly visible during the decision-making process of the AOO on the implementation of one energy saving measure. This is because the benefits, both financial and non-financial, of this measure are often unevenly distributed over the various apartment owners, whilst every apartment owner bears an equal share of the costs. 'The gap between costs and benefits is especially problematic for a measure that affects the exterior of the apartment building, as the benefits for an individual apartment owner are determined by the position of his apartment in the building'. Individual apartment owners find this unfair and are likely to vote against the implementation of these measures, particularly if the spending power of the AOO is limited. The problematic quality of the base of the AOO (§4.3.1.1) in combination with the lack of awareness of the joint ownership of the apartment building underlie this resistance of individual apartment owners.

4.3.2.7. Unclear and uncertain financial benefits

The literature study showed that unclear or uncertain financial benefits of energy saving measures often withhold AOOs from continuing their decision-making process. This is because AOOs, due to these unclear and uncertain financial benefits, are not willing to invest time and money in the specific analysis of the actual financial effects. The respondents indeed confirm 'that AOOs need a clear and reliable indication of the financial benefits of the proposed energy saving measures'. 'This indication should preferably be given by an independent energy consultant', adds a financial consultant. This is in line with the observations on the adverse effect of the provision of information, advice, and support by

commercial parties with a direct financial interest in the decision of the AOO to invest in energy saving measures from sub section §4.3.5.1.

The limited spending power of AOOs to hire expertise was already described as a problematic situation in sub section §4.3.2.5, and this limited spending power is also relevant for the clarification of these financial benefits. However, the respondents claim that 'also AOOs that do have, in theory, sufficient spending power to hire expertise, are reluctant to pay for an advice that will clarify the financial benefits of the energetic improvement'. 'This reluctance to invest in a proper advice can be explained by the doubt of the AOO on whether this pre-investment will ultimately be recouped with the implementation of energy saving measures' says a financial expert. 'To remove this reluctance', the respondents claim that either 'a financial contribution from the government is needed in the consultancy fees or a no-cure-no-pay construction that is made available by the advisors'.

In the best case, 'this reluctance to pay for a professional advice on the expected benefits of the energy saving measures may lead to AOOs only harvesting the low-hanging fruit, thereby placing the other fruit out of reach' according to an apartment owner. Unfortunately, most AOOs will probably decide to stop the decision-making process due to the unclear and uncertain financial benefits of the energetic improvement.

4.3.2.8. Imbalance between costs and benefits

In the literature study, it was found that the costs of the implementation of energy saving measures outweigh the perceived benefits of these measures for some AOOs. This imbalance between costs and benefits may even remain intact in the rare case that also non-financial benefits of the energetic improvement of the apartment building are included in the trade-off of costs and benefits. For these AOOs, investing in energy saving measures is not an attractive option.

The respondents confirm this problematic causal relation and explain that 'a balance between costs and benefits (*woonlastenneutraal*) is a minimum requirement for many AOOs to invest in energy saving measures'. 'In addition to the financial benefits of the reduction of the energy consumption, it is important that AOOs are aware of any non-financial benefits and that AOOs are able to include these non-financial benefits in their decision-making process'. 'This is important because a simple balance in financial costs and benefits in combination with an improvement of the sustainability of the apartment building is often not enough to persuade AOOs to actually take a positive decision on the implementation of energy saving measures'.

Examples of these non-financial benefits are an 'improvement of the comfort and quality of the apartment', 'a prolonged life span of the apartment building' and 'a reduction of the selling time of an apartment'. 'For private landlords and social housing associations, the reduction of the vacancy rate in the AOO is an additional benefit of the investment', says a company from the building industry. Although non-financial benefits are often not included in the trade-off of AOOs make, 'non-financial costs of the investment in energy saving measures are frequently included, such as expected nuisance of the construction work and a less attractive appearance of the exterior of the apartment building', according to an energy consultant.

Still, for AOOs in poorer neighbourhoods, even the inclusion of non-financial benefits in the decision-making process may still result in an imbalance between costs and benefits. 'In these neighbourhoods, apartment owners are faced with energy poverty and are financially forced to minimise their energy consumption', states a company from the building industry. For these AOOs, the rebound effect is relevant, as the actual reduction of their energy consumption because of the energy saving measures is less than expected. In these cases, the investment in energy saving measures is not an attractive option for the AOO.

4.3.3. National and municipal laws and policies

Thirdly, the limited effects of various existing laws on investments of AOOs in improving the energetic quality of their apartment buildings are discussed in this sub section. The limited effect is due to energy saving ambitions that are insufficiently embedded in national laws and a lack of enforcement for certain regulations. These effects will be discussed for both national and municipal laws and policies.

4.3.3.1. Limited effect of existing laws and policies

The limited effect of several existing laws, that have the objective to create a sense of urgency for investments in energy saving measures among apartment owners, is identified in the literature study. On the one hand, it is shown that the (inter)national energy saving ambitions are insufficiently embedded in national laws to trigger these investments. On the other hand, it is found that a large share of that AOOs does not meet the regulations on a proper functioning of the AOO because no enforcement is taking place. The lack of urgency among apartment owners that continues to exist is due to the limited effect of various existing laws and policies. This is confirmed by nine respondents during the interviews:

- With regard to the national laws that reflect the (inter)national energy saving ambitions, respondents state that the focus on saving energy has fluctuated over the years with each different government. According to VvE Belang, 'the focus of the current policies needs to be shifted from subsidising the large-scale generation of renewable energy to stimulating energy saving measures in the built environment'. 'Stimulating the reduction of the energy consumption in the built environment is a less costly approach and has a larger effect on the energy saving ambitions'. Furthermore, respondents claim that the sense of urgency is missing in the current laws and policies for the reduction of the energy use. 'This is, among others, caused by the objective for 2050, which is too far away and does not stimulate actors in the built environment to start moving towards this horizon'. Even some of the best AOOs do not get any further than the implementation of one energy saving measure, while the objective in 2050 requires the implementation of a combination of multiple energy saving measures. A social housing association observes this lack of urgency also among municipalities, as some municipalities are waiting for the release of national laws which enable them to force AOOs to take energy saving measures.

- The consequences of a lack of enforcement of the regulations on the functioning of AOOs has already been discussed in sub section §4.3.1.1. The quality of the base of many AOOs is problematic due to this lack of enforcement of the regulations. This obstructs the decision-making process in an early stage, as the sense of urgency to invest in energy saving measures is not present. A member of the board agrees that 'AOOs are prone to taking bad decisions as there are no penalties to punish the poor performance of an AOO'.

- Lastly, several respondents indicate that the European and national system of energy labels, which represent the energetic quality of a building, creates difficulties in stimulating AOOs to take energy saving measures. Firstly, respondents point out that 'several researches of the system of energy labels have shown that there is a discrepancy between the theoretical consumption of natural gas and electricity based on the energy label and the actual consumption of natural gas and electricity'. This observation was indeed found in the literature study in sub section §3.3.1. Through this mismatch, the system of energy labels is not suited for calculating the expected reduction of the energy use of a proposed energy saving measure. Secondly, the implementation of one energy saving measure in an apartment building does not necessarily result in an improvement of the energy label, as the effect of the measure is too small. In that case, the energy label suggests that no energetic improvement has taken place, despite the

reduction of the energy consumption of the building. Thirdly, the system of energy labels, in general, turns out to be unfit for monitoring the energetic quality of buildings, as the energy labels are not automatically updated after the implementation of an energy saving measure. 'Especially for AOOs, updating the energy label after an energetic improvement is always omitted as the consent of all apartment owners is needed for assigning the new energy label', an energy consultant explained.

In general, the respondents confirm the problematic causal relation that was found in the literature study and observe the limited effect of national laws on the sense of urgency among apartment owners to invest in energy saving measures. In addition, the respondents indicate that, besides the limited effect of national laws, the limited effect of national policies on the reduction of the energy consumption should be included in the formulation of the problematic causal relation: the effects of national laws and policies on the reduction of the energy consumption in the built environment and the effects of the regulations on the functioning of AOOs are too small to create a sense of urgency among apartment owners to invest in energy saving measures. One final note is that, although respondents confirm the presence of this problematic causal relation, the attitude in practice is that actors somehow have to work within this relatively fixed context of laws, policies and regulations.

4.3.4. Provision of information, advice and support

Subsequently, three problematic causal relations have to do with the provision of information, advice and support to AOOs. A problematic causal relation that is located at the start of the customer journey for AOOs is that there may be a lack of knowledge on energy saving measures among the apartment owners. The second problematic causal relation questions the effect of providing information, advice and support to apartment owners as a potential solution for this lack of knowledge. The third problematic causal relation illustrates this, as it proves to be difficult to warn apartment owners for the rebound effect with the provision of information, advice and support.

4.3.4.1. Lack of knowledge among apartment owners

Another problematic causal relation that is found in the literature study, is that a lack of knowledge on energy saving measures among apartment owners limits AOOs to become interested in energy saving measures. An energy consultant illustrates that "proposals for energetic improvements of the building were considered as nonsense only a few years ago, but currently the interest in energy saving measures is increasing". This increasing interest in energy saving measures is also observed by other consultants and at the information desk of VvE Belang. However, an apartment owner stresses that 'AOOs are still less interested in reducing the energy consumption compared to other actors in the built environment'. The lack of knowledge among apartment owners is in various ways causing this lagging interest in energy saving measures:

- In an AOO, every apartment owner needs to have at least a minimum level of knowledge on energy saving measures. This is because an apartment owner, like every homeowner, wants to be confident that he is making a correct and informed decision. Thus, 'sufficient knowledge among just a few apartment owners is not enough to arrive at an effective decision-making process'. Thus, there is a significant risk that the AOO will not become interested in energy saving measures if several apartment owners do not have sufficient knowledge on this topic.

- In Dutch, there is a confusion of tongues about the word *"duurzaamheid"* as it has two relevant meanings for an AOO. On the one hand, *duurzaamheid* can be interpreted as sustainability, which relates to the impact of the building on the environment and more specifically on the consumption of energy from fossil fuels. However, "many AOOs unintentionally assume that

duurzaamheid means durability, relating it to prolonging of the lifespan of the building which is one of the core tasks of an AOO". As many AOOs misunderstand the communication on reducing the energy consumption as communication on prolonging the lifespan of the building, the lack of knowledge on energy saving measures is not easy to solve.

- "It is still happing every once in a while, that an apartment owner, who is new to the organisation of the AOO is not aware of the fact that he owns an apartment right and not the apartment itself" says an apartment owner. This lack of knowledge makes that these apartment owners are not interested in and not willing to invest in the energetic quality of the building, which is their joint property. They are only interested in their 'own apartment'.

- Apartment owners often become interested in reducing the energy consumption of the AOO based on positive experiences from friends and family with energy saving measures. This exchange of experiences should naturally be encouraged, but there is one potentially complicating factor: these friends and family are often individual homeowners of single-family dwellings. "Most apartment owners do not know that certain popular energy saving measures among individual homeowners, such as solar panels, are very difficult, if not impossible, to implement in AOOs". 'Such a disappointment may cause the apartment owner to refrain from developing an interest in other energy saving measures that are easier to implement in an AOO'.

- Lastly, a loan as a financial resource is unknown or deterrent to many AOOs, especially in the early stage of becoming interested in energy saving measures. As the SVn proposed in sub section §4.3.2.3, AOOs need to be informed early in the customer journey on the possibility to obtain a loan. With this loan, they can cover the investment in the energetic quality of the building. Otherwise, AOOs may needlessly conclude that they have insufficient spending power for the implementation of energy saving measures.

A logical way to solve this lack of knowledge among apartment owners seems the provision of information, advice and support to AOOs. However, the provision of information, advice and support does not necessarily increase the interest in and the sense of urgency for the implementation of energy saving measures for AOOs as the problematic causal relation in the next sub section shows.

4.3.4.2. The effectiveness of the provision of information, advice, and support to AOOs

The problematic lack of knowledge among apartment owners on energy saving measures cannot be effectively solved, according to the literature study, by simply providing information, advice, and support to AOOs. From the literature study in sub section §3.3.2., it was found that the provision of information, advice, and support to AOOs has an uncertain effect on the sense of urgency to implement energy saving measures for various reasons. The explanations for this uncertain effectiveness from sub section §3.3.2. are repeated in table 13.

Table 13: explaining the uncertain effectiveness of the provision of information to AOOs based on the literature study

Explanations for the uncertain effectiveness of the provision of information, advice and support
Apartment owners are not concerned with their apartment building and are badly informed on the AOO
Apartment owners need time to grasp the complex matter of energy saving measures to get a sense of urgency
The length of residence in an AOO is short, causing a permanent need for the provision of information to new owners
It is difficult for information providers to connect to relevant changes in the course of life of apartment owners

The problematic causal relation and the four explanations of the uncertain effectiveness of the provision of information, advice, and support to AOOs are confirmed by more than half of the respondents in the interviews:

- The respondents observe that AOOs are not open to information on energy saving measures as apartment owners are not concerned with their apartment building and they are badly informed on the AOO. On the one hand, social housing associations point out that 'it is difficult to create enthusiasm for the reduction of the energy consumption among apartment owners, who are not intrinsically motivated to energetically improve their building'. Their observation is that "the information, that is currently provided, does contain insufficient incentives to seduce AOOs to consider taking energy saving measures". On the other hand, a consultant states that 'AOOs need some assistance in formulating their wishes for and questions on the reduction of their energy consumption towards the building industry'. This is because the apartment owners are badly informed on the legal, technical, and financial aspects regarding the implementation of energy saving measures within an AOO.

- Secondly, respondents observe that AOOs need some time to grasp the complex matter of energy saving measures. Currently, themes such as sustainability and saving energy are not appealing to AOOs. VvE Belang, among others, explains that 'information sessions with these themes do not attract a lot of AOOs'. 'Although most AOOs do not visit sessions about these themes at their own initiative, they are willing to be informed on the issue of energetic quality of the building when they are attending other information sessions'. Thus, it seems that AOOs in time will become interested in energy saving measures.

- VvE Belang confirms that "some types of apartment owners (e.g. aged between 30 to 50 years and aged over 65 years) tend to have a relatively short length of residence in an AOO as they plan to move to a different type of dwelling". Indeed, this causes a permanent need for the provision of information to new apartment owners. 'Moreover, this indicates that AOOs consist of at least two different groups of apartment owners based on their expected length of residence in the AOO'. As these two groups tend to have differing interests in the quality of the apartment building on the long and short term, each group will require an appropriate type of communication on energy saving measures to let them become interested in this topic.

- Lastly, respondents state, in line with the results from the literature study, that 'it is difficult for the providers of information, advice, and support to plan the first contact with an AOO at a moment that the AOO is open to this information, advice, and support (i.e. a window of opportunity)'. 'This timing is difficult as it is unknown for the provider when this window of opportunity presents itself'. Even more, there is currently no clear theoretical description of a window of opportunity in an AOO, as the individual windows of opportunity of apartment owners within an AOO are often not aligned with each other.

In addition to the four explanations, the respondents pointed out some other reasons for the uncertain effectiveness of the provision of information, advice, and support to AOOs for creating a sense of urgency among apartment owners to invest in energy saving measures:

- Firstly, respondents have different opinions on the effectiveness of providing AOOs with information on similar AOOs who have already improved the energetic quality of their building. Respondents from the building industry indicate that good examples of AOOs, who have taken energy saving measures, do not persuade other AOOs to do the same. 'This is because AOOs are convinced that they are in various ways not identical to these exceptional AOOs'. The respondents advocate that 'every energetic improvement of an AOO needs to be considered as a stand-alone project and not as a repetition of previous projects'. However, other respondents, including a process consultant, disagree with the building industry, as they observe that 'AOOs are in need of contact with and want to share experiences with other AOOs'. In addition, the

WoonWijzerWinkel states that 'the contact of AOOs with other AOOs who have already taken energy saving measures, has a positive effect on the decision-making process'.

- Secondly, some forms of communication may trigger negative reactions from apartment owners. A construction, maintenance, and renovation company did receive angry reactions from owners on a photograph that presented the result of the thermal scan of their apartment. This form of communication was perceived as offensive instead of purely informative.

- Furthermore, the WoonWijzerWinkel and some respondents from the building industry notice that the level of prior knowledge of apartment owners should be considered by the providers of information, advice, and support. 'The accessibility of the information and advice provided to the AOO needs to be such that every apartment owner is able to understand and act on its contents'.

- 'Information and advice that are too focused on the technical aspects of the energetic improvement of the apartment building, mostly do not contribute to a positive decision in the general meeting of owners, as the technical aspects are only a part of the full story' says a company from the building industry. An energy consultant notes that 'the softer side of the story needs to be integrated with these technical aspects to improve the credibility of the story towards the general meeting of owners'.

- An apartment owner adds to this list of explanations that 'the provided information and advice must have some added value to the AOO'. In this specific case, the advice provided by a municipality was essentially the same as the findings of the preliminary research that was conducted by the AOO.

- Moreover, another respondent predicts that some forms of support, which involve a personal approach, are not suited for creating the sense of urgency among an increasing number of AOOs. The personal approach of certain forms of support makes that, given the capacity of the provider of the support, this support will only be available for a select group of AOOs. For example, 'the course on energy saving measures for AOOs, which is characterised by a lot of personal interaction between the coaches and the AOOs, is not a scalable type of support'.

- Lastly, the provision of subjective information, advice, and support by a commercial party in an early stage of the customer journey is strongly ineffective in stimulating AOOs to take energy saving measures. A company from the building industry indicates that 'commercial parties should refrain from any advertisements at information sessions, as AOOs only appreciate the provision of objective information'. In the following sub section, §4.3.5.1, the problematic causal relation that is related to the distinction between objective and subjective information is discussed.

In table 14, the additional explanations for the uncertain effectiveness of the provision of information, advice, and support to AOOs are combined with the four explanations from table 13. The number of respondents that mentioned each explanation is also shown in this table.

The interviews support the observation of the uncertain effectiveness of the provision of information, advice, and support to AOOs for creating the sense of urgency to take energy saving measures. From, the interviews, additional explanations for this uncertain effectiveness were derived, in addition to the four explanations found in the literature study. Besides, the context, as discussed in sub section §4.3.3, of the limited effect of existing laws and policies on the sense of urgency to invest in energy saving

measures may possibly reinforce the lack of effectiveness of this provision of information, advice, and support.

Table 14: explaining the uncertain effectiveness of the provision of information to AOOs

Explanations for the uncertain effectiveness of the provision of information, advice, and support	#
Apartment owners are not concerned with their apartment building and are badly informed on the AOO	V
Variable effectiveness of information on similar AOOs, who have already implemented energy saving measures	V
The level of knowledge in AOOs is not taken into account by the providers of information, advice, and support	III
Apartment owners need time to grasp the complex matter of energy saving measures to get a sense of urgency	II
It is difficult for information providers to connect to relevant changes in the course of life of apartment owners	II
Information and advice that are too focused on the technical aspects of the energetic improvement of the apartment building, mostly do not contribute to a positive decision in the general meeting of owners	II
The length of residence in an AOO of some apartment owners is short, causing a permanent need for the provision of information to new owners and different forms of communication to different groups in the AOO	I
Some forms of communication may seem offensive and trigger negative reactions from apartment owners	I
The provided information and advice lack some form of added value to the AOO	I
Some forms of support, which involve a personal approach, are not scalable to reach larger numbers of AOOs	I
The provision of subjective information, advice, and support by a commercial party in an early stage of the customer journey is strongly ineffective	I

4.3.4.3. The rebound effect

Another problematic causal relation that was derived from the literature study is that the energetic performance of the building after the renovation, in terms of energy, can be less than expected due to the rebound effect. In case of the rebound effect, the perceived reduction of the energy demand caused by the implemented energy saving measures, makes that apartment owners are being more likely to waste energy through a negative change in their behaviour. The rebound effect is also frustrating for economical apartment owners, who are prior to taking energy saving measures already aware of their energy consumption, as the benefits from these measures turn out to be less than expected. It turns out to be difficult to warn apartment owners against the rebound effect with the provision of information, advice and support. However, none of the respondents mentioned the rebound effect as a cause for a lower energetic quality of the apartment building compared to the theoretical energetic quality that was predicted prior to the implementation of the energy saving measures. Presumably, this is because respondents observe numerous problematic causal relations in earlier stages of the customer journey that are deemed more urgent than the slightly disappointing results due to the rebound effect in the final stage of the customer journey.

4.3.5. The building industry

Finally, three problematic causal relations are discussed in which the building industry is involved. The first problematic causal relation discusses the ineffectiveness of providing information, advice and support to AOOs by companies from the building industry. This is because these AOOs are aware of the direct interest of these companies in their decision to investment in energy saving measures. Secondly, it is shown that many companies from the building industry do not want to do business with AOOs. Lastly, the effect of errors and mistakes from the building industry, during the renovation, construction and maintenance of the building, on the reduction of the energy consumption of AOOs is discussed.

4.3.5.1. Deterrent effect of the subjective provision of information, advice and support

In the previous sub section, it was found that the provision of subjective information, advice, and support by a commercial party is strongly ineffective in an early stage of the customer journey. This corresponds with the following problematic causal relation that is found in the literature study: *for especially*

small AOOs, due to a lack of expertise, it is difficult to structure and value information, advice, and support provided by various objective and subjective actors in order to identify and perceive the benefits of the energy saving measures. From the interviews, it follows that AOOs have a strong need for objective information, advice, and support from independent and reliable actors. An apartment owner adds that AOOs 'prefer receiving information from a reliable actor, such as a municipality, to search for information themselves'.

A process consultant states that 'in the early stages of the customer journey, the provision of information, advice, and support by commercial parties has a deterrent effect on AOOs'. 'This is because AOOs are aware of the financial interests of these commercial parties in their decision to invest in energy saving measures'. 'This interference of commercial parties has a counterproductive effect as AOOs find it difficult to structure and value the provided information'. 'Furthermore, this interference may evoke resistance among the apartment owners as AOOs fear to be tricked by these actors'. AOOs are concerned that these actors may be tempted to overstate the benefits of the energy saving measures, given their financial interest in the implementation of these measures. Some respondents are not only concerned with the traditional commercial parties, but also with the WoonWijzerWinkel, and state that 'they should refrain from a commercial approach towards AOOs, in order to preserve the image of an independent and reliable actor for the provision of information on energy saving measures'.

"In later stages, AOOs are more open to the involvement of commercial parties", says a process consultant. 'However, these commercial parties should preferably have no direct financial interest in the decision to reduce the energy consumption'. For example, 'AOOs appreciate that a reliable and independent actor provides an explanation of the benefits and costs of the proposed energy saving measures during the general meeting of owners'. A company from the building industry is aware of this mechanism and involves, by default, an independent third party to check and confirm their calculations of the expected benefits and costs of the plan. 'This results in more confidence of the AOO in the company and in the proclaimed effects of the energetic improvement of the apartment building'.

Thus, the interviews largely confirm the problematic causal relation that is found in the literature study. However, the respondents sharpen the formulation by stating that AOOs find it difficult to structure and value information, advice, and support from commercial parties, that have a direct financial interest in the decision of the AOO to invest in energy saving measures. Thus, the problematic causal relation is reworded as: for especially small AOOs, due to a lack of expertise, it is difficult to structure and value information, advice, and support provided by commercial parties with a direct financial interest in the decision of the AOO to invest in energy saving measures, in order to identify and perceive the benefits and costs of the energy saving measures.

4.3.5.2. The unwanted customer

According to the literature study, companies from the building industry are less willing to do business with AOOs in case of uncertainty with regard to who is authorised to sign a contract on behalf of the AOO. However, the results of the interviews with various actors form the AOO practice show a bigger problematic causal relation regarding the willingness of companies from the building industry to do business with AOOs. In short, the respondents explain that AOOs are unwanted customers for most companies from the building industry.

Even making the first contact with an AOO turns out to be a real challenge for companies from the building industry. An energy consultant explains that 'many, especially small, AOOs do not seek contact with advisors and companies from the building industry'. And, 'even the benevolent commercial parties are unable and/or reluctant to initiate the first contact with an AOO themselves, as contact details of (the board of) the AOO are difficult and time-consuming to trace'. Both consultants and companies from

the building industry point out that 'they need the support and recommendations from the municipality to have a productive first contact with the AOO'.
The AOO as a customer is situated between the individual private customer and the professional business customer. An energy consultant indicates that 'the size of especially small AOOs, and thus the magnitude of the energy consumption, does not correspond to the available business models of commercial parties'. In addition, 'companies struggle with making a distinction between the individual interests of apartment owners and the collective interests of the AOO, causing existing marketing strategies to lose their effectiveness'.

'Despite the large market potential, AOOs feel that they are labelled as unwanted customers'. VvE Belang expresses this feeling by stating that 'the building industry is convinced that an individual private customer simply gives less hassle than an AOO during the decision-making process.' Various respondents confirm that 'AOOs are considered as cumbersome and slow decision makers' by the building industry and that 'these companies do not want to pre-invest time and money in this uncertain and lengthy decision-making process'. The VNG region adds that 'the building industry only wants to be involved with AOOs who are already willing to invest in energy saving measures'. The WoonWijzerWinkel states that 'government prefers the involvement of the building industry in initiating this willingness of AOOs to invest'. 'However, if this involvement would be only slightly attractive for commercial parties, it would have already happened', says the WoonWijzerWinkel.

Some respondents claim that 'this unwillingness of the building industry to do business with AOOs is due to unfamiliarity with AOOs'. However, 'several attempts to increase the familiarity of the construction, maintenance, and renovation companies with AOOs have failed in practice due to disinterest from these companies'. In all probability, the fact that the building industry views AOOs as unwanted customers cannot just be explained by a lack of familiarity with the functioning of the AOO. This is illustrated with the observation of several respondents that 'even the benevolent companies from the building industry mostly have inadequate advice and offers to energetically improve AOOs'. This shows that the building industry is not truly motivated to explore the relatively unknown customer type of the AOO.

The conclusion based on the interviews is that this problematic causal relation is more encompassing than companies from the building industry who are simply less willing to do business with AOOs in case of uncertainty with regard to who is authorised to sign a contract on behalf of the AOO. Thus, the formulation of the problematic causal relation is expanded to: many companies from the building industry are unwilling to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process.

4.3.5.3. Errors and mistakes by the building industry

Another problematic causal relation that is found in the literature study is that during the construction and maintenance of energy saving measures, any construction or installation error or a lack of maintenance may decrease the actual amount of energy saved. Thus, the energetic quality of the AOO after the renovation may be less than expected. Several respondents confirm that these errors and mistakes of the building industry cause a mismatch between the expected energetic quality and the actual energetic quality of the AOO. An example of a mistake in a very early stage of the customer journey is that the 'calculations of the expected benefits of the energy saving measures are based on the theoretical energy consumption instead of the actual energy consumption of the apartment building', as was also discussed in relation to the system of energy labels in sub section §4.3.3.

An apartment owner describes a problematic situation after the renovation of their apartment building. 'Mistakes and errors of the company resulted in leakages in and the decay of the concrete structure of the building'. This indicates that 'AOOs need to be very alert on any mistakes and errors to prevent being involved in a tedious legal process'. Even more, a critical company from the building industry

points out that other 'construction, maintenance, and renovation companies hardly check their work for any mistakes and errors'.

4.4. Additions to the set of problematic causal relations

During the interviews, several problematic causal relations were mentioned by the respondents, which did not emerge from the literature study in chapter 3. Therefore, this section discusses these additional problematic causal relations and any possible link to the set of problematic causal relations that is derived from the literature study. Again, the five clusters from the previous section are used to structure the discussion of these additional problematic causal relations.

4.4.1. Organisational structure of the AOO

In addition to the problematic causal relations on the organisational structure of the AOO, respondents have brought forward another problematic causal relation. The respondents claim that, especially for small AOOs, an improved organisational structure of a functioning AOO needs to be pursued. This is because the current organisational structure is unable to deal with problems regarding the blocking power of apartment owners in small AOOs and with the mismatch of small AOOs and the physical structure of the apartment building.

4.4.1.1. Structure of a functioning AOO

In sub section §4.3.1.1, the following problematic causal relation was described: a poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process. This quality of the base of the AOO is determined based on a checklist of features of a functioning AOO. However, some respondents state that this checklist to determine the quality of the AOO is insufficient and incomplete. They claim that an improved organisational structure of the AOO needs to be pursued to allow for an effective decision-making process on energy saving measures.

An administrator states that, 'especially in small AOOs, apartment owners who vote against large maintenance works and the energetic improvement of the apartment building have too much power'. A change of the organisational structure of the AOO may be needed to allow for a smoother decision-making process on the improvement of the building. Another alarming issue is pointed out by an expert from the municipality of Rotterdam: 'there is a persistent mismatch between the organisational structure of small AOOs within the physical structure of a larger apartment block'. The energetic improvement of an apartment block is most effective if the energy saving measures are taken in all apartments at the same time. Insulating the exterior of the apartment building is a clear example of such an energy saving measure. Naturally, insulating the entire apartment building is far more effective than insulating only a few apartments as this results in energy leakages to adjacent apartments.

However, one apartment block may consist of a significant number of small AOOs, that each have their own decision-making process and financial means for the implementation of an energetic improvement. This results in deviations in maintenance level and in a different appearance of the exterior per AOO. This mismatch between the organisational structure of several AOOs in the building structure of one apartment block complicates an effective energetic improvement of the full apartment block at once. To summarise, the following additional problematic causal relation is derived from the interviews: the organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.

4.4.2. Financial issues

The respondents have identified three more problematic causal relations regarding financial issues during the interviews. Firstly, respondents observe that a surplus of equity in the reserve fund is not rewarded. Secondly, it is stated that a further development of the concept of (nearly) Zero Energy Building is needed to tackle the split-incentives of energy saving measures (as discussed in sub section §4.3.2.6). Lastly, respondents mention that is it hard for AOOs to combine the short-term measures for saving energy with the long-term maintenance works from their multi-year plan.

4.4.2.1. A surplus of equity in the reserve fund

In contrast to numerous AOOs with insufficient spending power, a problematic situation that was discussed in sub section §4.3.2.3, 'some AOOs have a surplus of equity in their reserve fund if the planned expenditures in the multi-year maintenance plan are taken into account', according to an apartment owner. Although this is a favourable position for an AOO, managing this surplus of equity is quite a challenge for AOOs. For example, an apartment owner points out that 'commercial banks do not provide a guarantee on funds in bank accounts exceeding €100.000'. Thus, in practice, a surplus of equity of an AOO is not really rewarded. This observation results in the following problematic causal relation: the current financial system does not stimulate AOOs to create a surplus of equity in their reserve fund. However, a surplus of equity in the reserve fund would be most welcome for an investment in the energetic quality of the AOO.

4.4.2.2. Development of (nearly) Zero Energy Buildings is needed

In sub section §4.3.2.6, the split-incentives for apartment owners of certain single energy saving measures were discussed as a problematic aspect in the decision-making process. The split-incentives of one energy saving measure can be balanced by taking multiple energy saving measures in a more integral energetic renovation of the apartment building. This may result in a so-called (nearly) Zero Energy Building. Several respondents state that this alternative to balance split-incentives of separate energy saving measures needs further development for several reasons:

- The focus of the (nearly) Zero Energy Buildings concept is on the reduction of the energy consumption and this is only appealing to a limited number of apartment owners. According to a company from the building industry, 'this one-issue movement needs an expanding focus on the multiple benefits of an integral energetic renovation of the apartment building to increase the enthusiasm of AOOs'.

- Furthermore, an energetic renovation to a (nearly) Zero Energy Building is currently achievable for only a limited group of AOOs. An energy consultant explains that 'an AOO needs to have high energy costs, a high periodic deposit, a reserve fund of sufficient size, and active apartment owners, in order to qualify for an attractive business case for this renovation'. 'In the end, only a few AOOs are able and willing to invest up to €80.000 per apartment', says a member of the *Platform Duurzaam VvE Beheer*. A company from the building industry states that 'this has to do with the fact that the investments can only be recouped by living in the apartment for 40 years, as the investment is only partly included in the property value.

- 'In some cases, the administrator of the AOO is against the (nearly) Zero Energy Buildings concept and therefore exerts strong influence on the decision-making process', says a process consultant.

- Also, 'the companies from the building industry are struggling, due to a lack of experience, to arrive at an integral energetic improvement of the apartment building', state two consultants. Furthermore, an energy consultant observes that 'companies are still searching for an optimal and affordable combination of established an innovative energy saving measures'.

- Lastly, companies from the building industry find it difficult to guarantee the performance of the integral energetic improvement on the long term. 'This is especially problematic for a series of energetic improvements that will hopefully result in a (nearly) Zero Energy Building and that are performed over time by different companies from the building industry', according to two energy consultants.

Thus, the respondents observe an additional problematic causal relation regarding the need for the further development of the (nearly) Zero Energy Buildings concept, in order to provide an attractive alternative to the single energy saving measures that result in split-incentives and that create division among the apartment owners.

4.4.2.3. Limited consistency between sustainable measures and maintenance works

Theoretically, the implementation of energy saving measures is preferably combined with the planned maintenance works from the multi-year maintenance plan of the AOO. However, an energy consultant points out that 'simply connecting the implementation of the energy saving measures to this multi-year maintenance plan may prove to be difficult as there are in practice few links between energy saving measures and maintenance works'. 'This is because several building components of the apartment building have a relatively long lifespan of up to 40 years, making it difficult to combine the short-term planning of the energy saving measures with the long-term planning of the maintenance works'. This observation from the AOO practice indicates the following additional problematic causal relation: the relatively long lifespan of several building components of the AOO complicates the theoretically efficient combination of the energy saving measures with the maintenance works from the multi-year maintenance planning.

