Interference and collaboration in the Dutch energy system

A methodology to analyse interference between policy measures, and a system perspective on interorganizational collaboration between public organizations

Sofie van Zijl

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Preface

Over the past year, I have worked on my master theses in CoSEM (also known as SEPAM) and SEC. The report that is lying in front of you is the result of this double degree research project. This report is also the final exam after a little over six years of studying at the Delft University of Technology.

These six years in Delft have changed and challenged me. I have found my place here, and was able to develop myself into who I am now.

The theses projects focus on a common element: the need of a long term vision for policies that aid the transition of energy systems to become more sustainable. Behind this long term vision are two essential drivers, the interconnections in the system and the human beings trying their hardest to develop and implement the right policy measures. An understanding of both these drivers is essential for the success of the long term policy vision that is needed to help the energy transition mature. I hope that in some way, this project inspires a change for the better.

I would like to thank my committee for their enthusiasm and their critical questions. I would especially like to thank my first supervisors of both master programmes, Caroline Wehrmann and Émile Chappin. You helped me see the forest for its trees and always knew how to motivate me to keep going, or some times to start over, if that was necessary. I have learnt a lot about myself the past year, and you have helped me in making sense of those lessons. For this all, I am grateful.
I would also like to thank all participants of the research for making the time for talking to me twice, and for answering all my questions in such an open and insightful manner.

Secondly, I would like to thank all the girls (and Bram) from the 'afstudeerhok'. Thank you for the support, the welcome distractions, and the shared stress. I would like to thank Eline and Amber for being there for me through the whole process. For looking after me, for listening to me ramble, and answering my questions.

Moreover, I would like to thank my parents. You always gave me the freedom to make my own choices and you have always believed these choices would be right. This has supported me in all my decisions, from choosing a high school, or a university, doing an exchange semester, to starting a second master. This freedom has brought me to where I am today.

Last, but not least, I would like to thank Max. Max has always been able to make me smile, even (or perhaps especially) at the times when I was questioning everything that I was doing. Thank you for your endless support and patience. I hope I can return the favour whenever you need it, wherever we are.

I would like to end with a quote that illustrates my experience of doing this research, and at the same time contains a beautiful view on the world:

> *"The most incomprehensible thing about the world is that it is comprehensible"*
> – Albert Einstein (Collins, 2016)

Sofie van Zijl
Delft, October 2017

Summary

The growing awareness of climate change has led to a series of (international) agreements for climate change mitigation. These have led the Dutch government to implement a multitude of policy measures to stimulate the transition towards a more sustainable energy sector. However, these individual policy measures are not necessarily tested or evaluated as a *policy strategy*. Within a policy strategy, multiple policy measures are combined to reach a single set of policy goals.

As the energy sector of the Netherlands is an integrated system, where the sub-systems also influence each other, the final effect of the policy measures is not always straightforward or clear. It is also possible that two or more policy measures interfere with each other in their effects on the energy sector of the Netherlands.

Recently, companies have voiced their concerns on the fluctuating effects of policy measures in the Netherlands, and have asked for a more long term vision for the policy measures (Accountant, 2016). This long term vision both needs to account for the interconnectedness of the energy system, as well as for the effects of a multitude of policy measures in the energy system that are all active at the same time.

Another component of a policy strategy is that to develop and implement a long term policy strategy, multiple governmental organisation have to collaborate. The policy measures are designed by different ministries within the Netherlands. In order to implement the coherent policy strategy, collaboration between these ministries is essential.

The research presented in this report consists of the theses projects of two master programmes together. Both projects aim to contribute to the development of a coherent and long term policy strategy for the energy transition in the Netherlands. The first presented research focusses on the identification, illustration, and analysis of interference between policy measures in the Dutch energy system. The second presented research focuses on the factors, and the relations between these factors, that influence interorganizational collaboration of policy makers in the Netherlands.

Interference of policy measures

The objective of the research into interference between policy measures is to provide a methodology to identify, illustrate, and allow for an interpretation of interference of policy measures. Research by Simões (2013) determines two characteristics of policy instruments that can be used to identify if policy measures interfere. These two characteristics are the policy goal and target group. The approach to identify interference between policy measures based on the characteristics of the policy measures is the basis of the proposed methodology. Two additional theories (systems thinking for socio-technical systems, and the Theory of Planned Behaviour) allow for the identification of new characteristics that include the main structures and processes of energy systems.

The designed methodology is summarised in Figure I. Step 1 is the selection of the system that will be analysed, and the scale of the policies that are present in this system.

Step 2 is the identification of the relevant policy measures for this system and the policy goals. For the Dutch energy system this is based on the existing NEO 2016 model (*Nationale Energieverkenning*) by ECN. The NEO model includes a list of policy measures that influences the energy system of the Netherlands, as well as the sectors these measures are active in.

Step 3 is a further characterisation of the list of policy measures. Based on policy documents (websites from governmental organisations, legislation, reports of governmental organisations, as well as the reports for the NEO 2016 model). The sector, target groups, types, sub-types, direction, process, specification, and policy goals are characterised for each policy measure.

Step 4 is the first step of creating a system overview for the chosen system. The methodology focusses on the identification of system factors that lead from the policy measures to the policy goals.

Step 5 identifies the different types of relations within the system overview. This is the last step in generating a system overview.

Step 6 is the identification of the illustrated interference within the generated system overview. The identification includes five types of interference. Which type the interference belongs to is based on the system factors, and the relation types that cause the interference.

Step 7 is the interpretation of the identified interference and its (qualitative) effect on the system.

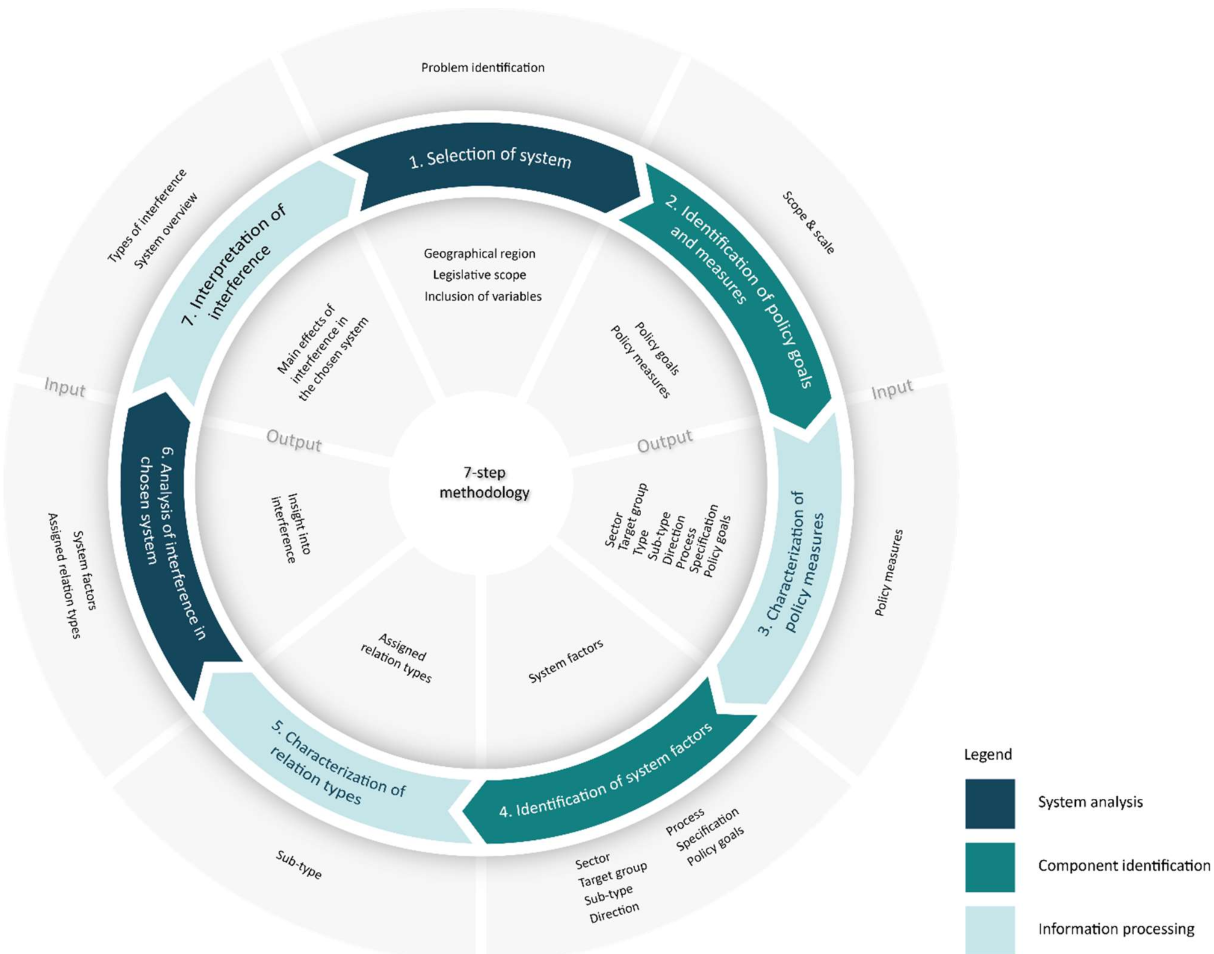

Figure I: Design of the 7-step methodology

The methodology is applied to the case study of the Dutch energy system. The identification and analysis of interference based on the characteristics of policy measures and the energy system, allows for the identification of five types of interference: (1) due to cross-sectoral factors, (2) due to behavioural aspects, (3) due to dependency of technologies, (4) due to two or more policy measures for one technology, and (5) due to policy chain integration.

For each of the five types it is possible to analyse the effects. The first type of interference has the largest effect, and creates feedback loops within the energy system. These feedback loops can both be positive and negative, and can have a different character based on the used time scale of the analysis.

The second and fourth types of interference decrease the uncertainty of the effects of policy measures in the energy system. The uncertainties are created by the behavioural aspects of the stakeholders and the individual rivers of each stakeholder. A policy measure provides incentives to create a change in behaviour, however these incentives are not always enough. Due to the interference of types 2 and 4, the incentives for a specific behaviour change are enlarged, decreasing the uncertainty of whether or not the incentives are enough.

The third type of interference also decreases the uncertainty in the system, but this is the uncertainty that the chosen behaviour or technology to incentivise will have the intended effects. Some technologies are dependent on other technologies as well. Two examples are discussed, one for EV's and their infrastructure, and one for the design specifications of alternative fuels and the use of these fuels. For both examples, both incentives are required for each individual policy measure to have their intended effect.

The fifth and last type of interference has little to no effect in the energy system, as there are no feedback loops created, or uncertainties decreased.

Based on the application of the 7-step methodology to the Dutch energy system, some limitations and further recommendations will be mentioned.

Interorganizational collaboration

A call to compare the theoretical and practical bodies of knowledge on interorganizational collaboration, has been raised in literature. This thesis project therefore focusses on two iterations between literature and a case study. A conceptual theoretical framework for factors that influence interorganizational collaboration between public parties has been constructed based on literature, and is tested and validated within the case study. The research into interorganizational collaboration also includes a focus on the relations between the identified factors. The relations can provide insight into the more complex system view of the factors that influence interorganizational collaboration between public parties.

The first identification of factors that influence interorganizational collaboration between public parties is based on literature. Systemic literature research identified 66 factors that could influence interorganizational collaboration between public parties. The interviews identified four new factors, leading to a total of seventy identified factors that can influence interorganizational collaboration between public parties. Based on a survey used for validation of the interview results, the five factors with the highest perceived importance have been determined:

- Professional, informal communication between personnel from individual organizations
- Communication in inter-organizational working teams
- Level of shared knowledge
- Specialization of collaborating organizations
- Performance of inter-organizational collaboration

The relations between the identified factors are not validated, but are based both on literature and the case study. This research indicated that a system approach of factors that influence interorganizational collaborations has not been done before, but can shed light on the developments and dynamics of interorganizational collaborations. The relations between the factors indicate that it is not as straight forward as it sometimes seems to identify important factors. Sometimes literature and the case study identified contradicting causalities of the relations, other times the different literature sources and participants all mentioned other causes for the same effects. If it is unknown what de causalities are, it is difficult to know how interorganizational collaborations can be influenced for the better. Further research into the relations between the factors is therefore just as essential as further research into the factors themselves. Other recommendations for further research are also mentioned.

Both researches are based on a view of the world in systems, and for both is searched for links between sub-systems. Finding the link between the technical energy system and the collaborations required in policy making was based on this system perspective. These two topics are invariably linked together. The integrations in the energy system increases the need for collaboration, whereas collaboration can increase (the effectiveness of) the integrations in the energy system.

Reading guide

As this report includes two master thesis projects, a small reading guide is included. The two master programmes of CoSEM and SEC together form a double degree at the Delft University of Technology.

Part I includes the general introduction and problem statements. This introduction and problem statement is the starting point for both master thesis projects.

Part II includes the CoSEM thesis research. Appendices A through F are also part of the CoSEM thesis project. Appendix F includes the scientific paper that is written for the CoSEM thesis project.

Part III includes the SEC thesis research. Appendices G through K are also part of the SEC thesis project. Chapter 17, the last chapter of Part III elaborates on the integration of both the CoSEM and SEC projects.

CoSEM thesis

Parts I and II together make up the CoSEM thesis report.

SEC thesis

Parts I and III together make up the SEC thesis report.

Contents

Appendices

The appendices are attached separately

List of Definitions

The definitions below are listed in order of appearance in the report. Each definition is also included as a footnote on the page where the term is first used.

1. Policy measure: a policy measure indicates a concrete institutional disposition that is implemented by a governmental organization and is applicable for a specified group of actors, has a clear set of conditions, and consequences is the conditions are not met.

2. Transposed: the transposition of legislation is required due to the *subsidiarity* principle of the European Union (EU). The central authority of the EU performs only those tasks that cannot be performed at a more local level. The policy measures that therefore can be based on national regulations will have to be included in the national legislation, instead of in the European legislation. Transposition is the adoption of European guidelines in the national legislation.

3. Renewable energy: "*Energy from a source that is not depleted when used, such as wind or solar power.*" (Oxford Dictionaries, n.d.-a)

4. Policy strategy: a set of policy measures that is designed as a whole and where all policy measures contribute to a common goal.

5. Interference: interference in this research is defined as the combined or simultaneous influence of more than one policy measure on a single component of the energy system.

6. Interdependency: a change in the state of one part of the system influences the state of another part in the system. This can be mutual, where both parts influence each other, or have a direction, where a change in A leads to a change in B, but a change in B does not influence A.

7. Policy instruments: a higher level collection of policy measures that focusses on the same system.

8. Insights into interference: this research aims to create insight into the interference between policy measures. The term 'insights' indicates an aim to know what the overall effects of interference on the system as a whole are, as well as what the causes of this interference are.

9. Goods: the crucial goods of the energy sector in the Netherlands are the energy carriers. Energy carriers are those forms of energy that are most widely used in the Netherlands and can be divided into three main categories; electricity, heat, and (fossil) fuels.

10. System component: a policy measure or system factor that is included in the system overview of this research.

11. Sustainable energy: *"Energy derived from natural resources that are capable of being replenished, such as water, wind, or solar power, and hence can be sustained in the long term; frequently (and in earliest use) attributive."* (Oxford Dictionaries, n.d.-b). all renewable energy sources are also sustainable. As the heat production in the Netherlands is not all done by renewable sources (e.g. Combined Heat and Power plants) the term 'sustainable heat' will be used instead of 'renewable heat'.

12. Applicable policy measure: the applicable policy measures are those measures that were active on May 1st, 2016, and could be found online, through one of the policy documents.

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Part I: Introduction

"Some people don't like change, but you have to embrace change, if the alternative is disaster"

– Elon Musk

1

Introduction

The first chapter of this thesis report will elaborate on the context and motivation for the following two parts of the report. First will a general introduction be given. Followed by the motivation for the research into interference between policy measures in the Dutch energy system and the research into the factors, and relations between these factors, of interorganizational collaboration between public parties in the Dutch energy system.