4.4.3. National and municipal laws and policies

During the interviews, respondents have pointed out that the instability of municipal policies may result in additional uncertainties for AOOs regarding their decision on investing in energy saving measures.

4.4.3.1. Instability of municipal policies

In sub section §4.3.3, the problematic causal relation regarding the limited effect of existing national laws and policies on creating a sense of urgency among apartment owners to invest in energy saving measures is discussed. During the interviews, the respondents noted an additional problematic causal relation regarding the inadequacy of municipal policies to stimulate the uptake of energy saving measures by AOOs. This inadequacy is related to the instability of the municipal policies on improving the functioning and maintenance level of AOOs in combination with reducing their energy consumption. An administrator points out that 'with the arrival of a new alderman in Rotterdam, his regular meetings with various administrators and other relevant actors from the AOO practice suddenly ended'. Furthermore, a company from the building industry 'highlights the temporary structure of important organisations, such as VVE-010 in Rotterdam, as a risk for the stability of the municipal policies'. This instability of municipal policies increases the uncertainty for AOOs, who are considering investing in energy saving measures. The following additional problematic causal relation can be derived from the interviews: the uncertainties for AOOs to invest in energy saving measures are increased by the instability, and thus the inadequacy, of the municipal policies that are directed at AOOs.

4.4.4. Provision of information, advice and support

In section §4.3 respondents have confirmed that many (small) AOOs do not have the financial resources to hire professional expertise from consultants. This support and advice of consultants would be beneficial for the decision-making process in an AOO. If this problematic causal relation can be solved, the respondents expect a new problem: the demand for consultants will be much higher than the 'supply'. In other words, respondents expect a potential short-term shortage of professional and independent consultants.

4.4.4.1. A shortage of professional and independent consultants

In sub section §4.3.2.5, the problematic causal relation on the difficulty to hire expertise from consultants for AOOs with limited spending power or a limited number of apartments was confirmed by the respondents. These AOOs are not able to hire professional assistance for their decision-making process. However, respondents have at the same time indicated that 'there would be a shortage of professional and independent consultants for advising AOOs, if this first problematic causal relation was solved'. A member of the *Platform Duurzaam VvE Beheer* observes that 'the demand for consultants with specific expertise on AOOs will be transcending the supply on the short term'. Two other consultants add that 'there are few independent and suitable consultancy organisations and the number of individual consultants is limited'. Lastly, a company from the building industry poses the question whether 'the current consultants are able to scale up their intensive personal approaches for advising and supporting AOOs to a more efficient approach that suits the foreseen increase in the number of AOOs that need independent advice and support'. To conclude, the respondents observe the following additional problematic causal relation: a potential short-term shortage of professional and independent consultants to advise and support AOOs to take energy saving measures may negatively affect the number of AOOs that effectively go through the decision-making process.

4.4.5. The building industry

Finally, respondents have mentioned two problematic causal relations regarding the building industry. They observe that apartment owners struggle in estimating the reliability of information that is provided by initiatives, such as the WoonWijzerWinkel. Their struggle reduces the effectiveness of the provision of information, advice and support by such initiatives. Secondly, respondents find the lagging development of energy saving measures by the building industry problematic.

4.4.5.1. The WoonWijzerWinkel

In relation to the problematic causal relation from sub section §4.3.5.1 regarding the provision of information, advice, and support by commercial parties with a direct financial interest in the decision of the AOO to invest in energy saving measures, there is a discussion among the respondents on the position of the WoonWijzerWinkel. Some respondents, including an apartment owner and a process consultant, 'value the WoonWijzerWinkel for its provision of high quality information and advice'. An energy consultant 'positions the WoonWijzerWinkel as a hybrid organisation between the municipalities and the commercial companies from the building industry'. However, two other consultants 'criticise the WoonWijzerWinkel for its too commercial character and its limited supply of integral combinations of energy saving measures'. The WoonWijzerWinkel acknowledges that 'this misconception as a commercial organisation is one of the reasons for the reserved attitude of some municipalities in the region towards the WoonWijzerWinkel'. Thus, an additional problematic causal relation is that it is difficult for apartment owners in AOOs to estimate the reliability, independency, and financial interests of initiatives such as the WoonWijzerWinkel, causing a reduced effectiveness of the provision of information, advice, and support by these initiatives.

4.4.5.2. Lagging development of the available energy saving measures

It was shown in sub section §4.3.5.2, that many companies from the building industry are unwilling to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process. Because of this unwillingness to do business with AOOs, the development of the number and type of available energy saving measures is lagging. On the one hand, 'this lagging development is reflected in the strong focus of the building industry on standard solutions for AOOs, while the largest benefits can only be obtained with customised solutions', says an energy consultant. On the other hand, 'this lagging development is due to the absence of cooperation between various companies in the building industry, causing suboptimal combinations of available energy saving measures and reluctance of contractors and installers to apply new and innovative energy saving measures', according to several companies from the building industry. Thus, the final additional problematic causal relation can be formulated: the focus on standard solutions and the absence of cooperation between companies from the building industry causes the lagging development of the set of available energy saving measures, which results in a suboptimal supply of energy saving measures towards the AOO.

4.5. Conclusion

The aim of this chapter is to compare the set of problematic causal relations that is derived from the literature study in chapter 3, with the problematic causal relations that are mentioned during the interviews by the various actors from the AOO practice. This comparison results in an answer to the second research sub question:

A.2. To what extent does the set of problematic causal relations from the literature study correspond to the problematic causal relations that are mentioned in interviews on the AOO practice?

In general, almost all problematic causal relations that are derived from the literature study, were confirmed by the various actors from the AOO practice during the interviews. Only two out of eighteen problematic causal relations were not confirmed by respondents during the interviews. Furthermore, several formulations of the problematic causal relations have been updated and slightly adjusted based on the input from the respondents. In addition to the original set of problematic causal relations from the literature study, a total of eight additional problematic causal relations are mentioned by the respondents.

Thus, the set of problematic causal relations, which was found in literature, corresponds to a relatively large extent to the set of problematic causal relations mentioned by the various actors from the AOO practice. The complete set of problematic causal relations is presented in table 15, together with an indication of the number of respondents that have mentioned each problematic causal relation. This indication resulted in a ranking of the 26 problematic causal relations based on their importance according to the actors from the AOO practice.

Table 15: complete set of problematic causal relations

#	Description of problematic causal relation
XVI	A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.
XVI	The effectiveness of the provision of information, advice, and support to AOOs to create a sense of urgency for the reduction of the energy consumption is uncertain for various reasons as discussed in sub section §4.3.4.2.
XVI	Many companies from the building industry are unwilling to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process.
XV	An AOO may have, for several reasons, insufficient spending power to pay for the total investment costs of the energy saving measures. In these cases, the AOO cannot decide to conduct any measures to save energy.
XIV	A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.
XII	A lack of knowledge among apartment owners in AOOs on energy saving measures limits AOOs to become interested in collectively saving energy in the apartment building.
X	The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process.
IX	The effects of national laws and policies on the reduction of the energy consumption in the built environment and the effects of the regulations on the functioning of AOOs are too small to create a sense of urgency among apartment owners to invest in energy saving measures.
IX	The specific loan conditions of a loan from the SVn limit the increase of the spending power of certain types of AOOs. For example, small AOOs with less than 10 apartments do not qualify for this loan. Moreover, the loan conditions do not allow for a loan that enables an energetic renovation to a (nearly) Zero Energy Building as the duration of the loan is too short.
VIII	For AOOs with limited spending power or a limited number of apartments, it is difficult to hire expertise from consultants to ensure an effective decision-making process within the AOO.
VIII	The transition from a sense of urgency to an effective decision-making process may be hampered by split-incentives of certain energy saving measures among apartment owners. Apartment owners who receive little benefits from the measure(s), but need to pay an equal share of the costs, are likely to vote against the implementation of these measures.
VIII	The uncertainties for AOOs to invest in energy saving measures are increased by the instability, and thus the inadequacy, of the municipal policies that are directed at AOOs.
VII	For especially small AOOs, due to a lack of expertise, it is difficult to structure and value information, advice, and support provided by commercial parties with a direct financial interest in the decision of the AOO to invest in energy saving measures, in order to identify and perceive the benefits and costs of the energy saving measures.
VI	It is difficult for apartment owners in AOOs to estimate the reliability, independency, and financial interests of initiatives such as the WoonWijzerWinkel, causing a reduced effectiveness of the provision of information, advice, and support by these initiatives.
VI	The focus on standard solutions and the absence of cooperation between companies from the building industry causes the lagging development of the set of available energy saving measures, which results in a suboptimal supply of energy saving measures towards the AOO.
VI	The need for the further development of the (nearly) Zero Energy Buildings concept, in order to provide an attractive alternative to the single energy saving measures that result in split-incentives and thus create division among the apartment owners.
VI	The spending power of AOOs is suboptimal as there are hardly any commercial banks or other commercial organisations that are willing to provide a loan to AOOs (e.g. access to capital).
V	The perceived benefits of the energy saving measures in some cases may be such that the costs of the energy saving measures exceed the benefits, even in the rare cases that non-financial benefits are included in the consideration. Therefore, the investment in energy saving measures is not an attractive option for some AOOs.
IV	Unclear or uncertain financial benefits of the energy saving measures often withhold AOOs to continue their decision-making process with an investment of time and money in the specific analysis of suitable energy saving measures for the apartment building.
IV	A potential short-term shortage of professional and independent consultants to advise and support AOOs to take energy saving measures may negatively affect the number of AOOs that effectively go through the decision-making process.
III	During the construction and maintenance of energy saving measures, construction or installation errors or a lack of maintenance may decrease the actual amount of energy saved by the measures. The energetic quality of the AOO may thus be less than expected.

II	The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.
I	The current financial system does not stimulate AOOs to create a surplus of equity in their reserve fund.
I	The relatively long lifespan of several building components of the AOO complicates the theoretically efficient combination of the energy saving measures with the maintenance works from the multi-year maintenance planning.
-	The costs of the loan as a financing instrument may disturb the delicate balance between financial costs and benefits of the investment in energy saving measures
-	The energetic performance of the building after the renovation, in terms of energy, can be less than expected due to the rebound effect.

As indicated at the beginning of this section, two problematic causal relations in table 15 were only found during the literature study. As these problematic causal relations were not mentioned by the various actors from the AOO practice, it is decided that these relations are not considered in the remainder of this research. Firstly, it is assumed that the effect of the problematic causal relation regarding the potentially disturbing effect of the financing costs of a loan, is included in the problematic causal relation regarding the limited spending power of AOOs. Secondly, the problematic causal relation that describes the rebound effect of an investment in energy saving measures was not mentioned by the respondents. Probably, this is because many AOOs have not yet proceeded to the specific stages in the customer journey in which this rebound effect becomes evident.

The remaining set of 24 problematic causal relations is reflected on from the perspective of foreseeable and planned changes and additions to the current system in the next chapter. Based on the estimations of the respondents, especially the potential effects of these changes and additions on the magnitude of the problematic causal relations are discussed.

5. EVALUATION OF SYSTEM IN THE NEAR FUTURE

5.1. Introduction to the evaluation of the system in the near future

The previous chapter resulted in a complete set of problematic causal relations. This set of problematic causal relations is derived from an extensive evaluation of the current system, which combines the results from the literature study and the interviews. This evaluation exclusively focussed on the current system. But in the near future, a few foreseeable or planned changes and additions will be made to the current system. These changes and additions may have a positive/negative effect on the set of problematic causal relations. Therefore, this chapter will evaluate the system in the near future and it will describe the potential effect of these changes and additions to the current system on the problematic causal relations. With these two steps, the chapter aims to answer the third research sub question of research part A:

A.3. What is the effect of planned/foreseeable changes of the current national and municipal approaches on the identified problematic causal relations?

Thus, in this chapter the effects of the foreseeable changes and additions on the set of problematic causal relations are studied. The interviews with various actors from the AOO practice are used to estimate any effects on the problematic causal relations. This study may indicate that the foreseeable changes and additions have a positive effect on a few problematic causal relations. Such a positive effect is an effect that slightly reduces the problematic character of the problematic causal relation. As this positive effect may have an impact on the ranking of the problematic causal relations in table 15, this study is relevant for the central research question of research part A: *what are the problematic causal relations that limit the effect of national and municipal approaches for stimulating AOOs to take energy saving measures?*

In this research, all foreseeable changes and additions to the current system are included that take effect in 2018 at the latest and that are mentioned by the various actors from the AOO practice. In section §5.2 the *Wet verbetering functioneren vereniging van eigenaars* is introduced and the potential effects on the problematic causal relations are discussed. Subsequently, section §5.3 discusses a subsidy from the Ministry of the Interior and Kingdom Relations for reducing the energy demand of AOOs. In section §5.4 the potential effects of a revolving fund that offers loans to small AOOs are described. Finally, section §5.5 discusses the development of platforms for AOOs through which knowledge and experience can be shared. The conclusion in section §5.6 provides an updated version of the ranking of the problematic causal relations. Based on this updated ranking, a selection is made in chapter 6 of the most important problematic causal relations, for which a solution needs to be sought in this research.

5.2. Wet verbetering functioneren vereniging van eigenaars

The first foreseeable change to the current system is the *Wet verbetering functioneren vereniging van eigenaars* (The Act on the improvement of the functioning of AOOs), which will come into force in 2017/2018. This act is a revision of the previously introduced act in sub section §3.2.2, which is included in *Boek 5 BW Appartementsrechten* (i.e. Fifth Book of the Civil Code on apartment rights). The *Wet verbetering functioneren vereniging van eigenaars* is approved by both the House of Representatives (e.g. *Tweede Kamer*) and the Senate (e.g. *Eerste Kamer*) of the Netherlands. However, the exact date at which the revision will come into force, is still to be determined.

The objective of the revision is to add some additional provisions to the existing act in order to improve the functioning of AOOs (Rijksoverheid, 2016d). In this act, there is a strong focus on the financial aspects regarding the AOO, including loans and the periodic deposit to the reserve fund (Rijksoverheid, 2016d). These two financial aspects are described in the following two sub sections.

5.2.1. Loan to an AOO is explicitly allowed

The problematic access of AOOs to commercial capital, as discussed in sub section §4.3.2, is also considered by the Ministry of the Interior and Kingdom Relations as a financial problem that needs solving. 'The current uncertainty on whether an AOO can obtain a loan is', according to the Ministry, 'one of the causes for the reluctance of banks and other commercial organisations to provide loans to AOOs' (Rijksoverheid, 2016c). 'By explicitly allowing the provision of loans to AOOs, with the only exception being a prohibition in the regulations of the AOO, the Ministry would like to see a reduction of this reluctance among banks and other commercial organisations' (Rijksoverheid, 2016c). 'Moreover, a provision is added to create more certainty on the transferability of a loan and other debts to new apartment owners' (Rijksoverheid, 2016d).

The uncertainty on whether an AOO can enter a loan is confirmed by the respondents. The *SVn* observes that 'many AOOs think that they are not allowed to obtain a loan from a bank or another commercial organisation, while only one percent of the AOOs has a prohibition on a long-term financial commitment in its regulations'. An administrator is pleased that 'this argument can no longer be used to discourage AOOs to consider obtaining a loan to invest in large maintenance works and energy saving measures'. Furthermore, the provision on the transferability of the loan to a new apartment owner is considered as a positive development.

In contrast to the Ministry of the Interior and Kingdom Relations in sub section §5.2.1, the respondents do not mention the potential positive effect of this act on the access to commercial capital for AOOs. This is because the access to commercial capital is determined by banks and other commercial organisations, who are perceived as non-cooperative by the respondents. Instead, the respondents view this change as a way to reduce the ignorance of AOOs on obtaining a loan. However, as sub section §4.3.4.2 on the effectiveness of the provision of information shows, it is doubtful whether this change will be effectively communicated to the AOOs in order to reduce this ignorance. Thus, the effect of explicitly allowing AOOs to obtain a loan is predicted to be negligible on the set of problematic causal relations.

5.2.2. Norm for the height of the periodic deposit

In the current act, there is no norm included to determine the minimum height of the periodic deposit of apartment owners to the AOO. This has a negative effect on the quality of the base of the AOO and more specifically on the spending power of the AOO. This is because AOOs are currently not stimulated to set a sufficiently high periodic deposit to the reserve fund. The revision of this act introduces two variations of a norm for the height of the periodic deposit. 'On the one hand, AOOs may set the height of their periodic deposit based on the costs for the planned maintenance works and improvements to the apartment building, as described in a multi-year maintenance plan' (Rijksoverheid, 2016d). 'On the other hand, AOOs without a multi-year maintenance plan are bound to a minimum yearly deposit of 0,5% of the reconstruction value (e.g. *herbouwwaarde*) of the apartment building' (Rijksoverheid, 2016d). 'This part of the revision is subject to a three-year transition period for AOOs that did not make any periodic deposits to the reserve fund yet' (Rijksoverheid, 2016d). Compliance of AOOs with this norm is not going to be actively enforced by (local) government, but 'the intention of the Ministry is that apartment owners are able to address the Board of the AOO and the other apartment owners in the general meeting of owners if the norm is not met' (Rijksoverheid, 2016c).

The respondents have varying opinions on the effect of a minimum norm for the height of the periodic deposits to the reserve fund. There are respondents who make critical remarks regarding the expected 'lack of enforcement on the extent to which AOOs abide by this revision of the act'. Indeed, VvE Belang and the Ministry of the Interior and Kingdom Relations confirm that 'the Ministry and local governments do not have the intention to actively enforce the minimum height of the periodic deposit'. However, the Ministry adds that in some cases 'a municipality may point this minimum norm out to the AOO, prior to the use of other measures such as the *Machtigingswet* and the *Woningwet*' as discussed in sub section §3.2.1. Regarding the effect of this minimum norm, a critical process consultant points out that 'this revision of the act is only relevant for AOOs who do not save enough money for maintenance works and improvements to the apartment building relative to this new norm'. 'It is questionable whether there are benevolent apartment owners, who are willing to advocate the compliance with this new norm in AOOs that currently do not function properly'. Moreover, a financial consultant states that 'AOOs are able to circumvent this norm of a yearly deposit of 0,5% of the reconstruction value by drafting a ramshackle multi-year maintenance plan that only includes a selection of the maintenance works and thus results in a lower periodic deposit'.

The actual intention of this part of the revision of the act, according to the Ministry and VvE Belang, is that 'benevolent apartment owners are enabled to address other apartment owners in order to arrive at a decision to increase the height of the periodic deposit during the assembly of the general meeting of owners'. Moreover, an administrator 'is expecting the active enforcement of this norm by the notary during his preparation of the transfer of the ownership of an apartment right'. These respondents assume that 'the revision of this act will stimulate more AOOs to draft a multi-year maintenance plan and that it will clarify the real monthly costs of the apartment for new apartment owners in advance'. VvE Belang and an administrator observe that 'the fact that the revision of the act is on its way makes that some AOOs are already drafting multi-year maintenance plans and are increasing the periodic deposits'. Thus, for some AOOs the effect of the minimum norm for the height of the periodic deposit might reduce the magnitude of the problematic causal relation regarding the insufficient spending power of AOOs to invest in energy saving measures. 'Due to the three-year transition period, the total effect of the minimum norm will not directly become visible', concludes an administrator.

5.3. Subsidy from the Ministry for reducing the energy demand

The second foreseeable addition to the system is the subsidy from the Ministry of the Interior and Kingdom Relations for stimulating AOOs to take energy saving measures. In sub section §3.2.1 of this research, the subsidy and the accompanying campaign are already briefly introduced. A total of €60 million is available for both individual home owners and AOOs to reduce their energy consumption (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016e). Although applications for this subsidy can already be made since the 15th of September 2016, this subsidy is discussed in this sub section, given its duration of more than two years till the 31st of December 2018 (Rijksdienst voor Ondernemend Nederland, 2016c). Two types of subsidy are available within this subsidy scheme: a subsidy on the implementation of at least two energy saving measures and a subsidy for an energy advice, the drafting of a multi-year maintenance plan, and for professional guidance during the decision-making process of the AOO (Rijksdienst voor Ondernemend Nederland, 2016c). These two types of subsidies are separately discussed in following two sub sections.

5.3.1. Subsidy on the implementation of two energy saving measures

AOOs can apply for a total subsidy of €6 million for the implementation of at least two energy saving measures (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2017). This is amount is explicitly set aside from the total available subsidy. This is because, in general, the decision-making process on applying for the subsidy and on implementing the energy saving measures takes longer for AOOs than

for individual home owners. 'Thus, most, if not all, of the subsidy would be applied for by the individual home owners if no portion of the subsidy would be set aside for AOOs'. And indeed, on the 26th of April 2017, the applications of individual home owners exceeded the available subsidy of almost €45 million, while the subsidy for AOOs is still open for applications (Rijksdienst voor Ondernemend Nederland, 2017).

An apartment owner is critical on the subsidy for the implementation of at least two energy saving measures, as 'this subsidy is an improper way to motivate AOOs'. He states that 'apartment owners must develop the consciousness to make this investment by themselves'. 'Moreover, this subsidy creates disparities, as this subsidy can only be applied for by AOOs that have (almost) sufficient spending power to implement energy saving measures'. However, considering the potential effect of this subsidy, the Ministry explains that 'this subsidy scheme, apart from the reduction of the energy demand through the implementation of two measures, intends to stimulate AOOs to draft a multi-year maintenance plan'. Such a multi-year maintenance plan in which these and other measures are included is a requirement for the application for the subsidy'. 'The presence of this multi-year maintenance plan will have a long-term positive effect on the quality of the base of the AOO and on the spending power of the AOO in the long-term'. However, the size of the positive effects on these two problematic causal relations, as discussed in sub sections §4.3.1.1 and §4.3.2.3, is depending on the actual use of this possibility to apply for a subsidy by AOOs.

5.3.2. Subsidy for an energy advice, a multi-year maintenance plan and for professional guidance

In addition to the subsidy for the implementation of energy saving measures, only AOOs may apply for a subsidy of €2 million for an energy advice or for the drafting of a multi-year maintenance plan and professional guidance during the decision-making process (Rijksdienst voor Ondernemend Nederland, 2016c). This is related to the observation of the problematic causal relations regarding the lack of knowledge among apartment owners on energy saving measures and especially the insufficient spending power of AOOs to hire expertise in sub sections §4.3.4.1 and §4.3.2.5.

In sub sections §4.3.2.5 and §4.3.2.7, several respondents observed that the costs for advice and support are considerably high for AOOs, while the willingness and ability of AOOs to pay for this advice and support is often lacking. In fact, a financial consultant, in line with this part of the subsidy scheme, stated in sub section §4.3.2.7 that 'a financial contribution in the consultancy fees is needed from the government to get AOOs to apply for advice and support from independent consultants'. An energy consultant expects this subsidy 'to contribute to the transition towards a functioning market for the provision of advice and support to AOOs on for example energy saving measures'. This expectation of a positive effect of this foreseeable addition to the current system relates to the problematic causal relation in sub section §4.3.5.2 regarding the fact that companies from the building industry still tend to view AOOs as unwanted customers. In addition, the SVn argues that 'this subsidy might also increase the interest of administrators in the theme of the reduction of the energy consumption, as their guidance of the AOO in the decision-making process might be eligible for this subsidy'. Lastly, the VNG region warns against 'the potential shortage of professional and independent consultants', as described in sub section §4.4.4.1, 'if the demand for advice and support from AOOs significantly increases in the short-term due to this subsidy'.

5.4. Revolving fund for small AOOs

Given the limited access to commercial capital for especially small AOOs, as described in sub section §4.3.2.2, the option to establish a revolving fund for AOOs consisting of less than 10 apartments is currently explored by the municipalities of Rotterdam and The Hague[11]. The municipalities of Rotterdam and The Hague aim to create a new financial resource for small AOOs, of which the availability is preferably scaled up to the regional or national level (Metropoolregio Rotterdam Den Haag, 2016). The proposed role of the municipalities in this initiative is that they will provide a guarantee for the loan to open the access to commercial capital for small AOOs (Metropoolregio Rotterdam Den Haag, 2016). If this revolving fund is implemented, AOOs may apply for a collective loan for both energy saving measures and maintenance works at this fund.

A member of the *Platform Duurzaam VvE Beheer* confirms that 'the current access to commercial capital and to the loans from the SVn is problematic for especially small AOOs'. 'The aim of this revolving fund is to improve this access, such that small AOOs are enabled to invest in both energy saving measures and maintenance works'. Thus, a potential positive effect of this third addition to the current system is expected on the problematic causal relations regarding the spending power of the AOO and the access to commercial capital, as described in sub sections §4.3.2.2 and §4.3.2.3. An additional advantage of the revolving fund, according to this respondent, is that AOOs that apply for a loan from this fund are required to demonstrate a sound multi-year maintenance plan. 'Thus, most AOOs that apply for a loan from the revolving fund, are stimulated to draft a multi-year maintenance plan, which has a positive long-term effect on the quality of the basis of the AOO'. However, the actual implementation of this revolving fund is still highly uncertain.

5.5. Development of platforms for AOOs

A last foreseeable addition to the current system is the development of platforms for AOOs. These platforms aim to bring apartment owners from various AOOs together to share information and knowledge with one another (Gemeente Capelle aan den IJssel, 2015; VvE Platform Schiedam, 2016). In 2014, the first platform for AOOs was initiated in the municipality of Schiedam by apartment owners from two AOOs (VvE Platform Schiedam, 2016). This and other platforms aim to share AOOs' knowledge on and experience with energy saving measures and other aspects such as the quality of administrators and the reliability of companies from the building industry (VvE Platform Schiedam, 2016). These platforms address especially the problematic causal relations regarding the lack of knowledge among apartment owners on energy saving measures and the uncertain and deterrent effect of the provision of information, advice, and support to AOOs, as discussed in sub sections §4.3.4 and §4.3.5. Given the number of information requests that these first initiatives receive from several interested actors throughout The Netherlands, it is expected that the number of platforms for AOOs will significantly increase in the coming years.

The development of platforms for AOOs to share knowledge and experience on several aspects, is described as a positive addition to the current system. According to a social housing association, 'these platforms may on the one hand function as a knowledgebase for questions on the reduction of the energy consumption'. This function has a positive effect on the problematic causal relations regarding the lack of knowledge among apartment owners and the uncertain and deterrent effect of the provision of information, advice, and support to AOOs, as discussed in sub sections §4.3.3 and §4.3.4. 'On the

[11] Note that the municipality of The Hague is also individually working on a revolving fund for AOOs in its municipality, which should not be confused with the initiative that is discussed in this sub section (Metropoolregio Rotterdam Den Haag, 2016).

other hand, the platform may provide valuable insights for municipalities and companies from the building industry on the interests and wishes of the apartment owners'. This function enables municipalities and companies from the building industry to match their policies and offers on energy saving measures to these interests and wishes, such that the problematic causal relations regarding the limited effect of municipal policies and the unwillingness of companies from the building industry to do business with AOOs, as described in sub sections §4.4.3 and §4.3.5, become a bit less problematic.

5.6. Conclusion

The analysis in this chapter of the potential effects of foreseeable changes and additions to the current system on set of problematic causal relations, aims to answer the third research sub question:

A.3. What is the effect of planned/foreseeable changes of the current national and municipal approaches on the identified problematic causal relations?

Based on the expectations of various actors from the AOO practice the potential effects of four foreseeable changes and additions to the current system on the problematic causal relations are explored. In general, the expected effects are considered to be limited, as the implementation and effective functioning of the additions and changes are still uncertain. Thus, to answer the third research sub question, the foreseeable changes and additions to the current system do not have a significant reducing effect on the set of problematic causal relations. For the sake of completeness, table 16 does indicate for each problematic causal relation whether one or more additions and changes are expected to have a negligible positive or negative effect.

Table 16: potential effects of foreseeable changes and additions on the set of problematic causal relations

Description of problematic causal relation	Effect
A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.	+
The effectiveness of the provision of information, advice, and support to AOOs to create a sense of urgency for the reduction of the energy consumption is uncertain for various reasons as discussed in sub section §4.3.4.2.	+
Many companies from the building industry are unwilling to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process.	++
An AOO may have, for several reasons, insufficient spending power to pay for the total investment costs of energy saving measures. In these cases, the AOO cannot decide to conduct any measures to save energy.	+++
A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.	++
A lack of knowledge among apartment owners in AOOs on energy saving measures limits AOOs to become interested in collectively saving energy in the apartment building.	+
The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process.	
The effects of national laws and policies on the reduction of the energy consumption in the built environment and the effects of the regulations on the functioning of AOOs are too small to create a sense of urgency among apartment owners to invest in energy saving measures.	
The specific loan conditions of a loan from the SVn limit the increase of the spending power of certain types of AOOs. For example, small AOOs with less than 10 apartments do not qualify for this loan. Moreover, the loan conditions do not allow for a loan that enables an energetic renovation to a (nearly) Zero Energy Building as the duration of the loan is too short.	
For AOOs with limited spending power or a limited number of apartments, it is difficult to hire expertise from consultants to ensure an effective decision-making process within the AOO.	+

The transition from a sense of urgency to an effective decision-making process may be hampered by split-incentives of certain energy saving measures among apartment owners. Apartment owners who receive little benefits from the measure(s), but need to pay an equal share of the costs, are likely to vote against the implementation of these measures.	
The uncertainties for AOOs to invest in energy saving measures are increased by the instability, and thus the inadequacy, of the municipal policies that are directed at AOOs.	+
For especially small AOOs, due to a lack of expertise, it is difficult to structure and value information, advice, and support provided by commercial parties with a direct financial interest in the decision of the AOO to invest in energy saving measures, in order to identify and perceive the benefits and costs of the energy saving measures.	+
It is difficult for apartment owners in AOOs to estimate the reliability, independency, and financial interests of initiatives such as the WoonWijzerWinkel, causing a reduced effectiveness of the provision of information, advice, and support by these initiatives.	
The focus on standard solutions and the absence of cooperation between companies from the building industry causes the lagging development of the set of available energy saving measures, which results in a suboptimal supply of energy saving measures towards the AOO.	
The need for the further development of the (nearly) Zero Energy Buildings concept, in order to provide an attractive alternative to the single energy saving measures that result in split-incentives and thus create division among the apartment owners.	
The spending power of AOOs is suboptimal as there are hardly any commercial banks or other commercial organisations that are willing to provide a loan to AOOs (e.g. access to capital).	+
The perceived benefits of the energy saving measures in some cases may be such that the costs of the energy saving measures exceed the benefits, even in the rare cases that non-financial benefits are included in the consideration. Therefore, the investment in energy saving measures is not an attractive option for some AOOs.	
Unclear or uncertain financial benefits of the energy saving measures often withhold AOOs to continue their decision-making process with an investment of time and money in the specific analysis of suitable energy saving measures for the apartment building.	
A potential short-term shortage of professional and independent consultants to advise and support AOOs to take energy saving measures may negatively affect the number of AOOs that effectively go through the decision-making process.	
During the construction and maintenance of energy saving measures, construction or installation errors or a lack of maintenance may decrease the actual amount of energy saved by the measures. The energetic quality of the AOO may thus be less than expected.	
The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.	
The current financial system does not stimulate AOOs to create a surplus of equity in their reserve fund.	
The relatively long lifespan of several building components of the AOO complicates the theoretically efficient combination of the energy saving measures with the maintenance works from the multi-year maintenance planning.	

To conclude, the foreseeable changes and additions to the current system, that were described and analysed in this chapter, do not sufficiently solve any of the problematic causal relations in table 16. With this last conclusion from the evaluation phase of this research, the central research question for research part A can be answered:

Part A: what are the problematic causal relations that currently limit the effect of national and municipal approaches for stimulating AOOs to take energy saving measures?

Thus, the set of 24 problematic causal relations in table 16 is collectively causing the insufficient outcome of the current national and municipal approaches to stimulate AOOs to take energy saving measures. In the next chapter, the intermezzo, some of these problematic causal relations will be selected for the remainder of this research. This is done to ensure the practicality of the remaining steps in this research.

6. ASSESSMENT FRAMEWORK

6.1. Introduction to the assessment framework

This chapter is an intermezzo between research part A and research part B. This intermezzo will provide an assessment framework that is based on the new insights gained from research part A. The assessment framework will be used in research part B to identify a municipal approach that is able to breach the problematic causal relations that restrict AOOs from taking energy saving measures.

Research part A resulted in a list of 24 problematic causal relations. The problematic causal relations on this list are too diverse. Breaching all problematic causal relations would require the development of more than one municipal approach. Therefore, this chapter starts with making a selection of problematic causal relations that can be and need to be addressed with a municipal approach at short notice. The selection procedure is described and executed in section §6.2. This selection procedure resulted in the selection of problematic causal relations that deal with the poor quality of administrators and the base of AOOs. For these problematic causal relations, an assessment framework will be developed in this intermezzo. Thus, this intermezzo addresses the following research sub question:

I.1. Which criteria and constraints result from research part A and assist in finding a municipal approach that is able to breach the problematic causal relations that restrict AOOs in taking energy saving measures?

The assessment framework indicates which constraints and criteria should be met by a potentially promising municipal approach to breach one or more problematic causal relations. Thus, the assessment framework is largely based on the problematic causal relations that are selected for the remainder of this research and is used to assess the alternatives that aim to address these problematic causal relations. Section §6.3 is the actual start of the formulation of the assessment framework as it describes the constraints that alternatives should measure up to. In section §6.4, the criteria are formulated that will identify the most promising alternatives. The practical use of the assessment framework is discussed briefly in section §6.5. Finally, section §6.6 summarises the selection of problematic causal relations and the formulation of the assessment framework.

6.2. Selection of problematic causal relations

In this section, a number of problematic causal relations are selected from the complete set of problematic causal relations from table 16 in section §5.6. To arrive at a substantiated selection, the first step in sub section §6.2.1 is to structure the list of problematic causal relations with the clusters from chapter 4. A sixth cluster is added for problematic causal relations regarding the administrator:

1. The organisational structure of the AOO;
2. Financial issues;
3. National and municipal laws and policies;
4. Provision of information, advice and support;
5. The building industry;
6. The administrator.

Subsequently, these clusters are positioned relative to one another: which cluster does reinforce the problematic causal relations in another cluster? Also, the clusters are positioned along the stages of the customer journey in sub section §6.2.2. Finally, the results from sub section §6.2.2 are used to make a selection of problematic causal relations in sub section §6.2.3. These problematic causal relations will be included in the remainder of this research.

6.2.1. Clustering problematic causal relations

This list of 24 problematic causal relations is too extensive and too diverse to include in the remainder of the research. The six clusters add some structure to this list. Each cluster is briefly introduced with a

short description. The accompanying table includes the problematic causal relations of the cluster. The table does also include a ranking for each problematic causal relation. This ranking is based on the number of respondents that mentioned the problematic causal relation during the interviews. The order of discussion of the six clusters is based on this ranking.

Firstly, the poor quality of administrators is, according to respondents, the most important problematic causal relation. The poor quality of an administrator has a negative effect on the decision-making process in the AOO. There is only one problematic causal relation directly related to the administrator.

Table 17: problematic causal relations regarding the administrator (cluster 1)

Description of problematic causal relation	Rank
A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.	1

The second most important problematic causal relation is the uncertain effectiveness of the provision of information, advice, and support. It is uncertain whether this is effective in creating a sense of urgency among AOOs to invest in energy saving measures. This problematic causal relation is presented in table 18 along with two related problematic causal relations.

Table 18: problematic causal relations regarding the provision of information, advice, and support (cluster 2)

Description of problematic causal relation	Rank
The effectiveness of the provision of information, advice, and support to AOOs to create a sense of urgency for the reduction of the energy consumption is uncertain for various reasons as discussed in sub section §4.3.4.2.	2
A lack of knowledge among apartment owners in AOOs on energy saving measures limits AOOs to become interested in collectively saving energy in the apartment building.	6
A potential short-term shortage of professional and independent consultants to advise and support AOOs to take energy saving measures may negatively affect the number of AOOs that effectively go through the decision-making process.	20

Subsequently, the third cluster of problematic causal relations has to do with the relations between AOOs and the building industry. This cluster describes relations in both directions. On the one hand, AOOs behave in a reserved manner towards the building industry. They fear that they receive subjective information from these companies. This is because the companies have a direct financial interest in the AOOs' investment in energy saving measures. On the other hand, companies are unwilling to do business with and pre-invest time and money in AOOs. This is also reflected in the lack of development of new and more adequate solutions. Both types of problematic causal relations are included in table 19.

Table 19: problematic causal relations regarding the building industry (cluster 3)

Description of problematic causal relation	Rank
Many companies from the building industry are unwilling to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process.	3
For especially small AOOs, due to a lack of expertise, it is difficult to structure and value information, advice, and support provided by commercial parties with a direct financial interest in the decision of the AOO to invest in energy saving measures, in order to identify and perceive the benefits and costs of the energy saving measures.	13
It is difficult for apartment owners in AOOs to estimate the reliability, independency, and financial interests of initiatives such as the WoonWijzerWinkel, causing a reduced effectiveness of the provision of information, advice, and support by these initiatives.	14
The focus on standard solutions and the absence of cooperation between companies from the building industry causes the lagging development of the set of available energy saving measures, which results in a suboptimal supply of energy saving measures towards the AOO.	15
During the construction and maintenance of energy saving measures, construction or installation errors or a lack of maintenance may decrease the actual amount of energy saved by the measures. The energetic quality of the AOO may thus be less than expected.	21

Fourthly, several problematic causal relations are related to the financial issues of investing in energy saving measures. Examples are the spending power of the AOO, the access to capital, the split-incentives of an investment, and the insufficient or uncertain size of the financial benefits of an investment. These problematic causal relations have received differing rankings from the actors from the AOO practice, as is shown in table 20.

Table 20: problematic causal relations regarding financial issues (cluster 4)

Description of problematic causal relation	Rank
An AOO may have, for several reasons, insufficient spending power to pay for the total investment costs of energy saving measures. In these cases, the AOO cannot decide to conduct any measures to save energy.	4
The specific loan conditions of a loan from the SVn limit the increase of the spending power of certain types of AOOs. For example, small AOOs with less than 10 apartments do not qualify for this loan. Moreover, the loan conditions do not allow for a loan that enables an energetic renovation to a (nearly) Zero Energy Building as the duration of the loan is too short.	9
For AOOs with limited spending power or a limited number of apartments, it is difficult to hire expertise from consultants to ensure an effective decision-making process within the AOO.	10
The transition from a sense of urgency to an effective decision-making process may be hampered by split-incentives of certain energy saving measures among apartment owners. Apartment owners who receive little benefits from the measure(s), but need to pay an equal share of the costs, are likely to vote against the implementation of these measures.	11
The need for the further development of the (nearly) Zero Energy Buildings concept, in order to provide an attractive alternative to the single energy saving measures that result in split-incentives and thus create division among the apartment owners.	16
The spending power of AOOs is suboptimal as there are hardly any commercial banks or other commercial organisations that are willing to provide a loan to AOOs (e.g. access to capital).	17
The perceived benefits of the energy saving measures in some cases may be such that the costs of the energy saving measures exceed the benefits, even in the rare cases that non-financial benefits are included in the consideration. Therefore, the investment in energy saving measures is not an attractive option for some AOOs.	18
Unclear or uncertain financial benefits of the energy saving measures often withhold AOOs to continue their decision-making process with an investment of time and money in the specific analysis of suitable energy saving measures for the apartment building.	19
The current financial system does not stimulate AOOs to create a surplus of equity in their reserve fund.	23
The relatively long lifespan of several building components of the AOO complicates the theoretically efficient combination of the energy saving measures with the maintenance works from the multi-year maintenance planning.	24

Fifthly, the problematic causal relations regarding the organisational structure of the AOO are in cluster five in table 21. These relations have to do with the quality of the base of the AOO, the mix of landlords and individual apartment owners in an AOO, and the mismatch between the organisational structure and the AOO practice.

Table 21: problematic causal relations regarding the organisational structure of the AOO (cluster 5)

Description of problematic causal relation	Rank
A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.	5
The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process.	7
The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.	22

Lastly, the sixth cluster describes the two problematic causal relations regarding the uncertain effectiveness of national and municipal laws and policies for stimulating AOOs to take energy saving measures. Table 22 presents these two problematic causal relations and their rankings.

Table 22: problematic causal relations regarding the national and municipal laws and policies (cluster 6)

Description of problematic causal relation	Rank
The effects of national laws and policies on the reduction of the energy consumption in the built environment and the effects of the regulations on the functioning of AOOs are too small to create a sense of urgency among apartment owners to invest in energy saving measures.	8
The uncertainties for AOOs to invest in energy saving measures are increased by the instability, and thus the inadequacy, of the municipal policies that are directed at AOOs.	12

6.2.2. Positioning the clusters of problematic causal relations

In the first part of this sub section, the six clusters of problematic causal relations are positioned relative to one another. This positioning indicates which clusters of problematic causal relations reinforce the problematic causal relations in other clusters. The second part of this sub section discusses the positioning of the problematic causal relations relative to the stages of the customer journey. The insights from this sub section the input for making a substantiated selection from the list of problematic causal relations in sub section §6.2.3.

The positioning of the clusters relative to one another is shown in figure 28. This positioning is based on the insights that are derived from research part A. This positioning indicates that there are two clusters of problematic causal relations that reinforce the problematic causal relations in the other four clusters.

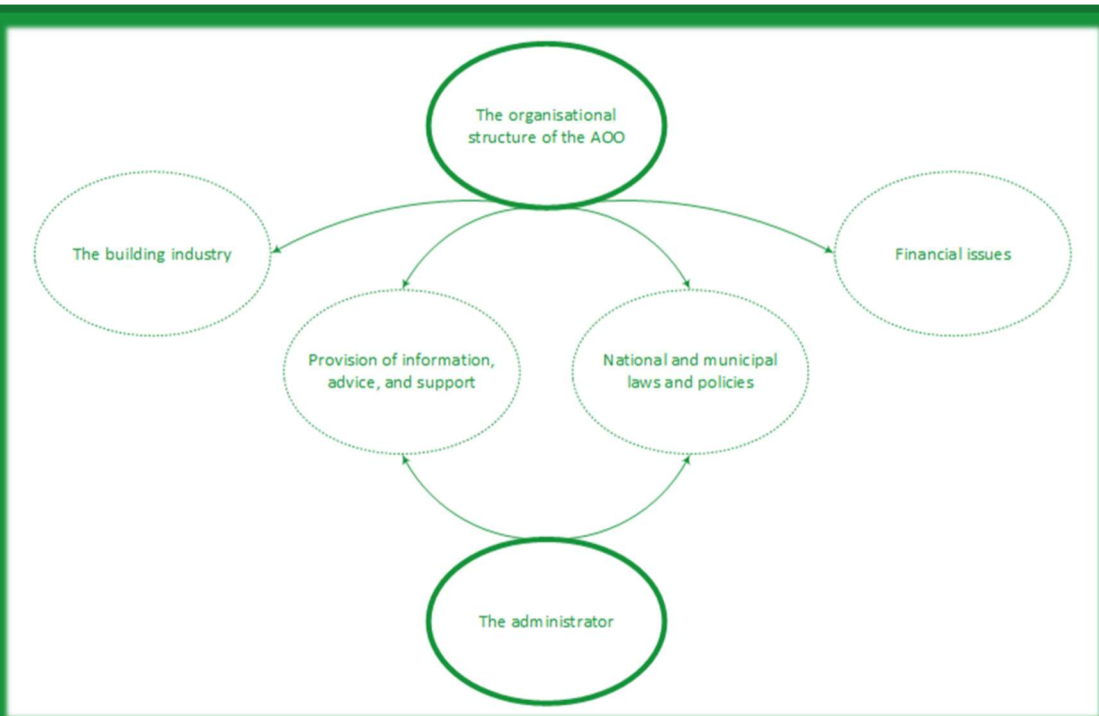


Figure 28: positioning of clusters of problematic causal relations relative to one another

A first observation is that issues with the quality of the administrator make the uncertain effectiveness of the provision of information, advice, and support even worse. This is because such an administrator is not likely to draw the attention of the apartment owners to the available information, advice and support. A second observation is that the poor quality of the administrator also aggravates the limited effect of national and municipal laws and policies. This type of administrator is not motivated to confront its AOOs with the obligations from the national and municipal laws and policies. The positive side is that an administrator of sufficient quality and with an interest in energy saving measures can improve

the effectiveness of both the provision of information, advice and support and of the national and municipal laws and policies.

Thirdly, the relative positioning in figure 28 indicates that the cluster of problematic causal relations regarding the organisational structure of the AOO has a reinforcing effect on four other clusters:

- Firstly, the current organisational structure of the AOO is not beneficial for the problematic relation with the building industry. For example, the insufficient quality of the base of the AOO has a negative impact on the attitude of many companies from the building industry towards AOO. These companies are unwilling to do business with and pre-invest time and money in such AOOs, as they perceive them as cumbersome and as slow decision makers within an uncertain and lengthy process.

- Secondly, the effectiveness of the provision of information, advice, and support is negatively affected by the organisational structure of the AOO. This is because AOOs with a poor organisational structure are less susceptible to these stimuli. These AOOs have to deal with more urgent issues than the implementation of energy saving measures.

- Thirdly, AOOs with a problematic organisational structure are difficult to influence with national and municipal laws and policies. After all, the national and municipal laws and policies on the functioning of the AOO did not improve the organisational structure of every AOO. In relation to this, the laws and policies on stimulating the uptake of energy saving measures are likely to have a similar outcome.

- Lastly, the financial issues are for a large part caused by the poor organisational structure of the AOO. Problems with the organisational structure of the AOO result in unfavourable (or even a lack of) decisions on the periodic deposit to the reserve fund or on the application for a loan. Moreover, the functioning of the AOO is an important precondition for the SVn, banks, and other commercial organisations to grant a loan to the AOO. Thus, the problematic causal relations regarding the financial aspects of the AOO are reinforced by the cluster of problems with the organisational structure of the AOO.

In figure 29, the clusters of problematic causal relations are positioned along the stages of the customer journey. This positioning indicates in which stages of the customer journey the clusters have a large effect on the decision-making process. The following relevant observations can be made:

- A first observation is that the (absence of the) administrator has an important effect on the first stages of the decision-making process. The administrator may or may not raise the awareness among the apartment owners on energy saving measures and may or may not stimulate the discussion on this topic. Pending the actual decision of an AOO to implement energy saving measures, in stages six and seven, the administrator has a similar effect on the decision-making process. During both parts of the customer journey, the administrator may play a decisive role. However, the description of the problematic causal relation regarding the administrator reveals that only a very limited number of administrators is currently fulfilling this decisive role.

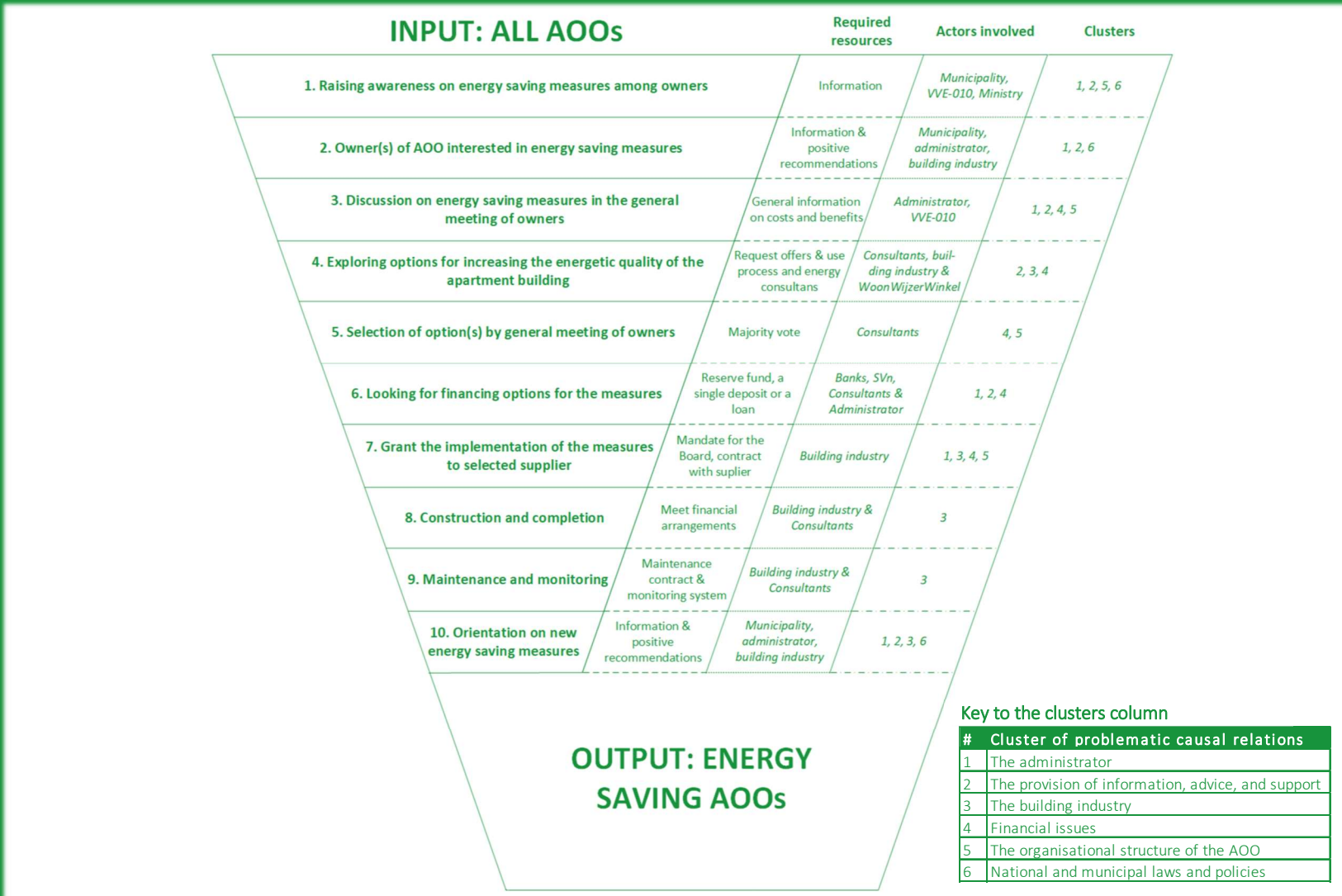


Figure 29: positioning of clusters of problematic causal relations positioned along the stages of the customer journey of the AOO

- Secondly, the cluster of problematic causal relations regarding the organisational structure of the AOO affects the entire decision-making process. The organisational structure of the AOO is especially relevant for the consecutive decisions that need to be taken by the AOO in the customer journey, as figure 29 illustrates. For every decision, the problems with the organisational structure of the AOO are again affecting the effectiveness and result of the process and discussion within the AOO. Thus, this cluster may cause a deadlock or failure of the decision-making process at various points in the decision-making process. The organisational structure of the AOO is a recurring risk for the effectiveness and result of the decision-making process.

- Lastly, the other clusters of problematic causal relations are either only relevant in the later stages of the customer journey or are strongly related to the clusters of problematic causal relations regarding the administrator and the organisational structure of the AOO. The limited relevance in the first stages of the customer journey applies to the problematic relation of AOOs with the building industry. Furthermore, the strong relations of the remaining three clusters with the clusters regarding the administrator and the organisational structure of the AOO are discussed at the beginning of this sub section and illustrate that these three clusters cannot be solved without first solving the first two clusters.

6.2.3. Final selection of problematic causal relations

Given the results of the positioning of the clusters of problematic causal relations, a final selection can be made. The selected clusters will be included in the remainder of the research. In the previous sub section, the clusters regarding the administrators and the organisational structure of the AOO clearly stood out. Both clusters are unique for AOOs. These issues are not relevant for individual home owners as they do not have an administrator and they are not part of an association. Thus, these two clusters illustrate the added complexity of the implementing energy saving measures in AOOs compared to individual home owners. Hence, these two clusters, consisting of a total of four problematic causal relations, are selected for the remainder of this research. Table 23 shows these four problematic causal relations. Chapter 12 will discuss some recommendations for the four clusters of problematic causal relations that are not selected.

Table 23: selected problematic causal relations

Description of problematic causal relation	Term
A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.	Short/ Medium
A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.	Short/ Medium
The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process.	Long
The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.	Long

The second column of table 23 illustrates that it is expected that two problematic causal relations can be solved in the short or medium term. Two other problematic causal relations will require more time given their strong legal embedding in the current system. In the remainder of the research the focus is on the problematic causal relations regarding the poor quality of administrators and the base of AOOs, while a brief exploration of the possible alternatives for the long-term problematic causal relations is conducted. The assessment framework that is used to compare the alternatives for the four problematic causal relations is introduced in the remainder of this chapter.

6.3. Assumptions and constraints

This section starts with the construction of the assessment framework. The assumptions and constraints are introduced for the short to medium term. This is the timespan in which it is expected that the problematic causal relations regarding the poor quality of administrators and the base of the AOO can be solved. The assumptions and constraints are based on the following elements from the system description in chapter 3:

- Restrictions on available resources of several actors, as described in sub section §3.2.1;
- Limitations to potential alternatives that are described in prevailing laws and governmental regulations, as briefly introduced in sub section §3.2.2;
- Uncertain developments caused by a number of external factors, such as included in sub section §3.3.3.

Firstly, a number of assumptions are introduced that constitute a basic scenario for the development of the system on the short to medium term (e.g. five to ten years). This basic scenario assumes little changes to the current system, as was described in chapter 3 and 4. This is line with the limited number of foreseen changes and additions to the current system in chapter 5. The basic scenario consists of the following assumptions:

- The governmental regulations on the energetic quality of buildings in five to ten years will be similar to the current regulations. Thus, no stringent regulations will come into effect in the short to medium term that allow for setting a minimum maintenance level and minimum level of the energetic quality of apartment buildings.

- The energy prices for electricity and gas are fixed in this research within a bandwidth of 10% from the current energy prices. It is likely that the energy prices will fluctuate in the short to medium term as various factors influence the height of the energy prices, but the actual value is very difficult to predict.

- The costs of energy saving measures are expected to drop slightly (e.g. with a range of 5-10%) in the short-term due to ongoing innovations and increasing competition between suppliers. Moreover, the costs of a renovation to a (nearly) Zero Energy Building are expected to drop significantly (e.g. over 10%) in the coming years (Stroomversnelling Nederland, 2015).

- The economic development is a rather general factor but has a significant effect on, for example, the payback time of an investment in energy saving measures. Based on the previous ten years, the economic development – in terms of the gross domestic product (i.e. bruto binnenlands product) – is fixed within a bandwidth of 5% of the level at the beginning of 2016 (Centraal Planbureau, 2016).

- Breakthrough innovations for energy saving measures need a significant period of time to develop such that they can make a substantial contribution to the energy saving ambitions. In the short to medium term, no substantial contributions of new innovations are expected (CE Delft, 2013). Thus, the assumption is that the energy saving ambitions need to be achieved with the energy saving measures that are currently available and proven.

Within this basic scenario, a set of constraints, also known as boundary conditions, is formulated. These constraints define the solution space in which potential alternatives for the problematic causal relations

can be found. In the description of the constraints, a specific interpretation of these constraints is included for the continuing example of the city of Rotterdam. The following constraints form the boundaries of the solution space:

- The spending power of AOOs and individual apartment owners is a boundary condition for potential alternatives. The costs for the AOO and individual apartment owners of a potential alternative cannot exceed the available spending power for investments in energy saving measures. In line with sub section §4.3.2.3, the spending power of an AOO consists of the reserve fund of the AOO, loans from the SVn or other financial organisations, single deposits to the reserve fund, and subsidies. The literature study in chapter 2 already indicated that Rotterdam has a relatively large share (67%) of apartments in AOOs with a WOZ value below €150.000 compared to the national share of 40% (CBS, 2016a). Moreover, a larger share of apartment owners in AOOs in Rotterdam tend to have a lower income compared to the national level (CBS, 2016a). Experts from the municipality of Rotterdam explain that AOOs with low WOZ values and with apartment owners with relatively low incomes are located in a few neighbourhoods that are known for their problematic socio-economic situation. Especially in these neighbourhoods, the majority of small AOOs of up to six apartments are located. Experience shows that these small AOOs are often non-active or at least not functioning properly, which results in less spending power of AOOs.

- The available resources of the municipality are constraining the (non-financial) costs of potential solutions that can be covered by the municipality. Aside from the financial resources that are used by an alternative, other types of resources, such as staff capacity, have a limited availability. Over the past few years, the municipality of Rotterdam has shifted from a leading role in stimulating AOOs to a facilitative role (Gemeente Rotterdam, 2015e). The financial resources (subsidies) to tempt AOOs to take energy saving measures are greatly reduced and the remaining financial resources are for a large part used to create an efficient and effective collaboration with other actors. The municipality of Rotterdam strongly emphasises that a shift from their facilitative role back to a leading role is out of the question. The alternative approaches need to correspond with the current financial and non-financial resources of the municipality of Rotterdam. The exact amount of (non-)financial resources available for stimulating AOOs to take energy saving measures cannot be determined as these resources are distributed among various budgets of several programs of the department of Building Control and Housing Inspection (*afdeling Bouw- en Woningtoezicht*) and the department of Public space and Housing (*afdeling Ruimte en Wonen*).

- It is assumed that the formulation of the property rights (i.e. het eigendomsrecht) will not be eased in the short to medium term. This means that the property rights in the Dutch legal system exclude several potential alternatives that aim to make changes to the property rights of one or more actors in the system. Thus, in combination with the assumption that the governmental regulations on the energetic quality of buildings will not be changed, the options to force owners to take certain actions are limited. As these property rights are regulated at the national level, a further description of this constraint in the context of Rotterdam is not needed.

- As the governmental regulations for social housing associations and private landlords significantly differ from the regulations for individual apartment owners, the (financial) resources of social housing associations and private landlords are thought of as a separate constraint. The financial position of the social housing associations in Rotterdam is gradually improving after they got a major blow from the financial crisis. From the four large social housing associations, only Woonstad Rotterdam currently has a stable financial position (Gemeente Rotterdam & Havensteder, 2015; Gemeente Rotterdam & Vestia, 2015; Gemeente Rotterdam & Woonbron,

2015; Gemeente Rotterdam & Woonstad Rotterdam, 2015). Furthermore, the performance agreements between the social housing associations and the municipality of Rotterdam point out that the social housing associations need to perform on various policy issues. Stimulating AOOs in which social housing associations own one or more apartments is just one of these policy issues. In addition to the challenging financial situation of the social housing associations in Rotterdam, the municipality has been intensively working on the problem of fraudulent private landlords (Gemeente Rotterdam, 2012).

- Lastly, the capacity of energy and process consultants and other companies from the building industry is a constraining factor for a number of potential alternatives. This because the consultants and companies have limited staff capacity and budget to use for informing, advising, and supporting AOOs on at least the short term (§4.4.4). This is because the required training for assisting AOOs, a relatively new customer group, takes time. The presence of VVE-010 and the WoonWijzerWinkel illustrates that the municipality of Rotterdam is a forerunner in initiating and supporting consultants and companies to inform, advise, and support AOOs in taking energy saving measures. Still, the staff capacity and available budgets of these initiatives will prove to be inadequate on the short to medium term if the demand for information, advice, and support from AOOs increases.

The resulting solution space is visualised in figure 30. The assumptions (in green) demarcate the basic scenario. The solution space is defined by the constraints (in dark yellow). Within the solution space a differentiation can be made between favourable and less favourable parts. This distinction is based on the extent to which one or more problematic causal relations can be solved. In section §6.4, criteria are formulated to distinguish between these parts of the solution space.

Figure 30: solution space based on assumptions and constraints

6.4. Criteria and the solution space

The solution space in figure 30 is still undiscovered. Which parts of the solution space are favourable and solve several problematic causal relations? The formulation of criteria provides some insight in the characteristics of the favourable parts of the solution space. The criteria are inspired by the analysis of the current system in chapters 3 and 4 and by the formulation of the selected problematic causal relations for the short to medium term. The following four criteria define the favourable parts of the solution space:

- Total costs of the alternative for all actors in the system, including the transaction costs. Thus, these are the aggregated costs of the alternative for all actors in the system. These are, among others, the municipality, the AOOs, the administrators, and the building industry. In this criterion, all costs are included that are made in a period of up to ten years (the medium term).

- The estimated quality of the administrators. The definition of an administrator of sufficient quality is an administrator that has at least the following characteristics[12]:
    1. Adequate level of knowledge on the topic of energy saving measures;
    2. Motivated to raise the awareness among and inform the AOO on the topic of energy saving measures;
    3. Decisions and behaviour of the administrator are fully in the interest of the AOO.

- The estimated number of AOOs with a good base and organisational structure. An AOO with a good base and organisational structure has at least the following characteristics[13]:
    1. Presence of a qualified daily management of the AOO;
    2. High attendance to or commitment among the general meeting of owners;
    3. A periodic deposit of the owners to the AOO is made;
    4. The presence of an active Board of the AOO with regard to energy saving measures;
    5. The presence of a reserve fund, preferably of sufficient size;
    6. The presence of a multi-year maintenance plan.

- The estimated number of AOOs in which energy saving measures have been taken. This indicates the number of AOOs that have successfully gone through the customer journey and improved the energetic quality of their apartment buildings.

The favourable parts of the solution space can be identified with the scores of an alternative on the four criteria. But how are these scores determined? The basis of this scoring system is the performance of the current system, as described in chapter 3 and 4 of this research. This performance of the current system will be compared to the performance of an alternative. Both performances are subject to the assumptions from the basic scenario and are estimated for the medium term (e.g. ten years).

In this system, an alternative with an equal performance as the current system will receive a score of zero (0) for the criterion. If an alternative performs less than the current system (a deterioration) it will receive a score of -1 for the criterion, for example the total costs. Alternatives that perform better than the current system, will receive a positive score of either +1 or +2, depending on whether it is a slight or a large improvement of the performance. Thus, each alternative will receive four scores, each varying between -1 and +2. If the sum of these four scores is higher than zero (0), the alternative is located

[12] The characteristics of an administrator of sufficient quality are directly based on the areas of improvement that were mentioned by several respondents in the interviews. These areas of improvement are discussed in sub section §4.3.1.
[13] The characteristics of an AOO with a good base and organisational structure are based on the missing features that were mentioned by at least two respondents in the interviews. These features can be derived from table 10 in sub section §4.3.1.

within the solution space, provided that the alternative meets all constraints. If the sum of the four scores nears +3, the alternative is in the favourable parts of the solution space. This is because, on average, the alternative will have a positive effect on more than one criterion. The scoring system for the alternatives is shown in figure 31

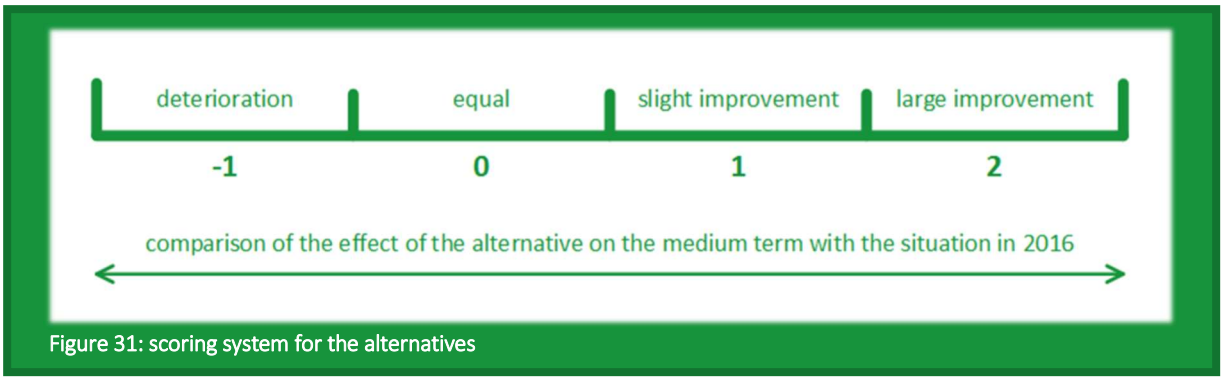


Figure 31: scoring system for the alternatives

The solution space in figure 32 consists of four sides. Each side represents one of the criteria. The top represents the total costs of the alternative for all actors in the system. The right side represents the quality of the administrators. At the bottom, the number of AOOs with a good base and organisational structure is included. The right side represents the number of AOOs in which energy saving measures have been taken. Each plane represents the maximum +2 score on a criterion. The favourable parts of the solution space are the positions at which multiple planes overlap. In the upcoming chapters, the aim is to find alternatives that are located near the middle of the solution space and that have a positive score on all four criteria.

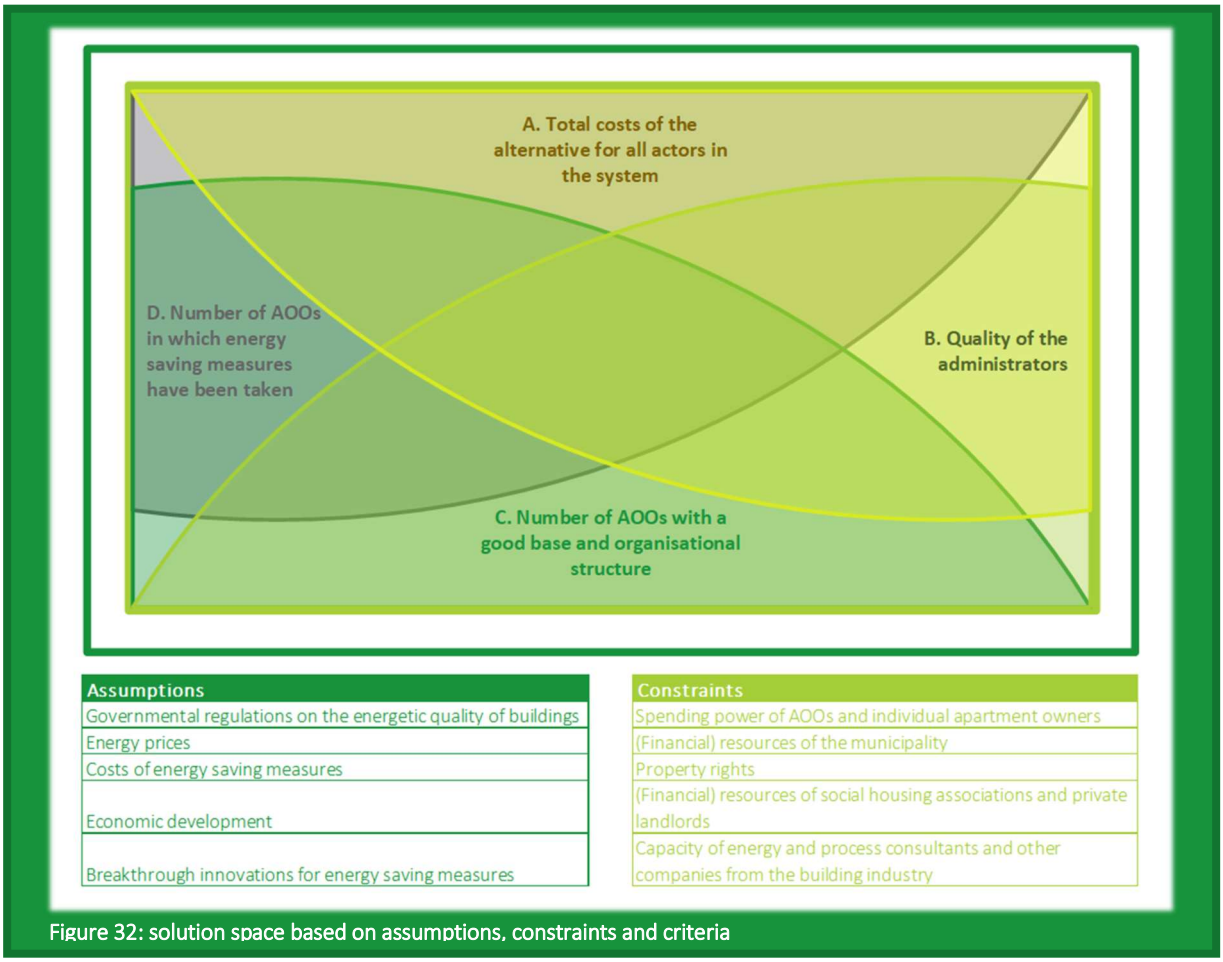


Figure 32: solution space based on assumptions, constraints and criteria

6.5. Use of the assessment framework

The assessment framework is key to find promising alternatives in chapter 8 and to give recommendations for a municipal approach in chapter 10. This section shortly introduces the use of the assessment framework in both chapters. At the start of both chapters an elaborate description of the assessment method is provided.