The growing awareness of climate change has led to a series of (international) agreements for climate change mitigation. Examples of these agreements are (1) the Kyoto agreement, the agreement that was adopted in 1997 in Kyoto, and started in 2005 (UNFCCC, n.d.-a), (2) the 'Energieakkoord' (Dutch energy agreement), this is an agreement between Dutch corporations, NGO's, and government parties to reach a set of climate change goals by 2020 (Sociaal-Economische Raad, 2013), and (3) the newly accepted Paris agreement, which is a follow up of the Kyoto agreement, and will start in 2020 (UNFCCC, n.d.-b). These agreements pinpoint a set of climate change and emission goals for each participating country. To reach these goals, each country needs to adopt a set of regulations and incentives to stimulate industries and other sectors to change their businesses to be more sustainable (e.g. capture CO_2 emissions from exhaust gasses of electricity plants, decrease energy requirements, and increase sustainable energy production).

The level of detail of policy measures[1] differs among individual agreements. The Dutch energy agreement is accompanied by a set of concrete policy measures, while the two mentioned international agreements remain at a higher policy level. This higher policy level focusses more on overall goals than on concrete measures. All three agreements and their policy goals influence the Dutch energy sector. The higher level international agreements have to be transposed[2] into Dutch legislation, and the Dutch energy agreement already includes concrete policy measures that influence the energy sector in the Netherlands. The policy measures aim to change the energy sector into a more sustainable sector.

1.1 Energy transition

The energy sector is still the largest greenhouse gas (GHG) emitting sector of the Netherlands. This sector accounted for 24% of all GHG emissions of the Netherlands in 2015 (CBS StatLine, 2016b). A reform of the energy sector is of key importance for the Netherlands to reach the climate change goals. The energy system in the Netherlands in 2015 was dependent on fossil fuels, mostly coal and natural gas, for 83% of the energy production, and renewable sources accounted for only 7% of the energy production, see Figure 1. The international Paris goals incorporate a reduction in GHG emissions, an increase in renewable energy[3] production, and an overall increase in energy efficiency. To help reach these goals, multiple policy measures are implemented by the Dutch government.

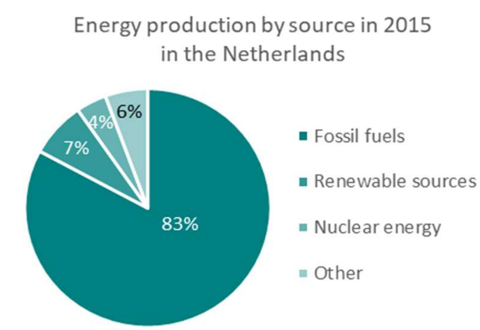

Figure 1: Energy production by source for the Netherlands in 2015. Data retrieved from (CBS StatLine, 2016a)

1.2 Policy strategy

The international agreements on climate change include a set of policy goals, but how these goals are translated into policy measures is left up to the individual countries. The Dutch government implemented a multitude of policy measures to stimulate the change towards a more sustainable energy sector. However,

[1] Policy measure: a policy measure indicates a concrete institutional disposition that is implemented by a governmental organization and is applicable for a specified group of actors, has a clear set of conditions, and consequences is the conditions are not met.

[2] Transposed: the transposition of legislation is required due to the *subsidiarity* principle of the European Union (EU). The central authority of the EU performs only those tasks that cannot be performed at a more local level. The policy measures that therefore can be based on national regulations will have to be included in the national legislation, instead of in the European legislation. Transposition is the adoption of European guidelines in the national legislation.

[3] Renewable energy: "*Energy from a source that is not depleted when used, such as wind or solar power.*" (Oxford Dictionaries, n.d.-a)

these individual policy measures are not necessarily tested or evaluated as a coherent policy strategy[4]. Within a policy strategy are multiple policy measures combined to reach a single set of policy goals.

Most production units of electricity, as well as other assets in the electricity sector, need large up front investments and have a long life time. This indicates a need for a clear future perspective before an investment is made. Recently, companies have voiced their concerns on the fluctuating effects of policy measures in the Netherlands and have asked for a more long term vision of the policy measures (Accountant, 2016).

To see a set of policy measures as a strategy can aid the development of a coherent strategy and the required long term vision for the energy transition. However, for a policy strategy to be effective should the influence of the policy measures together on the energy sector be evaluated.

The energy sector of the Netherlands is an integrated system, where the sub-systems also influence each other. This makes it more difficult to identify the final effect of the policy measures on the energy sector. It is also possible that two or more policy measures can interfere with each other in their effects on the energy sector of the Netherlands. It is this interference[5] between the policy measures themselves that also needs to be known in order to develop a valuable long term policy strategy. The concept of interference is further explained in Box I.

Another component of a policy strategy is in order to develop and implement a long term policy strategy multiple governmental organisation have to collaborate. The policy measures are designed by different Ministries within the Netherlands. For the Netherlands as a whole to develop a coherent policy strategy is collaboration between these ministries essential.

Box I – Explaining 'interference'
Interference between policy measures can be interpreted in different ways, and to make it even more complex, other terms are also used in literature that describe (almost) the same concept (e.g. overlap or integration of policy measures). Interference in this research is defined as the combined or simultaneous influence of more than one policy measure on a single asset of the energy system.

1.3 Double degree thesis project

The research presented in this report consists of the thesis projects of two master programmes together. The CoSEM (Complex Systems Engineering and Management) and SEC (Science Education and Communication) master programmes form a double degree programme at the Delft University of Technology. The two theses projects have the same problem formulation and motivation as explained in this introduction. Both projects will aim to contribute to the development of a coherent, and long term policy strategy for the energy transition in the Netherlands.

Within this thesis project will the CoSEM research focus on the identification, illustration, and analysis of interference between policy measures in the Dutch energy system. The CoSEM research is further explained in section 1.3.1 and in Part II of this report.

The SEC thesis project focuses on the factors that influence the interorganizational collaboration between policy makers of two ministries in the Netherlands, and the relations between these factors. The SEC research is further explained in section 1.3.2 and Part III of this report.

1.3.1 CoSEM thesis

Policy measures The government of the Netherlands aims to support the change of the energy system of the Netherlands towards a sustainable system by implementing policy measures. However, as the energy

[4] Policy strategy: a set of policy measures that is designed as a whole and where all policy measures contribute to a common goal.
[5] Interference: interference in this research is defined as the combined or simultaneous influence of more than one policy measure on a single component of the energy system.

sector of the Netherlands is an integrated system, where the sub-systems also influence each other, the final effect of the policy measures is not always straightforward or clear. It is also possible that two or more policy measures can interfere with each other in their effects on the energy sector of the Netherlands.

The interference between policy measures can influence the sense of security among investors in the energy sector. As most production units for electricity, as well as other assets in the energy sector, need large up front investments and have a long life time, a clear future perspective is required before an investment is made. Recently, companies have voiced their concerns on the fluctuating effects of policy measures in the Netherlands and have asked for a more long term vision (Accountant, 2016). This long term vision can (partly) be provided by analysing the interference in the energy sector before implementing new policy measures.

Integration of the energy system and policy measures As the energy system is a complex-socio technical system, there are many interdependencies[6] between the assets in the system. Examples of 'assets' are an electricity plant, the electricity grid, or a windmill. The interdependencies between the assets can cause indirect effects of policy measures to influence the energy system as a whole. An example of interference is provided in Box II.

Box II – Example of interfering policy measures

An example of interference between two policy measures includes a policy measure that is focussed on a reduction in GHG emissions and requests electricity production units to adopt CCS (Carbon Capture and Sequestration). And a policy measure that is focussed on an increase in energy efficiency.

With CCS the exhaust gasses of fossil fuelled electricity plants are filtered, this process takes out a large part of the CO_2 emissions in the exhaust gas, reducing the GHG emissions of the production. Another policy measure might ask the same production units to increase their energy efficiency over the coming years. The interference that is present in this example is based on the effects of CCS. The adoption of CCS increases the energy demand of the electricity plant itself. The energy input capacity of the electricity plant will be the same, but the electricity output capacity of the plant will decrease, lowering the energy efficiency of the electricity plant.

In this case the two policy measures cause the owners of the electricity plants to make a trade-off between the two targets of the regulations.

In the example of Box II is the timing of the policy measures also important. If the policy measure that requires an energy efficiency increase is implemented first, it is likely that an efficiency increase over the coming years is indicated as a growth compared to current performance. When the second policy measure is implemented, which requires the fossil electricity plant owners to adopt CCS technologies, their energy efficiency decreases rather than increases, making it difficult to reach the goals of the first policy measures. If the measures are implemented the other way around, the use of CCS technologies is already part of the 'current' energy demand, giving the production units a better chance at reaching the required reduction in energy demand.

The CoSEM research will focus on the interference between multiple policy measures in the energy sector of the Netherlands. This includes the production, transport, and final use of energy carriers. The transport and production of fossil fuels (e.g. natural gas and oil) are not taken into account in this thesis project. These aspects may however be visible in the policy analysis, as a single policy measure can both influence the demand of electricity and fossil fuels at the same time.

[6] Interdependency: a change in the state of one part of the system influences the state of another part in the system. This can be mutual, where both parts influence each other, or have a direction, where a change in A leads to a change in B, but a change in B does not influence A.

1.3.2 SEC thesis

There are two ministries in the Netherlands that are responsible for a large part of the energy policy measures. The focus of this part of the thesis project is on the collaboration between these two ministries and their implementation organizations. The research will specifically focus on the factors that influence the collaboration process, as well as the relations between these factors. Collaboration between public parties is expected to need to increase as the complexity of the system increases (Bouwen & Taillieu, 2004; Conteh, 2012; Dawes, Cresswell, Pardo, & Durant, 2009; Esteve, 2013). Even if the policy makers are aware of the interference between policy measures, if they do not collaborate among the different ministries, can the effects of interference not be mitigated or used for the better. A long term coherent policy strategy therefore needs insights into the contents of the interference, as well as insight into the practice of policy making to deal with this interference. Collaboration is seen as an important aspect in the practice of policy making and the increasing complexity of the systems. This form of collaboration is given many names, such as 'joined-up government' (Flinders, 2002; Williams, 2002), 'public networks' (Esteve, 2013), or 'collaborative networks' (Conteh, 2012). The common elements of all explained approaches are that multiple organizations have to work together to reach a common, or aligned aim. As this thesis project focusses on a relatively small number of organizations that work together is the name of a 'network' not appropriate. The common efforts between government organizations will in this thesis report be referred to as interorganizational collaboration (between public parties).

A call to compare the theoretical and practical bodies of knowledge on interorganizational collaboration has been raised in literature (Raisiene, 2011). This thesis project therefore focusses on two iterations between literature and a case study. A conceptual theoretical framework for factors that influence interorganizational collaboration between public parties will be constructed based on literature, and is tested and validated with the case study. This validated theoretical framework will be extended for a small number of factors. This extension focuses on the possible methods to influence a specific factor of interorganizational collaboration to better the process or outcomes of the collaboration. This extension will first be conceptual and based on literature, where after it will again be tested with the case study.

The SEC research also includes a focus on the relations between the identified factors. The aim of the thesis project is not to identify all relations between the factors, but to include the context and dynamics of the factors. The relations can provide insight into the more complex system view of the factors that influence interorganizational collaboration between public parties.

Part II: Interference of policy measures in the Dutch energy system

"The shift to a cleaner energy economy won't happen overnight, and it will require tough choices along the way."

– Barack Obama

2

Research approach

The research into the analysis of interference between policy measures will be explained in this chapter. First will existing approach for analyses of the energy system be discussed. Then will the context of the research be discussed, as well as the knowledge gaps that are identified from both the existing approaches and the context. The knowledge gaps lead to the research question and the research design.

2.1 Existing approaches

Research exists that analyses interferences of a defined set of policy measures. There is also research that focussed on a higher policy level, for instance on an international policy level, rather than on a national level of concrete policy measures. The research for this thesis project aims to propose a methodology to identify and analyse system wide interference on the level of national policy measures, combining the two mentioned aspects. To the authors knowledge, has research into the system wide interference between policy measures for policy makers not yet been done (Gottschamer & Zhang, 2016).

However there are models that provide numerical results for the implementation of policy measures for policy makers, but it is uncommon for these models to present the interference within the system to the users of the model. The models are black box models, where for the users only the inputs and outputs are visible, but the trends and relations within the model are not visible. Two often cited models are the '*Nationale Energieverkenning*' (National Energy Outlook, NEO-model) by ECN, and the Energy Transition Model (ETM).

NEO 2016 The NEO-model is based on optimization formulas for the energy (electricity and heat) demand of the Netherlands, as well as the greenhouse gas emissions and the production mix used to supply the energy in the Netherlands (ECN, 2016b). The model does take the causal relations of the system into account, but does not show these to the users. The results of the model are the expected effects of the policy measures, for example as a reduction of tonnes CO_2 emitted. However, the model does not allow for the users to see how these numerical results are obtained.

ETM The ETM is an open source model supported by companies, NGO's, and government institutions in the Netherlands. The ETM uses linear optimization formulas to calculate the effect of policy measures (ETM, n.d.). These calculations are often modelled more simplistic than real world effects, as interference and interdependencies within the system are often not included in the calculations. However, as the ETM is built to be more of a didactic tool, this is not an issue for that models purpose. The ETM aims to show that a single policy measure (or a defined set of policy measures) can have multiple effects on the energy system in the Netherlands. In trying to show this effect, they do not show the user the relations within the energy system that cause these effects.

The most important difference between the two models is that the NEO-model uses all policy measures (currently implemented measures as well as expected measures) as an input and gives one output of expected results. The ETM allows the user to see the effects of a single policy measure, or for a set of policy measures. However, both models do not show the users of the models what happens within the energy system that accounts for the effects a policy measure can have. The models do not show the user which causal relations are present in the system, or if there are any indirect effects or interference that influence the effectiveness of the policy measure. It is this transparency and information into the workings within the energy system that this thesis project aims to make visible.

2.2 Research context

The example in Box II of interference between two policy measures illustrates the possibility that the effectiveness of policy measures in the energy sector of the Netherlands is also influenced by the interference between two or more policy measures.

With the growing globalization and Europeanization, as well as a shift to more complex socio-technical problems, policy making becomes more and more difficult. This growing level of complexity is recognized in the scientific world and many researchers see the need for policy integration (Briassoulis, 2004; Ghersi, 2014; Greening & Bernow, 2004), this is illustrated with the following quote of (Briassoulis, 2004, p.2):

> *"Policies are often found to be little coordinated, to overlap or even to be in conflict. The policy system is unduly complicated, producing inefficient or even ineffective solutions, giving rise to new problems and waste of resources."*

Most research on policy integration, as well as a literature review paper that analysed 114 papers that were published between 2000 and 2011 on the interaction between climate change, land-use, and energy (Pasimeni et al., 2014), mention the need for further research into how different policies interfere. Briassoulis (2004) states that it is of key importance to identify the right policies to integrate, as not all polices can be extensively integrated. However, there is no method suggested to identify the critical policies, in other words, they do not indicate how 'overlap between policies' can be methodologically identified.

Most research into policy integration focusses on the integration between environmental and energy policies, whereas none of the researches explicitly mentions the possibility for interference energy policies itself (Briassoulis, 2004; Ghersi, 2014; Greening & Bernow, 2004; Simões, 2013). This thesis project focusses on the interference within the set of energy policy measures.

Identification of interference As mentioned are models available that indicate the direct effects of policy measures (or a set of policy measures) for the energy sector in the Netherlands. However, this research aims to show what relations and effects are present within the systems that are not shown to the users of the existing models for the energy sector.

Research by Sofia Simões (2013) focusses on the integration of higher level policy instruments[7] for energy and environmental legislation. The research indicates an overlap of policy instruments when they have the same (similar) policy goals (e.g. reduction in GHG emissions) and/or they try to change the behaviour of the same stakeholder group. The research then focusses on quantifying the cost-effectiveness of policy instruments, including possible overlaps between policy instruments, rather than identifying and explaining the overlaps between policy instruments (Simões, 2013, p.55):

> *"Because this framework focuses on the policy instruments and actors or stakeholders, it also does not address the other components of the policy process (objects, goals and the structures and procedures). Including these components would be relevant to understand the motives behind each overlap and co-effect but that is not the purpose of the framework. It merely aims at providing a systematic approach to identify and assess them."*

The research by Simões states a methodology for identifying overlapping policy measures, this is something most research papers on interference between policy measures do not include. However, the research by Simões does not include a methodology to analyse the effects of the identified interference.