The first assessment in chapter 8 is a quick preliminary selection to reduce the list of alternatives from chapter 7 to a limited number of promising alternatives that can be elaborated and explored in greater detail in chapter 9. Firstly, the numerous alternatives that are introduced in chapter 7 and that are derived from the literature study, the interviews, and a brainstorm are subject to a check on whether these alternatives comply with the constraints from section §6.3.

Secondly, the remaining alternatives are assessed with the criteria from section §6.4. The input from these scores come from applying the combined insights from the literature study and the interviews to the interaction between the alternative and the current system. To arrive at scores for each alternative on all four criteria, the scoring system from section §6.4 is used. Thus, an alternative receives a score for each criterion varying from -1 to 2, which results in a sum of the four scores that varies from -4 to 8. Based on these total scores, a few promising alternatives will emerge from the long list of alternatives of chapter 7. These promising alternatives are selected for the optimisation of (combinations) of alternatives in chapter 9.

The results of the assessments, the key insights from the research and the results of an expert validation are combined in chapter 10 in several recommendations for a municipal approach. These recommendations describe the most important elements that are part of such a municipal approach. Also, the recommendations mention a number of aspects that should be considered, when designing such a municipal approach.

6.6. Conclusion

This chapter is the intermezzo between research part A and research part B. This intermezzo provides an assessment framework that is based on the new insights gained from research part A. The assessment framework will be used in research part B to identify a municipal approach that is able to breach the problematic causal relations that restrict AOOs from taking energy saving measures. This intermezzo addresses the following research sub question:

I.1. Which criteria and constraints result from research part A and assist in finding a municipal approach that is able to breach the problematic causal relations that restrict AOOs in taking energy saving measures?

In short, the various steps that have been taken to arrive at an answer to this research sub question are described. Firstly, the problematic causal relations are structured with six clusters, as included in table 24. Secondly, these six clusters are positioned relative to one another and along the customer journey to determine which problematic causal relations are best to select for the remainder of the research. Another argument that is used for the selection is that some clusters of problematic causal relations represent the added complexity of the AOO. This is a level of complexity that is not present for individual home owners in their decision-making process on the implementation

Table 24: clusters of problematic causal relations

#	Cluster of problematic causal relations
1	The administrator
2	The provision of information, advice, and support
3	The building industry
4	Financial issues
5	The organisational structure of the AOO
6	National and municipal laws and policies

of energy saving measures. This combination of analyses and arguments has resulted in the selection of two clusters of problematic causal relations (e.g. regarding the administrator and the organisational structure of the AOO) consisting of four problematic causal relations, as presented in table 25.

Table 25: selected problematic causal relations

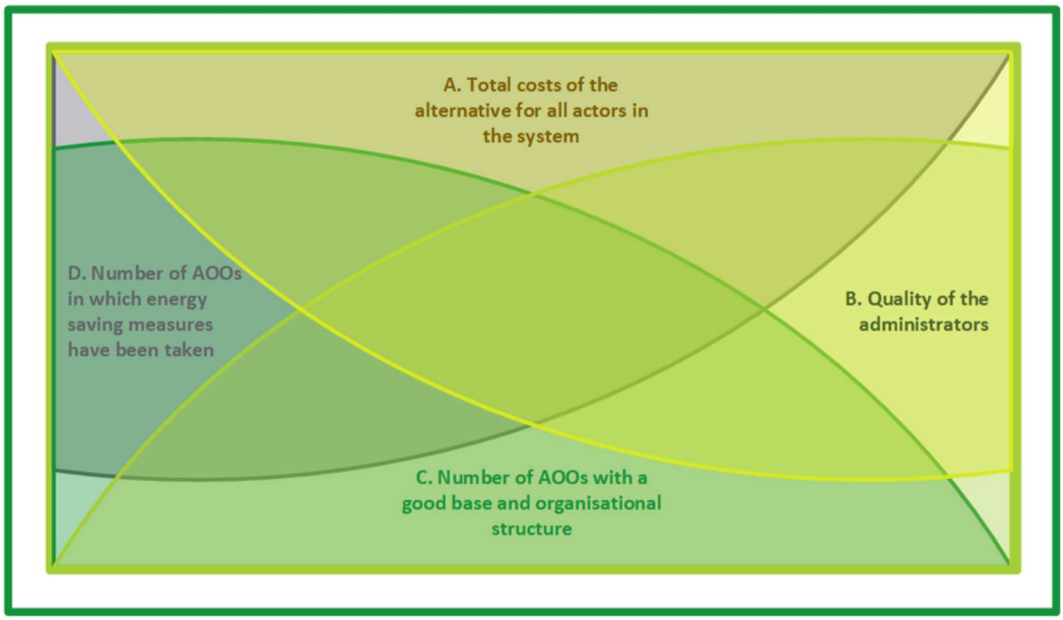
Description of problematic causal relation	Term
A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.	Short/ Medium
A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.	Short/ Medium
The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process.	Long
The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.	Long

Thirdly, a differentiation is made between problematic causal relations that can be addressed either on the short to medium term or on the long term. The focus in the remainder of the research is on the two problematic causal relations that can be addressed on the short to medium term, as these are currently reinforcing the negative effects of many other problematic causal relations. Alternatives for the two problematic causal relations that need to be addressed on the long term are only explored and discussed briefly in chapter 7.

Fourthly, a few assumptions are introduced that constitute a basic scenario for the independent development of the system on the short to medium term (e.g. five to ten years). Within the basic scenario, a few constraints, boundary conditions, are formulated. These constraints define the solution space for the short to medium term in which potential alternatives for the problematic causal relations can be found. The assumptions and constraints are in a short format included in figure 33 and are more elaborately described in the previous sections.

Fifthly, four criteria are formulated that provide some insight in the characteristics of the favourable parts of the solution space. The more the criteria in figure 33 overlap at a particular point in the solution space, the more attractive this point is as a potential alternative for addressing the problematic causal relations. In the middle of the solution space all four criteria overlap, while the influence area of just one criterion is present in the corners of the solution space.

Lastly, the use of the assessment framework in the remaining chapters of this research is discussed. The list of potential alternatives, to be composed in the next chapter, is assessed in a quick preliminary selection in chapter 8. These results are used for making combinations of promising alternatives in chapter 9. The insights from these chapters and from an expert validation are used in chapter 10 at recommendations for a municipal approach that can change the selected problematic causal relations.



Assumptions
Governmental regulations on the energetic quality of buildings
Energy prices
Costs of energy saving measures
Economic development
Breakthrough innovations for energy saving measures

Constraints
Spending power of AOOs and individual apartment owners
(Financial) resources of the municipality
Property rights
(Financial) resources of social housing associations and private landlords
Capacity of energy and process consultants and other companies from the building industry

Figure 33: assessment framework that consists of a solution space based on assumptions, constraints and criteria

7. DESIGN OF ALTERNATIVES

7.1. Introduction to the design of alternatives

In the formulation phase, several alternatives are designed to address the selected problematic causal relations from sub section §6.2.3. This relates to the first research sub question of research part B:

B.1. Which alternatives are suggested in literature and in the interviews for changing the problematic causal relations?

In this chapter, the focus returns to the continuing example of the municipality of Rotterdam. The designs of the alternative approaches are based on this specific context, which is described in more detail with the constraints from the assessment framework in section §6.3. However, it is likely that the alternative approaches are also valuable for other municipalities, given the observations from sub section §2.2.1.

Most of the input for the alternatives is derived from interviews with various actors from the AOO practice. The description of the interview research method is included in section §4.2. The suggested alternatives from the respondents are elaborated and adjusted based on several observations from the literature study and a brainstorm. The brainstorm is based on the insights from the analysis in chapters 3 to 5. Section §7.2 describes several alternative approaches that address the problematic causal relation regarding the quality of the administrator. Subsequently, section §7.3 presents alternative approaches that address the poor quality of the base of the AOO. These two sections include alternative approaches for problematic causal relations that can be solved on the short to medium term (e.g. within ten years). Thereafter, section §7.4 briefly describes a number of alternatives for the two problematic causal relations that can only be solved on the long term: those relations regarding the mix of privately-owned and rented apartments in AOOs and regarding the organisational structure of small AOOs. For some alternatives, the constraints from section §6.3 need to be released in order to address these long-term problems. Lastly, the conclusion in section §7.5 provides an overview of the alternative approaches that will be assessed in chapter 8.

7.2. Alternatives regarding the administrator

From the interviews, the literature study and the brainstorm, several alternatives are derived that address the poor quality of administrators. These alternatives aim to address the following problematic causal relation from sub section §6.2.3: *a poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures*. This problematic causal relation was discussed in sub section §4.3.1.1. In that sub section, three key characteristics of a high-quality administrator are identified:

1. Adequate level of knowledge on the topic of energy saving measures;
2. Motivated to raise the awareness among and inform the AOO on the topic of energy saving measures;
3. Decisions and behaviour of the administrator are fully in the interest of the AOO.

These three characteristics are the themes that are used to structure the alternatives in this section. Every alternative is assigned to the theme with which it is mostly closely related.

7.2.1. Adequate level of knowledge on the topic of energy saving measures

Administrators have a direct and prolonged contact with AOOs. AOOs contract administrators for several years. Therefore, AOOs often turn towards their administrator for advice on difficult decisions. Most

administrators are not able to support AOOs that are interested in taking energy saving measures, because their level of knowledge is inadequate on this topic. Due to this lack of support, AOOs get stuck in the early stages of the customer journey and do not reach the final stage in which energy saving measures are taken.

To arrive at an adequate level of knowledge of administrators on the topic of energy saving measures, two types of alternatives are mentioned by respondents and in the literature study. Firstly, their level of knowledge can be increased by actively providing information to them. This alternative provides the required tools to administrators for them to inform AOOs on the topic of energy saving measures. Secondly, a course on reducing the energy consumption of AOOs is proposed as an alternative in table 26. The aim of both types of alternatives is that by improving the access to information via the administrator, some of the barriers in the very early stages of the customer journey will be easier to overcome for AOOs.

Table 26: alternatives for an adequate level of knowledge among administrators on the topic of energy saving measures

1.A. Informing administrators	*2. Administrators return to the classroom*
- technical information on energy saving measures - roadmap to advise AOOs - through brochures, informative letters and websites - from the municipality, VvE Belang, or the Ministry	- a course for administrators on reducing the energy consumption of AOOs - actively taking part in a course is more effective than passively receiving information - course can be outsourced by the municipality to an independent organisation, analogous to the existing course for AOOs - the course discusses a variety of energy saving measures and describes interesting combinations of such measures with upcoming maintenance
To improve and upgrade the minimum knowledge level of administrators in such a way that they can inform and advise AOOs on the topic of energy saving measures.	
1.B. Ready-to-use information packages for administrators	
- administrators have a direct and prolonged contact with AOOs - individual administrators lack effective information packages they can provide to AOOs - these information packages inform AOOs on both maintenance and energy saving measures - composing these information packages requires a significant investment in time and money - the Ministry, VvE Belang or a collaboration of municipalities centrally compose these packages and distribute them among the administrators	
With the free of charge distribution of ready-to-use information packages to administrators, they are stimulated to spread this knowledge among their AOOs	The main aim of the course is to enable administrators to answer basic questions on energy saving measures.

7.2.2. Motivated to raise the awareness among and inform AOOs

In general, administrators tend to limit their efforts. They limit their tasks to simply assisting AOOs with maintaining the apartment building. Other tasks, such as stimulating AOOs to reduce their energy consumption, are not carried out. The main reason is that these tasks are not included in the terms and conditions of the contract between administrator and AOO. Thus, most administrators are simply not paid for efforts related to energy saving measures. Another reason is that some administrators receive a fee for every kilowatt-hour electricity and m^3 natural gas that is consumed by the AOO. Administrators receive this fee from energy suppliers or middlemen. These administrators are not motivated to inform AOOs on energy saving measures, as this decreases their revenues.

Three types of alternatives to motivate administrators to raise the awareness among and inform AOOs on the topic of energy saving measures are presented in this sub section. One option is to arrange regular meetings with the alderman of the municipality or to initiate a collaboration with the municipality. Secondly, new financial opportunities are pointed out to administrators. These financial opportunities

emerge when AOOs take energy saving measures. Lastly, AOOs can be steered towards high-quality administrators, who are more motivated to stimulate these AOOs to take energy saving measures. Through this steering, motivated administrators are financially rewarded with new customers. These three types of alternatives are included in table 27. Their common ground is that a short-term (social or financial) incentive for administrators is created to actively inform AOOs on energy saving measures. The aim is to let the administrators continue their efforts on the long-term without the need of any additional incentives.

Table 27: alternatives to motivate administrators to raise the awareness among AOOs and to inform them

3.A. Meetings with the municipality	*4. Creating a financial interest in saving energy*
- regular meetings between the municipality and administrators - discussions with the alderman on challenges that are present in the AOO practice - emphasising the need to stimulate AOOs to take energy saving measures	- energy saving measures in AOOs result in new administrative tasks, such as calculating the energy costs per apartment or arranging the periodic payment of fees to (energy) companies - these additional tasks can be included in a more encompassing contract between AOO and administrator - pointing out these new opportunities for administrators is crucial to create a small financial incentive
The presence of and the interaction with the alderman motivates administrators to inform and advise AOOs on reducing their energy consumption.	Given that administrators are aware of the financial opportunities of reducing the energy consumption of the AOO, they will more likely advise them on additional energy saving measures.
3.B. Collaboration with the municipality	*5. Assign formerly participating AOOs in the VVE-010 programme to high-quality administrators*
- administrators select promising AOOs, who they want to inform, based on criteria such as maintenance level, energy label and attendance to general meetings of owners - the municipality contributes expertise by sending specialists to general meetings of owners - in addition, the municipality is perceived by AOOs as a neutral and independent organisation	- the programme guides AOOs towards a satisfactory maintenance level and financial situation - VVE-010 is able to advise AOOs on their selection of a new administrator, when this programme ends - in this advice, the motivation of administrators to inform AOOs on energy saving measures is explicitly included - motivated administrators are thus financially rewarded with new customers
By selecting promising AOOs and by informing them in collaboration with the municipality, the effectiveness of the joint efforts is expected to be high.	In addition to rewarding motivated administrators, the risk of AOOs falling back in the same behaviour (that caused the need for participating in the VVE-010 programme) is reduced with a high-quality administrator.

7.2.3. Decisions and behaviour of administrator are fully in the interest of AOO

The contract between the administrator and the AOO is no guarantee that the decisions and behaviour of the administrator is in the interest of the AOO. An administrator who is independent from other market parties and acts in the interest of the AOO is not self-evident in practice.

This third sub section describes two types of alternatives to align the behaviour of administrators with the interests of AOOs. Firstly, the variable quality of administrators is made transparent. This is done with either an open platform with customer reviews or a black- and whitelist that is drawn up by the municipality. This enables AOOs to contract a high-quality administrator, whose behaviour and decisions are aligned with the interests of the AOO. Secondly, by adding enforceable obligations to the current certification system, unwanted behaviour of certified administrators can be ruled out. This effect can be enforced by several actors. For example, the municipality will only do business with administrators who have a certificate. By enabling AOOs to switch to a high-quality administrator and by ruling out

unwanted behaviour of these administrators, the decisions and behaviour of administrators will be more aligned with the interests of AOOs.

Table 28: alternatives to align the decisions and behaviour of administrators with the interests of the AOO

6.A. Customer reviews	*7. Certification with enforceable obligations*
- a national platform for customer reviews about administrators, based on the initiative of VvE Platform Schiedam - increase the transparency on the performance of administrators of standard and additional tasks - this platform can be used by AOOs to select a new administrator	- the current SKW certification system is not able to rule out unwanted behaviour of administrators - by adding enforceable obligations to the system, interventions in at least two types of behaviour can be made o firstly, these obligations involve the procedure to outsource specific tasks to other market parties o secondly, these obligations create a partial responsibility for the height of the periodic deposit to the reserve fund - adding these obligations to the certification system is supported by several other actors, who will only do business with administrators that have a certificate
This platform improves the market transparency and enables AOOs to select a high-quality administrator that acts in their interests.	
6.B. Black- and whitelist	
- the municipality, in collaboration with other actors, such as social housing associations, composes lists of low and high-quality administrators - these lists can be used to warn AOOs against administrators that are known to cause problems	
This warning system of the municipality and other actors enables AOOs to switch to a high-quality administrator before major problems can arise.	Enforceable obligations in the certification system ensure that unwanted and irresponsible behaviour of certified administrators is ruled out.

7.3. Alternatives regarding the base of the AOO

A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process. This is the description of the second problematic causal relation that was selected in sub section §6.2.3. In retrospect, table 3 in sub section §3.2.1 shows the combined efforts of a number of actors to address this problematic causal relation. In short, these efforts consist of the *Woningwet*, the *Machtigingswet*, the integrated approach of VVE-010, the loan from the NEF, and subsidies from the municipality and the Ministry of the Interior and Kingdom Relations on insulation and advice. The subsequent analysis in chapter 4 and 5 has indicated that additional measures are needed to complement these existing efforts. The description of alternatives in this sub section is limited to these additional measures. The various problems regarding the base of the AOO are discussed in sub section §4.3.1. In the interviews, the following important missing features of AOOs were mentioned at least twice:

1. Presence of a qualified daily management of the AOO;
2. High attendance to or commitment among the general meeting of owners;
3. A periodic deposit of the owners to the AOO is made;
4. The presence of an active Board of the AOO with regard to energy saving measures;
5. The presence of a reserve fund, preferably of sufficient size;
6. The presence of a multi-year maintenance plan.

These six important missing features are clustered in four themes to structure the alternatives in this section. Every alternative is assigned to one of the following themes with which it is most connected:

A. Daily management and the Board: qualified and active;
B. Commitment to and involvement with the AOO;
C. Suitable and stable financial position;
D. From short-sightedness to a long-term vision.

7.3.1. Daily management and the Board: qualified and active

As discussed in sub section §4.3.2.3, small and medium AOOs lack the spending power to hire professional board members. In these AOOs inexperienced apartment owners volunteer as a Board member, but lack the specific knowledge and skills to improve the base of the AOO. Thence, the observation is that these types of Boards have not become active yet with regard to energy saving measures.

Two alternatives are discussed that provide the daily management and the Board of the AOO with tools to improve its base. A solid base of the AOO is a prerequisite to become active in the field of energy saving measures. In table 29, a course to improve the level of knowledge of the daily management and Board members is suggested. Secondly, a strategy is described for the municipality or for social housing associations to buy apartments in an AOO to improve the organisation from the inside. By increasing the level of knowledge of the Board of the AOO, through courses or active involvement of external actors, the daily management and the Board are provided with tools to improve the base of the AOO.

Table 29: alternatives for a qualified and active daily management and Board

8. Management course	*9. Buying into an AOO*
- a course for Board members of mostly small AOOs on the daily management of the AOO - organised and paid for by the municipality - consisting of basic knowledge on AOOs, including financial, legal and technical aspects - also, energy saving measures are discussed - participants in the course are encouraged to discuss these topics in the general meeting of owners - practical experience of Board members can be shared with other participants	- the municipality or a social housing association buys at least one apartment in the AOO - improving the base of the AOO from the inside through active involvement of one of these organisations - using the right to speak in the general meeting of owners and the right to put topics on the agenda of this meeting - advise the Board of the AOO on various topics, such as maintenance and the periodic deposit
With this course, the level of knowledge of volunteering apartment owners, with little experience in the AOO practice, is improved. Moreover, these Board members are stimulated to discuss energy saving measures in their AOO.	The involvement of a neutral and professional organisation with the internal organisation of the AOO, is of help for the daily management and Board of small to medium AOOs.

7.3.2. Commitment to and involvement with the AOO

Another missing feature of AOOs is a high attendance or commitment to the general meeting of owners. As a minimum level of attendance is required to take majority votes in the general meeting of owners, this missing feature results in a time-consuming decision-making process. Secondly, the lack of commitment to the AOO does not stimulate individual apartment owners to act in the interest of the association, but to act in his or her own interest. This sub section presents, in table 30, two alternatives that aim to improve the level of commitment to the AOO. By increasing the commitment to the AOO through more frequent formal and informal contacts among apartment owners, it is easier for the AOO to arrive at a widely supported decision-making process and at decisions that are in the interest of the AOO.

Table 30: alternatives for commitment to and involvement with the AOO

10. Increase the frequency of the general meeting of owners	*11. Informal contact within the AOO*
- at least twice a year a general meeting of owners - strategy of repetition has a positive effect on the commitment of apartment owners to the AOO - essential for taking large decisions, as apartment owners are part of the discussion and share views	- facilitating informal contact among apartment owners in between meetings - through newsletters, online platform, organisation of informal meetings - organised by the apartment owners
Increasing the frequency of the general meeting of owners improves the commitment to the AOO and helps to arrive at a widely supported decision-making process.	The AOO is a sort of mini-society. Apartment owners become committed to the Association and are stimulated to act in the interest of the joint ownership.

7.3.3. Suitable and stable financial position

Financial problems are common and are hard to solve for AOOs. For the Board of the AOO it is difficult to improve the financial position of the AOO by simply increasing the periodic deposit to the reserve fund. This is because apartment owners have bought this apartment based on the perspective of low monthly costs. These apartment owners have insufficient financial means to pay the needed additional monthly costs for increasing the reserve fund to a sufficient level. There is also a risk of apartment owners who want low monthly costs and suggest to lower the periodic deposit, after energy saving measures are taken. This is because these energy saving measures have reduced the energy costs of the AOO. In this sub section, two alternatives are discussed that aim to improve the financial position of the AOO. By informing potential apartment owners on the real monthly costs and by discouraging AOOs to lower their periodic deposit, a long-term balance between the financial resources and the expected future costs can be obtained.

Table 31: alternatives for a suitable and stable financial position

12. Objective information on the real monthly costs	*13. Do not lower the periodic deposit*
- potential apartment owners are informed on the real monthly costs for maintaining and improving their apartment and the apartment building - a joint effort by the real estate agent, the notary and the Board of the AOO - instead of (too) low monthly costs, a properly functioning AOO is the best selling point for every apartment owner	- for most AOOs, the expected (long-term) costs for maintenance works and improvements exceed the financial resources (the reserve fund and periodic deposit) - this does not change after energy saving measures have been taken, despite the reduction of energy costs - administrators, consultants and market parties will encourage AOOs to keep the periodic deposits on the original level
Informing potential apartment owners on the real monthly costs, makes it easier for the Board of the AOO to increase the periodic deposit to a sufficient level.	Lowering the periodic deposit after taking an energy saving measure is discouraged by several market parties in order to balance the expected costs in the future with the current financial resources.

7.3.4. From short-sightedness to a long-term vision

In many decisions of AOOs some level of short-sightedness can be observed. This short-sightedness results in a focus on maintaining the apartment building and an absent focus on improving the apartment building. In this sub section, three types of alternatives are presented regarding the presence of a multi-year maintenance plan and, more in general, regarding the drafting of a long-term vision on maintaining and improving the apartment building. By stimulating AOOs, either by landlords and administrators or by legal obligations, to develop a long-term perspective on the future of their apartment buildings, short-term decisions will be more in line with the long-term interests of the AOO.

Table 32: alternatives to go from short-sightedness to a long-term vision

14.A. Joint development of a vision	*15. Multi-year maintenance plan as a legal obligation*
- many AOOs have a mix of privately-owned and rented apartments - owners of rented apartments, the social housing associations or private landlords, are experienced in developing a vision for their properties - trade associations and the municipality will encourage these landlords to develop a joint vision on the apartment building together with other apartment owners in the AOO	- the multi-year maintenance plan is a tool for apartment owners, who are predominantly focused on the short term, to arrive at a long-term vision on the maintenance and improvement of the apartment building - the multi-year maintenance plan is a solid basis for determining the appropriate height of the periodic deposit - in the Fifth Book of the Civil Code, a legal obligation for having a multi-year maintenance plan can be included
A jointly formulated long-term perspective on the future of the apartment building is of positive influence on the short-term decisions.	A legal obligation for AOOs to have a multi-year maintenance plan stimulates apartment owners to arrive at a long term vision.
14.B. Leading role of administrators on energy saving measures	*16. Mandatory implementation of energy saving measures with a payback time of less than five years*
- the municipality encourages high-quality administrators to actively inform AOOs on energy saving measures - administrators are able to include the topic of saving energy on the agenda for the coming general meeting of owners - in addition, administrators can take a leading role by requesting a minimum level of energy saving measures in the specifications of maintenance activities	- in accordance to the *Activiteitenbesluit* for companies - the national government may decide to obligate AOOs to take energy saving measures that have a payback time of less than five years
When high-quality administrators become active in informing AOOs on energy saving measures and when they take a leading role, short-term decisions can be taken in line with a long-term perspective.	With such an obligation, it is likely that AOOs will expand their focus beyond simply maintaining the apartment building.

7.4. Alternatives to problematic causal relations on the long term

Various alternatives for the problematic causal relations regarding the quality of the administrator and the quality of the base of the AOO have been presented in the preceding sub sections. As stated before, these two problematic causal relations are the focus in the remainder of this research. However, in chapter 6 two other problematic causal relations were selected:

1. The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process;

2. The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed to arrive at an effective decision-making process.

Completely solving these two problematic causal relations will require more time than solving the problematic causal relations from the previous two sections. It is important to note that some alternatives for the long-term problematic causal relations may be implemented within a relatively short time span. However, it will take more than ten years for the full effects of these alternatives to completely solve

the problematic causal relations. This sub section presents the alternatives and describes any conflicts of these alternatives with the constraints from section §6.3.

7.4.1. Effective decision-making process in AOOs with a mix of privately-owned and rented apartments

To improve the effectiveness of the decision-making process in AOOs that consist of a mix of privately-owned and rented dwellings, four alternatives are briefly discussed in this sub section.

A. Integrating the decision of tenants into the decision-making process

In AOOs with a mix of privately-owned and rented apartments, the landlord needs the consent of at least 70% of the tenants to cast a positive vote for the (energetic) renovation of the apartment building. Because of this rule, many decision-making processes in mixed AOOs are either delayed pending the decision of the tenants or blocked by a rejection of the plans by these tenants. The effectiveness of the decision-making process can be improved by integrating the decision of the tenants in the decision-making process of the AOO. This integration can be initiated by the landlord and/or the administrator. The general meeting of owners may invite tenants to their meetings, in which the plans for the (energetic) renovation are discussed. By involving tenants early in the process, it is more likely that they develop a positive attitude towards the plans. Besides, this integrated decision-making process enables the landlord to organise the voting of the tenants in time, such that the he can cast its vote in the general meeting of owners. Implementing this alternative will involve trial and error to find an effective way of involving tenants in the decision-making process of the AOO. To convince more landlords and/or administrators to take this step, some pilot projects are needed to show the added value of involving tenants in this process.

B. Organisational separation of administrator and landlord

Many mixed AOOs were once fully owned and managed by one social housing association. Gradually, social housing associations have sold several units to individual apartment owners. The administrator did not change due to the persisting majority share of the social landlord in the AOO. In these AOOs, the administrator is related to the organisation of the social housing association. Theoretically speaking, internal policies ensure that the administrator operates independently from the social housing association. In practice, the administrator is not perceived as a neutral actor by the other apartment owners, due to its organisational relation with the social housing association. Such perceptions often result in doubt in the reliability of the administrator. This is harmful for the decision-making process. The organisational separation of administrator and landlord is an alternative to prevent such tensions in the AOO. The essence of this organisational separation is that the administrator can no longer be related to any apartment owner in the AOO. This organisational separation can be realised through either an informal agreement between municipality and social housing associations or a legally binding addition to the Fifth Book of the Civil Code on apartment rights by the Ministry. In the latter case, this alternative restricts the property rights of the social housing association, as they are slightly limited in choosing an administrator they prefer. Both options to create organisational separation between administrator and landlord will require some preparation time and their effects will have to increase over the years.

C. Buying back apartments from individual apartment owners

In other apartment buildings, the trend of selling several apartments to individual owners was not continued by the social housing association. This has resulted in AOOs in which the social housing association sold only one or a few apartments. The social housing association still owns most – approximately 90 to 95 percent – of the apartments. Given this significant majority share, the general meeting of owners is controlled by the social housing association. The votes of individual apartment owners are practically useless. A way to solve this situation is for the social housing association to eventually buy the once sold apartments from the individual apartment owners. By once again obtaining the full ownership of

the apartment building, the social housing association can manage and improve the apartment building on its own. The social housing association can do this without harming the interests of individual apartment owners. This alternative will require more resources from social housing associations than currently available, according to the constraint in section §6.3.

D. Constraining the control of the general meeting of owners by landlords

The extent to which landlords control the general meeting of owners can also be constrained with other means. Is it reasonable that one owner with a majority share of the votes can impose its plans or lack of plans on other owners? An alternative to this situation is for the Ministry of the Interior and Kingdom Relations to intervene in the ownership structure of the AOO. This intervention will limit the maximum share of votes that a single owner can have in the general meeting owners to 50%, regardless of the number of apartments he owns. With this intervention, the landlord needs the support of other apartment owners for its plans to obtain a qualified majority – more than 50% – in the general meeting of owners. Regardless the exact form of this intervention, this alternative affects the property rights of the landlord. Thus, for the implementation of this alternative, the constraint on property rights from section §6.3 needs to be released.

7.4.2. Optimising the organisational structure for small AOOs

The evaluation of the current system in chapter 4 shows that especially small AOOs lack the required knowledge and financial resources to arrive at an effective decision-making process. In sub section §4.4.1.1, the organisational structure of small AOOs was identified as the underlying problematic causal relation. The following three alternatives aim to optimise this organisational structure of small AOOs

E. Creating a collective of small AOOs

Small AOOs need to deal with limited financial resources and incomplete knowledge. In addition, building companies complain about the assistance these AOOs need and the revenues they generate from this customer type. The building companies suggest that small AOOs will start to collaborate and form a collective for maintenance and improvement of the apartment building. Building companies expect that, based on the economies of scale, these collectives will require less assistance from them. An interesting breeding ground for these collectives is the emergence of platforms, such as VvE Platform Schiedam from section §5.5. Starting from these platforms, groups of 5 to 6 small AOOs can be formed with similar ambitions for their apartment buildings. A collective of small AOOs will go through the customer journey as a group, helping and learning from the other AOOs. In fact, a parallel and informal collective organisational structure is added to the individual organisational structure of each AOO. An additional advantage of this new organisational structure is that companies from the building industry will become more interested in groups of AOOs. However, it will take time and experience for collectives of AOOs and for the building industry to solve this long-term problematic causal relation.

F. Creating larger AOOs

However, for several small AOOs, this informal and voluntary collaboration with other small AOOs is not enough. To optimise the organisational structure of these small AOOs, a connection has to be made between their organisational structure and the physical structure of their apartment buildings. In postwar districts in The Netherlands, many apartment buildings with three to five floors have been built. These apartment buildings can be considered as one physical object. These apartment buildings are known to consists of several small AOOs, one or two for every staircase in the apartment building. However, one organisational structure would be optimal for these apartment buildings, given the maintenance works on the shared façades and roof. Thus, to optimise the organisational structure, these small AOOs are united in one large AOO for the entire apartment building. Pilots show that it is not likely that small AOOs are autonomously able and willing to create one organisational structure (Stichting Verbouw Rustenburg-Oostbroek, 2010; Waals van der, 2014). Therefore, the interference of the Ministry of the

Interior and Kingdom Relations is needed. For the Ministry, it will be a challenge to balance the urgent need for one organisational structure with one of the constraints, the protection of the property rights of individual apartment owners from section §6.3.

G. Housing Investment Zone

In the transition towards one organisational structure for several small AOOs in one apartment building, this alternative provides a financial arrangement for the maintenance of certain elements of the building. For small AOOs in one apartment building a financial construction, a Housing Investment Zone, can be created by the municipality. In this Zone, every apartment owner is required to pay its financial contribution for the joint maintenance of the apartment building. Normally, a contribution would be paid to the AOO, which is often a much lower periodic deposit to the reserve fund. Through this special form of tax, a reserve fund of sufficient size is created that can be used by the collaborating small AOOs to maintain (and optionally improve) the building. Starting from this financial arrangement, it is expected that the creation of one organisational structure will be less difficult. Thus, the Housing Investment Zone may be an alternative that enables the fusion of several small AOOs in one large AOO. For this alternative, the municipality will need additional resources to initiate and execute the laws and policies related to the Housing Investment Zone.

7.5. Conclusion

Based on suggestions from respondents in the interviews, observations from the literature study and a brainstorm, several alternatives are designed and briefly introduced in this chapter. This resulted in a set of alternatives, which corresponds to the first research sub question of research part B:

B.1. Which alternatives are suggested in literature and in the interviews for changing the problematic causal relations?

This set of promising alternative approaches addresses the problematic causal relations that were selected in sub section §6.2.3 and that are included in table 33. In that sub section, it was indicated that the focus of the remainder of the research is on the problematic causal relations regarding the poor quality of administrators and the base of AOOs. In addition, a brief exploration of the possible alternatives for the two long-term problematic causal relations will be conducted.

Table 33: problematic causal relations for which alternatives were formulated

Description of problematic causal relation	Term
A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.	Short/ Medium
A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.	Short/ Medium
The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process.	Long
The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.	Long

The alternatives to solve the two problematic causal relations regarding the quality of the administrators and the quality of the base of the AOO are presented in table 34. These alternatives will be assessed in the next chapter with the assessment framework that is described in section §6.5.

Table 34: short to medium term alternatives

Problematic causal relation	Theme	#	Key notion of the alternative
Quality of the administrators	Adequate level of knowledge on the topic of energy saving measures	1.a.	Informing administrators with brochures, informative letters and a web-site, in such a way that they can inform and advise AOOs on energy saving measures.
		1.b.	The free of charge distribution of ready-to-use information packages to administrators, such that they are stimulated to spread this knowledge among AOOs.
		2.	A course to enable administrators to answer basic questions on energy saving measures.
	Motivate ad-ministrators to raise the awareness among and in-form AOOs	3.a.	Regular meetings of administrators with the municipality and the alder-man to motivate administrators.
		3.b.	A collaboration with specialists from the municipality improves the effec-tiveness of administrators in informing AOOs.
		4.	Make administrators aware of the financial opportunities in assisting AOOs to reduce their energy consumption.
		5.	Assign AOOs that were part of the VVE010 programme to motivated ad-ministrators who stimulate AOOs to take energy saving measures.
	Administrators' decisions and behaviour are fully in the in-terest of the AOO	6.a.	National platform for customer reviews to improve the market transpar-ency and to enable AOOs to select high-quality administrators.
		6.b.	A black- and whitelist that is updated by the municipality and others and that is used as a warning system against low quality administrators.
		7.	Enforceable obligations in the certification system for administrators en-sure that unwanted behaviour of certified administrators is ruled out.
Quality of the base of the AOO	Qualified and active daily management and Board	8.	With a course, the knowledge level of volunteering apartment owners in small AOOs, who have little experience in the AOO practice, is improved.
		9.	By buying at least one apartment in the AOO, the municipality or social housing association is able to improve the base of the AOO from the in-side.
	Commitment to and involve-ment with the AOO	10.	Increase the frequency of the general meeting of owners to at least twice a year to arrive at a widely supported decision-making process.
		11.	Facilitate informal contact among apartment owners in between general meetings of owners.
	Suitable and stable financial position of the AOO	12.	Inform potential apartment owners on the real monthly costs, so that the periodic deposit to the reserve fund can be increased to a sufficient height.
		13.	Market parties discourage AOOs to lower the periodic deposit after taking one or more energy saving measures, in order to balance the expected costs in the future with the current financial resources of the AOO.
	A long-term vi-sion for the apartment building	14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective.
		14.b.	High-quality administrators will put the topic of energy saving measures on the agenda of the general meeting of owners and will request a mini-mum level of energy saving measures in maintenance works.
		15.	A legal obligation for AOOs to have a multi-year maintenance plan in order to stimulate apartment owners to arrive at a long term vision.
		16.	A legal obligation for AOOs to take energy saving measures that have a payback time of less than five years.

Also, a brief exploration was conducted for the problematic causal relations regarding the decision-making process in mixed AOOs and the organisational structure in small AOOs. The alternatives that may solve these problematic causal relations on the long term are presented in table 35.

Table 35: long term alternatives

Problematic causal relation	#	Key notion of the alternative
Decision-making process in AOOs with a mix of privately-owned and rented apartments	A.	Integrate the decisions of tenants into the decision-making process within the AOO in order to generate commitment to the plans and to prevent any delays in the process.
	B.	Organisational separation of administrator and landlord, such that the administrator is no longer related to any apartment owner in the AOO.
	C.	In AOOs, apartments that were once owned by the social housing association, who is still the owner of 90 to 95% of the other apartments in the apartment buildings, are bought back by this social landlord.
	D.	Constrain the control of landlords on the general meeting of owners by limiting the maximum share of votes of one owner to no more than 50%.
Optimal organisational structure for the functioning of small AOOs	E.	Create an informal collective of small AOOs, such that groups of 5 to 6 AOOs can be formed with similar ambitions for their apartment buildings. This collective of AOOs will go through the customer journey as a group.
	F.	In apartment buildings with several small AOOs, these AOOs are united in one organisational structure in accordance to the physical structure of the building they share.
	G.	Introduce a Housing Investment Zone to add a financial construction to an apartment building that consists of several AOOs. Through this special tax, a reserve fund is created that can be used by the collaborating small AOOs to maintain the building.

8. ASSESSMENT OF ALTERNATIVES

8.1. Introduction to the assessment of alternatives

This chapter will be the first step in answering the second research sub question of research part B. In this chapter, the alternatives that are designed to improve the quality of the administrators and the base of the AOOs will be assessed. This assessment framework from section §6.5 is used to reduce the alternatives from chapter 7 to a shortlist of promising alternative approaches. In the next chapter, combinations of these promising alternatives will be made. Together, these chapters answer the following question:

B.2. Which municipal approaches are, given the overall result in the assessments, able to change the problematic causal relations?

The first step of the assessment in section §8.2 is to check the compliance of the alternatives with the constraints from section §6.3:

- The spending power of AOOs and individual apartment owners: the costs of a potential alternative for the AOO and individual apartment owners cannot exceed their available spending power for investments in energy saving measures. The spending power of an AOO consists of the reserve fund of the AOO, loans from the SVn or other financial organisations, single deposits to the reserve fund, and subsidies;
- The available resources of the municipality for alternative approaches deviate only slightly from its current financial and non-financial resources;
- With regard to property rights (i.e. *het eigendomsrecht*) it is assumed that the formulation of the property rights will not be eased on the short to medium term;
- Also, the (financial) resources of social housing associations and private landlords that are required for alternative approaches may not be significantly higher than the current (financial) resources;
- The current capacity of energy and process consultants and other companies from the building industry, in terms of staff capacity and budget, is a constraining factor for alternative approaches.

Any alternatives that does not comply with one or more constraints is not located within the solution space of figure 33 in section §6.6. This also holds for alternatives that conflict with any of the assumptions from section §6.3. These alternatives are directly excluded from the selection process.

Secondly, the remaining alternatives are assessed with the criteria from section §6.4. This assessment is limited to a quick estimation of the scores on every criterion in section §8.3:

A. Total costs of the alternative for all actors in the system;
B. Quality of the administrators;
C. Number of AOOs with a good base and organisational structure;
D. Number of AOOs in which energy saving measures have been taken.

The input for the scores of an alternative on these criteria comes from the combined insights of the literature study and the interviews. These insights are written down in chapters 3 to 5 of this research. The basis of the scoring system is that the expected effect of the alternative on the medium term (e.g. ten years) is compared with the performance of the current system (as described in chapters 3 and 4). The scoring system distinguishes between a deterioration of the situation, an equal situation, and a slight or large improvement of the situation compared to this performance of the current system and adheres qualitative scores to each option.

Lastly, the scores of an alternative on each criterion are equally weighted in the calculation of its total score in the last sub section of §8.3. Thus, the total score of an alternative is simply the sum of its scores on the four criteria. Based on the total scores, a number of promising alternatives will emerge from the list of alternatives of chapter 7. In section §8.4, an overview is provided of the promising alternatives that are selected for the optimisation of combinations of alternatives in chapter 9.

8.2. First assessment: compliance with assumptions and constraints

The first step of the assessment is to check the compliance of the alternatives with the assumptions and constraints of the assessment framework. The constraints are summarised in the previous section and the assumptions are included in table 36.

Table 36: assumptions and constraints

Assumptions for the system in five to ten years
Governmental regulations on the energetic quality of buildings will remain similar to current regulations
Energy prices may deviate 10% from the current prices for electricity and gas
Costs of energy saving measures will slightly drop with 5-10%
Economic development has a maximum deviation of 5% from the reference point at the beginning of 2016
Breakthrough innovations for energy saving measures are not substantial

Together, these assumptions and constraints are the borders of the solution space from chapter 6. Within this solution space, all alternatives are present that can potentially solve the two problematic causal relations regarding the quality of the administrators and the base of the AOO. By checking whether the alternatives from table 35 in chapter 7 comply with the assumptions and constraints, it is decided which alternatives are located within the solution space. Only the alternatives that are located within the solution space, will be further assessed in the coming sections.

Firstly, the compliance of the alternatives with the five assumptions is checked. The results of this check are displayed in table 37. This table shows that one alternative did not pass this first assessment: *a legal obligation for AOOs to take energy saving measures that have a payback time of less than five years (#16)*. This alternative does not comply with the assumption that no additional governmental regulations on the energetic quality of buildings will come into effect in the short to medium term. This alternative is therefore excluded from the selection process.

Table 37: compliance of alternatives with assumptions

#	Key notion of the alternative	Governmental regulations on the energetic quality of buildings	Energy prices	Costs of energy saving measures	Economic development	Breakthrough innovations for energy saving measures
1.a.	Informing administrators with brochures, informative letters etc.					
1.b.	Provide administrators with ready-to-use information packages					
2.	A course for administrators					
3.a.	Regular meetings of administrators with the municipality					
3.b.	Collaboration of administrators with the municipality					
4.	Make administrators aware of the financial opportunities					
5.	Assign AOOs that were part of the VVE-010 programme to motivated administrators					

6.a.	Platform for customer reviews on the quality of administrators					
6.b.	A black- and whitelist on the quality of administrators.					
7.	Enforceable obligations in the certification system for administrators					
8.	A course for volunteering apartment owners in small AOOs					
9.	Improve the base of the AOO from the inside with the purchase of an apartment					
10.	Increase the frequency of the general meeting of owners to at least twice a year					
11.	Facilitate informal contact among apartment owners					
12.	Inform potential apartment owners on the real monthly costs					
13.	Market parties discourage AOOs to lower the periodic deposit after taking one or more energy saving measures					
14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective					
14.b.	High-quality administrators take the lead on the topic of energy saving measures					
15.	A legal obligation for AOOs to have a multi-year maintenance plan					
16.	A legal obligation for AOOs to take energy saving measures that have a payback time of less than five years	x				

Secondly, the remaining nineteen alternatives are checked on their compliance with the five constraints. The results of this check are displayed in table 38. Three alternatives do not comply with at least one constraint: *assign AOOs that were part of the VVE-010 programme to motivated administrators (#5), enforceable obligations in the certification system for administrators (#7),* and *improve the base of the AOO from the inside with the purchase of an apartment (#9)*. To start, assigning AOOs to certain administrators is in violation of the constraint on property rights. This is because the property rights ensure that, among others, AOOs are free to choose for any administrator they like, irrespective of the preferences of the municipality. Furthermore, the municipality does not have the (financial) resources to enforce any additional obligations to the current certification system for administrators. Finally, both the municipality of Rotterdam and the social housing associations do not have sufficient (financial) resources to purchase apartments in AOOs in order to improve the base of the AOO from the inside.

Table 38: compliance of alternatives with constraints

#	Key notion of the alternative	Spending power of AOOs and apartment owners	(Financial) resources of municipality	Property rights	(Financial) resources of (social) landlords	Capacity of consultants and companies
1.a.	Informing administrators with brochures, informative letters etc.					
1.b.	Provide administrators with ready-to-use information packages					
2.	A course for administrators					
3.a.	Regular meetings of administrators with the municipality					
3.b.	Collaboration of administrators with the municipality					
4.	Make administrators aware of the financial opportunities					
5.	Assign AOOs that were part of the VVE-010 programme to motivated administrators			x		
6.a.	Platform for customer reviews on the quality of administrators					
6.b.	A black- and whitelist on the quality of administrators.					
7.	Enforceable obligations in the certification system for administrators		x			

8.	A course for volunteering apartment owners in small AOOs					
9.	Improve the base of the AOO from the inside with the purchase of an apartment		x		x	
10.	Increase the frequency of the general meeting of owners to at least twice a year					
11.	Facilitate informal contact among apartment owners					
12.	Inform potential apartment owners on the real monthly costs					
13.	Market parties discourage AOOs to lower the periodic deposit after taking one or more energy saving measures					
14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective					
14.b.	High-quality administrators take the lead on the topic of energy saving measures					
15.	A legal obligation for AOOs to have a multi-year maintenance plan					

Thus, four alternatives are found to be outside the solution space, which is demarcated by the assumptions and constraints. These alternatives are excluded from the second assessment in the next section.

8.3. Second assessment: performance according to the four criteria

In this second part of the assessment, the remaining alternatives receive a qualitative score for each of the four criteria from section §6.4:

- Total costs of the alternative for all actors in the system, including the transaction costs. Thus, these are the aggregated costs of the alternative for all actors. These actors are, among others, the municipality, the AOOs, the administrators, and the building industry. In this criterion, all costs are included that are made in a period of up to ten years (the medium term).

- The estimated quality of the administrators. The definition of an administrator of sufficient quality is an administrator that has at least the following characteristics:
    1. Adequate level of knowledge on the topic of energy saving measures;
    2. Motivated to raise the awareness among and inform the AOO on the topic of energy saving measures;
    3. Decisions and behaviour of the administrator are fully in the interest of the AOO.

- The estimated number of AOOs with a good base and organisational structure. An AOO with a good base and organisational structure has at least the following characteristics:
    1. Presence of a qualified daily management of the AOO;
    2. High attendance to or commitment among the general meeting of owners;
    3. A periodic deposit of the owners to the AOO is made;
    4. The presence of an active Board of the AOO regarding energy saving measures;
    5. The presence of a reserve fund, preferably of sufficient size;
    6. The presence of a multi-year maintenance plan.

- The estimated number of AOOs in which energy saving measures have been taken. This indicates the number of AOOs who have successfully gone through the customer journey.

These qualitative scores are based on the combined insights from the literature study and the interviews. These insights are written down in chapters 3 to 5. The basis of the scoring system is shown in figure 34. Each alternative receives four qualitative scores, one for each criterion. These scores are established based on a comparison of effect of the alternative on the medium term (e.g. ten years) with

the performance of the current system (as described in chapters 3 and 4). The scoring system distinguishes between a deterioration of the situation (-1), an equal situation (0), and a slight (+1) or large improvement of the situation (+2) and adheres qualitative scores to each option.

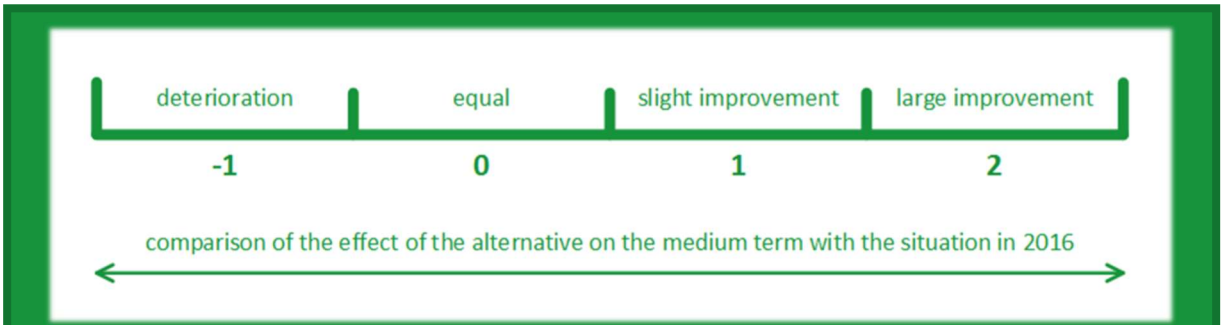


Figure 34: scoring system for the alternatives

For each criterion, the alternatives are assigned to the categories: deterioration of the situation, equal situation, and improvement of the situation. The allocation of alternatives that result in an improvement of the system is done based on the following rule: *all alternatives that effectuate an improvement to the performance of the current system are ranked relative to one another from the alternative with the slightest improvement to the alternative with the largest improvement. The first 50% of the alternatives are attributed to the category of slight improvement and the second 50% is attributed to the category of large improvement*. This is done for each criterion separately. The resulting scores of this second part of the assessment are summarised in table 39. In the following four sub sections, a brief explanation is given of the establishment of the contents of the table.

8.3.1. Total costs of the alternative

This first criterion includes the aggregated costs of the alternative for all actors. These actors are, among others, the municipality, the AOOs, the administrators, and the building industry. For scoring the alternatives, a significant increase of the total costs is described as a deterioration of the situation. Such a significant increase of the total costs is caused by the additional efforts of actors needed for the implementation of the alternative. For example, the collaboration of administrators with specialists of the municipality requires additional efforts from both actors *(#3b)*.

In contrast, some alternatives do not result in a significant increase of the total costs. These alternatives receive a score for an equal situation. This is because the required additional efforts of actors are limited and can be paid for from the budgets of the actors for the medium term. For example, the required efforts of the municipality for informing administrators with brochures, informative letters etc. are limited and can be paid from the current budget *(#1a*).

8.3.2. Quality of the administrators

Secondly, the effect of alternatives on the quality of the administrators is estimated. In this estimation, the effect of the alternative is reviewed on the following three characteristics of an administrator of sufficient quality:

1. Adequate level of knowledge on the topic of energy saving measures;
2. Motivated to raise the awareness among and inform the AOO on the topic of energy saving measures;
3. Decisions and behaviour of the administrator are fully in the interest of the AOO.

Some alternatives do not have any effect on these three characteristics, such that the quality of the administrators does not change. For example, providing administrators with ready-to-use information packages for AOOs does improve the level of knowledge of AOOs *(#1b*). However, this alternative has no effect on the level of knowledge or motivation of administrators and does not ensure that administrators act fully in the interest of the AOO. Within this alternative, the administrators are only passing on information.

Other alternatives slightly or largely improve the quality of the administrators. The distinction between a slight and large improvement is based on the thoroughness and long-term effect of the alternative on these three characteristics. This distinction is illustrated with two alternatives: an online platform for customer reviews on the quality of administrators (*#6a*) and a black- and whitelist on the quality of administrators that is updated by the municipality and social housing associations (*#6b*). Both alternatives improve the quality of administrators by stimulating administrators to act fully in the interest of the AOO. The black- and whitelist is more thorough and more threatening for poor-quality administrators because of the involvement of influential actors, such as the municipality and social housing associations, in this warning system. Therefore, this alternative results in a large improvement of the situation and the online platform results in a slight improvement of the system.

Table 39: performance of alternatives on the four alternatives

#	Key notion of the alternative	Total costs of the alternative	Quality of the administrators	Number of AOOs with a good base and organisational structure	Number of AOOs in which energy saving measures have been taken
1.a.	Informing administrators with brochures, informative letters etc.	0	+1	0	0
1.b.	Provide administrators with ready-to-use information packages	0	0	+1	+1
2.	A course for administrators	-1	+2	+1	+1
3.a.	Regular meetings of administrators with the municipality	0	+1	0	0
3.b.	Collaboration of administrators with the municipality	-1	+2	+2	+2
4.	Make administrators aware of the financial opportunities	0	+2	0	+2
6.a.	Platform for customer reviews on the quality of administrators	-1	+1	+1	0
6.b.	A black- and whitelist on the quality of administrators.	-1	+2	+2	+1
8.	A course for volunteering apartment owners in small AOOs	-1	0	+2	+2
10.	Increase the frequency of the general meeting of owners to at least twice a year	0	0	+1	+1
11.	Facilitate informal contact among apartment owners	0	0	+1	+1
12.	Inform potential apartment owners on the real monthly costs	-1	0	+2	+2
13.	Market parties discourage AOOs to lower the periodic deposit after taking one or more energy saving measures	0	0	+1	0
14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective	0	0	+2	+2
14.b.	High-quality administrators take the lead on the topic of energy saving measures	0	+1	+2	+1
15.	A legal obligation for AOOs to have a multi-year maintenance plan	-1	0	+2	+2

8.3.3. Number of AOOs with a good base and organisational structure

The estimated number of AOOs with a good base and organisational structure is the third criterion. AOOs have a good base and organisational structure if they meet the following characteristics:

1. Presence of a qualified daily management of the AOO;
2. High attendance to or commitment among the general meeting of owners;
3. A periodic deposit of the owners to the AOO is made;
4. The presence of an active Board of the AOO with regard to energy saving measures;
5. The presence of a reserve fund, preferably of sufficient size;
6. The presence of a multi-year maintenance plan.

Some alternatives do not improve the base or organisational structure of the AOO. Most of these alternatives were specially designed for the problematic causal relations regarding the poor quality of administrators. This holds, for example, for making administrators aware of the financial opportunities of stimulating AOOs to take energy saving measures (*#4*). In itself, this alternative does not have a significant effect on any of the six characteristics of an AOO with a good base and organisational structure.

Other alternatives have a positive effect on one or more of these characteristics. For example, informing potential apartment owners on the real monthly costs of their apartment (*#12*) and discouraging AOOs to lower their periodic deposit to the reserve fund after taking energy saving measures (*#13*) have a positive effect on the two financial characteristics. Given that the second one has a potential effect on a relatively small group of AOOs, only AOOs in which energy saving measures have been taken, this alternative results in a slight improvement. In contrast, informing potential apartment owners has a stronger effect on a greater range of AOOs and therefore results in a large improvement on this criterion.

8.3.4. Number of AOOs in which energy saving measures have been taken

Lastly, the final criterion is the estimated number of AOOs in which energy saving measures will be taken because of the alternative. These AOOs will successfully go through the customer journey. A small number of alternatives does not result in a significant increase of the number of AOOs in which energy saving measures have been taken. These alternatives fully focus on improving the quality of the administrators or the quality of the AOO and do not have an indirect positive effect on this final criterion. An example is the regular meetings that are organised with administrators and the municipality (*#3a*). Even though this alternative slightly improves the quality of the administrators, no significant increase in the number of AOOs who have taken energy saving measures is expected.

Other alternatives do result in a higher number of AOOs in which energy saving measures will be taken. For example, high-quality administrators who take the lead on the topic of energy saving measures (*#14b*) result in a slight improvement of this criterion. A large improvement on this criterion is caused by the joint development of a long-term perspective on the apartment building by social housing associations and private landlords together with individual apartment owners in mixed AOOs (*#14a*). The effect of this alternatives is expected to be stronger as the apartment owners are committed to the long-term perspective, whereas in the first alternative the administrator, as an external actor, takes the lead on this topic.

8.3.5. Results of the second assessment

The results of this second assessment are included in table 40. For each criterion, an alternative could potentially receive a score varying from -1 to +2. Thus, the combined score of an alternative could potentially vary from -4 to +8. Given that all results in table 40 are positive, each alternative can improve the current situation within 10 years on at least one of the criteria.

Table 40: results of the second assessment

#	Key notion of the alternative	Result
1.a.	Informing administrators with brochures, informative letters etc.	+1
1.b.	Provide administrators with ready-to-use information packages	+2
2.	A course for administrators	+3
3.a.	Regular meetings of administrators with the municipality	+1
3.b.	Collaboration of administrators with the municipality	+5
4.	Make administrators aware of the financial opportunities	+4
6.a.	Platform for customer reviews on the quality of administrators	+1
6.b.	A black- and whitelist on the quality of administrators.	+4
8.	A course for volunteering apartment owners in small AOOs	+3
10.	Increase the frequency of the general meeting of owners to at least twice a year	+2
11.	Facilitate informal contact among apartment owners	+2
12.	Inform potential apartment owners on the real monthly costs	+3
13.	Market parties discourage AOOs to lower the periodic deposit after taking one or more energy saving measures	+1
14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective	+4
14.b.	High-quality administrators take the lead on the topic of energy saving measures	+4
15.	A legal obligation for AOOs to have a multi-year maintenance plan	+3

As alternatives with a high score are more promising than alternatives with low scores, table is rearranged in table 41. In this table, the alternatives are ranked based on their results from the second assessment. This ranking is used to identify the most promising alternatives for the optimisation of (combinations) of alternatives in chapter 9. Given the ranking in table 41, all alternatives with a score of at least +3 are considered as promising alternatives and are selected for the optimisation in chapter 9.

Table 41: ranking of the alternatives based on the second assessment

#	Key notion of the alternative	Result
3.b.	Collaboration of administrators with the municipality	+5
4.	Make administrators aware of the financial opportunities	+4
6.b.	A black- and whitelist on the quality of administrators.	+4
14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective	+4
14.b.	High-quality administrators take the lead on the topic of energy saving measures	+4
2.	A course for administrators	+3
8.	A course for volunteering apartment owners in small AOOs	+3
12.	Inform potential apartment owners on the real monthly costs	+3
15.	A legal obligation for AOOs to have a multi-year maintenance plan	+3
1.b.	Provide administrators with ready-to-use information packages	+2
10.	Increase the frequency of the general meeting of owners to at least twice a year	+2
11.	Facilitate informal contact among apartment owners	+2
1.a.	Informing administrators with brochures, informative letters etc.	+1
3.a.	Regular meetings of administrators with the municipality	+1
6.a.	Platform for customer reviews on the quality of administrators	+1
13.	Market parties discourage AOOs to lower the periodic deposit after taking one or more energy saving measures	+1

8.4. Conclusion

In this chapter, the first step in answering the final research sub question of research part B is taken. This first step consists of reviewing the alternatives that are designed in chapter 7 according to the assessment framework that is described in section §6.5.

B.2. Which municipal approaches are, given the overall result in the assessments, able to change the problematic causal relations?

To start, the compliance of the alternatives with the assumptions and constraints from section §6.3 was checked. The outcome of this check is that four alternatives do not comply with these assumptions and constraints. These four alternatives in table 42 are excluded from the selection process.

Table 42: excluded alternatives from the selection process (first assessment)

#	Key notion of the alternative
5.	Assign AOOs that were part of the VVE-010 programme to motivated administrators
7.	Enforceable obligations in the certification system for administrators
9.	Improve the base of the AOOs from the inside with the purchase of an apartment
16.	A legal obligation for AOOs to take energy saving measures that have a payback time of less than five years

Secondly, the remaining alternatives are assessed with the criteria from section §6.4. This assessment is limited to a quick estimation of the scores on every criterion. These scores are equally weighted and added for each alternative. This has resulted in a ranking of the remaining alternatives on their total scores. From this ranking, nine promising alternatives have been selected with a significantly positive score (e.g. at least +3). These alternatives are included in table 43. In the next chapter, any reinforcing effects of an alternative on any of the other eight selected alternatives are identified. These reinforcing effects are the basis for making combinations of promising alternative approaches in chapter 9.

Table 43: selected promising alternatives

#	Key notion of the alternative	Result
2.	A course for administrators	+3
3.b.	Collaboration of administrators with the municipality	+5
4.	Make administrators aware of the financial opportunities	+4
6.b.	A black- and whitelist on the quality of administrators.	+4
8.	A course for volunteering apartment owners in small AOOs	+3
12.	Inform potential apartment owners on the real monthly costs	+3
14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective	+4
14.b.	High-quality administrators take the lead on the topic of energy saving measures	+4
15.	A legal obligation for AOOs to have a multi-year maintenance plan	+3

9. OPTIMISING PROMISING ALTERNATIVES

9.1. Introduction to optimising promising alternatives

In this chapter, the search is continued for a municipal approach that can change the selected problematic causal relations. The nine promising alternatives from chapter 8 will be assessed for a third time. This third assessment indicates whether an alternative has a positive reinforcing effect on other alternatives. In short, an alternative has a reinforcing effect on another alternative if it increases the performance of this alternative on at least one of the criteria from section §6.4. These reinforcing effects are identified in section §9.2.

These reinforcing effects are the basis in section §9.3 for making combinations of promising alternatives. The overall performance of such combinations of alternatives is better than the sum of the performances of individual alternatives. This is because the reinforcing effects between alternatives make the combinations of alternatives more effective. In other words, the whole is greater than the sum of its parts. These combinations of promising alternatives are described in more detail in section §9.4. These are the municipal approaches that are able, given their overall results in the assessment to change the problematic causal relations:

B.2. Which municipal approaches are, given the overall result in the assessments, able to change the problematic causal relations?

This chapter is concluded in section §9.5 with an overview of the combinations of promising alternatives. Recommendations for a municipal approach that can change the problematic causal relations are provided in chapter 10.

9.2. Third assessment: reinforcing effects of alternatives

In the previous chapter, nine alternatives have made it through the first and second assessment. These are promising alternatives that may be able to change both problematic causal relations: the poor quality of administrators and the poor quality of the base of the AOO. However, none of these alternatives obtained a positive score on all four criteria in the second assessment (table 39 in section §8.3). Thus, none of these alternatives can sufficiently address both problematic causal relations. This is due to the diversity of these problematic causal relations.

To deal with this diversity and to address both problematic causal relations, combinations of alternatives are needed. The third assessment of the alternatives provides essential information for making potentially strong combinations. In a strong combination of alternatives, the collective performance of the selected alternatives is better than the sum of the individual performances.

In such combinations of alternatives, the performance of one alternative reinforces the performance of another alternative. This is illustrated in figure 35. In this figure, the following situations are shown:

1. Two stand-alone alternatives;
2. A poor combination of two alternatives. There are no reinforcing effects;
3. A moderate combination of two alternatives. There is a one-way reinforcing effect between alternatives A and B;
4. A strong combination of two alternatives. There is a two-way reinforcing effect between alternatives A and B.

In this assessment, every possible combination of two alternatives is considered. For each combination, the correct situation is selected: no reinforcing effects, a one-way reinforcing effect or a two-way reinforcing effect. To select the correct situation, one question needs to be answered: *does alternative A enhance the performance of alternative B?*

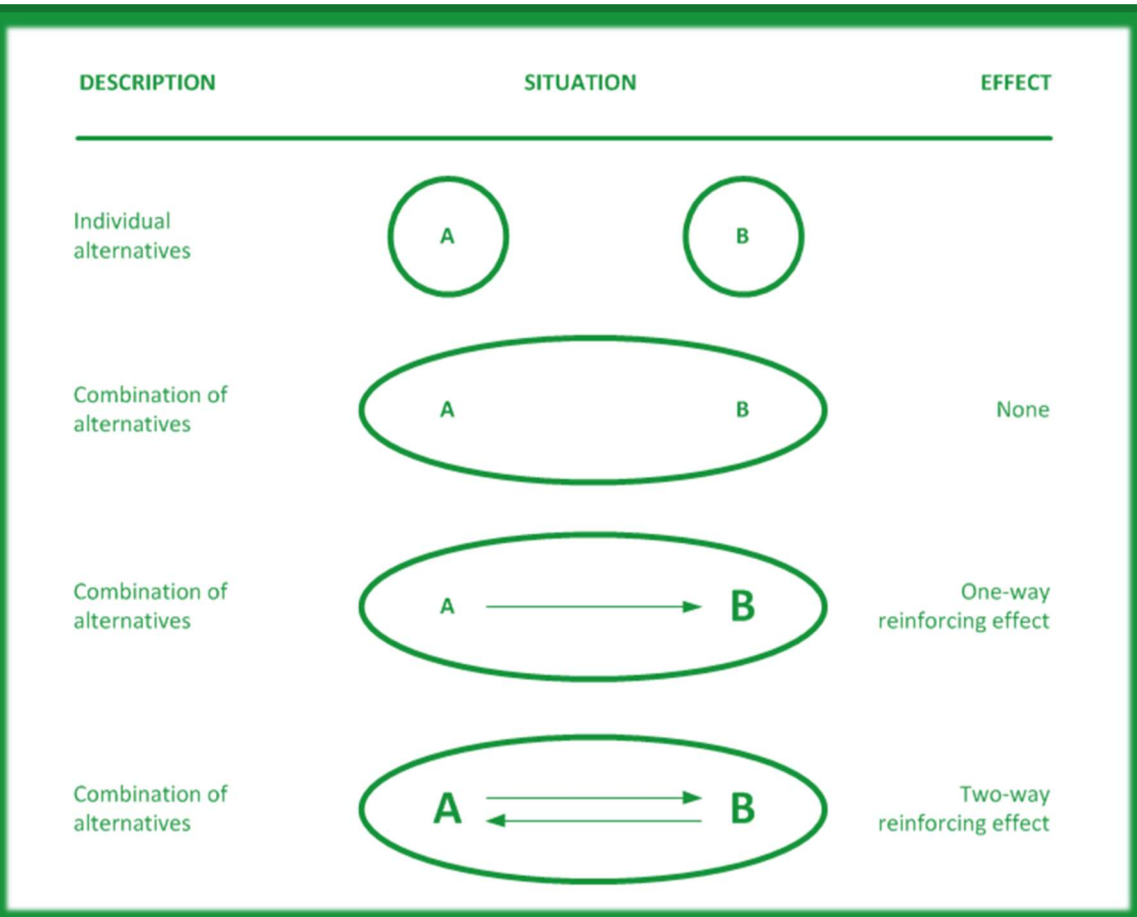


Figure 35: reinforcing effects in a combination of alternatives

The results of the third assessment are included in table 44. In each cell, the effect of the alternative in the corresponding row on the alternative in the corresponding column is shown. If there are no reinforcing effects for a combination, a score of 0 is included in the corresponding cell of the table. A one-way reinforcing effect is indicated with + and a two-way reinforcing effect with ++.