The methodology proposed by Simões can be used within this thesis project as a first indication of the expected interference between policy measures. However, it does not provide a full understanding of this interference. Furthermore, the methodology excludes the possibility that two policy measures do not interfere, but that once a third policy measure is added to the system, interference does occur between all three policy measures. The possibility for interference between three or more policy measures will be taken into account in this thesis project.

Knowledge gaps The above mentioned 'gaps' in the current scientific body of knowledge on indirect effects and interference of policy measures indicate three main missing aspects.

First, the core models used by policy makers to design and/or evaluate policies in the energy sector of the Netherlands do not include interference of policy measures explicitly.

Second, the research by Simões does include interference, but on a higher level of policy instruments rather than policy measures. The indirect effects of policy measures are not analysed in her research. Also the focus of the research is on quantifying cost-effectiveness of the policy instruments rather than identifying all (or indicate how to identify all) interference between policy instruments.

[7] Policy instruments: a higher level collection of policy measures that focusses on the same system

Research problem The identification of interference between policy measures is important for the development of coherent policy strategies and policy integration. Especially when the policy environment becomes even more dynamic and complex.

The development of a methodology to systematically identify and analyse interference of policy measures is crucial for this process of policy development and policy integration.

Research objective The objective of the research is to provide a methodology to create insight into the interference of policy measures in the energy sector in the Netherlands. The deliverable will be a methodology to compose a system overview that indicates the interfering policy measures and their effects on the energy system. The focus of this research remains on how to identify and analyse interference between policy measures, rather than to create a complete set of found interference.

Relevance of the research The relevance of this research is explained in terms of the gains for society, and the gains for the scientific community.

In order to reach the climate change goals, a system approach of the influence of policy measures on the energy sector of the Netherlands is needed. This research will support such system approach by developing a method to identify interference of policy measures. This in turn will support the understanding of policy makers when designing policy measures for the electricity sector in the future. This can be seen as the societal relevance of the project, as the whole of society benefits from effective policy measures that help designing a climate change mitigation plan and to reach the global targets for climate change mitigation.

The scientific relevance is in the contribution of a methodology for analysing interference of policy measures, which is applied to a case study of the Netherlands. As explained in this chapter, there is a need for these insights, but not yet a clear methodological body of knowledge on how to tackle this lack of insight.

2.3 Research questions

The research question for this thesis project is:

> **How can interference between policy measures in the Dutch energy system be identified and analysed in order to gain insights in the effects of policy measures on the energy system as a whole?**

The sub-questions that needed to be answered in order to be able to answer the main research question are the following;

1. What characteristics have the policy measures that are present in the energy sector?
2. How can these characteristics be translated to a form where it is possible to identify interference and insights into the interference[8] become possible?
3. Where in the Dutch energy sector is interference of policy measures prominent?

2.4 Research methodology

This research project will look into the energy sector of the Netherlands as a socio-technical system. This approach is further explained in section 3.1.2.

A common method of visualizing a system is by using system diagrams. This research will use system diagrams as a basis structure. Figure 2 represents an outline of a system diagram. Within a system diagram are external factors, key performance indicators (KPI's), and means for reaching these KPI's present. The external factors of this research are the policy measures, the KPI's are the policy goals, and the means are the

[8] Insights into interference: this research aims to create insight into the interference between policy measures. The term 'insights' indicates an aim to know what the overall effects of interference on the system as a whole are, as well as what the causes of this interference are.

possible technologies that can be implemented within the energy system. The remainder of the research is divided into two parts, a policy analysis and a system analysis.

The policy analysis starts with the identification of relevant policy measures. And continues to characterize these policy measures in order to identify interference. This characterization of policy measures is based on the methodology of Simões that will be extended to include more characteristics. This will be further explained in section 3.1.

The system analysis focuses on the composition of the different system factors, and the relations between these system factors. The composition of system factors is based on the characterization of the policy measures, and will be further explained in section 3.4.

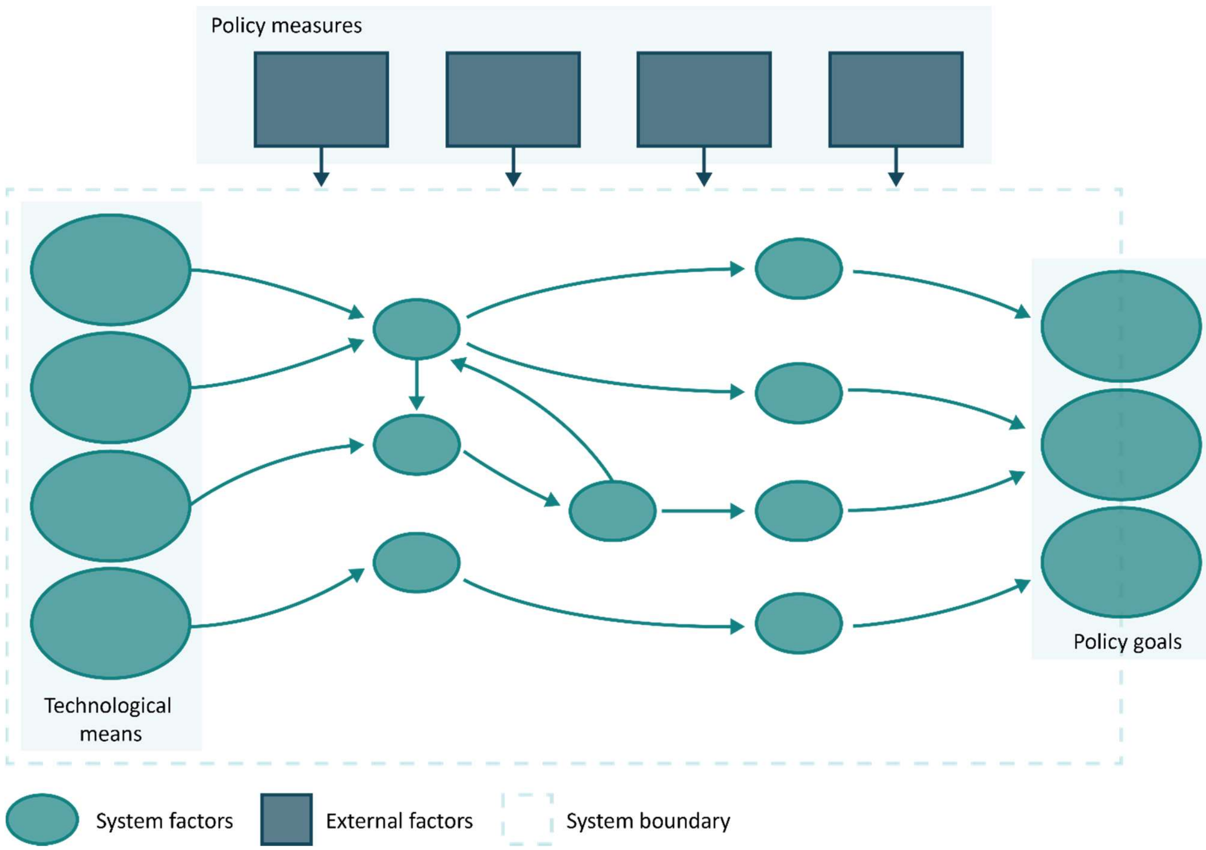

Figure 2: Schematic representation of a system diagram

2.5 Research design

The rest of the report is build up based on the research design. The research design is depicted in Figure 3. Chapter 3 includes the design of the 7-step methodology. Chapter 4 includes the policy analysis. Chapter 5 includes the system analysis. Chapter 6 uses reference cases as a validation of the identified system and interference, and focusses on the use of the system overview to identify and analyse interference. Chapter 7 and 8 are respectively the discussion and conclusion.

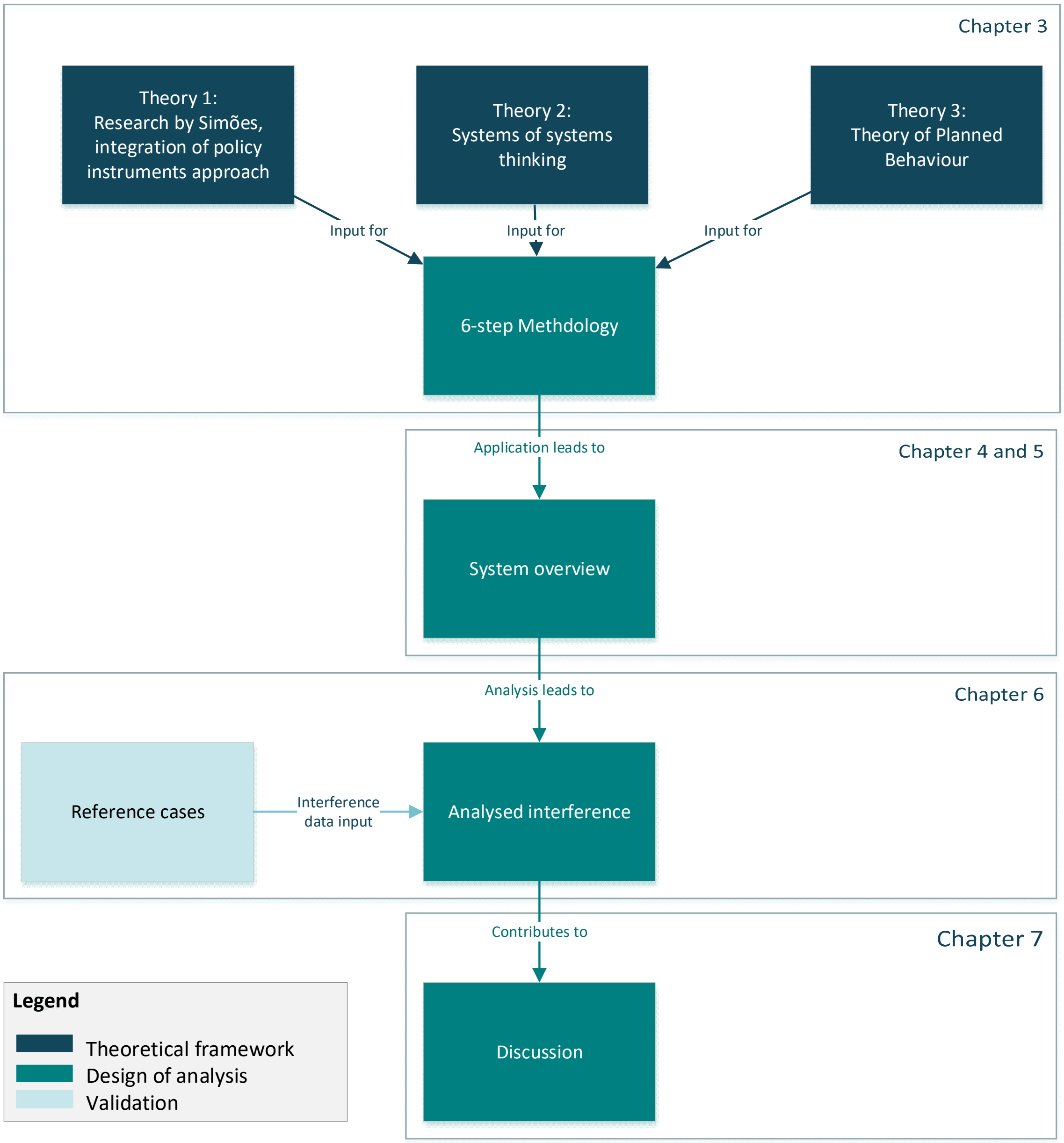

Figure 3: Research design for interference between policy measures in energy systems

3

A methodology to identify interference between policy measures

This chapter will explain the designed methodology. The seven steps of the methodology, and their theoretical bases will be discussed in sections 3.1 through to 3.7. The 7-step methodology will be introduced in section 3.8, and section 3.9 includes the general rules for the use of the 7-step methodology.

The methodology is then applied to the case study of the Dutch energy system in chapters 4, 5, and 6. These chapters will provide examples of the use of the methodology for this case study.

The handbook for using this methodology therefore exists of section 3.9 on the general rules, and Boxes III through XVI of chapters 4, 5, and 6.

3.1 Theoretical foundation of the methodology

The seven steps of the proposed methodology are based on three theoretical contributions. The first theoretical contribution is that of Simões (2013). She proposes a methodology to identify interference, based on the characteristics of policy measures themselves. The research by Simões has been introduced in section 2.2 on the research context.

The three theoretical contributions will be discussed below.

3.1.1 Integration of policy instruments

The research by Simões (2013) focusses on the integration of higher level policy instruments for energy and environmental legislation. The approach identifies interference by finding those policy measures that have the same goal, and influence the same stakeholders. The effects of the policy measures on the (energy) system are not further analysed.

To be able to identify and analyse the interference within the system, the methodology of Simões (2013) will be extended to include the structures and processes of the energy system in the Netherlands. Two additional theories are used to determine the main structures and processes for the methodology. The two theories are systems thinking applied to socio-technical systems, and the Theory of Planned Behaviour. The next two paragraphs will discuss these two theories.

3.1.2 Systems thinking for socio-technical systems

The Dutch energy system is characterised by a multitude of stakeholders, different goals, long-time investments, and large scale (sub) systems with long lifetimes. There is a strong physical embeddedness of energy production technologies that rely on the current system, which makes changing the system more difficult. The energy system also relies greatly on the use of energy by the individuals and companies in the Netherlands. The social norms on energy demand and sustainability play a large role in the energy transition.

These characteristics of the energy sector in the Netherlands lead to the perspective of complex socio-technical systems (Johansson, Jonsson, Veiback, & Sonnsjo, 2016, p.431):

> *"The complexity of the [energy] system and the interaction between technology and actors motivates the use of a sociotechnical approach when analysing energy systems"*

Complex socio-technical systems are described as (Bollinger et al., 2014, p.2):

> *"highly interconnected networks of interacting social and technical components that cannot easily be addressed independently from one"*

The energy system of the Netherlands has many different sub-systems. Within these sub-systems there are different incentives necessary to reach the envisioned change. Some examples of characteristics of the energy sector are; the nature of electricity, which cannot be routed on demand, or stored for long periods of time at acceptable costs. Whereas natural gas and oil are easier to route to a specific location and can (more) easily be stored. Heat transport and distribution is yet again a different story, where heat can be directed more easily than electricity, but is also difficult to store, as losses towards the direct environment are difficult to prevent. As each sub-system is different, the implemented policy measures will also vary among the sub-systems.

For this research, a view of systems of systems thinking is adopted to analyse the socio-technical energy system. This perspective allows for the set of production units, infrastructures, and applications of electricity, as well as the policy measures, to be seen as sub-systems. Systems thinking is also explained as (Sterman, 2001, p. 9-10):

> *"the ability to see the world as a complex system, in which we understand that 'you can't do just one thing' and that 'everything is connected to everything else.'"*

There are many applications of systems thinking, however, this research will focus on the following application; "*understanding the interaction of component subsystems*" (Maani & Cavana, 2000, p19). These applications are most useful for complex socio-technical systems, such as the energy system in the Netherlands.

Systems thinking describes as structure of a system as follows (Sterman, 2000, p. 107):

> *"The behaviour of a system arises from its structure. That structure consists of the feedback loops, stocks and flows, and nonlinearities created by the interaction of the physical and institutional structure of the system with the decision-making processes of the agents acting within it."*

This quote by Sterman (2000) identifies two dimensions for socio-technical systems: the physical and institutional dimension. Moreover, also a third dimension can be identified (Keirstead, Jennings, & Sivakumar, 2012, p.3484):

> *"An energy system is a socio-technical system, comprised of more than just pipelines, fuels, and engineering equipment [e.g. 9]. Markets, institutions, consumer behaviours and other factors affect the way technical infrastructures are constructed and operated."*

This quote by Keirstead et al. (2012) indicates the physical dimension ('pipelines, fuels, and engineering equipment'), institutions, and markets. These markets are part of the economic dimension of the energy system. This economic dimension includes the supply and demand of the main goods of the system. Keirstead et al. (2012) also mention consumer behaviour as an influence on socio-technical systems. This behavioural aspect will be discussed in the next section.