Table 44: reinforcing effects of alternatives

#	Key notion of the alternative	2	3.b.	4	6.b.	8	12	14.a.	14.b.	15
2.	A course for administrators		+	++	0	0	0	0	+	0
3.b.	Collaboration of administrators with the municipality	0		++	++	0	+	0	++	0
4.	Make administrators aware of the financial opportunities	++	++		0	0	0	0	++	0
6.b.	A black- and whitelist on the quality of administrators.	+	++	0		0	0	0	++	0
8.	A course for volunteering apartment owners in small AOOs	0	0	0	0		+	+	0	0
12.	Inform potential apartment owners on the real monthly costs	0	0	0	0	0		++	0	0
14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective	0	0	0	0	0	++		++	++
14.b.	High-quality administrators take the lead on the topic of energy saving measures	0	++	++	++	0	0	++		0
15.	A legal obligation for AOOs to have a multi-year maintenance plan	+	+	+	0	+	+	++	+	

For nine combinations of alternatives a two-way reinforcing effect is found in this assessment. The combinations of alternatives are shown in table 45. This information is used in section §9.3 to make combinations of promising alternatives. These combinations consist of more than two alternatives.

Table 45: combinations of two-way reinforcing alternatives

#	#	First alternative	#	Second alternative
1.	2.	A course for administrators	4.	Make administrators aware of the financial opportunities
2.	3.b.	Collaboration of administrators with the municipality	4.	Make administrators aware of the financial opportunities
3.	3.b.	Collaboration of administrators with the municipality	6.b.	A black- and whitelist on the quality of administrators.
4.	3.b.	Collaboration of administrators with the municipality	14.b.	High-quality administrators take the lead on the topic of energy saving measures
5.	4.	Make administrators aware of the financial opportunities	14.b.	High-quality administrators take the lead on the topic of energy saving measures
6.	6.b.	A black- and whitelist on the quality of administrators.	14.b.	High-quality administrators take the lead on the topic of energy saving measures
7.	12.	Inform potential apartment owners on the real monthly costs	14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective
8.	14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective	14.b.	High-quality administrators take the lead on the topic of energy saving measures
9.	14.a.	In mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective	15.	A legal obligation for AOOs to have a multi-year maintenance plan

9.3. Combining promising alternatives

This section will result in a number of combinations of promising alternatives. To make these combinations, several decisions need to be made. For example, which alternatives are combined? How many alternatives are included in one alternative? It is important that these decisions are supported by reliable information. The required information for making these decisions, is derived from the assessments that are conducted in chapters 8 and 9.

This information is used to check whether combinations of alternatives meet the following conditions:

1. In each combination, at least one pair of alternatives with a two-way reinforcing effect is included (§9.3, table 45);
2. A combination of alternatives addresses both problematic causal relations:
   a. At least one alternative has a score of +2 on the criterion *quality of the administrators* (§8.3, table 39);
   b. At least one alternative has a score of +2 on the criterion *number of AOOs with a good base and organisational structure* (§8.3, table 39);
3. The combination of alternatives has a substantial positive effect on the four criteria. The added result of the individual alternatives is at least + 12. This score ensures combinations of at least three alternatives (§8.3.5, table 40).

Firstly, these conditions ensure that each combination does include at least one two-way reinforcing effect. This will make the performance of the alternative better than the sum of the performances of individual alternatives. Secondly, the conditions make that the combination of alternatives will address

both problematic causal relations. Lastly, the conditions request a total score for the combination of alternatives of at least +12. On average, such a combination of alternatives will have a significant positive effect on all four criteria.

To find combinations of alternatives that meet these three conditions, the following procedure is followed:

1. Select a combination of alternatives with a two-way reinforcing effect from table 45/figure 36;
2. Check whether this combination addresses both problematic causal relations;
   a. If yes: proceed to step 3;
   b. If no: add an alternative that sufficiently addresses (+2) the remaining problematic causal relation and that has a two-way reinforcing effect with one of the alternatives from step 1;
3. Check whether the added result of the alternatives is at least +12;
   a. If yes: a combination that meets the three conditions is found;
   b. If no: add another alternative that has a two-way reinforcing effect with one of the alternatives from step 1 or 2;

This procedure has identified seven combinations of three alternatives that meet these three conditions. The combinations are shown in table 46. It is important to note that these are minimum combinations of alternatives. By adding more alternatives to the combinations, the collective performance may be further improved. However, adding more alternatives might also increase the total costs of the combination. Several alternatives are included in more than one combination. The exceptions being alternatives 2, 8, 12 and 15. These alternatives will be added to the minimum combinations at the end of this section.

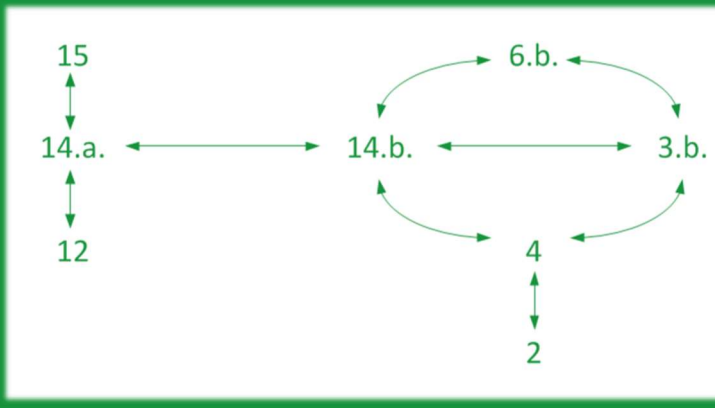


Figure 36: visualisation of two-way reinforcing effects between alternatives

Table 46: minimum combinations of alternatives

#	Alternative A	Alternative B	Alternative C	1. Number of two-way reinforcing effects	2a. Total score on *quality of the administrator*	2b.Total score on *number of AOOs with a good base and organisational structure*	3. Total result of the alternatives
1.	2	4	3.b.	2	3	1	12
2.	3.b.	4	6.b.	**2**	**3**	**2**	**13**
3.	3.b.	4	14.b.	**3**	**2**	**2**	**13**
4.	3.b.	6.b.	14.b.	**3**	**2**	**3**	**13**
5.	3.b.	14.b.	14.a.	2	1	3	13
6.	4	14.b.	14.a.	2	1	2	12
7.	6.b.	14.b.	14.a.	**2**	**1**	**3**	**12**

In the last four columns of table 46, the compliance of the minimum combinations with the three conditions is shown. Firstly, the number of two-way reinforcing effects among the alternatives is determined (figure 36). Secondly, all (+2) scores of the alternatives on the criterion *quality of the administrator* are counted. The same is done for the criterion *number of AOOs with a good base and organisational structure*. Lastly, the results of all alternatives in the second assessment on all four criteria (§8.3.5) are added.

The seven minimum combinations show large similarities, as several alternatives are included in more than one combination. It is not sensible to continue this research with seven strongly overlapping combinations of alternatives. Therefore, the three dominant and on all conditions best performing minimum combinations are selected from table 46. These are the combinations 2 up to and including 4. To limit the overlap in combinations, instead of combination 5, combination 7 is added to the list. Otherwise, every combination would include alternative 3.b, the collaboration of administrators with the municipality.

The following alternatives are not yet included in this selection of four minimum combinations of alternatives: 2, 8, 12, and 15. The next step is to make optimal combinations of alternatives by adding these remaining alternatives to the minimum combinations. This will add some diversity to the four municipal approaches. The alternatives are assigned to a combination, based on its added value for that combination. This added value can be deduced from table 44 on the reinforcing effects. For each of the remaining alternatives, two scores are deduced from table 44. The first score in table 47 is the sum of the reinforcing effects of the remaining alternative on the combination. The second score is the sum of the reinforcing effects of the alternatives in the combination on the remaining alternative.

Table 47: added value of unused alternatives on minimum combinations

	Combination			Remaining alternatives							
#	A	B	C	2		8		12		15	
2.	3.b.	4	6.b.	+3	+3	0	0	0	+1	+2	0
3.	3.b.	4	14.b.	+4	+2	0	0	0	+1	+3	0
4.	3.b.	6.b.	14.b.	+2	+1	0	0	0	+1	+2	0
7.	6.b.	14.b.	14.a.	+1	+1	+1	0	+2	+3	+3	+2

The aim is to add each remaining alternative to one combination. However, arriving at a conclusion based on the information in table 47, is not straightforward. The following line of reasoning is used to determine which alternative is added to which combination:

1. Firstly, alternative 8 is added to combination 7 as this alternative has no added value for other combinations;
2. Likewise, alternative 12 is added to combination 7 based on its added value. A positive addition is that alternative 8, which was just added to this combination, has a one-way reinforcing effect on this alternative;
3. Also, alternative 15 has most added value for combination 7. However, it does not seem reasonable to add three alternatives to one combination. Therefore, this alternative is added to combination 3;
4. Lastly, alternative 2 has similar added values for combinations 2 and 3. Given that one alternative is already added to combination 3, this alternative is added to combination 2.

9.4. Combinations of promising alternatives

In the previous section, four combinations of promising alternatives are composed. Complex procedures and lines of reasoning were needed to make these combinations. This section will provide a description of each combination. This description includes the following elements:

- The essence of the combination;
- The alternatives that are combined and their interactions;
- The character of the combination:
  - Carrot or stick;
  - Market-led or government-controlled;
  - Aimed at administrators or AOOs;
- The role of the municipality;
- The potential long-term effects in terms of number of energy saving measures taken.

The following four municipal approaches are discussed in sub sections §9.4.1 up to and including §9.4.4:

- The first combination of alternatives is a municipal approach with a strong role for the municipality in educating, collaborating with and monitoring administrators. The key assumption of this approach is that the resulting improvement of the overall quality of administrators will have a positive effect on the quality of the base of AOOs.

- Secondly, a combination of alternatives is aimed at the supply and demand in the developing market of energy saving measures. This approach aims to encourage more AOOs to hire an administrator and to follow his advice on taking energy saving measures. By pointing out the financial opportunities and through a collaboration, the municipality wants to make these administrators more interested in energy saving measures.

- The third municipal approach presents a measuring bar for assessing the quality of administrators. Thus, this approach will further develop the element of monitoring administrators from the first combination of alternatives.

- Lastly, the fourth municipal approach stimulates the creation of a joint long-term vision on the apartment building by individual apartment owners, social and private landlords, and administrators. Preferably, this long-term vision will structure the decision-making process within the AOO and will reduce the focus on the short-term selfish interests of the apartment owners.

9.4.1. Education, collaboration and monitoring for administrators

The first combination of alternatives is fully focused on improving the overall quality of administrators. Within three phases – education, collaboration, and monitoring – the municipality wants to train high-quality administrators. The interpretation of this first municipal approach may include a process, as visualised in figure 37, and various elements, as described below.

Starting with a course, administrators are taught on various energy saving measures and on combining these measures with the normal maintenance of the building. This course is offered by the municipality of Rotterdam to the administrators. By actively following this course, the administrators will obtain an adequate level of knowledge on the topic of energy saving measures.

However, an adequate level of knowledge on this topic is no guarantee that administrators will stimulate AOOs to take energy saving measures. Therefore, it is important to motivate administrators. This can be done by pointing out the financial opportunities of stimulating AOOs to reduce their energy consumption. These financial opportunities include additional tasks for which the administrator can be paid, such as calculating the energy costs per apartment or arranging the periodic payment of fees to (energy) companies.

Subsequently, administrators can practice their new insights – gained from the education phase – in practice. This is done in collaboration with specialists from the municipality. Promising AOOs are selected by the administrator, based on criteria such as maintenance level, energy label and attendance to general meetings of owners. These AOOs will be informed by the administrator and the municipality on energy saving measures during one or more meetings. The period of collaboration will take 6 up to 12 months. Afterwards, administrators should be able and motivated to make their AOOs aware of the potential benefits of taking energy saving measures. Whether this is really the case, will be monitored by the municipality with a black- and whitelist.

During this collaboration with the administrators, the municipality can identify low-quality administrators. Some administrators who pop up on the blacklist might get a second chance in the education

phase. Otherwise, the municipality will actively inform AOOs, whose administrators are on the blacklist, on the quality of their administrator. This way, some AOOs may drop their blacklist administrators, such that these administrators will be punished for their reluctance to contribute to the uptake of energy saving measures by AOOs.

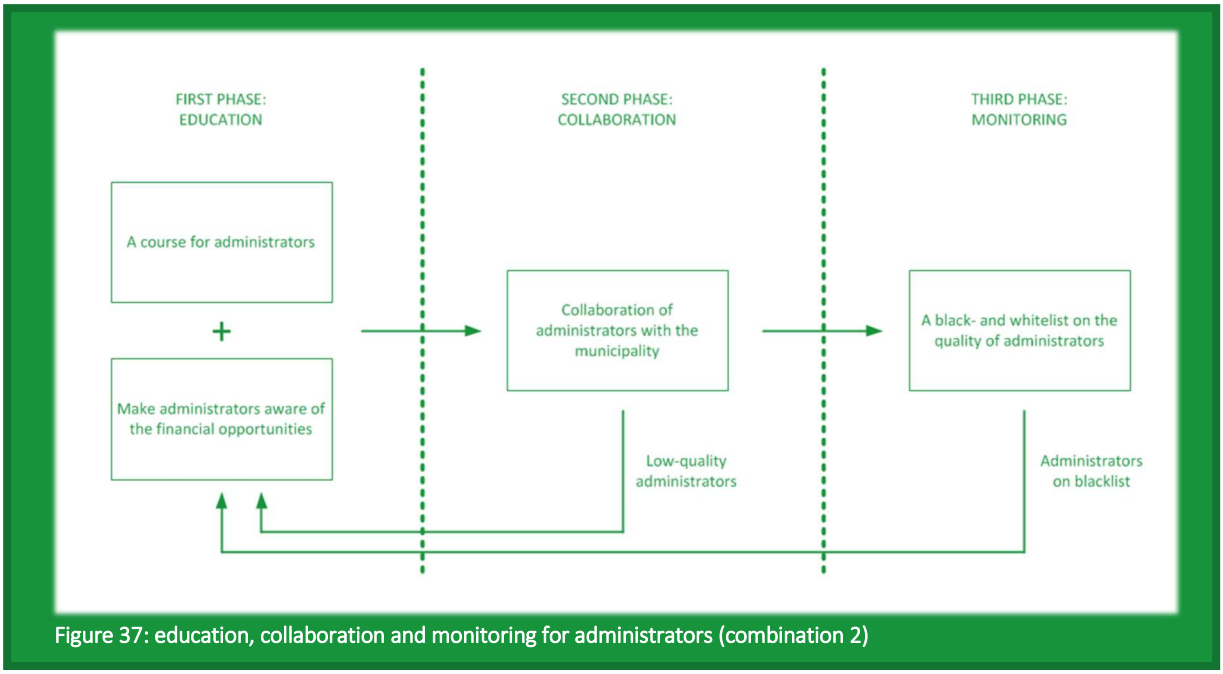


Figure 37: education, collaboration and monitoring for administrators (combination 2)

This strongly government-led combination of alternatives influences the overall quality of administrators. With this approach, high-quality administrators are trained (carrot) and low-quality administrators are punished (stick). By improving the overall quality of administrators, it is likely that this has a smaller, but also positive, effect on the quality of the base of their AOOs. These AOOs are more likely to make it through the first stages of the customer journey and to arrive at a decision-making process on energy saving measures.

Naturally, this municipal approach does not have a direct or indirect effect on AOOs without an administrator. This is a downside of the approach. The rationale of this approach is that administrators can be the kick-starters for AOOs to take energy saving measures. Once this first group of AOOs – with an administrator – has successfully made it through the customer journey for energy saving measures, a new approach can be designed for stimulating AOOs without an administrator.

9.4.2. Creating supply and demand in a developing market

The second combination of alternatives consists of four steps. With these four steps, both supply and demand are created on the underdeveloped market of AOOs and energy saving measures. Currently, most administrators do not advise AOOs on this topic and AOOs do not ask for it. This process to create a new market for advice on energy saving measures could resemble the process from figure 38.

The first step of this process is to include a new legal obligation in the Fifth Book of the Civil Code. This is an obligation for all AOOs to have a multi-year maintenance plan. Currently, the multi-year maintenance plan is only mandatory for AOOs that were built from 2006 onwards. This step cannot be taken by the municipality of Rotterdam. Changes to the Fifth Book of the Civil Code can only be made by the national government. The legal obligation makes that AOOs are more likely to hire an administrator to

assist them with the multi-year maintenance plan. An additional advantage is that a multi-year maintenance plan enables AOOs to develop a long-term vision on the maintenance and improvement of the apartment building.

The second step is to make administrators aware of new financial opportunities. They can offer additional tasks to AOOs who need a new multi-year maintenance plan. Or administrators can offer additional tasks to AOOs who want to invest in energy saving measures. These financial opportunities are pointed out by the municipality of Rotterdam and VVE-010 in special seminars. The aim is to make administrators more interested in the AOO customer group. With the definition of interested being that administrators want to invest time in AOOs and that they actively advise AOOs on long-term issues.

Thirdly, the municipality of Rotterdam will start a collaboration with the administrators. This collaboration focusses on administrators who have become interested in advising AOOs on their long-term vision of the apartment building. During this collaboration, the administrators are trained and motivated by the municipality to provide AOOs with high quality advice on maintenance and energy saving measures. Besides, this collaboration with the municipality will gain trust from AOOs in administrators. This is because the municipality is viewed by AOOs as an independent, objective and trustworthy organisation. Thus, in this step both administrators and AOOs are prepared for new interactions on the advice market.

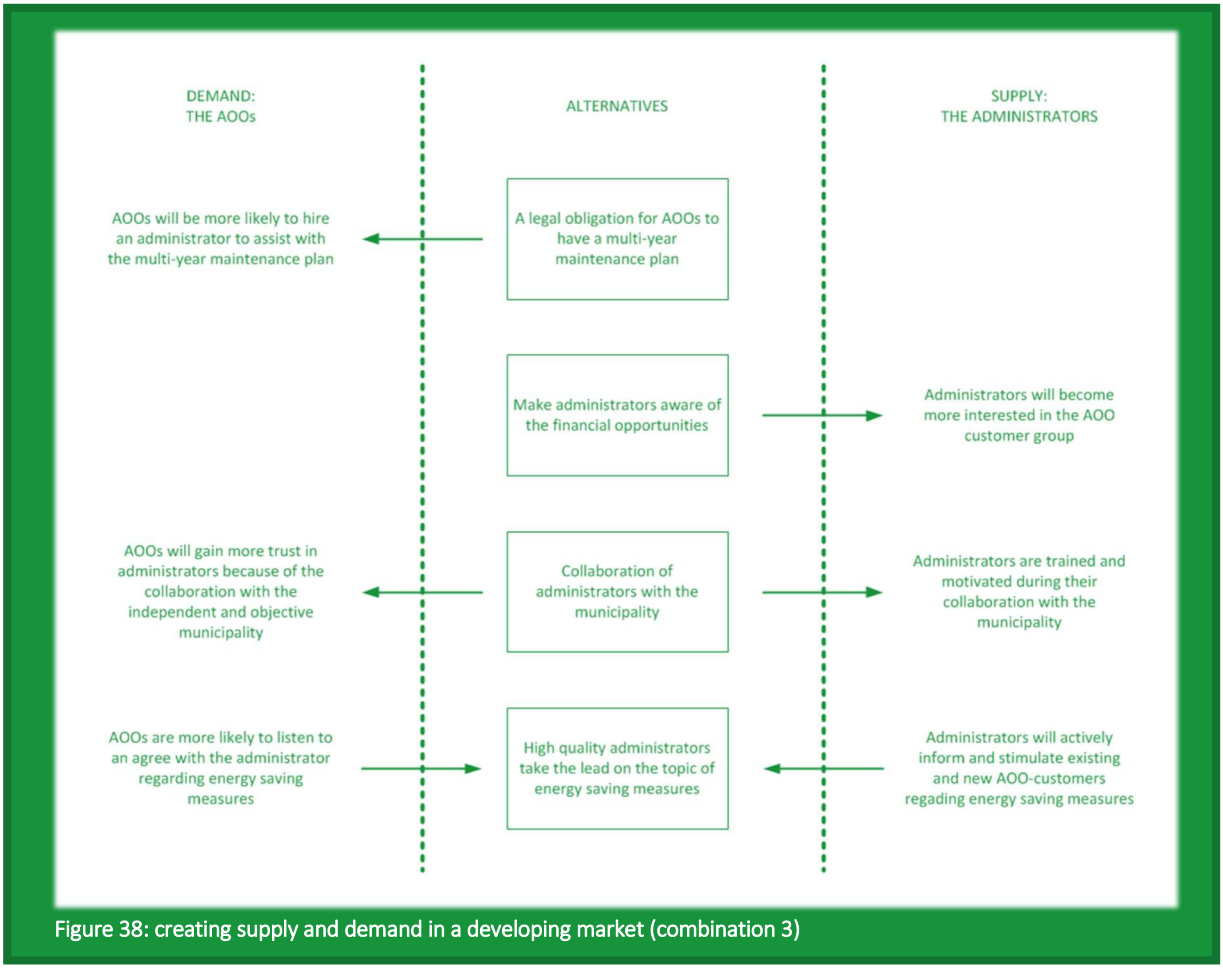


Figure 38: creating supply and demand in a developing market (combination 3)

Lastly, the municipality will withdraw from the market. From this point, the administrators take the lead in advising AOOs on the topic of energy saving measures. With high quality advice and interesting offers, administrators will aim to trigger AOOs to invest in the reduction of their energy consumption. It is the challenge of the administrators to match their supply with the demand of the AOOs on the market.

In a nutshell, the national government will create the conditions for a developing market for advising AOOs on energy saving measures. This is done with a new legal obligation for AOOs. The municipality of Rotterdam will guide, train and motivate administrators to create the supply on the market. Gradually, the role of the municipality will decrease in this process. Ultimately, the demand (the AOOs) and the supply (the administrators) will meet on the market for advice on the long-term vision for the apartment building. Potentially this will result in more AOOs that will take energy saving measures. These AOOs are more often assisted by trained and motivated administrators.

When this combination of promising alternatives succeeds in developing a market for advising AOOs on energy saving measures, it is essential that also other market parties are willing to do business with AOOs. A follow-up consisting of additional steps is needed to stimulate these other market parties, especially companies from the building industry, to do business with AOOs.

9.4.3. Measuring bar for the quality of administrators

The third combination of alternatives is, in a nutshell, a measuring bar for the quality of administrators. This sub section presents a possible design for such a measuring bar. Based on the ranking of an administrator on the measuring bar, the municipality of Rotterdam will decide whether to start a collaboration with the administrator. Ultimately, this measuring bar should make the differences in quality between administrators more transparent for both the municipality and AOOs. The three steps to start and update this measuring bar are visualised and briefly described in figure 39.

The measuring bar for the quality of administrators is a sliding scale from low-quality to high-quality administrators. In between, the administrators shift from a blacklist, through a greylist, to a whitelist. An initial classification of the administrators is needed to start using the measuring bar. This initial classification is made based on the available information on administrators from the municipality of Rotterdam, VVE-010, and VvE Belang. With this information, the administrators are classified according to the following categories:

- *Low-quality:* in case of serious complaints by at least ten AOOs in the previous year. Serious complaints are, for example, that the administrator is negligent in meeting its legal obligations or that the behaviour of the administrator conflicts with the interests of the AOO;
- *Blacklist:* in case of complaints by at least five AOOs in the previous year. For example, complaints regarding a sloppy administration, a lack of commitment or favouring subcontractors;
- *Greylist:* in case of insufficient information to classify the administrator;
- *Whitelist:* in case of less than five complaints by AOOs in the previous year and if the municipality has a positive viewpoint on the administrator;
- *High-quality:* in case of less than five complaints by AOOs in the previous year and if the municipality has a positive viewpoint on the administrator and if the administrator is known to advise AOOs on maintenance and energy saving measures.

This classification of the administrators needs to be updated at least every year, based on complaints by AOOs. For this, the complaints of AOOs need to be collected through a joint effort of the municipality of Rotterdam, VVE-010, and VvE Belang. Complaints of AOOs that are actively shared with these organisations need to be registered. Furthermore, a yearly survey is send to a representing share of all AOOs in Rotterdam. With this information, the classifications of administrators on the measuring bar can be updated every year. These classifications are published every year, by for example VvE Belang, to improve the transparency on the varying quality of administrators for AOOs.

Based on the classifications, the municipality of Rotterdam will select a number of administrators from the grey- and whitelist. With these administrators, the municipality will try to initiate a collaboration of one year. In this year, the municipality aims to train and stimulate the administrators to improve the

quality of their services. The goal is to stimulate the administrators to take the lead on the topic of energy saving measures. Meanwhile, the municipality is able to get to know a number of administrators better. These new insights may help the municipality in classifying these administrators. This is especially relevant for administrators on the greylist.

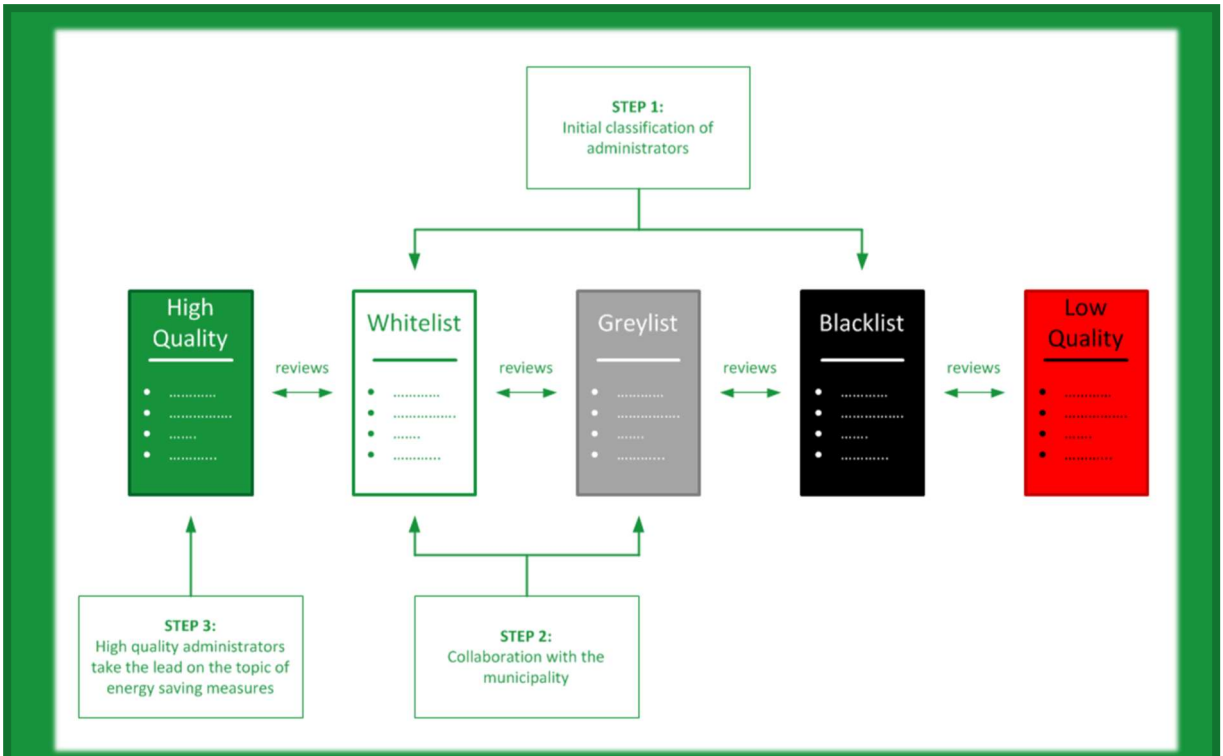


Figure 39: a measuring bar for the quality of administrators (combination 4)

A potential long-term effect of this municipal approach is that AOOs can select an administrator of sufficient quality. Furthermore, administrators are stimulated to improve the quality of their services with this measuring bar. Lastly, the administrators of sufficient quality are stimulated to take the lead in advising AOOs on energy saving measures. Thus, this alternative addresses the quality of the base of the AOO and the quality of the administrator and may have a positive effect on the number of energy saving measures that are taken by AOOs.

9.4.4. Creating a joint long-term vision on the apartment building

Lastly, the fourth combination of alternatives is about creating a joint long-term vision on the apartment building. This sub section presents a possible design for the municipal approach. From two sides, attempts are made to reach a joint long-term vision. On the one hand, AOOs are informed on and stimulated to develop a long-term perspective for their apartment buildings. On the other hand, administrators are challenged by the municipality to take the lead on the topic of energy saving measures. Both sides are visualised in figure 40.

The first pillar of this combination addresses the AOOs. The first step is to inform potential apartment owners on the real monthly costs of the AOO, as the periodic deposit is often too low. Potential apartment owners may be informed via the Dutch home sales website *Funda*. This would be an addition to the existing AOO checklist on this platform. Moreover, involving brokers in informing potential apartment owners would significantly increase the efficiency of this effort. Initially, only a warning is communicated via Funda and the brokers if the periodic deposit of the AOO is too low to pay for normal maintenance of the apartment building. Later, an estimation of the real monthly costs to pay for normal

maintenance may be calculated and communicated. Hopefully, this measure will discourage potential apartment owners to buy an apartment that they cannot afford in the long run.

The second step is to open the existing course for AOOs on energy saving measures for a larger audience. Currently, only a select number of apartment owners can follow this course that is paid for by the municipality. This course is particularly important for small AOOs. This is because certainly not every small AOO is able to hire an administrator. Neither do all small AOOs have a social housing association or a private landlord in their midst. With this course, small AOOs are trained to be autarkic in developing a long-term perspective on their apartment buildings. This long-term perspective is a starting point for the discussion on energy saving measures.

Lastly, social housing associations and private landlords with property in mixed AOOs are challenged by the municipality to develop a joint long-term vision on the building. This vision is a coproduction of these social housing associations and private landlords on the one hand and the individual apartment owners on the other hand. Through the development of a joint vision, the tension between the interests of the large (social) landlords and the interests of the individual apartment owners may be partly removed. But more importantly, this long-term vision is a window of opportunity to discuss the topic of energy saving measures.

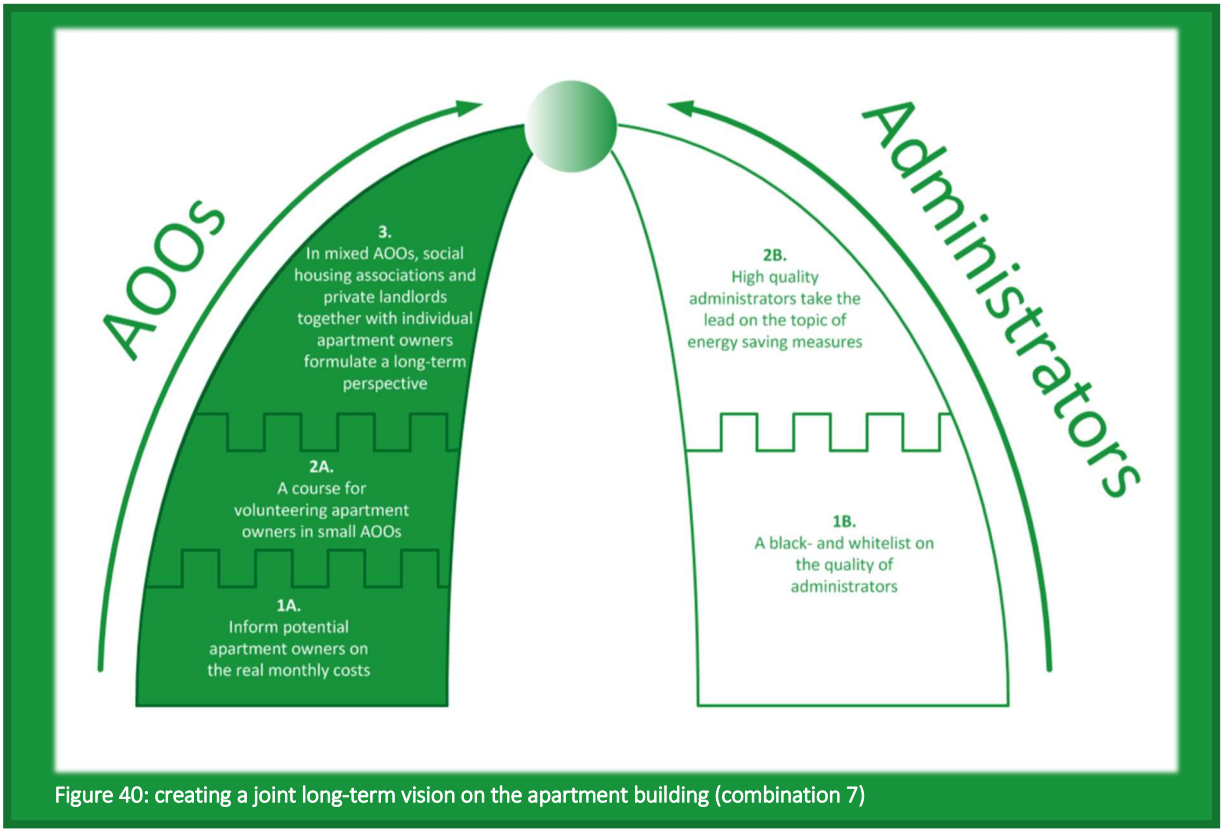


Figure 40: creating a joint long-term vision on the apartment building (combination 7)

The second and less extensive pillar of this combination of alternatives addresses the administrators. With a black- and whitelist on administrators, the municipality wants to stimulate these administrators to improve the quality of their services. The municipality will facilitate administrators on the whitelist, such that they can take the lead on the topic of energy saving measures. These high-quality administrators give a boost to the AOOs that are informed and stimulated with the measures from the first pillar.

The potential effects of this combination of alternatives are, to start, that less apartments will be bought by buyers who cannot afford the real monthly costs for normal maintenance of the building. On the long run, this will make it easier for AOOs to increase the periodic deposit to a sufficient height. This

higher periodic deposit is essential to carry out the plans from the long-term vision. Secondly, AOOs – including small and mixed AOOs – are stimulated and facilitated to develop a long-term vision on the apartment building. Such a long-term vision is a productive starting point for a discussion on energy saving measures. Lastly, administrators are challenged by the municipality to take the lead on the topic of energy saving measures. These administrators can boost the discussion in AOOs on this topic during the development of the joint vision.

9.5. Conclusion

In the previous chapters, numerous alternatives are designed and assessed to solve the problematic causal relations regarding the quality of the base of the AOO and the quality of the administrator. This chapter is a continuation of these chapters and will answer the following research sub question:

B.2. Which municipal approaches are, given the overall result in the assessments, able to change the problematic causal relations?

The nine selected promising alternatives from chapter 8 are the starting point for making a number of combinations of alternatives. To make these combinations, the information from the first two assessments in chapter 8 is combined with new clues from a third assessment at the beginning of this chapter.

In this third assessment, the reinforcing effects from one alternative on other alternatives are identified. If alternative A does improve the performance of alternative B, this is defined as a one-way reinforcing effect. If alternative B does also improve the performance of alternative A, this is called a two-way reinforcing effect. In total, nine two-way reinforcing effects are identified. These reinforcing effects make the performance of the whole greater than the sum of the performances of the individual alternatives.

Subsequently, a few conditions are formulated for making combinations of the nine promising alternatives. For example, a condition is that each combination of alternatives has at least one two-way reinforcing effect. Other conditions relate to the effect of the combination of alternatives on both problematic causal relations. Based on these conditions, a procedure has been followed to make combinations of promising alternatives. This resulted in four combinations of promising alternatives, which are briefly summarised in tables 48 and 49. These are the municipal approaches that, given the overall result in the assessments, can change the problematic causal relations.

Table 48: overview of combinations of promising alternatives I

#	Essence	Carrot/ Stick	Market/ Government	AOOs/ administrator	Role of municipality
1.	Educating, collaborating with and monitoring administrators	Both	Government	Administrator	Active
2.	Creating supply and demand in the developing market of energy saving measures	Both	Both	Both	Gradually less active
3.	A measuring bar for the quality of administrators	Both	Both	Administrator	Initiative
4.	Creating a joint long-term vision on the apartment building	None	Government	AOOs	Stimulating and facilitating

Table 49: overview of combinations of promising alternatives II

#	Element	Description
1.	Essence	Educating, collaborating with and monitoring administrators
	Alternatives	• a course for administrators • make administrators aware of the financial opportunities • collaboration of administrators with the municipality • a black- and whitelist on the quality of administrators
	Potential long-term effects	High overall quality of administrators. Potentially an improvement of the overall quality of the base of AOOs.
2.	Essence	Creating supply and demand in the developing market of energy saving measures
	Alternatives	• a legal obligation for AOOs to have a multi-year maintenance plan • make administrators aware of the financial opportunities • collaboration of administrators with the municipality • high-quality administrators take the lead on the topic of energy saving measures
	Potential long-term effects	AOOs may develop a long-term vision on the apartment building and are more often assisted by educated and motivated administrators.
3.	Essence	A measuring bar for the quality of administrators
	Alternatives	• a black- and whitelist on the quality of administrators • collaboration of administrators with the municipality • high-quality administrators take the lead on the topic of energy saving measures
	Potential long-term effects	Firstly, AOOs get access to information on the quality of administrators. This helps AOOs to select an administrator of sufficient quality. Secondly, administrators are stimulated with the measuring bar to improve the quality of their services to AOOs. Lastly, administrators are stimulated by the municipality to take the lead on saving energy.
4.	Essence	Creating a joint long-term vision on the apartment building
	Alternatives	• inform potential apartment owners on the real monthly costs • a course for volunteering apartment owners in small AOOs • in mixed AOOs, social housing associations and private landlords together with individual apartment owners formulate a long-term perspective • a black- and whitelist on the quality of administrators • high-quality administrators take the lead on the topic of energy saving measures
	Potential long-term effects	Less apartments will be bought by buyers who cannot afford the real monthly costs. This makes it easier for AOOs to increase the periodic deposit, which is needed for the investments from the long-term vision. Such a vision is developed by more and more AOOs due to the stimulating and facilitating role of municipality and administrators.

These four combinations of promising alternatives are input for the next chapter in part C of this research. In that chapter, recommendations will be given for a suitable municipal approach that is able to change the problematic causal relations regarding the quality of the base of the AOO and the quality of the administrator.

10. RECOMMENDATIONS FOR A MUNICIPAL APPROACH

10.1. Introduction to recommendations for municipal approach

Four municipal approaches – combinations of promising alternatives – are presented in the previous chapter. Basically, these municipal approaches are based on the insights from the literature study and the interviews with respondents from the AOO practice. However, to arrive at these four municipal approaches also several assumptions and decisions have been made. What is the effect of these assumptions and decisions: do the municipal approaches solve the problematic causal relations that are present in the current system? And which type of municipal approach is best suited to change these problematic causal relations? These questions will be answered in this chapter. With these answers, also the main research question can be answered:

Which type of municipal approach is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings?

The type of municipal approach, that can change the problematic causal relations, will be described with a number of recommendations in this chapter. These recommendations identify the most important elements that are part of such a municipal approach. Also, the recommendations mention a number of aspects that should be considered, when designing such a municipal approach. These recommendations are based on the key insights from this research and on the results of an expert validation of the four municipal approaches.

This expert validation is a session that is organised with experts from the AOO practice. In this session, experts from the municipality of Rotterdam and VVE-010 were invited. They are asked to react to the effect and the practicability of the four municipal approaches. During this session and in a follow-up online survey, these experts have named strong and weak points for each of the four municipal approaches. From these strong and weak points, a number of practical recommendations can be deduced for a municipal approach, that is able to change the problematic causal relations in practice. Section §10.2 will describe the expert validation in more detail and will present the resulting strong and weak points for each municipal approach.

These strong and weak points are used in section §10.3 to arrive at recommendations for a municipal approach. The recommendations are also based on the key insights of the analysis of the current system in chapters 3 and 4 and on the results of the assessments of the alternatives in chapters 8 and 9. An overview and conclusion of this chapter is provided in section §10.4.

10.2. Expert validation: strong and weak points

The expert validation of the four municipal approaches took place in July 2017. In total 11 experts from the municipality of Rotterdam and VVE-010 participated in this session. All experts are experienced in working with AOOs. Their professional roles vary from building inspectors, to policy makers for housing quality and for the energetic quality of the housing stock. This group of experts is less diverse than the group of respondents that were interviewed in this research. However, this is in line with the objective of the expert validation. The objective of the expert validation is to find out which type of municipal approach is truly able to address the problematic causal relations. This selected group of experts is able, given their experience in daily practice, to estimate the effects of the four municipal approaches and the practicability of these approaches within their organisations.

The session with these experts is a combination of a presentation and an open discussion. The contents of the presentation include the main research question and the research objective from section §2.3, a brief overview of the results of the analysis in chapter 4, a description of the selected problematic causal

relations from section §6.2, and a strong emphasis on the four municipal approaches from chapter 9. Because of the limited time available for the subsequent discussion, an online survey was used to gather the reactions of the experts for each of the four municipal approaches. This online survey is completed by eight experts and has provided most input for the strong and weak points of the four municipal approaches. As a reminder, the strong and weak points of the following four municipal approaches will be discussed in the remainder of this section:

1. A combination of education, collaboration and monitoring for administrators with a strong role for the municipality;
2. Creating supply and demand in a developing market for advice on energy saving measures, that is provided by administrators to AOOs;
3. A measuring bar for the quality of administrators with a strong emphasis on monitoring the performance of the administrators;
4. And creating a joint long-term vision on the apartment building with the combined efforts of individual apartment owners, social and private landlords, and administrators.

These four municipal approaches are discussed in the upcoming sub sections §10.2.1 up to and including §10.2.4.

10.2.1. Education, collaboration and monitoring for administrators

For the first municipal approach, that uses education, collaboration and monitoring to improve the overall quality of administrators, the experts have identified a number of strong points. They state that a course on energy saving measures and on combining these measures with the normal maintenance of the building, is an effective tool to improve the level of knowledge of administrators. An adequate level of knowledge is one of the three characteristics of an administrator of sufficient quality (§6.4). Moreover, the experts claim that such a course fits with the needs that are expressed by the administrators. The same holds for a positive collaboration of the municipality with the administrators that results in mutual trust. Administrators have stated that they would like to be in close contact with the municipality on the topic of AOOs and energy saving measures.

In general, the experts find the white list on administrators a strong point of the municipal approach. They expect a positive effect from communicating a list of high-quality administrators. This positive effect is not necessarily that AOOs will be convinced to switch to a high-quality administrator. But the experts do expect that a white list will motivate administrators to improve the level of quality of their services to AOOs.

The experts formulate a widespread desire for increasing the transparency on the quality of administrators. They confirm the added value of a monitoring system, that is able to distinguish a high-quality administrator from a low-quality administrator. However, the experts are not convinced that there is currently an objective method available to measure the quality of administrators. This is because their observations from the AOO practice show that one administrator does not offer a consistent quality of services to all of its AOOs. Thus, two AOOs may perceive totally opposite quality levels for their administrator. This a weak point in the monitoring part of this municipal approach. Experts state that more research is needed to arrive at a monitoring system that is able to objectively assess an administrator's quality.

Another weak point of this municipal approach has to do with the administrator's business case. This business case is that administrators want to have many AOO customers that require little attention. Experts state that the profit margin of the administrators will evaporate if they need to give more attention to their AOOs. Nevertheless, providing AOOs with advice on energy saving measures does offer

new financial opportunities for administrators. These financial opportunities can be pointed out by the municipality to the administrators, to motivate them to advise AOOs on this new topic. However, whether these financial opportunities are sufficient to compensate for the loss of profit margin is a question that needs answering in another research.

10.2.2. Creating supply and demand in a developing market

The opinions of the experts differ on the second municipal approach, that aims to create supply and demand in a developing market for advice on energy saving measures. This advice is provided by administrators to AOOs. Some experts perceive the new legal obligation for all AOOs to have a multi-year maintenance plan as a strong point of the municipal approach. The multi-year maintenance plan is one of the six characteristics of an AOO with a good base. Compliance with this legal obligation is relatively easy to check and can be communicated, for example, on Funda, a Dutch home sales website.

However, other experts think that the legal obligation of having a multi-year maintenance plan for all AOOs is a weak point of the approach. This is because the results of this municipal approach depend on the national government, as they must add this legal obligation to the Fifth Book of the Civil Code. The experts fear that this dependence on the legislator may cause significant delays in the implementation process of this approach. Moreover, experts question whether the proposed legal obligation is sufficient to stimulate the uptake of energy saving measures by AOOs. This is because a standard multi-year maintenance plan is, as the name suggests, limited to the maintenance of the apartment building. Therefore, the experts would prefer a legal obligation for a sustainable multi-year maintenance plan (i.e. *duurzame meerjarenonderhoudsplanning*), which combines the maintenance with the sustainable improvement of the apartment building. However, this suggested sustainable multi-year maintenance plan does not comply with one of the assumptions from section §6.3: *no additional governmental regulations on the energetic quality of buildings will come into effect in the short to medium term*. Therefore, a sustainable multi-year maintenance plan is not included in this municipal approach.

10.2.3. Measuring bar for the quality of administrators

The strong and weak points of the third municipal approach, a measuring bar for the quality of administrators, show significant overlap with the strong and weak points of the first municipal approach in sub section §10.2.1. The first municipal approach uses a black and white list system to monitor the quality of administrators. The third municipal approach includes a more detailed version of this black and white list system.

Thus, the strong point of the third municipal approach is the communication of a list of high-quality administrations (a white list). And again, the experts formulate a widespread desire for increasing the transparency on the quality of administrators. But the experts claim that a municipal approach that consists almost entirely of a monitoring system for the quality of administrators, is not able to change the problematic causal relations. The proposed municipal approach is too limited and should include other elements, such as educating and motivating administrators. Moreover, the experts, once again, explain that there is currently no objective tool at hand to monitor the quality of the administrators.

In addition, the experts have formulated some new weak points of this approach. Firstly, some experts fear that the municipality may be held liable for errors and mistakes in the measuring bar. An example of such a mistake is that an administrator is, unjustified, added to the black list of the municipality. Or an AOO who gets into trouble with a poor-quality administrator that is still on the white list of the municipality. In both cases, the municipality may be held liable by the administrator or the AOO for making this mistake. Secondly, this measuring bar may come at the expense of a good relation of the municipality with the administrators. Especially the administrators who are added to the low-quality lists may

become querulous. Lastly, this measuring bar system may increase the transparency on the quality of administrators, but for AOOs switching to another administrator will remain a difficult and time-consuming step. Therefore, experts do not expect that this municipal approach will result in AOOs who will actively switch to an administrator with a higher quality level.

10.2.4. Creating a joint long-term vision on the apartment building

In general, the experts support the essence of the fourth municipal approach: the creation of a joint long-term vision on the apartment building through the combined efforts of individual apartment owners, social and private landlords, and administrators. The experts agree that providing courses to individual apartment owners in small AOOs, and preferably also in larger AOOs, is a strong point of this approach. These courses enable apartment owners to express their desires for and to get involved in developing a joint long-term vision for their apartment building. Lastly, many experts think that informing potential apartment owners on the real monthly costs of the AOO is the strongest point of this approach. They stress that this preventive measure will discourage potential apartment owners to buy an apartment they cannot afford. Balancing the spending power of apartment owners with the monthly costs of the apartment will, in the long run, result in more financial resources that can be used for achieving the long-term vision.

The experts do question if Funda, a Dutch home sales website, is a suitable platform for informing potential apartment owners on the real monthly costs of an apartment. This is because the revenues of Funda will decrease, if less apartments are sold on the website. Therefore, experts suggest involving mortgage lenders instead. These mortgage lenders may check whether the AOO, in which the potential apartment owner wants to buy an apartment, has a good base and organisational structure. A mortgage lender can do this by requesting information from the AOO and by checking the reported height of the periodic deposit to the reserve fund. In case of an AOO with a poor base, the mortgage lender may decide to not provide the mortgage to the potential apartment owner. This should stimulate poor quality AOOs to improve their base, given that it will become more difficult to sell an apartment in these AOOs. Lastly, as a reminder, also for this municipal approach the observation is relevant that it is rather difficult to objectively assess the quality of an administrator.

10.3. Recommendations

This section uses the strong and weak points of the four combinations of alternatives to arrive at recommendations for a municipal approach. With these recommendations, a municipal approach that can change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings, can be designed. The key insights of the analysis of the current system in chapters 3 and 4 and the results of the assessments of the alternatives in chapters 8 and 9 are also used to arrive at these recommendations.

These recommendations can be used by the municipality of Rotterdam and other municipalities to design a municipal approach that is able to improve the overall quality of administrators and to improve the quality of the base of AOOs. On the one hand, the recommendations identify the most important elements that are part of such a municipal approach. On the other hand, the recommendations mention a number of aspects that should be considered, when designing such a municipal approach. Both types of recommendations are included in the following sub sections. Together, the recommendations describe a municipal approach that can be implemented by the municipality at short notice and, to a large extent, independent from other actors.

10.3.1. Administrators: a collaboration with the municipality

First of all, it is recommended to include a collaboration of the municipality with the administrators in the municipal approach. In the analysis of the current system in chapter 4, the negative effect of the poor quality of the administrator on the decision-making process of the AOO is identified as one of the most important problematic causal relations. In the assessment of the alternatives in chapter 8, the alternative 'collaboration of administrators with the municipality' received the highest score. This is because the effect of a collaboration between the municipality and the administrators is twofold.

On the one hand, the collaboration with the municipality has a positive effect on the administrators' level of knowledge on energy saving measures and their motivation to inform AOOs on this topic. Thus, this collaboration has a positive effect on two (out of three) characteristics of an administrator of sufficient quality. On the other hand, this collaboration allows the municipality to have an indirect relation with a large group of AOOs. It is not easy for the municipality to obtain this reach through direct relations with AOOs, as figure 41 shows. The collaboration with administrators enables the municipality to scale their approach up to a far larger group of AOOs.

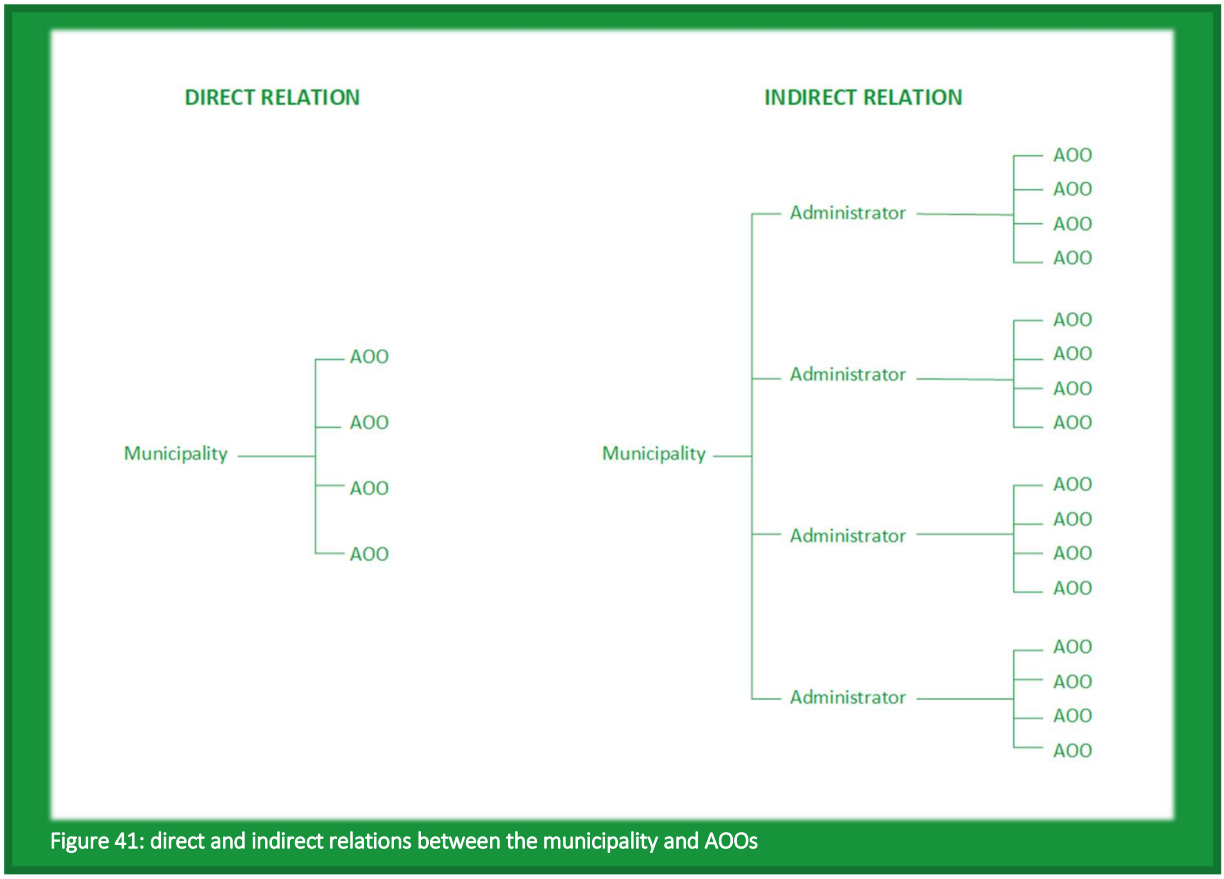


Figure 41: direct and indirect relations between the municipality and AOOs

What are the characteristics of a suitable collaboration between the municipality and the administrators for the municipal approach? It is recommended, in line with the expert validation, to aim for a positive type of collaboration that stimulates mutual trust. Too much focus on the poor performance of certain administrators is counterproductive. In this positive type of collaboration, the municipality provides the administrators with certain tools, such as courses, information packages and expertise. High-quality administrators may be added to a white list that is communicated by the municipality. Furthermore, it is highly recommended to keep an eye on the business case of the administrators. A sound business case is a prerequisite for motivating administrators to stimulate AOOs to take energy saving measures.

The collaboration of the municipality with the administrators is rather intense during the first year. During this first year, specialists of the municipality will work closely together with the administrators on several meetings. Various subjects can be discussed in these meetings, based on the needs of the AOO, varying from the functioning of an AOO to the implementation of energy saving measures. AOOs are invited for these meetings based on criteria such as maintenance level, energy label and attendance to general meetings of owners. After this first year, administrators should be able and motivated to provide high quality advice to their AOOs on their own. The collaboration can be continued by drafting a covenant between municipality and administrator. This covenant includes several effort commitments for both the administrator and the municipality.

The elements from this sub section will have no effect on AOOs who do not have an administrator. Because of the scalability of the approach, as shown in figure 41, this is a conscious choice. The collaboration with the administrators simply allows the municipality to have an indirect effect on a far larger group of AOOs. Nevertheless, the other two elements of the municipal approach are relevant for AOOs without an administrator.

10.3.2. AOOs: improving their quality from the inside

Secondly, the analysis of the current system in chapters 3 and 4 and the positioning of clusters of problematic causal relations in chapter 6 have made it clear that the municipal approach needs to improve the quality of the base of the AOO. Various alternatives can be thought of for improving the quality of the base of the AOO, as is illustrated in chapter 7. One option is to aim to improve the quality of the base of the AOO from the outside, with alternatives such as an obligation for a multi-year maintenance plan or a purchase of several apartments in an AOO by a social housing association. But experts warn that the effects of these types of alternatives may turn out to be disappointing.

Instead, these experts suggest a municipal approach that aims to improve the base of the AOOs from the inside. The first element is to inform and enthuse individual apartment owners with courses for the functioning of their AOO. Such courses can be used in a later stage to inform and stimulate individual apartment owners to invest in the energetic quality of the apartment building with the AOO. By educating and motivating individual apartment owners, these owners are enabled to take a leading role in their AOO during the decision-making process on the periodic deposits, the daily management, and other aspects of the base of the AOO. However, the scalability of these courses is a point of concern that needs attention in the municipal approach. Currently, the courses are provided to a relatively small group of apartment owners.

The second element is to inform and warn potential apartment owners on the real monthly costs of the apartment and on AOOs with a poor base. The aim is to discourage potential apartment owners to buy an apartment that they cannot afford in the long run. It is important to balance the spending power of apartment owners with the monthly costs of the apartment, as this will result, in the long run, in more financial resources that can be used for achieving a well organised AOO. The collaboration with mortgage lenders would be an interesting step for the municipality. These mortgage lenders will check whether the AOO, in which the potential apartment owner wants to buy an apartment, has a good base and organisational structure. A mortgage lender can do this by requesting information from the AOO and by checking the reported height of the periodic deposit to the reserve fund. In case of an AOO with a poor base, the mortgage lender may decide to not provide the mortgage to the potential apartment owner. This should stimulate poor quality AOOs to improve their base, given that it will become more difficult to sell an apartment in these AOOs. However, the willingness of mortgage lenders to play this role needs to be checked with a market research.

10.3.3. The apartment building: a joint long-term vision

Thirdly, the municipality should stimulate AOOs to develop a joint long-term vision on their apartment buildings. Normally, individual apartment owners tend to focus only on their own interests in a general meeting of owners. This may result in tensions between apartment owners with different interests, as is found in the analysis of the current system in chapter 4. Composing a joint long-term vision enables both individual apartment owners and social and private landlords to become aware of the interests of other members in the AOO. Integrating these interests in one long-term vision, helps the owners to make a decision in the general meeting of owners that is in the interest of the AOO and the apartment building. This is a first shift in focus.

Moreover, a joint long-term vision enables apartment owners to think about the future of the apartment building. The apartment owners currently focus only on the conservation and maintenance of the apartment building. Indeed, this is the core task of an AOO. But a long-term vision may stimulate apartment owners to think about improving the apartment building and more specific, improving the energetic quality of the apartment building. This is the second shift in focus. Together, these shifts in focus make that the decision-making process in an AOO will be smoother and will include topics such as energy saving measures.

To realise the ambitions in the long-term vision, it is important that the AOO will decide on a periodic deposit that is of sufficient height to make the desired investments in the long run. Thus, a joint long-term vision may also be helpful for structuring the financial decisions in an AOO.

How does the municipality stimulate AOOs to compose such a joint long-term vision? Firstly, in the courses for individual apartment owners, the topic of a joint long-term vision is rather important. These courses provide the apartment owners with tools to start a discussion in their AOO on the future of the apartment building. Secondly, the municipality can make effort commitments with administrators via the covenants. Based on these effort commitments, the administrators are expected to kickstart the discussion in the AOO and to assist with the composition of the vision. Moreover, the administrators can hand information from the municipality over to the various apartment owners in the AOO. Lastly, and only if needed, the municipality may draft a second covenant with both social and private landlords on their efforts to arrive at a joint long-term vision on the apartment building. Naturally, it is both interesting and important to track the progress of AOOs in realising the ambitions from their long-term vision. This is an element that should be included in the municipal approach.

10.4. Conclusion

The objective of this chapter is to present a number of recommendations for a municipal approach that can change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings. These recommendations identify the most important elements that are part of such a municipal approach. Also, the recommendations mention a number of aspects that should be considered, when designing such a municipal approach. These recommendations are based on the key insights from this research and on the results of an expert validation of the four municipal approaches.

This expert validation, with professionals from the municipality and VVE-010, has resulted in an overview of strong and weak points for the four municipal approaches from chapter 9. From these strong and weak points, that are presented in table 50, a number of practical recommendations can be deduced for a municipal approach that is able to change the problematic causal relations in practice.

Table 50: overview of strong points and weak points of the municipal approaches

#	Municipal approach	
1.	**Educating, collaborating with and monitoring administrators**	
	Strong points	*Weak points*
	• A course for administrators • The direct contact between administrators and municipality • Positive effect of a white list on the performance of administrators	• An objective monitoring method for the quality of administrators is currently not at hand • Uncertainty on whether the new financial opportunities for administrators outweigh the potential loss of profit margin
2.	Creating supply and demand in the developing market of energy saving measures	
	Strong points	Weak points
	• The presence of a mandatory multi-year maintenance plan can be checked and communicated on home sale websites, such as Funda	• The implementation process of the approach may be significantly delayed by the national legislator • The effect of a mandatory multi-year maintenance plan may be insufficient to trigger the uptake of energy saving measures by AOOs
3.	A measuring bar for the quality of administrators	
	Strong points	Weak points
	• Positive effect of a white list on the performance of administrators	• Monitoring the quality of the administrators is not sufficient to change the problematic causal relations • An objective monitoring method for the quality of administrators is currently not at hand • The municipality may be held liable for mistakes in the measuring bar • It may come at the costs of a bad relation of the municipality with some administrators • The approach does not sufficiently enable AOOs to switch to another administrator
4.	Creating a joint long-term vision on the apartment building	
	Strong points	Weak points
	• Warning potential apartment owners for the real monthly costs of the apartment • Informing apartment owners in small, and preferably also large AOOs with a course	• Mortgage lenders, instead of AOOs, should be involved in warning potential apartment owners for the real monthly costs of an apartment • An objective monitoring method for the quality of administrators is currently not at hand

The following three recommendations for a municipal approach are derived from the key insights from this research and from the results of an expert validation of the four municipal approaches:

1. The municipal approach includes the collaboration of the municipality with administrators. With this collaboration, the municipality aims to improve the quality of the administrators and to reach a larger group of AOOs. This collaboration will take the form of a positive approach towards the administrators to create mutual trust. Also, the municipality will respect the need of administrators for a sound business case. The first year of the collaboration is intensive, with the municipality and the administrators working closely together. Thereafter, a covenant is signed with effort commitments for both the administrators and the municipality.

2. The second recommendation is to try to improve the quality of the base of the AOO from the inside and not from the outside. Firstly, the municipality will ensure that courses are provided to apartment owners. The aim of these courses is to inform and enthuse these individual apartment owners to take the lead in their AOO. These apartment owners are stimulated to address any issues with the base of the AOO in the general meeting of owners and to start the discussion on energy saving measures. Secondly, the municipality will ask mortgage lenders to inform and warn potential apartment owners in case of an unrealistic periodic deposit or in case of an AOO

with a poor base. This will stimulate apartment owners to improve the base of their AOO, in order to sell apartments in the future.

3. Thirdly, it is recommended to stimulate AOOs to develop a joint long-term vision on the future of their apartment buildings. This long-term vision will result in a shift from individual interests to collective interests, in a focus on (energetically) improving the apartment building instead of conservation and maintenance of the building, and the vision will structure the financial decisions in the AOO. The municipality can stimulate the development of such a vision via the courses for individual apartment owners, the effort commitments with administrators and optionally via a covenant with the social and private landlords.

A municipal approach that combines these three recommendations is expected to be able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings. Thus, the three recommendations for a municipal approach answer the main question of this research:

Which type of municipal approach is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings?

The overall conclusions and recommendations of this research are presented in chapter 11. A reflection on this research is included in chapter 12.

11. CONCLUSIONS AND RECOMMENDATIONS

11.1. Conclusions

On the 12th of December 2015, the international community agreed upon the Paris Agreement. This agreement's objective is to keep global warming below 2 °C and preferably below 1.5 °C (relative to the pre-industrial level). For the Netherlands, the practical implication of this agreement is an 80% reduction of its greenhouse gas emissions in 2050 compared to 1990. This is a big challenge. This holds especially for the built environment, the sector that is responsible for 34% of the total Dutch energy consumption.

This research focuses on a challenging issue in this built environment: how to reduce the energy consumption of apartment buildings that are the joint ownership of Associations of Owners? In an Association of Owners (AOO), individual apartment owners are not able to significantly improve the energetic quality of their apartments by themselves. This is because, from a legal perspective, the apartment owner does not own the physical apartment itself, but owns an apartment right instead. This apartment right can be seen as a license to use the apartment in accordance with the applicable rules for the specific building block. All owners of one or more units in the building block jointly own the property. And thus, the consent of a large majority of these owners is needed to improve the energetic quality of the apartments in the apartment building.

Unfortunately, this required consent is not the only challenge for AOOs. Many AOOs are faced with serious maintenance problems for their apartment buildings. These maintenance problems are the result of a lack of: financial resources, of a long-term plan for the building, of competent board members, and of commitment of apartment owners to the AOO. Several municipalities in The Netherlands, including the municipality of Rotterdam, are motivated to help AOOs with these issues. Moreover, these municipalities, given their municipal energy saving ambitions that stem from the Paris Agreement, want to stimulate AOOs to improve the energetic quality of their apartment buildings. Therefore, this research uses the municipality of Rotterdam as an example to answer the following main research question:

Which type of municipal approach is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings?

This main research question is answered in four steps. The thorough analysis of the problematic causal relations is executed in research part A with a literature study and interviews. In the intermezzo, a selection from the list of problematic causal relations is made for the remainder of the research. Moreover, the intermezzo presents an assessment framework: a tool to identify promising alternatives – solutions – that are able to change the problematic causal relations. Research part B designs and assesses several alternatives, in order to arrive at a number of recommendations for a municipal approach in research part C. To answer the main research question, it is a prerequisite that these four steps are able to address the scientific problem of this research:

How to make a complete analysis of this complex multi-actor system and how to formulate alternatives for issues within this system from the perspective of only one actor?

11.1.1. Research part A: problematic causal relations

The literature study and interviews of research part A resulted in the identification of 24 problematic causal relations, that withhold AOOs from taking energy saving measures. This set of problematic causal relations varies from financial issues to companies that are unwilling to do business with AOOs. Because of this diversity, the discussion of the problematic causal relations in this sub section is limited to the five relations that are most often mentioned by the respondents:

1. A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on taking energy saving measures. A poor-quality administrator is an administrator that does not meet the following criteria:
    a. Adequate level of knowledge on the topic of energy saving measures;
    b. Motivated to raise the awareness among and inform the AOO on the topic of energy saving measures;
    c. Decisions and behaviour of the administrator are fully in the interest of the AOO.

2. The effectiveness of the provision of information, advice, and support to AOOs to create a sense of urgency for the reduction of their energy consumption is uncertain. This uncertain effectiveness has to do, among others, with:
    a. apartment owners who are not concerned with their apartment building and who are badly informed on the AOO;
    b. individual interests of apartment owners that are not aligned with the individual interests of other apartment owners;
    c. labelling the information that is provided by commercial parties as subjective information.

3. Many companies from the building industry are not willing to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process.