The three dimensions of socio-technical systems are used to identify the main boundaries of the system that analysed and the important processes within this system. The institutional dimension includes policies, social norms, and behaviour, the physical dimension includes for example energy production technologies or energy transport technologies, and the economic dimension includes the supply and demand of goods. Section 3.5 further explains the three dimensions of socio-technical systems.

3.1.3 Behaviour in socio-technical systems

Policy measures essentially influence the behaviour of a person. For example whether or not a person will implement a technology, or change their consumption patterns. This indicates that policy measures are developed in order to influence the behaviour of the individuals within the country. This behaviour change should then lead to the intended change of the system the individuals find themselves in, in this thesis project this is the energy system of the Netherlands.

To be able to analyse the influence of the policy measures on the energy system it is necessary to include behavioural changes in the system overview. This addition should clarify the causal relation between e.g. informative and financial factors and the actual change in behaviour, in for example investment decisions. A widely used theory to connect cause and effect for the adoption of technologies is the Theory of Planned Behaviour (Jensen, 2017). The Theory of Planned Behaviour is applicable in multiple different contexts (such as information technology, psychology, and social policy) and is seen as "*the most dominant model of attitude-behaviour relations*" (Armitage & Christian, 2003). The Theory of Planned Behaviour is developed by Azjen (1991) and includes three attributes that influence the intention of a person to change their behaviour.

The three attributes are *attitude*, *social norms*, and *perceived behavioural control*. All three influence ones *intention* to perform a certain behaviour (or behaviour change). The perceived behavioural control together with the intention to change the behaviour play a large role in the actual (change in) behaviour. This model is shown in Figure 4. The three attributes and the intention variable will be explained below, as well as their application in the system overview of this thesis.

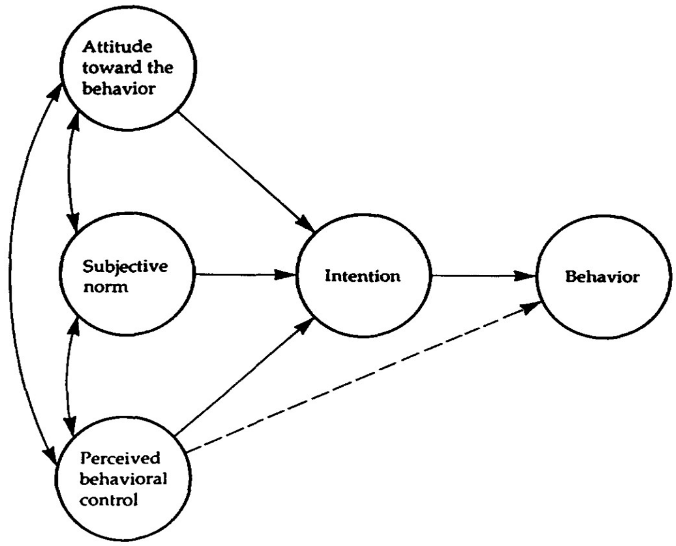

Figure 4: Theory of Planned Behaviour from (Ajzen, 1991)

Intention The intention of an individual to perform a certain behaviour or change in behaviour is defined as follows (Ajzen, 1991, p.181):

> *"Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior. As a general rule, the stronger the intention to engage in a behavior, the more likely should be its performance."*

As can be seen in Figure 4 is this intention influenced by all three attributes (attitude, social norms, and perceived behavioural control). The intention again influences the actual behaviour. If someone intents to put on a sweater instead of the heater, their intention to do so could lead to the actual behaviour of putting on a sweater. If the person actually puts on a sweater is also based on the confidence of the person that they can achieve this behaviour (the perceived behavioural control). However, if someone intends to place solar panels on their roof, this is not necessarily a guarantee that they end up placing solar panels on their roof. They have to be convinced they have the control and resources to do so. If they think they do not have the resources (time, money, or available roof) or they think they do not have the ability of installing the solar panels (or have them installed) their intention alone will not lead to the implementation of solar panels.

The three attributes that influence the intention to perform a certain behaviour are the attitude towards this behaviour, subjective norms, and the perceived behavioural control of the individual performing the behavioural actions. The three attributes will be shortly explained below.

Attitude The attribute 'attitude' (or 'attitude towards behaviour') is the positive or negative value a person associates with the intended behaviour, and is explained by Azjen (1991, p.191) as:

> *"[…] we learn to favor behaviors we believe have largely desirable consequences and we form unfavorable attitudes toward behaviors we associate with mostly undesirable consequences."*

This attitude consists of experiential aspects (feelings, past experiences) and instrumental aspects (knowledge). An example provided by (Wan, Shen, & Choi, 2017, p.70) of these two aspects is:

> *"Experiential attitude is an individual's affective feelings toward behavior (e.g., recycling is good behavior); whereas instrumental attitude refers to an individual's evaluation of behavior's outcomes (e.g., recycling could reduce landfill burden)."*

Subjective norms The subjective norm consist of the likelihood that peer groups approve or disapprove of a certain behavioural choice (Ajzen, 1991). Here it is also important to take into account to which degree the person who has to choose for a certain behaviour thinks the opinions of peers are important. For example in a neighbourhood where many houses installed solar panels on their roof, a home owner can feel the 'peer pressure' to adhere to this social (subjective norm) if he or she attributes value to the opinions of the neighbours.

Perceived behavioural control Ajzen (1991, p.196) states that:

> *"The more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater should be their perceived control over the behavior."*

The perceived behavioural control indicates to what extent the individual sees themselves capable of the behaviour, and thinks adopting the behaviour is feasible (Jensen, 2017). This sense of control is also influenced by past experiences with the implementation of a behavioural choice. Whereas the attitude is influenced by the experience of the *consequence* of the behavioural choice.

Theory of planned behaviour for organizations The Theory of Planned Behaviour is focussed on the behaviour of individuals, mostly consumers. However, a small but growing body of knowledge researches the application of the Theory of Planned Behaviour for organizations (Southey, 2011). The application of the Theory of Planned Behaviour for management decisions of organizations by Rivera-Camino (2012, p.402) is explained as:

> *"This study uses the theory of planned behavior (Ajzen, 1991) as a theoretical basis because it has been employed successfully in many studies linking pro-environmental attitudes and behavioral intention (Kaiser and Gutsche, 2003)."*

The three attributes for the organizations are based on organizational theories. The attitude of an organization towards an action or behaviour is based on the attitudes of managers within the organization (Rivera-Camino, 2012, p.402-403):

> *"Such an attitude also orients managers to achieve differentiated leadership with regard to environmental matters (Stead and Stead, 1995), promotes new relationships with buyers and suppliers (Elkington, 1994), and guides internal organizational changes (Rothenberg, Maxwell, and Marcus, 1992). When managers perceive strategies as tools for generating corporate benefits, their commitment increases and they are likely to institute significant internal change (Noble and Mokwa, 1999)."*

The attitude of managers in organizational decision making in this research, or innovation adoption, is found to be of significant influence (Damanpour & Schneider, 2006, p.231):

> *"A contribution of this study is its examination of top managers' attitude toward innovation, a factor often neglected in previous multidimensional studies of innovation adoption. Our results confirm Hage and Dewar's (1973) finding on the explanatory power of organizational leaders' attitudes, and add by showing that the impact of managers' attitude toward innovation on the adoption of innovation is considerably stronger than both environmental and managers' demographic characteristics, and is nearly as strong as that of organizational factors"*

Innovation adoption is indicated as a decision making process to adopt new actions or behaviour, an attitude towards an innovation is therefore not as different from an attitude towards sustainable behaviour (Damanpour & Schneider, 2006, p.215):

> *"empirical studies of organizational innovation have conceived innovation as an event or outcome and have measured its adoption as a dichotomous decision"*

This first quote of Damanpour & Schneider (2006) also mentions organizational factors as important, however these organizational characteristics are difficult to influence with policies, whereas the attitude of an individual can be influenced by policies. The study by Rivera-Camino (2012) also includes organizational and personal characteristics, such as organizational culture, and past behaviour of an individual. These characteristics influence the development of the three attributes of the Theory of Planned Behaviour, similar as this thesis project sees policy measures as an influence on the development of the three attributes. This thesis project does not take into account the organizational and personal characteristics specifically, as these are not influenced by policies directly. This does not indicate that these characteristics are not present within the system.

The subjective norms of an organization are likely to be based on the opinions of their stakeholders. As Rivera-Camino (2012, p.404) explains:

> *"stakeholders appear as critical drivers of corporate ecological responses (Berry and Rondinelli, 1998) and pressures from industry stakeholders can prompt managers to adopt environmental strategies (King and Lenox, 2000). Also, empirical evidence confirms that a positive relationship exists between the intensity of stakeholder pressure perceived by the manager and a firm's level of green marketing (Langerak, Peelen, and Van der Veen, 1998)."*

This dependency on the opinions and views of their stakeholders as a whole has also been mentioned by Rowley (1997, p.906-907):

> *"Stakeholder research has concentrated primarily on classifying individual stakeholder relationships and influences. However, this analysis cannot be extended to explain how a firm reacts to its stakeholders, because each firm faces a different set of stakeholders, which aggregate into unique patterns of influences. Thus, firms do not respond to each stakeholder individually, but instead must answer the simultaneous demands of multiple stakeholders."*

Rowley (1997) indicates that the network an organization is part of influences the decisions of this organization itself. In the theoretical framework as applied by Rowley (1997) is made use of the research by Oliver (1991). This research focusses on strategic responses of organizations on institutional processes, as is explained as follows (Rowley, 1997, p.895):

> *"Oliver's (1991) insightful integration of resource dependence theory and institutional theory provides a worthwhile context for studying organizational responses to stakeholder pressures. She identifies a continuum of behaviors, ranging from passive compliance with external pressures (institutional theory) to active manipulation and control of external pressures (resource dependence theory). At the resource dependence end of the continuum, an organization is able to manipulate the allocation of critical resources actively through strategies designed to gain control over the organization's exchange partners (Pfeffer & Salancik, 1978; Thompson, 1967). Under other conditions an organization must acquiesce to external pressures, since its survival is contingent on its compliance with expectations from institutional constituents, such as the state, and professional and interest groups (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Zucker, 1977)."*

The research by Rowley (1997) further uses the density and centrality of the stakeholder networks of organizations to classify their probable response to external pressures. Similar to the organizational characteristics mentioned for the development of the attitude towards behaviour are the network characteristics of the organizations not included in this thesis project. This does not indicate that these characteristics do not influence the reactions of organizations on their stakeholders' views (or the subjective norms) but merely that they are not directly influenced by policy measures.

The third attribute is perceived behavioural control. The perceived behavioural control for managers in organizations is twofold, one relating to internal control and one relating to external control (Rivera-Camino, 2012). The internal control factor includes the awareness of managers of the issues of the organizations and the environment. The external control factor includes the perceived barriers of performing the action or behaviour. The internal control is explained as (Rivera-Camino, 2012, p.404):

> *"The internal control factor pertains to earlier research on the relationship between the manager's awareness of the firm's problems and the firm's performance (Thomas, Clark, and Gioia, 1993). Studies show that awareness is a significant factor in fostering environmental concern (Ashford, 1993), and this factor motivates managers to improve their organizations' environmental performance (Starik and Rands, 1995) and to adopt pollution-prevention activities (Schmidheiny, 1992)."*

The external control is categorized differently by different researchers (e.g. (Rivera-Camino, 2012; Salzmann, Ionescu-Somers, & Steger, 2005)). This explanation will differentiate between financial, social, and environmental factors of perceived control (Salzmann et al., 2005). The financial business case of organizations is based on investments, returns on investments, and risk (avoidance). The social and environmental factors of perceived control for organizations are based on corporate social responsibility and corporate social performance (Salzmann et al., 2005). The relations ship between the financial performance (FP) and environmental/social performance (ESP) of organizations for business cases on corporate sustainability is explained as an 'inverted U-shape' (Salzmann et al., 2005, p. 28):

> *"The inverted U suggests that there is an optimal level of ESP. Deviations from this corporate optimum are associated with lower levels of FP (Lankoski, 2000). Just such an inverted U relationship has been discovered by, among others, Bowman and Haire (1975), Sturdivant and Ginter (1977) and Lankoski (2000). This relationship is intuitively appealing, since ''excessive'' improvements in ESP (e.g. towards a zero emission goal) are extremely costly and would most certainly damage corporate profits (Salzmann, forthcoming)."*

The external control variable is therefore based on more than just a financial business case, but is nonetheless dependent on the investment strategies of the organizations.

The relations between the three attributes for organizations are not all identified in the research by Rivera-Camino (2012). His research includes only an influence of subjective norms on the other two attributes. Here, the influence of subjective norms on the attitude towards a behaviour stems from studies that suggest that stakeholder pressure can influence the attitude towards a specific behaviour of the managers. The relation between the subjective norms and perceived behavioural control is derived from the notion that stakeholder pressure can be seen as a barrier for performing specific activities or behaviour, this relation can also be found in theories on stakeholder pressures for sustainable behaviour (Meixell & Luoma, 2015, p. 73 and 75):

> *"Top managers might be motivated by a number of factors including desire for a particular corporate image with customers and other stakeholders (Ageron et al., 2012), or because sustainability is an integral part of the company's vision and mission (Foerstl et al., 2010), or because top managers' own values support sustainability (Walker and Jones, 2012)."*

Rivera-Camino (2012) does not mention that the other influence that are indicated in Figure 4 are not present for organizations, but they are not included in the research. This thesis project assumes the other indicated relations are also present for organizations. As the attitudes of organizations towards sustainable behaviour also influences the social norms of a society as a whole, this is no different than for individuals. The same holds for the influence of the perceived behavioural control and social norms, and the relation between the attitude and the perceived behavioural control.

The three attributes correspond with the three behavioural factors of the system overview, attitude, subjective norms, and perceived behavioural control. The intention that is developed with these three attributes and the uncertainty of this intention being transformed into action is represented by the differences in relations between the system factors. The relation from perceived behavioural control factors to implementation factors is identified as a 'threshold' relation. Threshold relations indicate the need for a factor to grow above a certain level before the influence on the next factor occurs, i.e. the behavioural factor has to exceed a minimum level before a person transforms their intention into action. All relational types are explained in section 3.6. How to apply the behavioural factors in the system overview will be discussed in section 5.1.2.

3.2 The selection of a system

This thesis project focusses on policy measures that influence the energy sector of the Netherlands. The selection of the energy sector is the first step of the methodology that is proposed in this research report.
It is important to determine which sector will be analysed and what the boundaries are of this sector. The scope an scale of the analysed system within the identified boundaries are based on the three dimensions of socio-technical systems, the three dimensions are introduced in section 3.1.2.

The first boundary of the system that has to be determined is part of the physical dimension: the geographical boundary. This geographical boundary is also the basis for the other boundaries, scopes and scales. The geographical boundary influences the selection of policy measures (institutional dimension), as well as the inclusion of production, transportation, and processing of goods[9] (physical dimension), and the supply and demand dynamics of these goods (economic dimension).

A fourth dimension is added for the selection of the system, this is the dimension of time. The time dimension determines which variables (e.g. production capacity) are variable, and which are constant within the selected system. The boundaries, scopes and/or scales of the four dimensions are discussed below.

Physical dimension The physical dimension needs to be scoped based on a geographical region and the inclusion (or exclusion) of technological systems. For example, the region could be a province, a country, or a continent.

The technical systems are based on the production, transportation, and processing of goods. Which goods are included differs for each system, examples of goods are crops and electricity, but also knowledge can be seen as a good in (e.g.) an educational system. The technologies included are those that are involved in the production, transportation, and processing of the applicable goods for a system, within the chosen geographical region.

Institutional dimension If a geographical region is chosen, also the legislative scale of the institutions needs to be determined. For example, if a country is chosen as the geographical region of the system, the legislative scale determines if municipal, provincial, national, or international institutions are included.

Economic dimension The same holds for the economic dimension. Here the key determination is to identify which costs or prices of the production, transportation, and processing of goods are seen as an external variable (which cannot be influenced within the system boundaries), and which costs/prices are influenced within the chosen system.

[9] Goods: The crucial goods of the energy sector in the Netherlands are the energy carriers. Energy carriers are those forms of energy that are most widely used in the Netherlands and can be divided into three main categories; electricity, heat, and (fossil) fuels.

Time dimension Also the time dimension indicates what system components[10] can be regarded as constant, and which are seen as variable. For example, the production capacity of a certain good is a constant given on a time scale of months, maybe even years for some systems. But on a longer time scale, new production capacity can be build, changing the production capacity from a constant factor into a variable.

3.3 Identification of policy goals and policy measures in the energy sector

Policy measures are the concrete guidelines of legislation focussed on influencing individuals and companies. Policy measures are therefore the most direct form of legislation to influence the energy system in the Netherlands. The policy measures aim to aid in the transition of the energy system to a more sustainable sector. The aims of the policy measures in the system are represented by policy goals. The identification of policy goals and policy measures will be discussed below.

3.3.1 Identification of policy goals.

Policy goals represent the key performance indicators of the system overview. All policy measures together aim to influence the policy goals, therefore their success to do so can be identified by analysing the *path* through the system overview from policy measure to policy goal. How to identify policy goals and what the applicable policy goals for the Dutch energy system are, is explained in section 4.2.1.

3.3.2 Identification of policy measures

Interference between policy measures occurs throughout the system. If only a small selection of policy measures that influence a system are taken into account, also only a small amount of the inference that is present in the system can be found, illustrated and analysed with this methodology. It is therefore important to include a complete as possible set of policy measures for the chosen system. How to identify relevant policy measures, as well as the identified policy measures for the Dutch energy system will be further elaborated on in section 4.2.2.

3.4 Characterisation of policy measures

All policy measures have to be characterised according to the same set of *rules* if we want to be able to compare all measures. The initial methodology by Simões (2013) determines two characteristics of the policy measures that can be used to identify if policy measures interfere. These two characteristics are the goal and target group. For the 7-step methodology is the target group also specified per sector. The two additional theories (for systems thinking, and the Theory of Planned Behaviour) allow for the identification of five more characteristics that include the main structures and processes of energy systems.

The theory on systems thinking led to the identification of the main processes in the energy system. The TPB needs a characterization of policy measures that allows to identify which behavioural attribute is influenced by a specific policy measure. The characteristics for type and sub-type can provide the information to make this distinction.

In total provide the three theories eight characteristics that can be used to identify and analyse interference between policy measures in the energy system. Each of the eight characteristics aims to provide insight into the policy measure itself, as well as onto the aim and goal of the measure. The eight characteristics are: (1) sector, (2) target group, (3) type, (4) sub-type, (5) direction, (6) process, (7) specification, and (8) policy aims.

How to characterize the policy measures for the eight characteristics and the result of this categorization is explained in chapter 4.

3.4.1 Sector

The Oxford dictionary defines a sector as ‘A distinct part or branch of a nation's economy or society or of a sphere of activity such as education.’

[10] System component: a policy measure or system factor that is included in the system overview of this research

The characterisation of policy measures for sectors is based on the actors (e.g. individual people or companies) the policy measure influences. Within the energy system of the Netherlands is not just energy production applicable, the different applications or uses of energy, as well as the different users of energy also influence the energy production and transport. The seven sectors included in this methodology are based on the sectors of the NEO 2016 model by ECN (2016), and are (1) multisector, (2) energy, (3) industry, (4) transport, (5) built environment, (6) greenhouse industry, and (7) agriculture industry.

3.4.2 Target group

The target group is based on the nature of actors (stakeholders) that is influenced within the different sectors. Policy measures make a distinction between commercial parties and consumers (individual people). The three target groups are: (1) Consumers, (2) Commercial parties, and (3) ETS-parties.

Consumer parties are individual people that act based on their home lives, and not based on their professional environment. Commercial parties are the parties in their professional environment, e.g. companies, entrepreneurs, and farmers. The third and last category of a target group includes the ETS (emission Trading Scheme) parties in the Netherlands. There are ETS-parties in only three of the seven sectors: the energy sector, industry sector, and transport sector. For the energy and industry sector the ETS-parties are those companies that the European Commission defined as (European Commission, 2017b): "*heavy energy-using installations (power stations & industrial plants)*". These parties are categorized listed in the EU ETS annex I (European Parliament, 2003b). For the transport sector are the air transport companies part of the ETS-parties (European Commission, 2017b).

3.4.3 Type

There are different types of possible policy measures, this distinction is made on the influence the policy measure exerts. A well-known distinction is that of carrots (stimulating good decisions) and sticks (punishing bad decisions) (Ministry of Economic Affairs, 2016a). This distinction will be made in more detail for the possible policy measures, in order to determine which behavioural aspect these policy measures influence.

A policy measure can either regulate the actions of a stakeholder in doing something, give financial incentives to the stakeholder, or provide information to the stakeholder. Most policy measures are designed and implemented by policy makers alone. However, there are also policy measures that are the result of an agreement or collective aim of policy makers and stakeholders. These two dimensions of policy measures lead to two determinants for a type of policy measure: the influence it exerts, and the unilateral or multilateral origin of the policy measure. This leads to six different types of policy measures: (1) unilateral regulation, (2) multilateral regulation, (3) unilateral financial, (4) multilateral financial, (5) unilateral information, and (6) multilateral information.

Regulatory measures limit certain activities or require a certain performance from a specified actor. Financial measures provide incentives for actions or technologies to be implemented, this can either be accomplished by making other options more expensive, or by enhancing the business case of the preferred option. Informative measures focus on the spread of information on the preferred actions or technologies in order to create awareness of the possibilities and consequences of these actions and technologies, as well as the process of the administrative applications and regulations on the implementation of technologies.

3.4.4 Sub-type

The identified types for policy measures indicate the kind of influence that is exerted, and the role of the stakeholders in developing the policy measure. The sub-type indicates how this influence is implemented in the system. The Intergovernmental Panel on Climate Change identified ten different instruments for policy measures: (1) regulations, (2) standards, (3) taxes, (4) charges, (5) permits, (6) voluntary agreements, (7) subsidies, (8) incentives, (9) information instruments, and (10) R&D facilitation (IPCC, 2007, p. 750). These ten instruments indicate a wide variety of possible mechanisms for policy measures.

The possible sub-types of policy measures for this methodology are based on the ten instruments the IPCC mentions. However, a 'tax' is already more specified than an 'informative instrument'. The sub-types of this methodology include the more detailed level such as a tax sub-type. The characteristic *type* represents the higher level of detail such as 'informative'. The possible sub-types are indicated in Table 1. Examples of all sub-types can be found in section 4.3.4. The different sub-types will be shortly defined below.

Table 1: Possible sub-types for the policy measures

Subtypes of policy measures per type dimension	Regulatory	Financial	Informative
Unilateral	- Permits - Design specifications - Maximum - Obligatory implementation - User-friendliness of technologies - Enforcement	- Costs - Financing options - Return on investment - Insurance - Tax - Price	- Administrative process - Stakeholder involvement rules - Information supply
Multilateral	- Cooperatives	- Projects	- Information exchange - Support in implementation process

Regulatory unilateral policy measures include six sub-types. The sub-type for **permits** indicates policy measures where a stakeholder is obliged to buy or receive permits for a certain action or behaviour.

Design specification measures pose concrete requirements for products or production processes that have to be adhered to.

Policy measures that influence the **user-friendliness** of processes or products focus on the frequency of mandatory tests for technologies (e.g. lifts or cars).

Another sub-type includes policy measures that indicate a **maximum** for a certain action or behaviour (e.g. maximum allowed speed on highways, or maximum amount of fertilizer allowed in agriculture).

As mentioned for the regulatory sub-types determine some policy measures that a target group is obligated to implement a technology. The policy measures that obligate a stakeholder to implement a certain technology are categorised as **obligatory implementation** measures.

The last regulatory sub-type is the enforcement of other regulatory policy measures. Not everybody is aware of these policy measures, or wants to implement the obligatory technologies or design limitations. Therefore a policy measure can be implemented to **enforce** the stakeholders to implement the obligatory technologies.

Regulatory multilateral policy measures contains a single sub-type, cooperatives. **Cooperatives** are voluntary collaborations of which a government party is also a member. These collaborations have a formalised goal and all parties sign the collaboration agreement at the start.

Financial unilateral policy measures includes six sub-types. The first financial measure focusses on the **costs** of technologies or processes for stakeholders. There are different costs possible, such as investment costs, or R&D costs. For the measures that explicitly discern the costs, this distinction will also be accounted for in the sub-type of the measure. As two policy measures that focus on different aspects of costs for a single technology or process are likely to be more effective than two policy measures that both influence (e.g. decrease) the investment costs for the technology or process.

Financing options policy measures differ from cost measures as the financing option measures do not provide an option for a stakeholder to receive a part of their costs in return, but does provide options to loan money to implement certain technologies.

The **return on investment** sub-type of policy measures influences the revenue stream of corporations. Return on investment measures therefore do not influence costs or financing options but they do allow for a more certain business case (e.g. for renewable energy production technologies by guaranteeing a minimum income for each kWh of electricity produced).

Insurance measures allow the actors to insure financial risks of developing or implementing new technologies where the uncertainties of the business case are still high.

Tax measures influence the costs of implementing a technology or using a resource by adding a percentage of the market costs to the price of the resource or technology for the target groups in the energy system (e.g. coal tax).

The last financial sub-type is also the most specific one. Policy measures that focus on changes in **prices** of energy carriers have a different influence on the energy system than the other financial measures, as price measures influence both demand and production of the energy system at the same time.

Financial multilateral policy measures also includes a single sub-type, **projects**. Here there is a single participating party together with a governmental party that agree on a joint project, whereas in a cooperative there are multiple private parties and possibly also multiple public parties involved. The projects often also include a possibility for a subsidy.

Informative unilateral policy measures include three sub-types. The first is the **administrative process** sub-type. The administrative process includes the application procedure for permits, a tender procedure, or other mandatory administrative aspects of implementing a technology. This process can be made easier or shorter with alternative policy measures.

Some other unilateral informative policy measures determine the process of involving stakeholders into development processes, an example of a group stakeholders is the group of inhabitants of an area. These policy measures belong to the sub-type of **stakeholder involvement**.

The last of the three sub-types is i**nformation supply**. Information is often spread by governments to create awareness of certain technologies, or behavioural aspects.

Informative multilateral policy measures is the last type and includes two sub-types. **Information exchange** occurs in professional networks where the goal is the sharing of information. These networks are started by the policy makers and focus on the exchange of information between the parties that are part of the professional network.

Support for implementation processes is a sub-type of collaboration for smaller groups, where public parties play a supportive role. Instead of participating in the process, aid the public parties the stakeholders in their implementation processes and development of collaborations.

3.4.5 Direction

The policy measures influence their target groups in a certain direction, policy measures therefore change the state of a system factor. This variable that is influenced can either decrease or increase. The variable that is influenced in this methodology is indicated by the sub-types (e.g. the tax on something is increased or decreased). The policy measures are characterised for the direction of their sub-types.

Not all subtypes are assigned a direction. The sub-types that are not assigned directions are: (1) design specifications, (2) obligatory implementation, (3) cooperatives, and (4) projects. Some of these sub-types do not have a numerical value that can increase or decrease. For example, for design specifications, and obligatory implementation, something cannot be less obligatory now than in the past, it either is or is not obligatory.

The other sub-types could in theory increase or decrease, but are not implemented that way. There is no *number* of projects or cooperatives implemented, there is an option for participation in a cooperative or project implemented, thus this sub-type cannot increase or decrease as a whole.

3.4.6 Process

The policy measures all influence the energy system of the Netherlands, however they influence different processes within the energy system. The main processes of the energy system are depicted in Figure 5.

Here the production, transport, and use of energy carriers are the main processes. For each processes are emissions and losses identified. There are measures possible to decrease the losses (energy efficiency measures) and to decrease the GHG emissions (GHG emission reduction measures).

The energy production also influences the energy prices, which influence the energy demand, and therefore the final energy use.

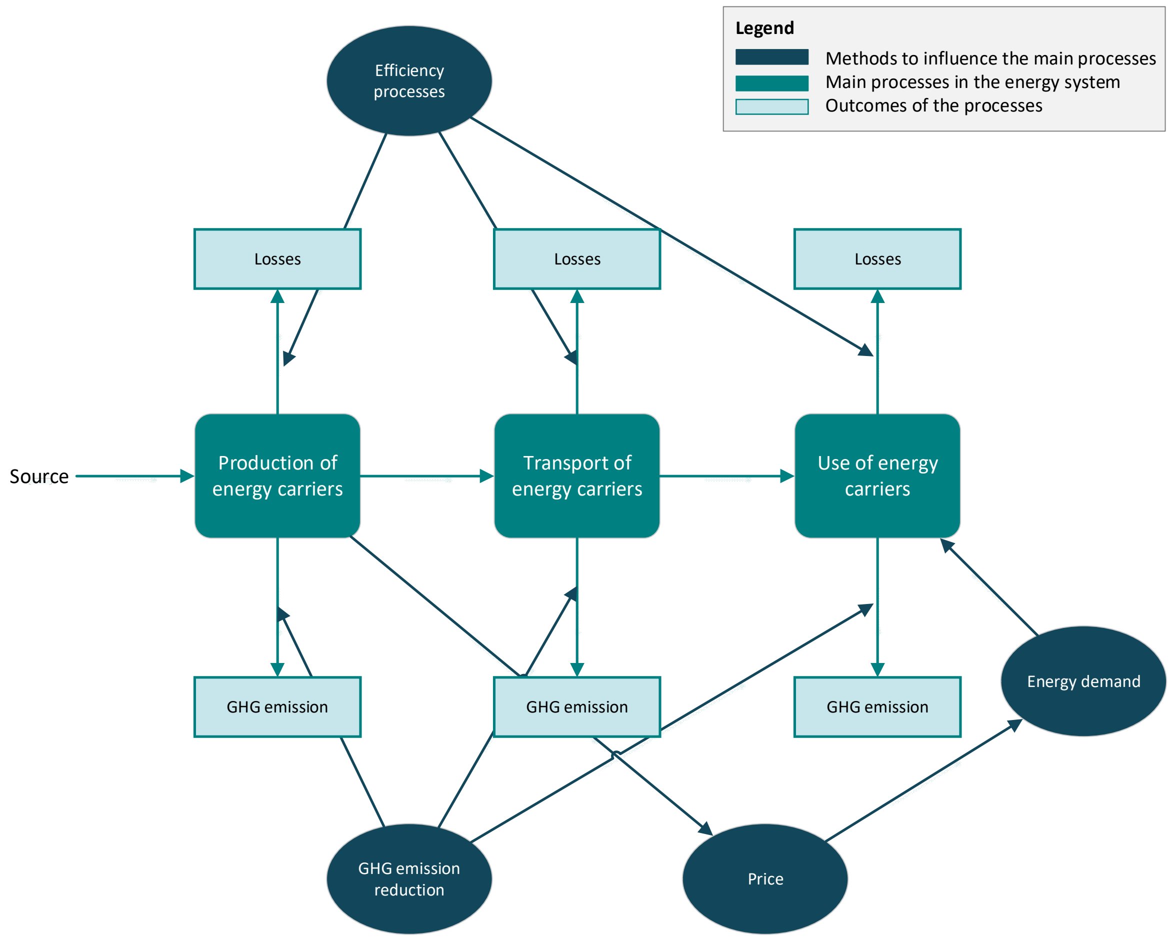

Figure 5: Processes in the energy system of the Netherlands

The policy measures are characterized for which process they influence directly. These process form the categories for the possible process characterisations. The possible options for process characterisation are indicated in Table 2.

Most of the process options are self-explanatory and are also explained in Figure 5. The options within the production of energy carriers category indicate different production methods. Transport of energy carriers focusses solely on the transport of electricity and heat, and is not to be confused with the transport sector which focusses on logistic operations and personal mobility. The demand category includes the demand or demand reduction for the different energy carriers, whereas the price of the energy carriers focusses on the effects of the demand (the use) of energy. The emission category indicates the emission or emission reduction by processes in the energy system. The efficiency category includes efficiency for fuel efficiency, energy efficiency, and efficiency of the mode of transport (e.g. vessels or trucks) of logistic operations.