4. An AOO may have insufficient spending power to pay for the total investment costs of the energy saving measures. In these cases, the AOO cannot decide to improve the energetic quality of their apartment building. The spending power of an AOO consists of the following elements:
    a. the reserve fund that is being filled by the periodic deposits of apartment owners;
    b. a loan from the SVn, a bank, or a commercial organisation for the AOO;
    c. a single deposit to the reserve fund of the AOO by each individual apartment owner;
    d. a subsidy for the implementation of energy saving measures.

5. A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process. An AOO with a poor base is an AOO that does not meet the following criteria:
    a. presence of a qualified daily management of the AOO;
    b. high attendance to or commitment among the general meeting of owners;
    c. a periodic deposit of the owners to the AOO is made;
    d. the presence of an active Board of the AOO with regard to energy saving measures;
    e. the presence of a reserve fund, preferably of sufficient size;
    f. the presence of a multi-year maintenance plan.

It is not feasible to formulate a number of recommendations for a municipal approach that are able to address all 24 problematic causal relations that are identified in research part A. This is because these problematic causal relations are part of an interrelated system, in which new issues arise after solving existing issues. Therefore, a selection of the problematic causal relations is made in the intermezzo.

11.1.2. Intermezzo: selection of problematic causal relations

In the intermezzo, problematic causal relations are selected that cause problems for AOOs during their first steps in the customer journey. These problematic causal relations make that AOOs are not able to continue their decision-making process on improving the energetic quality of their apartment buildings.

Moreover, problematic causal relations are selected in the intermezzo if they reinforce other problematic causal relations. This procedure resulted in the selection of problematic causal relations that deal with the poor quality of administrators and the poor quality of the base of the AOO:

1. A poor-quality administrator does not stimulate or even hinders an AOO to have an effective decision-making process on energy saving measures.
2. A poor quality of the base of the AOO makes it difficult for an AOO to go through the first stages of the customer journey and to arrive at an effective decision-making process.

It is expected that these problematic causal relations can be largely solved within a period a five to ten years. In order to change these problematic causal relations, research part B provides recommendations for a municipal approach. It needs to be noted that there are two other problematic causal relations that are related to the organisational structure of the AOO. But it is not expected that they can be solved within a period of ten years, and therefore it is decided to leave them out of the remainder of this research. However, these problematic causal relations are mentioned in the recommendations of sub section §11.2.4.

Thus, the research is continued with two problematic causal relations. In order to find a municipal approach that is able to change these problematic causal relations, an assessment framework is constructed. This assessment framework is used to rate the alternatives that are designed in research part B. By combining a number of alternatives, a municipal approach can be created. The assessment framework consists of constraints and criteria. The constraints can be seen as conditions that an alternative has to meet. The constraints require that the alternative does not change or exceed the current state of:

- the spending power of AOOs and individual apartment owners;
- the (financial) resources of the municipality;
- property rights;
- the (financial) resources of social housing associations and private landlords, and;
- the capacity of energy and process consultants and other companies from the building industry.

The criteria are used to estimate whether an alternative is able to successfully change a problematic causal relation. The following four criteria are used in research part B to assess the alternatives:

- Total costs of the alternative for all actors in the system, including the transaction costs.
- The estimated quality of the administrators.
- The estimated number of AOOs with a good base and organisational structure.
- The estimated number of AOOs in which energy saving measures have been taken.

11.1.3. Research part B: recommendations for a municipal approach

The input for the alternatives is derived from the interviews with various actors from the AOO practice. The alternatives that are suggested by the respondents are elaborated and adjusted based on a number of observations from the literature study and a brainstorm. This has resulted in a list of 20 alternatives. With the constraints and criteria of the assessment framework, this list has been narrowed down to 9 promising alternatives:

1. A course for administrators to improve their level of knowledge;
2. The collaboration of administrators with the municipality;
3. Make administrators aware of the financial opportunities that come with AOOs who invest in energy saving measures;

4. A black- and whitelist on the quality of administrators;
5. A course for apartment owners in small AOOs;
6. Informing potential apartment owners on the real monthly costs of the apartment;
7. Formulate a long-term perspective on the apartment building in mixed AOOs with social housing associations and/or private landlords and individual apartment owners;
8. High-quality administrators who take the lead on the topic of energy saving measures;
9. A legal obligation for AOOs to have a multi-year maintenance plan.

These promising alternatives are combined into four municipal approaches. The strong and weak points of these municipal approaches have been pointed out by experts from the municipality of Rotterdam and VVE-010 in an expert validation. The following municipal approaches are assessed during the expert validation:

1. A combination of education, collaboration and monitoring for administrators with a strong role for the municipality;
2. Creating supply and demand in a developing market for advice on energy saving measures that is provided by administrators to AOOs;
3. A measuring bar for the quality of administrators with a strong emphasis on monitoring the performance of the administrators;
4. And creating a joint long-term vision on the apartment building with the combined efforts of individual apartment owners, social and private landlords, and administrators.

The strong and weak points of the four municipal approaches, the key insights of the analysis of the current system in research part A, and the results of the assessments of the alternatives in research part B are used to arrive at recommendations for a municipal approach. This municipal approach should be able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings. These recommendations can be used by the municipality of Rotterdam and other municipalities to design a municipal approach that is able to improve the overall quality of administrators and to improve the quality of the base of AOOs. By changing these two problematic causal relations, it is less difficult for AOOs to go through the decision-making process and to improve the energetic quality of their apartment buildings.

The recommendations identify the most important elements that should be part of the municipal approach. Also, the recommendations mention a number of aspects that should be taken into account, when designing a municipal approach. Together, the recommendations describe a municipal approach that can be implemented by the municipality at short notice and, to a large extent, independent from other actors:

1. The municipal approach includes the collaboration of the municipality with administrators. With this collaboration, the municipality aims to improve the quality of the administrators and to reach a larger group of AOOs. This collaboration will take the form of a positive approach towards the administrators in order to create mutual trust. Also, the municipality will respect the need of administrators for a sound business case. The first year of the collaboration is intensive, with the municipality and the administrators working closely together. Thereafter, a covenant is signed with effort commitments for both the administrators and the municipality.

2. The second recommendation is to try to improve the quality of the base of the AOO from the inside and not from the outside. Firstly, the municipality will ensure that courses are provided to apartment owners. The aim of these courses is to inform and enthuse these individual apartment owners to take the lead in their AOO. These apartment owners are stimulated to address any issues with the base of the AOO in the general meeting of owners and to start the discussion on energy saving measures. Secondly, the municipality will ask mortgage lenders to inform and

warn potential apartment owners in case of an unrealistic periodic deposit or in case of an AOO with a poor base. This will stimulate apartment owners to improve the base of their AOO, in order to sell apartments in the future.

3. Thirdly, it is recommended to stimulate AOOs to develop a joint long-term vision on the future of their apartment buildings. This long-term vision will result in a shift from individual interests to collective interests, in a focus on (energetically) improving the apartment building instead of conservation and maintenance of the building, and the vision will structure the financial decisions in the AOO. The municipality can stimulate the development of such a vision via the courses for individual apartment owners, the effort commitments with administrators and optionally via a covenant with the social and private landlords.

A municipal approach that combines these three recommendations is expected to be able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings. Thus, the three recommendations for a municipal approach answer the main question of this research:

Which type of municipal approach is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of their apartment buildings?

In addition to these three recommendations for a municipal approach, other recommendations can be derived from this research. These recommendations are presented in the section §11.2.

11.2. Recommendations

In the previous section, the main research question is answered with three recommendations for a municipal approach that is able to change the problematic causal relations, that currently withhold AOOs from improving the energetic quality of the apartment building. This section discusses other recommendations that are derived from this research:

- Firstly, some recommendations are given for the implementation of the suggested municipal approach. Is additional research desirable or needed for the implementation of the municipal approach? This is discussed in sub section §11.2.1.

- Secondly, some recommendations are provided in sub section §11.2.2 for the implementation of the municipal approach in other municipalities. Are adjustments to the suggested municipal approach needed for the implementation in other municipalities than Rotterdam?

- Thirdly, the municipal approach is not able to change all 24 problematic causal relations that are identified in this research. Thus, after the successful implementation of the municipal approach, several problematic causal relations remain to be solved. Which problematic causal relations should be addressed with a second (municipal) approach? This is discussed in sub section §11.2.3.

- Finally, two long-term problematic causal relations regarding the problematic organisational structure and poor base of the AOO are placed outside the scope of this research. However, these problematic causal relations need to be solved in order to enable small and/or mixed AOOs to improve their base and to take energy saving measures. In sub section §11.2.4, some recommendations for a solution for these long-term problematic causal relations are provided.

11.2.1. Additional research for the implementation of the municipal approach

This research provides three recommendations for a municipal approach that is able to change the problematic causal relations, that withhold AOOs from improving the energetic quality of their apartment buildings. There are some elements in these three recommendations that would benefit from further research. This further research would ease the implementation of the municipal approach and is likely to enlarge the effectiveness of the approach.
The first recommendation is to include the collaboration of the municipality with administrators in the municipal approach. The research has shown that it is important in this collaboration that the municipality respects the need of administrators for a sound business case. But what is a sound business case for an administrator? A profound insight in their current business case is a prerequisite for identifying new financial opportunities for administrators. What are these new financial opportunities for administrators who advise and support AOOs in their decision-making process on energy saving measures? These questions are not answered in this research, but are relevant for a successful collaboration between municipality and administrators. Thus, *it is recommended to perform further research on the current business case of and new financial opportunities for administrators*.

Furthermore, it is found that an objective method for determining the quality of administrators is currently not available. Moreover, designing such a method has proven to be difficult in this research. This is because the quality of an administrator proves to be rather diffuse in daily practice: an administrator does not offer a consistent quality of services to all of its AOOs. Two AOOs may perceive totally opposite quality levels for their administrator. It is interesting to start *a follow-up research that designs and tests other methods for determining the quality of administrators*. Still, it may be hard to actually find an objective method for measuring the quality, but this research is likely to contribute to the development of an improved definition of the 'quality of an administrator'. This in itself, is valuable information that can be used to improve certain elements of the suggested municipal approach.

The second recommendation of this research is to improve the quality of the base of the AOO from the inside. Part of this recommendation is that municipalities will ask mortgage lenders to inform and warn potential apartment owners in case of an unrealistic periodic deposit or in case of an AOO with a poor base. Mortgage lenders are also asked to not provide a mortgage to the potential apartment owner in case of an AOO with a poor base. This should stimulate poor quality AOOs to improve their base, given that it will become more difficult to sell an apartment in these AOOs. However, the willingness of mortgage lenders to actually perform this task is an uncertain element in the suggested municipal approach. *A market research is recommended to map the willingness of different mortgage lenders to cooperate*. In addition, it is recommended that this research addresses the *risks of an open market* for the implementation of this part of the municipal approach. Is it likely that potential apartment owners will turn to mortgage lenders that do not cooperate with the suggested approach of the municipality?

The third recommendation for a municipal approach is to stimulate AOOs to develop a joint long-term vision on the future of their apartment buildings. It is expected that this long-term vision will result in a shift from individual interests to collective interests, in a focus on (energetically) improving the apartment building instead of conservation and maintenance of the building, and that the vision will structure the financial decisions in the AOO. Currently, little data is available to link the presence of a joint long-term vision with the implementation of energy saving measures by AOOs. Thus, it is interesting to *monitor whether the ambitions for improving the energetic quality of the apartment building, that are formulated in the joint long-term vision, will be implemented by the AOOs*. Based on the results of this monitor, the municipality may decide to take additional measures to stimulate the implementation of the measures in the joint long-term vision.

11.2.2. Implementation of the research in other municipalities

This research used the municipality of Rotterdam as a continuing example in the analyses of research part A and for the design of alternatives in research part B. However, the ambition of this research is more comprehensive and is formulated in chapter 2: develop a municipal approach that is also relevant for other municipalities in The Netherlands. This sub section provides some recommendations for the implementation of the suggested approach in other municipalities.

It is recommended for other municipalities, who want to implement the municipal approach, to pay attention to two issues. Firstly, the municipality of Rotterdam obtained a large body of knowledge of and experience with AOOs over the past years. This knowledge and experience is actively shared and captured within the organisation. It is expected that this knowledge level of the municipality of Rotterdam is rather high. The recommendations for the municipal approach assume that this level of knowledge is present within the organisation of the municipality. Therefore, *it may be necessary for other municipalities to obtain a more than basic level of knowledge on AOOs, in order to successfully implement the municipal approach*. Secondly, the municipality of Rotterdam, together with the four large social housing associations, has set up the organisation of VVE-010. VVE-010 is implementing the policies of the municipality and provides basic services and support to AOOs on the topic of energy saving measures. Over the years, VVE-010 has assisted numerous AOOs, who often have issues with their base. Thus, the municipality of Rotterdam has a related organisation that is experienced with problematic AOOs and that will help with the implementation of the municipal approach. Other municipalities are not expected to have such an organisation. *For these municipalities, it is recommended to invest in their staff capacity, before implementing the municipal approach*. Thus, the recommendations for the municipal approach are expected to be applicable to other municipalities, if these two issues are taken into account.

Moreover, the implementation of the municipal approach might benefit from the collaboration of municipalities with one another. For example, both administrators and mortgage lenders often operate in several neighbouring municipalities. If these administrators and mortgage lenders are approached by a collective of municipalities for a collaboration, instead of by one municipality, they are more likely to accept the offer. Furthermore, it is likely to be cost effective for municipalities to collectively provide courses to apartment owners. Thus, *it is recommended that municipalities collaborate with one another for the implementation of the municipal approach*.

11.2.3. Recommendations for a second (municipal) approach

The suggested municipal approach addresses the two most crucial problematic causal relations that can be solved in the short to medium term. However, the list of 24 problematic causal relations in chapter 4 shows that other problematic causal relations need to be solved as well. Thus, which problematic causal relations should a second (municipal) approach address? For the recommendations in this sub section, it is assumed that the implementation of the first municipal approach has been effective and has largely solved the problematic causal relations regarding the poor quality of administrators and the poor base of the AOO.

Looking at the process that AOOs have to go through for implementing energy saving measures – the customer journey – the next problematic causal relations that they are likely to encounter are the financial issues and problems with the building industry. The size of the financial issues depends on the short-term effects of both the first municipal approach and the *Wet verbetering functioneren vereniging van eigenaars* from section §5.2. The first municipal approach aims to improve the base of the AOO. Two characteristics of an AOO with a good base are that a periodic deposit of the owners to the AOO is made and that there is a reserve fund present, preferably of sufficient size. The *Wet verbetering functioneren*

vereniging van eigenaars will also stimulate apartment owners to agree on a periodic deposit to the reserve fund that is in line with the multi-year maintenance plan. It is recommended to monitor the spending power of AOOs. *If the monitor indicates the continued existence of insufficient spending power of AOOs, it is recommended for municipalities to start enforcing the regulations in the Wet verbetering functioneren vereniging van eigenaars*. It should be noted that the enforcement of these regulations will require a significant amount of resources from the municipality.

Furthermore, the analysis of the current system identified two problematic causal relations regarding loans for AOOs. Firstly, the loan conditions of the SVn limit the increase of the spending power of certain types of AOOs. This is the case for AOOs with less than 10 apartments and for AOOs that need a loan with a duration of more than 15 years. Secondly, there are hardly any commercial banks or other commercial organisations that are willing to provide a loan to AOOs. If this situation persists, *it is recommended that the second (municipal) approach includes at least new types of loans for small AOOs and for AOOs that need a loan with a duration of more than 15 years*. It should be noted that municipalities will need the cooperation of the national government for this element of the second approach.

Of all problematic causal relations regarding the companies from the building industry, there is one relation that the second (municipal) approach needs to address. This is the problematic causal relation that many companies from the building industry are unwilling to do business with and pre-invest time and money in AOOs, as they are perceived as cumbersome and slow decision makers within an uncertain and lengthy process. The positive effects of the first municipal approach on the quality of the base of the AOO, will enable municipalities to refute this perception of AOOs. *It is recommended that the companies from the building industry are told about AOOs with a good base, in courses that are organised by the municipality of Rotterdam or the WoonWijzerWinkel*. In addition, the municipality may *stimulate the development of platforms for AOOs*, as discussed in section §5.5. These platforms may *help AOOs to find other AOOs with similar energy saving ambitions*. These groups of AOOs are far more interesting – given the required efforts per AOO relative to the turnover – for companies from the building industry than individual AOOs.

Lastly, the number of energy saving measures that are taken by AOOs after the implementation of the first municipal approach needs to be monitored. If the number of energy saving measures that are taken is still lagging, it is recommended to *explore the option with the national government for a legal obligation for implementing energy saving measures*.

11.2.4. Solving the long-term problematic causal relations regarding the organisational structure of the AOO

Finally, this research identified two problematic causal relations regarding the organisational structure of the AOO. It is expected that these issues cannot be solved within ten years. However, solving these problematic causal relations is crucial for certain types of AOOs. This is because these problematic causal relations are located at the beginning of the customer journey for AOOs, who want to improve the energetic quality of their apartment buildings. These are the relevant problematic causal relations:

- The transition from a sense of urgency to an effective decision-making process may prove to be difficult for certain types of AOOs. Especially AOOs with a mix of privately-owned and rented apartments may experience problems, as the owner with a majority stake in the AOO may block the decision-making process.
- The organisational structure of a functioning AOO, that is currently being pursued, needs to be improved. To ensure a smoother completion of the first stages of the customer journey, especially for small AOOs, an improved organisational structure is needed in order to arrive at an effective decision-making process.

In chapter 7, a brief exploration of alternatives is carried out for these issues. This has resulted in some alternatives, such as: constraining the control by landlords on the general meeting of owners, integrating the decision of tenants into the decision-making process of the AOO, and merging smaller AOOs into a larger AOO that fits the physical structure of the building block. It is highly likely that this research did not identify all potential alternatives. Moreover, the alternatives that were found, are only briefly explored. *Therefore, it is recommended to start a new research on potential solutions for these two long-term problematic causal relations at short notice*. With emphasis, it is recommended to do so at short notice, because solving these problematic causal relations will require significant preparation time.

12. REFLECTION

12.1. Introduction to the reflection

This final chapter provides a reflection on this research. In this reflection, some cautionary remarks are made with regard to two research methods – the interviews and the expert validation – in section §12.2. Furthermore, the objectivity of a number of important decisions in this research are discussed in section §12.3. Finally, a reflection of the suitability of the selected research method to address the scientific problem of this research is provided in section §12.4.

12.2. Reflection on research methods

12.2.1. Interviews

With regard to the use of interviews as a research method in this research, the following remarks can be made:

- The interviews with 32 respondents from the AOO practice are held in mid-2016. The publication of this research is at the end of 2017. Thus, one and a half years have elapsed since the interviews were held. During these one and a half years, the respondents may have developed new insights in the problematic causal relations or they may have conceived of new solutions. These new insights are not included in this research. Because of this, it could be argued that the input from the interviews is a little bit dated. This issue is partially solved with the expert validation that is held in July 2017. During this expert validation, several problematic causal relations and the four municipal approaches have been presented. From this expert validation, no evidence is obtained that the problematic causal relations or the four municipal approaches are dated. Moreover, the focus of the recommendations of this research on the role of administrators was an eye-opener for most experts.

- The answers of the respondents, regarding the issues that limit AOOs to take energy saving measures, are used in two ways in chapter 4. Firstly, the answers are used in section §4.3 to check whether the problematic causal relations, that are found in the literature study, are also observed in practice by respondents. Secondly, their answers are used to supplement the list of problematic causal relations that is found in the literature study. These additional problematic causal relations are presented in section §4.4 and are exclusively based on the answers of the respondents. Thus, it should be noted that some problematic causal relations are based on the observations of a limited number of professionals from the AOO practice.

- The 32 respondents in the interviews belong to 13 different types of organisations. Two of these organisations became the main focus of research part B: the AOOs and the administrators. In total, six interviews were held with (board) members of AOOs. However, it is noteworthy that only one administrator is interviewed for this research. With hindsight, it would have been better for this research if more administrators were interviewed. Instead, most information on administrators is obtained from other organisations in this research. Because of this, some information on administrators is missing, such as information on their business case. Therefore, it is recommended in sub section §11.2.1 to do some further research on the business case of and new financial opportunities for administrators.

12.2.2. Expert validation

The following remarks can be made with regard to the use of an expert validation as a research method:

- *It is important to note that the experts that took part in the expert validation could not take note of the complete research*. Instead, the presentation of the research was limited to the main research question and the research objective from section §2.3, a brief overview of the results of the analysis in chapter 4, a description of the selected problematic causal relations from section §6.2, and the four municipal approaches from chapter 9. This brief presentation is motivated by the limited time available for both the presentation and the discussion. It can be argued that the experts may have mentioned other, more, or less strong and weak points, if they would have been able to take note of the complete research. Thus, the strong and weak points that are mentioned by the experts in section §10.2 should be viewed from this perspective.

- Another remark is that some new suggestions have been made by the experts during the validation. No in-depth analysis of these new suggestions has been executed in this research. Instead, *for each new suggestion that is included in the recommendations for the municipal approach, a note is added in chapters 10 and 11 that further research is required*. This is, for example, the case for the suggestion to involve mortgage lenders for informing and warning potential apartment owners on AOOs with a poor base or with too low periodic deposits (§11.2.1).

12.3. Reflection on important decisions

This section provides a reflection on four important decisions that have been made in this research. These decision relate to the selection of the problematic causal relations in section §6.2, the formulation of the assumptions and constraints in section §6.3, the selection of the alternatives in chapters 8 and 9, and the formulation of the recommendations for a municipal approach in section §10.3.

12.3.1. Selection of problematic causal relations

The selection of the two clusters of problematic causal relations, regarding the quality of administrators and the quality of the base of the AOO, took place in section §6.2. The arguments for this selection are presented in sub section §6.2.2. Due to this selection, *the suggestions of the respondents for alternatives for the four other clusters of problematic causal relations – that were not selected – are not included in this research*. Thus, some of the data from the interviews about these four clusters is not reported in this research. These four clusters are: issues with the building industry, financial issues, problems with the provision of information, advice and support, and issues with the national and municipal laws and policies. However, there is one exception for this remark: in sub section §11.2.3 some recommendations are provided for a second (municipal) approach that addresses some of the problematic causal relations from the clusters above.

In addition, in section §6.2 it is decided to focus on the two problematic causal relations – from the two selected clusters – that can be solved within ten years. This decision is based on the desire of municipalities to implement the municipal approach in short notice and preferably independent from other actors. Due to this decision, *the two long-term problematic causal relations regarding the organisational structure of the AOO have received far less attention in this research*. Nevertheless, the analysis in research part A shows that these two long-term problematic causal relations need to be addressed as well. It is expected that it will not be easy to solve these problematic causal relations. Therefore, it is highly recommended in sub section §11.2.4 to start a further research on these two problematic causal relation on short notice.

12.3.2. Assumptions and constraints

For the sake of the implementation of the municipal approach within ten years, a number of assumptions and constraints have been added to the assessment framework in section §6.3. It needs to be noted that these assumptions and constraints greatly limit the number of alternatives for the selected problematic causal relations. This holds for the following assumptions and constraints:

- Both the assumption that no governmental regulations will be formulated on the energetic quality of buildings and the constraint that the property rights will not be eased within ten years limit the number of alternatives that are available for addressing the problematic causal relations. *This assumption and constraint exclude any far-reaching alternatives that require the involvement of the national government*.

- Another constraint is the available resources of the municipality, both financial and non-financial. These available resources are, to a large extend, fixed for a period of on average four years. Thus, constraining these available resources is in line with the reality. However, it is questionable whether these available resources are sufficient to succeed in a significant improvement of the energetic quality of apartment buildings at short notice. Thus, the remark is that *the municipality may need additional resources in order to meet the municipal energy saving ambitions*. In that case, the constraint on the available resources of the municipality has to be released.

12.3.3. Selection of alternatives

Thirdly, several – in some cases implicit – decisions have been made in the selection procedure for the alternatives in chapters 8 and 9. To start, the researcher has made several decisions while assessing the alternatives in section §8.3. In this section, each alternative has received a score between -1 and +2 on all four criteria. Even though these scores are based on the insights that are gained in research part A, this assessment will never be fully objective. This is because the researcher is simply not able to fully disregard his/her views. Thus, it should be noted that *the assessment of the alternatives is as objective as possible given the presence of bias for the researcher*.

Another remark has to do with the selection procedure that is used in chapters 8 and 9. For example, a total score of +3 on all four criteria is set as the minimal score for an alternative to be classified as promising in section §8.3. Another example is the procedure that is used in section §9.3 to make combinations of promising alternatives: the four municipal approaches. Some arguments are provided for these decisions in the selection procedure, but also other decisions could have been supported with sound arguments. Thus, the remark is that *other decisions could have been made in the selection procedure of the alternatives*.

12.3.4. Formulation of recommendations for a municipal approach

Finally, a reflection on the formulation of the recommendation for a municipal approach in section §11.2. These recommendations focus on the main ingredients for a municipal approach that is able to address the selected problematic causal relations. *The recommendations do not offer a fully completed municipal approach that can be directly implemented by a municipality*. This is a *deliberate decision*, so that municipalities will be challenged to make minor changes and additions to the suggested municipal approach based on their specific municipal context.

12.4. Reflection on the research steps and the scientific problem

Finally, this section reflects on the ability of the four research steps to deal with the scientific problem of this research: *how to make a complete analysis of this complex multi-actor system and how to formulate alternatives for issues within this system from the perspective of only one actor?* This reflection pinpoints the elements in these four research steps that are crucial for addressing the scientific problem. This scientific problem needed to be addressed in order to answer the main research question. Therefore, these elements are also crucial for the answer to the main research question.

In research part A, a thorough analysis of the issues in this complex multi-actor system is executed. The following elements in this first research step are crucial to address the scientific problem:

- For a thorough analysis of the system, it is crucial to collect and combine the diffuse knowledge on this complex multi-actor system. Scraps of this knowledge are collected from many sources during an extensive literature study. Nevertheless, the acquired level of knowledge from the literature study is suboptimal. The body of literature does not contain all knowledge about the system for several reasons (§4.1). To arrive at an acceptable level of knowledge, it is key that this research combines the literature study with interviews with various experts. These experts are selected from a variety of organisations to collect knowledge from different parts of the system. Nevertheless, it is not probable to assume that this research element results in a complete level of knowledge. However, it does result in a level of knowledge that is acceptable for a thorough analysis of the system.

- Subsequently, it is essential to make an integral analysis of this collected knowledge. In case of a complex multi-actor system, it is not enough to analyse parts of the system and to combine the results. With such an approach, important relations between the numerous parts of the system will go unidentified. This research combines two integral analyses: an actor analysis and a systems analysis. These analyses result in a list of problematic causal relations between parts of the system.

- Finally, it is important that the actor analysis and systems analysis are exclusively based on the acquired knowledge from the literature study. This offers two advantages. Firstly, the results from these analyses can be checked and confirmed with the acquired knowledge from the interviews. This builds a 'security check' or validation of results into the research method. The problematic causal relations that are mentioned in both the literature study and in the interviews, are expected to be highly relevant for answering the main research question. Secondly, this research element illustrates the knowledge gaps in the body of literature, as the acquired knowledge from the interviews results in the identification of additional problematic causal relations between parts of the system.

Subsequently, the intermezzo makes a selection from the list of identified problematic causal relations. Moreover, the intermezzo presents an assessment framework: a tool to identify promising alternatives – solutions – that are able to change the problematic causal relations. The following elements in this second research step are crucial to address the scientific problem:

- The integral analysis of the system results in an extensive list of problematic causal relations. With each additional problematic causal relation on the list, the number of potential alternatives increases exponentially. This illustrates the need for selecting only a number of problematic causal relations from the list. Naturally, this is a research element that could be part of any

research. However, the crucial element of this research step is that the most important problematic causal relations are selected for the remainder of this research. These are problematic causal relations that trigger other problematic causal relations. The integral analysis of the system in research part A provides the clues for identifying such problematic causal relations.

- Secondly, a key element of this research step is that the systems engineering approach is used to construct an assessment framework. It is remarkable that this approach is used, as the complex multi-actor system of AOOs and energy saving measures is a system that is difficult to quantify. This systems engineering approach resulted in a semi-quantitative assessment framework that provides several criteria and constraints that alternatives have to meet. These criteria and constraints are helpful to identify promising alternatives in this research.

In research part B, the acquired knowledge from the literature study and interviews is used to design several alternatives. These alternatives are assessed with the assessment framework. This third research steps contains one special research element: the systems engineering approach is used to combine several alternatives and to construct municipal approaches that are able to address the selected problematic causal relations. The systems approach is used to identify a reinforcing relation between two alternatives. Such a reinforcing relation is present if alternative A improves the performance of alternative B. Preferably, alternative B does also improve the performance of alternative A. With this research element, municipal approaches are constructed with a collective performance that is better than the sum of the individual performances of the alternatives. This results in efficient municipal approaches that are able to address the selected problematic causal relations.

Finally, research part C provides a number of recommendations for a municipal approach. To arrive at these recommendations, the four municipal approaches from research part B are assessed during an expert validation. This expert validation is the crucial research element of this fourth research step. The expert validation is another 'security check' of the results at the end of the research. The four municipal approaches are presented to experts from the municipality of Rotterdam. The experts are encouraged to identify strong and weak points for the implementation of these municipal approaches. These strong and weak points are used to formulate robust recommendations for the municipal approach. These recommendations need to ensure that the municipal approach can be implemented by the municipality and that the approach is able to deal with the selected problematic causal relations within the complex multi-actor system.

These are the research elements that make the research design and method both unique and suited to address the scientific problem of this research. Moreover, these research elements ensure that the main research question is answered.

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APPENDIX I: RESEARCH FLOW DIAGRAM

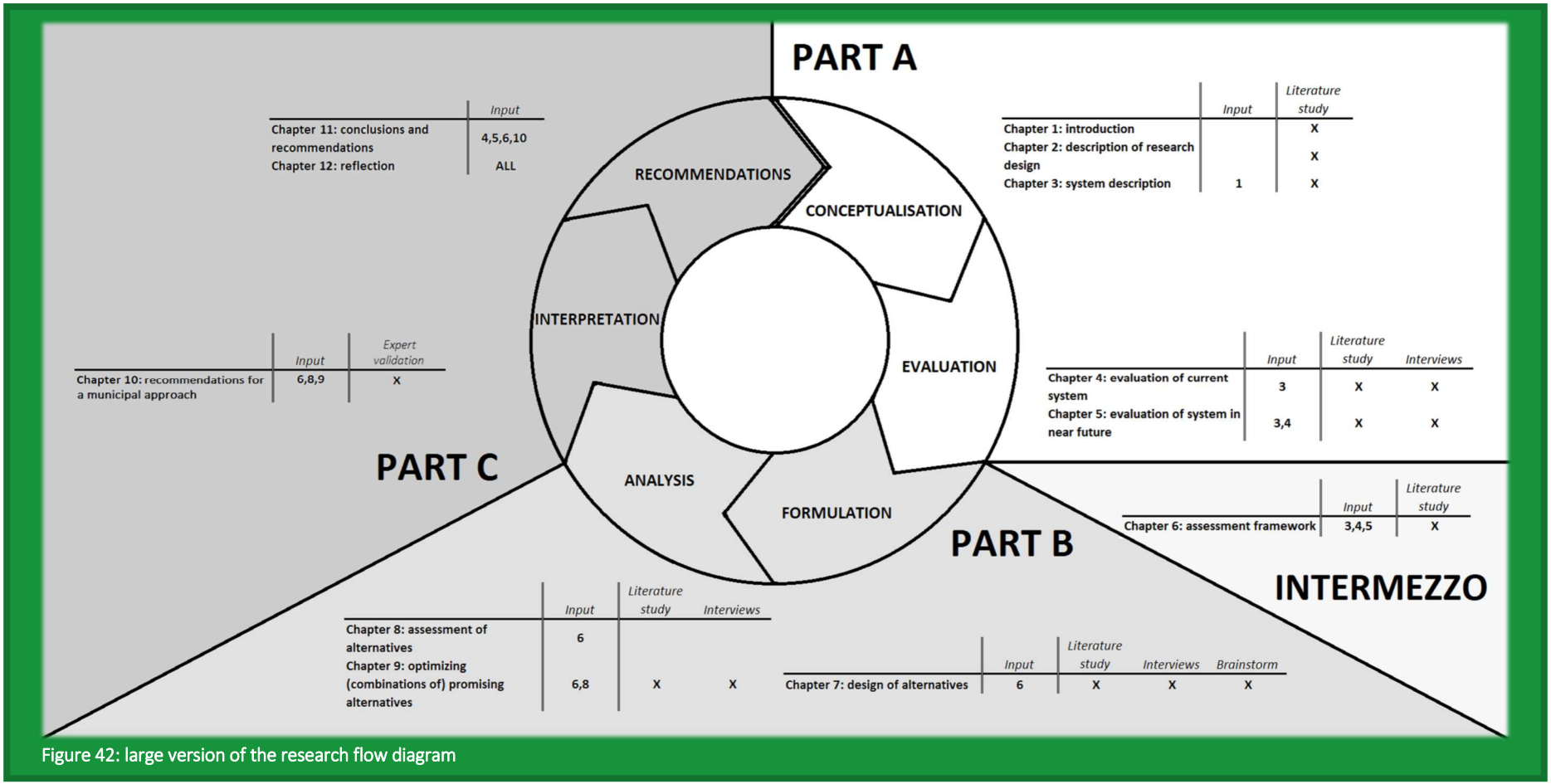

Figure 42: large version of the research flow diagram