Table 2: Possible process characterisations

Category	Possible process characterisations
Production of energy carriers	Central renewable electricity production Decentral renewable energy production Decentral renewable electricity production Renewable heat production Fossil fuel electricity production
Transport of energy carriers	Electricity transport Electricity transport reliability
Demand of energy carriers	Energy efficiency
Prices of energy carriers	Electricity price Natural gas price LNG price
GHG emission reduction	GHG emission CO_2 emission GHG emission reduction CO_2 emission reduction
Efficiency in use of energy carriers	Fuel efficiency measures Energy efficiency Efficiency of vehicles, or of modes of transport for logistics

3.4.7 Specification

The characterization steps above lead to emphasize the similarities between policy measures. However, there are still individual characteristics of policy measures that are essential to the system analysis. These individual aspects can be classified as technology specifications and location specifications. These specifications indicate the technology and location of the process characteristic of a policy measure. A policy measure can be characterised for the process of energy production, a technology specification can be 'wind energy' and a location specification can be 'at sea', or for the demand of energy the location specification can be 'in buildings'.

Each policy measure can have either a technology specification, a location specification or both. Where possible it is more insightful to include both the technology and location specification, as this keeps more information on individual policy measures within the system overview.

3.4.8 Policy goal

The policy goals of the energy system have been explained in section 3.3.1. Each policy measures should be characterised for the policy goal they aim to achieve.

3.5 Identification of system factors

The identification of system factors is dependent on the dimension of the socio-technical system the policy measure influences directly (see section 3.3.2). The identification of system factors per dimension are explained in the sections 3.5.1 through 3.5.3.

3.5.1 Institutional dimension of policy chains

All policy measures are intrinsically part of the institutional dimension and almost all can be translated into system factors in the same manner. There is one exception, the policy measures that directly influence the price of an energy carrier cannot be translated into system factors in the same manner. The policy measures that directly influence the price of energy carriers do not have a location or technology speciation, these policy measures do not directly influence the choice of implementation for a specific behaviour. The price of the energy carriers influence all implementation decisions, and not one decision in particular. The price policy measures will be further discussed for the economic dimension in section 3.5.3.

For all other policy measures are the characteristics defined in the third step of this methodology. These characteristics lead to the policy chains. A policy chain is the collection of system factors that connect the policy measure to a policy goal. There are up to seven system factors in a policy chain, they will be discussed below. The visualisation of a policy chain can be seen in Figure 6.

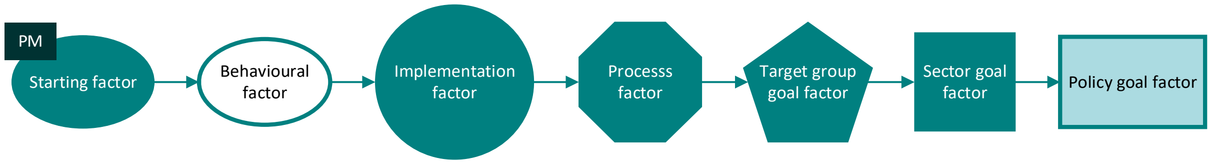

Figure 6: Visualisation of the system factors within a policy chain

Policy measure The abbreviation PM stands for 'policy measure' and will be indicated by the number of the policy measure. This number corresponds with the numbers of the policy measures in all chapters and applicable appendices.

Starting factor The starting factor of a policy measure is the first presence of the measures in the system overview. The starting factors are a combination of the sub-type, direction, process, specification, target group, and sector for each policy measure.

Behavioural factor The three attributes of the Theory of Planned Behaviour; attitude, subjective norms, and perceived behavioural control, are the behavioural factors. The behavioural factors are the second factor in the policy chains. Which of the three behavioural factors is applicable depends on the sub-types of the policy measures.

The attitude towards a behaviour is based on the appreciation of the consequences of performing the behaviour. The policy measures that allow an individual or company to experience the consequences, or provide insight into the consequences are the informative measures that provide information and the voluntary measures that allow the participants to implement the behaviour on a small scale.

The subjective norms are influenced by societal perceptions and expectations of behaviour. The policy measures that influence the view of society on a certain behaviour are process measures that determine stakeholder involvement, the professional networks for information sharing, and collaboration projects where large parts of a sector are involved together. These measures in a way influence the peer pressure individuals or companies feel to perform a certain behaviour.

The perceived behavioural control is influenced by the sense of feasibility or the expected business case for the behaviour, the measures that aid the individual in the implementation process), as well as the voluntary measures that aid the process of implementation.

One type of policy measures has not yet been included in this analysis of the Theory of Planned Behaviour. This is the restrictive type of policy measures. Restrictive measures do not alter the attitude towards an intention towards (a change in) behaviour. Restrictions force a behavioural change, and therefore do not need to influence the behavioural attributes.

Implementation factor All policy measures essentially influence whether or not a person will implement a *technology* or not, how this technology is used, or the frequency of use. The system factor that is influenced by the starting factor is therefore called an implementation factor, and indicates who implements what technology or behaviour. The implementation factor includes the specification, process, target group, and sector characteristics of the starting factors.

Process factor The system factor that is influenced by the implementation factor is the process factor. Process factors leave out the specifications, but include the process, target group, and sector characteristics. This allows for the system overview to indicate which technologies contribute to the same processes within the energy system.

Goal factors The policy chains ends at the identified policy goals. There are three types of goal factors included in the system overview. The first goal factor is the *target group goal*, the second goal factor is the *sector goal*, the last goal factors is the *policy goal*.

The target group goal factor is influenced by the process factor of the policy chain and includes the target group, sector, and policy goal. This is the first system factor where the policy goal is included.

The sector goal factor is influenced by the target group goal factor, and includes only the sector and policy goal.

In the same way is the policy goal influenced by the sector goal factor. The policy goal factor includes just the policy goal.

3.5.3 Economic dimension

The economic dimension is determined by the dynamics of supply and demand of the most important 'goods' within the system. For the energy system, the most important goods are the energy carriers (electricity, heat, and (fossil) fuels). The three different economic factors are production, demand, and price of energy carriers.

Price The production and demand of energy carriers are already present in the policy chains of the institutional dimension and are indicated with the process and specification characteristics. As mentioned are price policy measures implemented differently in the system overview. There is a price factor for each of the energy carriers, an electricity price, heat price, and (fossil) fuel price.

There is an electricity market in the Netherlands, the market output is an electricity price per hour, based on the marginal costs of the electricity production. The electricity price on the market is therefore dependent on the electricity production methods that are used at that time. There will be made a distinction between electricity production with renewables and with fossil fuels, as this distinction is also part of the policy goals, and policy measures.

The policy measures that directly influence the price of an energy carrier do not have a policy chain, but are directly linked to the price factor of the energy carrier. These policy measures, however, can influence specific target groups and leave out others. This target group's characterisation should also be included in the cross-sectoral factors for price.

Dynamics The dynamics (e.g. feedback loops) that are included in the policy chains include only the institutional relations, those connections that are based on the nature of the policy measures themselves.

There are also economic dynamics, the main economic dynamics are shown in Figure 7, and include the relations between the production, demand, and price of the energy carriers. The prices of all three energy carriers influences the demand of all energy carriers the target group can choose as an alternative energy source was well (e.g. for building heating is the choice often not made by the inhabitants, but by municipalities), as the prices of alternatives influence which energy carrier is chosen to be used.

The economic dynamics are cross-sectoral and will be represented in the system overview with cross-sector factors. The cross-sectoral factors that represent the economic dimension are the central electricity production, central electricity demand, electricity price, natural gas demand, natural gas price, fuel demand, and fuel price.

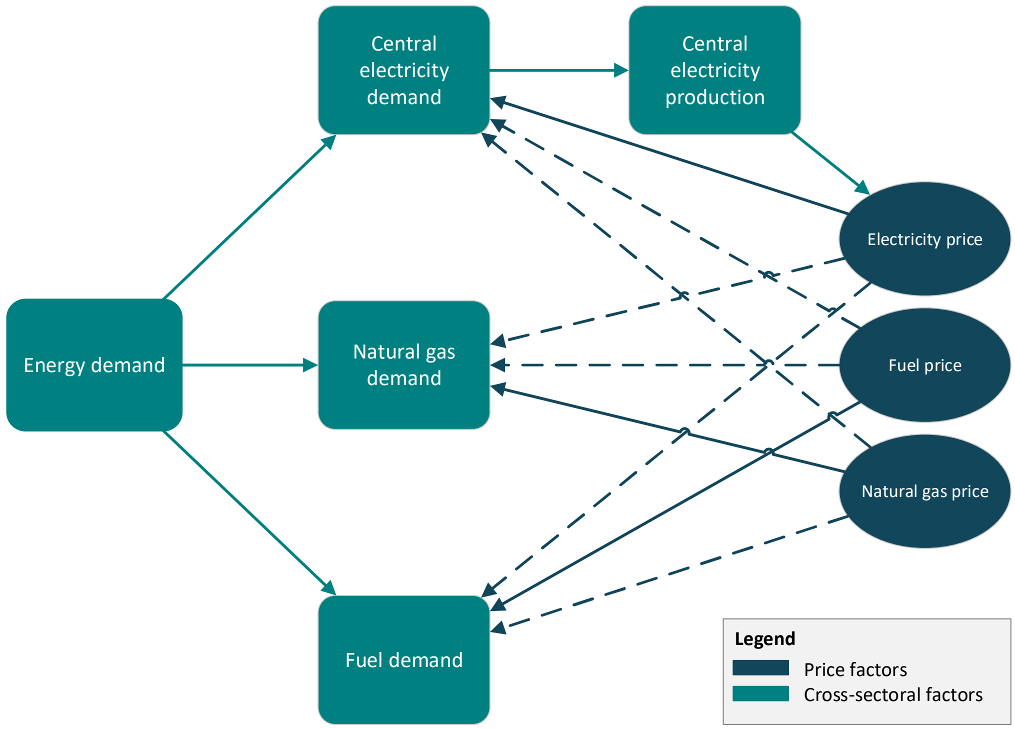

Figure 7: Dynamics in the economic dimension of socio-technical systems

3.5.4 Physical dimension

The physical dimension consists of two categories, production and transportation of energy carriers. Both categories of the physical dimension are included in the specifications of the policy characterisation. The dynamics between the two categories (production and transport) have yet to be included in the system overview. This is done in a similar manner as for the economic dimension. The cross-sectoral factors newly identified for the physical dimension are (1) Electricity transport reliability, and (2) Balance on electricity grid.

Technologies The technological specifications of policy measures are initially represented by the implementation factors. Implementation factors indicate the use of a specific technology, for a specific target group, within a specific sector. However the technologies can be implemented for multiple target groups across multiple sectors. The implementation of a technology (e.g. electric heat pumps) in the consumer built environment does also influence the implementation of electric heat pumps in the commercial greenhouse industry. The more electric heat pumps are installed, the more the subjective norms on installing electric heat pumps is changed to favour the implementation of electric heat pumps on a national level, the more cost efficient the electric heat pumps can be produced, and the more experience people have with the benefits of electric heat pumps. Therefore should the implementation factors with identical technology specifications be linked to the behavioural factors of other implementation factors with the same technological specification for other sectors. These relations are called ‘cross-sectoral relations’.

Dynamics The dynamics of the physical dimension are illustrated in Figure 8, and include the relations between the production and transport of energy carriers. Just as for the economic dimension are these dynamics cross-sectoral and will they be represented in the system overview with cross-sector factors. The cross-sectoral factors that represent the physical dimension are electricity transport reliability, balance on the electricity grid, and central electricity production. The last cross-sectoral factor is also an economic factor, this factor will be represented once in the system overview, but connects to both dimensions.

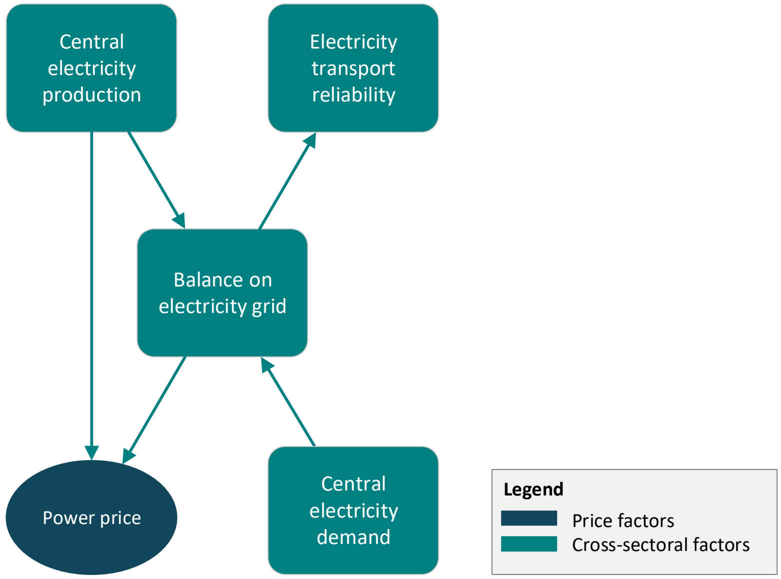

Figure 8: Dynamics in the physical dimension of socio-technical systems

3.6 Relations between system factors

The system overview as can be developed using the characteristics presented up to here, neglects information compared to the textual explanation of the system. Even though there is a clear structure, some essential information has not been included yet. This is the information included by defining the relationships between the system factors. There are five different types of relations identified: (1) Thresholds, (2) Dependent relations, (3) Delays, (4) Non-linear relations, and (5) Linear relations.

Threshold relations Some influences of a system factor on another will not change the outcome of the effect factor unless the influence of the causal factor exceeds a certain value. An example is a financial incentive, if the financial incentive for (e.g.) solar panels is too low to create a feasible business case, the perceived behavioural control value will not change. This causes the implementation of the financial measure to lead to very little change in the implementation of capacity of solar panels.

Dependent relations The implementation factors of similar technologies for different target groups or sectors depend on each other. The available experience with technologies, the societal opinion of technologies, as well as the affordability of the technology depends on the implementation of the technology in the entire system. It is also possible for two implementation factors, or an implementation factor and a policy measure, to be dependent on each other for their effect on a single process factor (e.g. the implementation of a technology and the implementation of infrastructure for the same technology, or the design and implementation of a single technology).

Delay relations A delay between the cause and effect factors can arrive from multiple sources. Some examples are implementation time (e.g. the time it takes for a factory to buy, install, and use an energy efficiency measure), decision time (e.g. the time it takes from receiving new information about solar panels to deciding to buy solar panels), and reaction time (e.g. the time it takes for a society to change its social norms to see sustainable heating[11] as a necessary and purposeful measure).

[11] Sustainable energy: *"Energy derived from natural resources that are capable of being replenished, such as water, wind, or solar power, and hence can be sustained in the long term; frequently (and in earliest use) attributive."* (Oxford Dictionaries, n.d.-b). All renewable energy sources are also sustainable. As the heat production in the Netherlands is not all done by renewable sources (e.g. Combined Heat and Power plants) the term 'sustainable heat' will be used instead of 'renewable heat'.

Non-linear relations Non-linear relations are those relations that are influenced by unpredictable, or intermittent causes. An example is the relation between electricity production capacities and the actual electricity production. As this electricity production is dependent on demand, as well as intermittent renewable electricity production units there is no linear relation between these factors.

Linear relations Linear relations are those relations that increase or decrease with a linear relationship. These relations are only present further down the policy chains, where the non-linear characteristics are no longer present.

3.7 Analysis and interpretation of found and illustrated interference

The last two steps of the 7-step methodology are the analysis and interpretation of interference. The application of the first five steps of the methodology to the Dutch energy systems allowed for the induction of five types of interference. These five types of interference, their effects, and interpretations are discussed in the next two sections.

3.7.1 Types of interference

There are different types of interference present in the system. The types of interference have different causes, and are present between the different system factors. The five types of interference are: (1) interference that is caused by the cross-sectoral factors, (2) interference that is caused by the cross-sectoral relations between behavioural and implementation factors, (3) interference of policy chains due to dependency relations between these policy chains, (4) interference that is caused by two or more policy measures that influence the same implementation factor, and (5) interference due to the integration of policy chains.

Cross-sectoral factors The first type of interference is the interference caused by the different processes across the sectors (sub-systems) in the energy system. These processes also interact with each other, creating feedback loops within the energy system.

Cross-sectoral relations The second type of interference is caused by the cross-sectoral relations between policy chains. It is possible that two policy measures provide incentives for the same technologies, but for different sectors. However, the implementation of the a technology in one sector, also influences the behavioural aspects for the implementation of the same technology in another sector. The implementation and use of technologies provides success stories, and adopting this technology will become more and more 'normal' in the energy system. It is also possible for learning curves to proceed, leading to possible cost reductions for the implementation of this technology.

Dependency The third type of interference is based on the possible dependency of the implementation of two or more technologies. An example is the implementation of electric vehicles (EV) for consumer transport, and the implementation of the (charging) infrastructure for the EV's. The implementation of EV's is dependent on the implementation of the infrastructure for EV's, and vice versa. If there are EV's but you cannot charge them throughout the Netherlands, they will be used less. The total number of EV's can still increase, but the kilometres travelled with EV's is likely to decrease, as people will only use them close to where they can charge them. Alternatively, if there is an infrastructure but no EV's, the amount of kilometres travelled with an EV will also not increase. The effect of EV's and its infrastructures alone therefore do not (significantly) influence the emission reduction in the transport sector, but together they can have this influence.

Two policy measures The interference due to two or more policy measures that influence the implementation of the same behaviour has a reasonably strong effect on the system. The effect is similar to that of the second type of interference. As more policy measures for the same behaviour provide more incentives, and a larger chance of an intention to change the behaviour is created.

Integration of policy chains The last type of interference is also caused by the policy chains. However, this type of interference takes place further down the policy chains, closer to the policy goals. This type of interference occurs for policy measures with the same policy aims and sector. This is similar to the interference as identified by Simões (2013).

3.7.2 Interpretation of interference

The interpretation of the interference is based on three aspects, the size (number of policy measures and policy chains), spread (number of sectors), and dynamics (uncertainty and feedback loops). These three aspects include the weight of the policy measure, as well as the reach of the policy measure. The aspects of uncertainty and feedback loops will be explained below.

Section 6.2 will provide examples for, and the results of, the interpretation of interference in the Dutch energy system.

Uncertainty The uncertainty in the system is twofold. First, it is uncertain what part of the intended target group will create an intention to change their behaviour, and what part will not only intend to do so, but also actually change their behaviour. Second, it is uncertain if the behaviour that is incentivised by policy measures contributes to the overall aim of this policy measure. Both aspects will be explained.

Only for those stakeholders that are influenced enough that they create an intention to implement a certain behaviour or technology, and that have a high enough perceived control for this implementation, will the policy measure lead to a change in the energy system. The presence of more than one policy measure to influence an implementation factor can have both a positive and a negative effect. If both policy measures provide incentives for the implementation of this behaviour or technology, their collaborate influence can provide the last bit of motivation for a stakeholder to overcome the threshold of the behavioural aspects and create an intention. If one of the policy measures provides incentives and one provides disincentives, they can cancel out (or decrease) each other's effects on overcoming the threshold.

This uncertainty of the effect of policy measures is dependent on this threshold in behavioural aspects. For each stakeholder is a policy measure either effective, or not effective at all. For the Netherlands as a whole this is more continuous, as the height of the thresholds is different for each stakeholder, based on their individual drivers and motivation.

The uncertainty if a behaviour change (or implementation of a technology) will actually lead to the desired change in the energy system is more complex than the uncertainty of the behavioural factors. The effects of a behaviour change in the entire system are vast in number, and can change over time. Some interference can contribute to the reduction of uncertainty by incentivising two technologies, or two behaviours, that together are more likely to reach their aim, than each individual one.

Feedback loops Feedback loops are created when the effect of a policy measure (e.g. on an implementation factor) influences the system in such a way that this effect comes full circle and influences the same implementation factor again. A feedback loop is negative when the initial effect of the policy measure on an implementation factor is counter acted after a full loop, and positive is the effect is enhanced after a full loop. Feedback loops are important in the interpretation of the effects of interference, as they can cause long term spiralling effects, that are far greater than the effect of individual policy measures.

3.8 Methodology

Once all system factors and relations have been identified using the steps as described in this chapter a system overview can be constructed. All policy chains including behavioural factors are known and can be designed. The cross-sectoral factors and relations based on technology specificities allow for more integration in the energy system. The relation types provide more information on possible barriers for policy measures to have a significant effect. And the interpretation of interference is based on the five types of interference. The seven steps of the methodology and their outputs are depicted in Figure 9.

The methodology will be applied to a case study for the Dutch energy system in chapters 4 and 5. These chapter explain how the steps can be completed, what the results of the steps are, and provide some examples. At the end of the fifth chapter is the system overview complete and can interference be identified, and analysed. This is elaborated on in chapter 6.

The found interference in this researched will be validated using the political discussion for two example cases. These cases are electric vehicles and sustainable heat. The political discussions are expected to indicate possible relations with other policy measures (interference) as well as possible barriers for the effectivity of the policy measures.

The two cases will not include all identified interference in the system overview. However based on those two cases, that include multiple sectors, complete policy chains, cross-sectoral factors, and all possible types of relations it is expected that conclusions can be drawn on the suitability of this methodology for the identification, illustration, and analysis of interference between policy measures within the energy system of the Netherlands.

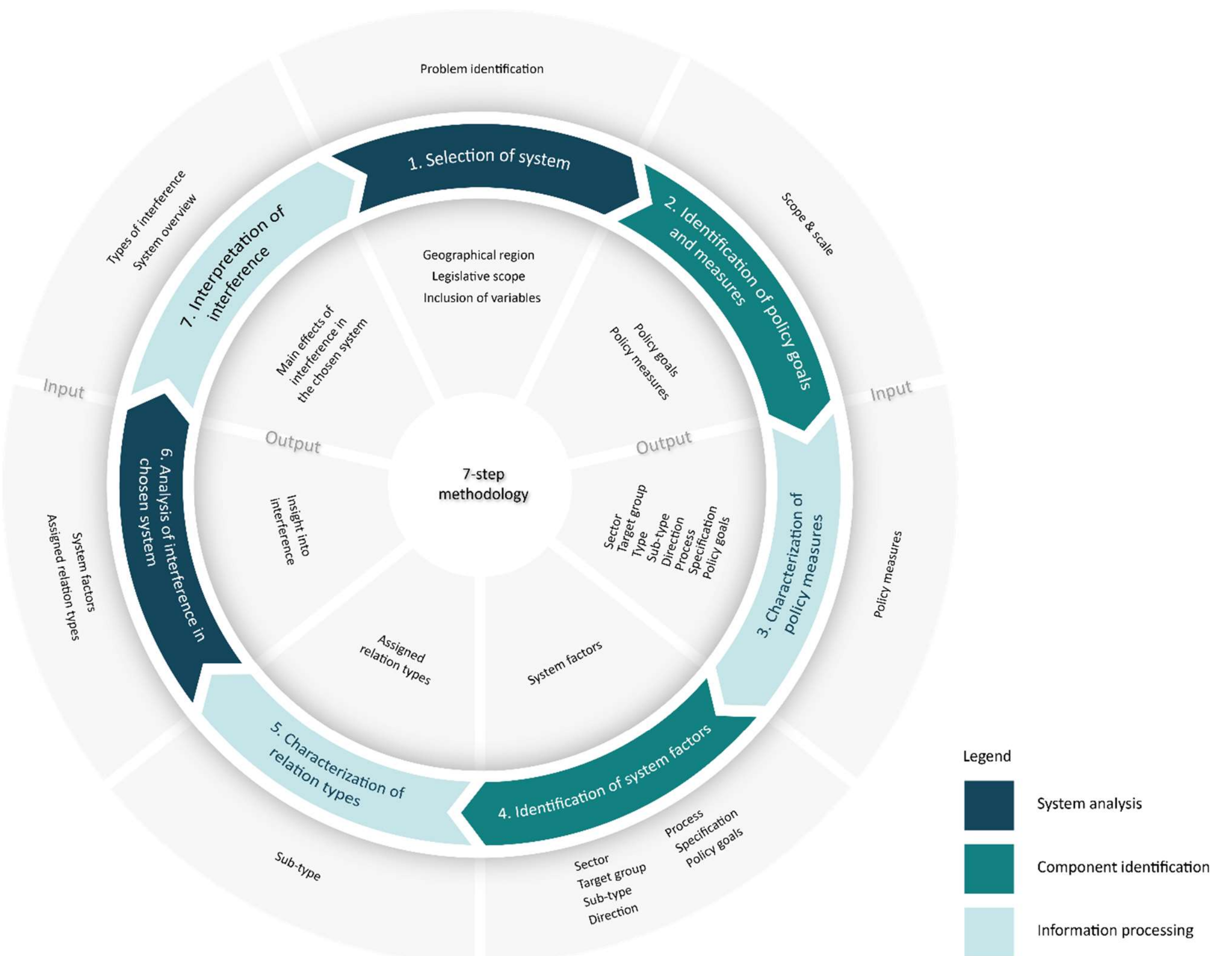

Figure 9: Design of the 7-step methodology

3.9 General rules

The handbook of applying the 7-step methodology as explained in this chapter consists of the collection of Boxes III through XVI as well as some general rules. These boxes are included in chapters 4, 5, and 6, where the application and results of the seven steps are elaborated on. The general rules will be explained below.

Overall aim of the general rules The overall aim of the general rules is to minimize the amount of system factor within the system overview, without excluding relevant information. The relevant information is included by differentiating policy chains (splitting one policy chain into two or more policy chains), while the amount of system factors can be minimized by integrating policy chains (taking two or more policy chains together in one policy chain). To keep the amount of system factors limited, integration of policy chains will be done as soon as possible, while differentiation will be done as late as possible within the policy chain.

There are also some general rules designed for the characterisation of policy measures. The five general rules will be discussed below.

3.8.1 Characterisation of policy measures

1. The possible choices for the eight characteristics of the policy measures are finite options. It is not possible to add options to (e.g.) the possible types, or process characteristics of the policy measures. An exception to this rule is the specialisation, the two categories of options (technology and location specifications) are finite, but there are many different options within these categories. These options within the two categories are not finite and are solely dependent on the policy measures that are selected.
2. Some characterisations also influence other characterisations. The target group options are dependent on the sector characteristic, the sub-type is dependent on the type, and the direction is again dependent on the sub-type.

3.8.2 Differentiation within policy chains

3. A policy measure can be characterized for more than one of the options per characteristic, except for the sector characteristic.
   a. A policy measure will have a starting factor for each type (or sub-type) it is characterised for.
   b. A policy measure will also have a starting factor for each process characteristic.
   c. If a policy measure is assigned more than one target group for the same sector, the policy chain will differentiate at the process factor.
      There is one exception to this rule. If there is an implementation factor that is identical to the one for the policy measure with two target groups, but only for one of the target groups (e.g. one policy measure is characterised as industrial, <u>commercial</u>, financial, tax, decrease, GHG emission reduction, and GHG emission, whereas another policy measures is characterised as industrial, <u>commercial & ETS</u>, financial, tax, decrease, GHG emission reduction, and GHG emission) the policy chain may differentiate at the implementation factor. This differentiation does not lead to more system factors, than if they are not differentiated. Before the differentiation, there is one factor for commercial parties and one for commercial & ETS parties, while when the differentiation does take place there is one factor for commercial parties, and one for ETS parties.
   d. If a policy measure is assigned more than one policy goal, the policy chain will differentiate at the target group goal factor.

3.8.3 Integration of policy chains

4. As soon as two or more policy chains include identical factors for the same factor type (e.g. identical implementation factors, or target group goal factors) the policy chains will be integrated.
5. It is possible for the process factor to be identical to the target group goal factor, as some options for the process characterization correspond with the policy goal options (GHG emission and energy efficiency). In this case will the process factor be excluded from the policy chain.

4

Policy analysis of the Dutch energy system

The previous chapter introduced the 7-step methodology. This chapter of the thesis project is the first of two chapters that discuss the case study of the 7-step methodology for the Dutch energy system.

This chapter will discuss which policy measures are included in the research, as well as how these policy measures can be translated into information that can be used in a system overview. Accordingly will the first system factors, the starting points, also be composed.

The policy analysis in this chapter provides all information regarding the policy measures that is required as input for the system overview that will be developed in chapter 5.

4.1 Step 1- System selection

The selection of a system is dependent on the overall aim of the research. This thesis project aims to research transitions in an energy system, the start of the system selection is therefore 'an energy system'. Box III explains how the system boundaries and scope can be determined.

> **Box III – System selection**
>
> Before a system can be analysed, it needs to be selected. The selected system should have clear boundaries. The system boundaries have to be specified for the three dimensions of a socio technical system: institutional, physical, and economic, as well as for a fourth dimension: time.
>
> After the system is selected (this is based on the aim of the research as a whole), a geographical region needs to be selected. The technologies included are those that are involved in the production, transportation, and processing of the applicable goods for a system, within the chosen geographical region.
>
> The institutional scale does not need to be identical to the geographical region. However, legislation for a larger region than is chosen as a geographical region, is more difficult to include and interpret within the chosen system, as it is possible that some dynamics between system components are lost due to the geographical boundaries. Including the legislation of a smaller region (e.g. municipal legislation for a geographic region of a country) can lead to more detail in the system, but can also cause an overload of information that makes it impossible to identify the important interference and dynamics within the system for the chosen geographical region. It is therefore recommended to choose a legislative scale similar to the geographical region.
>
> The economic variables (costs and prices) that are determined within the geographical region of the system are recommended to be included as internal variables in the system. However the costs/prices that are determined based on global markets are recommended to be included as external variables, which cannot be influenced within the system.
>
> Which time scale to choose depends on the goals of the study, if the goal is to see the short term effects, a time scale should be chosen that allows for constant production, transportation, and processing capacities, but for differentiating demands and production outputs. If the development of a system as a whole is researched, a longer time scale should be chosen, allowing for variable production, transportation, and processing capacities.

The results of the system selection will be discussed for socio-technical systems, and the time scale. As is discussed in the first three chapters, focusses this thesis project on the transition of energy systems towards a more sustainable system. The selection of a system will therefore be based on the characteristics of energy systems. These characteristics are also explained in the first three chapters, and include (among others) long pay-back times for investments, a large social participation, and volatility due to the nature of electricity as a good.

4.1.1 Three dimensions of a socio-technical system

The three dimensions include a physical dimension, an institutional dimension and a financial dimension.

Physical dimension The physical dimension of the energy system is based on a geographical region of a country, the Netherlands. This region is chosen as currently the energy production and transportation is still mostly a national affair. More international trends are starting, but they are not yet developed into a true international energy system of (e.g.) Europe.

The essential goods of the energy system are the energy carriers: electricity, heat, and (fossil) fuels. Within the Netherlands is electricity produced, transported, and processed (or used). Heat is more and more produced on a national level, but is not yet transported nationally. The use of heat, however, is a national affair. More and more buildings and processes use heat, and not electricity or gas, for heating purposes. There are fossil fuels produced in the Netherlands, as there is a natural gas present below the surface of the Netherlands, however oil, coal, and other fuels are not produced in the Netherlands. All fossil fuels are relatively easy to transport, and are transported around the globe. The Netherlands does use (process) fossil fuels in their national energy system. This leads to the inclusion of production, transport, and processing of electricity, the production and processing of heat, and the processing of fossil fuels in the selected energy system for the Netherlands.

Institutional dimension The institutional dimension is also selected on a national level, and includes only national legislation. International legislation (EU legislation) is only included if the legislation is transposed into Dutch legislation. Municipal and provincial legislation are not included, as that would lead to an information overload, and add multiple scale dimensions to an already complex national energy system.

Economic dimension The economic dimension is based on the national scale as well. The electricity price is determined nationally, heat does not have a standardized price, and the fossil fuel prices are determined globally. This leads to the inclusion of an internal variable for the electricity price, and an external variable for the fossil fuel prices.

The production costs of electricity, and heat, as well as the processing costs of the energy carriers are partly based on global costs (e.g. a coal fired electricity plants uses international technologies and is not restricted to prices of technologies in the Netherlands), and partly based on national legislation (taxes and subsidies influence the costs of certain processes specifically for the Netherlands, but not for other countries, e.g. tax on the use of coal for energy production). The production, transportation, and processing costs of the goods are therefore included as variables.

4.1.2 Time scale

As the dynamic character of a system is different for a short or long time scale, a choice has to be made as to which time scale is adopted, and which elements are therefore variable.

The research of this thesis project focusses on the transition of the energy system into a more sustainable system. This transition requires a dynamic production and process capacity, and therefore includes a long term time scale. This causes the production, transportation, and processing capacities and technologies of the energy system to be variable.

4.1.3 System boundaries

Results The system that will be used as a case study in this thesis project is the energy system in the Netherlands, including the production, transport, and processing of electricity. Also the processing, but not production and transport, of fossil fuels are included. The production and processing, but not transport of heat are also included. This is depicted in Table 3.

Table 3: Inclusion and exclusion of the production, transport, and processing of the three main goods

Inclusion and exclusion of technical systems	Electricity	Heat	(Fossil) Fuels
Production	Included	Included	Excluded
Transportation	Included	Excluded	Excluded
Processing	Included	Included	Included

The included legislation is also limited to the national level of the Netherlands. The prices of electricity are included as a variable, the price of fossil fuels are included as constant, and the heat price is excluded, as there is not (yet) a central price for heat within the Netherlands, or globally. The costs of production, transport, and processing of energy carriers are included as variables. A long term time scale is adopted, causing the production, transportation, and processing capacities and technologies of the energy system to be variable.

4.2 Step 2 – Policy goals and policy measures

Policy measures are the concrete guidelines of legislation focussed on influencing individuals and companies. Policy measures are therefore the most direct form of legislation to influence the energy system in the Netherlands. In the Dutch energy sector there are three goals the policy measures together aim to achieve. These policy goals will be discussed first, followed by the relevant policy measures that will be included in this research.

4.2.1 Policy goal identification

In Box IV is explained how policy goals can be identified.

> Box IV – Policy goal identification
>
> A policy goal can be recognized by three characteristics: (1) the goal is adopted by the government as a whole (instead of by one or two governmental organizations alone), (2) it indicates a measureable change of the current situation (e.g. a percentage of increase or decrease based on a reference point in the past), (3) and is specified for a clear time frame (e.g. before 2050).
>
> A policy goal is often stated on the website of the national government, and/or on the websites of international governmental organizations (such as the United Nations).

Most national governments have a website and on this website is an overview present of all government related topics. Choose the topic that is closest related to the system you have chosen to analyse. On the webpage for the chosen topic should a section be present that is named 'policy information' or 'policy strategy' or something similar. This section will indicate the main aims for policy measures for the chosen topic. It might be necessary to look at more than one topic, if the system you have chosen is relatively large. The policy aims mentioned at the webpages are the policy goals.

Below will the examples for the energy systems of the Netherlands and Germany be discussed, as well as the found policy goals for the energy system of the Netherlands.

Examples For the energy system in the Netherlands the main governmental website is Rijksoverheid.nl. On this website can you choose the topic 'climate change' on the tab 'topics'. For the topic climate change is a link listed that is named 'climate policy'. On the webpage for climate policy is listed that the Netherlands is part of international agreements, and is a link present to the European goals (European Commission, 2017a). The webpage of the European commission identifies three policy goals; reduction of greenhouse gas emission, increase in renewable energy production, and an increase in energy efficiency.

A second example will be provided for the German energy sector. The website of the national government is Bundesregierung.de. On this website can the topic of sustainability be chosen. On the sustainability webpage is a link present to Germany's national sustainable development strategy. The report on the sustainable strategy mentions the energy policy goals (The Federal Government of Germany, 2002);

> *"With regard to the target of energy policy, the Council endorsed the recommendations made by the Enquete Commission "Protection of the Earth's Atmosphere", which called for a 40 % reduction of CO2 emissions by 2020, compared to 1990. Furthermore, the Council also proposed a new efficiency offensive, resulting in a efficiency gain of 3 % annually. It also demanded an end to coal subsidies by 2010 and an increase in the proportion of renewable energy to 50 % by 2050, compared to 2000."*

Results The identification of policy goals is not as straight forward as the rest of the steps of the methodology to find, illustrate, and analyse interference between policy measures. However, using the guidelines presented in Box II, the policy goals should be identifiable.

The policy goals for the Dutch energy system are identified as; reduction of greenhouse gas emission, increase in renewable energy production, and an increase in energy efficiency. The found policy goals, including their measurable change and time frame are summarised below (European Commission, 2017):

1. Reduction in greenhouse gas emissions of 40% (compared to 1990) before 2030;
2. Increase of renewable energy production to a minimum share of 27% of the energy mix before 2030;
3. Increase in energy efficiency with a result of 27% energy savings before 2030.

4.2.2 Policy measure identification

In Box V is explained how policy measures can be identified.

> Box V – Policy measure identification
>
> The selection of policy measures is the most tedious step of the methodology. The specific characteristics of a policy measure on a national level are that a policy measure is implemented by one (or more) of the ministries, it has a specified group of stakeholders it aims to influence, and includes concrete actions to be undertaken by the government to implement the policy measure.
>
> These characteristics allow for the differentiation between policy measures and (e.g.) policy instruments. The three characteristics are not (all) applicable to policy instruments. Policy instruments are often a more general aim of the government, including multiple stakeholders and/or lacking concrete actions.

Policy measures can be found on the same websites of the national governments as the policy goals have been found. It is important to select multiple topics and click through as many links that seem relevant. Most countries will have evaluation reports of their policy measures for the different sectors. These evaluation reports provide you with a complete overview of the applicable policy measures. Below will the example for the energy systems of the Netherlands be discussed, as well as the found policy measures for the energy system of the Netherlands.

Example On the website of the Dutch national government (via the topic renewable energy) is a report available that is called the 'Energieagenda' (energy agenda). This report explains the essence of the views on the energy sector of the Dutch national government. The data this report references to is the NEO 2016 model that has been discussed in chapter 2. The NEO 2016 report (that accompanies the NEO 2016 model) is an evaluation report on the effectiveness of all policy measures related to the energy system of the Netherlands. The policy measures used in this report are the selected policy measures for the analysis of this thesis project. The report also includes information on the sectors the policy measures are active in and whether or not they are part of the 'Energieakkoord' (see chapter 1).

Results The selection process for the policy measures is depicted in Figure 10. The NEO model incorporates both current legislation as well as planned legislation that is not yet (fully) implemented. This thesis project focusses on existing policy measures. Therefore only those policy measures that were implemented at the publishing date of the NEO 2016 model, May 1st 2016, are included in the list of applicable policy measures[12]. This cuts the list of 194 policy measures included in the NEO 2016 model down to a list of 141 policy measures.

The list of 141 active policy measures included some doubles, a policy goal, and some policy measures that were not possible to identify. These policy measures were excluded from the list of applicable policy

[12] Applicable policy measure: the applicable policy measures are those measures that were active on May 1st, 2016, and could be found online, through one of the policy documents

measures, leaving a list of 119 policy measures to be included in this thesis project. The list of selected policy measures with a short description can be found in Appendix A.

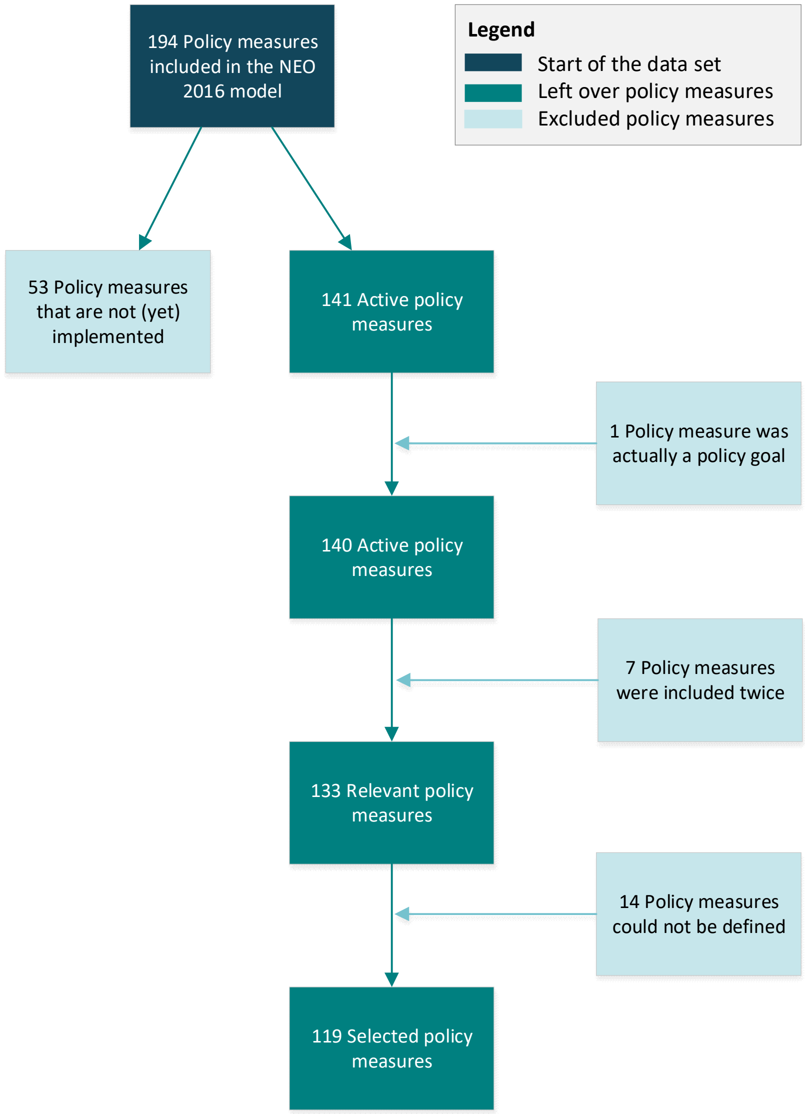

Figure 10: Selection process for the policy measures

Seven policy measures were mentioned twice, once in the 'multisector' sector and once in another. The list of policy measures for this research assumes that the policy measures of the 'multisector' sector are active in all of the other six defined sectors, unless explicitly stated otherwise in policy documents. An example is policy measure number 6, the increase in percentage of an investment that can be deducted off of revenue taxes by corporations ('Verhoging aftrekpercentage EIA van 41,5% naar 58%'). The same policy measure is included as number 69, albeit under a slightly different name ('Verhoging EIA percentage'). For those duo's that have one of the measures categorized as multisector, the multisector measures was kept. For one duo, both measures belonged to the same sector, therefore there was no difference as to keep either one specifically. There was one duplicate where the two policy measures were categorized under two different sectors where none were the 'multisector' sector. Here the policy documents led to a choice of sector.

For example, the policy measure for the Centre of expertise on energy saving (no. 71, 'Expertisecentrum energiebesparing', or ECE) was mentioned for the industry sector, and the built environment sector. As the

website of the ECE itself indicates a focus more on the industry, than on the built environment (ECE, n.d.). Therefore was chosen to include this policy measure in the industry sector.
One policy measure was actually a policy goal, measure number 164 is the directive on renewable energy that states that 14% of the energy production in 2020 should be renewably produced energy (CE Delft, 2014).

Thirteen policy measures could not be clarified using the policy documents. As the methodology to find, illustrate, and analyse interference requires the policy measures to be characterised are these fourteen measures also taken out of the policy list. These 13 measures are listed at the end of Appendix A.

4.3 Step 3 – Policy measure characterisation

In Box VI is explained how policy measures can be characterised.

> **Box VI – Policy measure characterisation**
>
> Once a policy measures is identified, the right characteristic for each of the eight characterization categories needs to be chosen. The eight characterization categories are (1) sector, (2) target group, (3) type, (4) sub-type, (5) direction, (6) process, (7) specification, and (8) policy aim. The different choices for each category of characteristics are explained in section 3.4.
> To be able to choose the right options within each characterization category, detailed information on the policy measure is required. This information can be found in policy documents. Possible policy documents are legislative texts, research reports commissioned by a governmental organization, or brochures of governmental organizations on application procedures (e.g. for subsidies) that describe the policy measure and the eligibility rules for stakeholders.
>
> Once the information is found, for each of the eight characteristics can the right option be chosen.

Examples Sources for the additional information on policy measures in the Dutch energy system can be the websites and brochures of governmental implementation organizations (the organizations that are responsible for the implementation of policy measures in society), examples are Rijkswaterstaat.nl and RVO.nl. As well as legislative texts for implemented laws and regulations (Overheid.nl), and research reports (or research reports commissioned by the national government), such as . It is essential that all sources for the additional policy information are governmental sources, as at this stage in the methodology we are interested in the policy measures itself and not the views of society or a commercial party on these policy measures.

The sector and process characterisations are shortly elaborated upon below, as they ask for a little more thought than the other characterisations.

Sector As for all policy measures a sector was already identified within the NEO 2016 model, it was no longer required to find this information in the policy documents. However, the sector the policy measure is active in is always clear in the policy documents, as it is explained for whom the policy measures are applicable.

Process Each policy measure has to be formalised for the process within the energy system it directly influences (emission, production, demand, use, transport, or efficiency) and the energy carrier it uses (electricity, heat, (fossil) fuel). Some policy measures can identify with two energy carriers for the same process, electricity and heat. For the policy measures that do not make the distinction between electricity and heat, the energy carrier 'energy' can be used.

4.3.1 Sector

There are seven sectors identified in the NEO 2016 model, these sectors are: (1) multisector, (2) energy, (3) industry, (4) transport, (5) built environment, (6) greenhouse industry, and (7) agricultural industry.

Examples As for all policy measures a sector was already identified within the NEO 2016 model, it was no longer required to find this information in the policy documents.

For two policy measures, the identified sector by the NEO model did not correspond with the sectors identified in the policy documents, here the sector identified by the policy documents was leading. These two policy measures will be explained shortly below.

The first measure is the Energy tax with a raise for renewable energy production (no. 20, 'Energiebealsting met opslag voor duurzame energie'). The policy measures for the regular energy tax is also included in the list of policy measures and is identified as a multisector policy measure. The policy measure for the energy tax including the raise for renewable energy production was identified as an energy sector policy measure in the NEO 2016 model. However, the energy tax is applicable to all energy users, and not only those energy users in the energy *sector* (Overheid.nl, 2017b). The policy measure for the energy tax including the raise for renewable energy production therefore has been to be moved to the 'multisector' sector.

The second policy measure that has been moved to another sector is the Directive for indirect emissions costs of ETS (no. 25, 'Regeling Indirecte Emissiekosten ETS'). This policy measure compensates companies that have higher electrical costs due to the ETS system, if those companies themselves are not part of the ETS system. This measures is therefore not applicable for electricity producers. The policy measures was characterized as an energy sector measure, however the policy documents clearly state that companies in the energy sector (electricity producers) are not eligible for the subsidy (Overheid.nl, 2017; RVO.nl, n.d.-d). The policy measure for indirect emission costs due to the ETS therefore has been moved to the multisector sector.

Results Each policy measure can be formalised for only one sector. The division of the policy measures among the seven different sectors can be seen in Table 4.

Table 4: Number of policy measures per sector

Sector	Number of policy measures
Multisector	14
Energy	20
Industry	8
Built environment	24
Greenhouse industry	8
Transport	33
Agricultural industry	12
Total	119

4.3.2 Target group

The three possible target groups are: (1) Consumers, (2) Commercial parties, and (3) ETS-parties. The target groups are determined for stakeholders within a sector.

Examples An example of a consumer target group is a household, this is a consumer target group in the built environment. A commercial target group within the built environment can be a housing corporation, or a building company.

All policy documents state clearly which target group is applicable. For example the EIA measure (no. 4) mentioned before, focusses on revenue tax. As consumer parties do not have a revenue, this measure is identified for both the commercial and ETS-parties. Most commercial policy measures are also applicable to ETS-parties. Unless it is explicitly stated in policy documents that a measure is solely for commercial or solely for ETS-parties should the policy measure be identified for both target groups.

Results The policy measures have all been identified with up to three target groups per policy measure. The division of the policy measures among the three different target groups can be seen in Table 5.

Table 5: Number of policy measures per target group

Target group	Number of policy measures
Consumer	46
Commercial	93
ETS-parties	36
Total	175

However, as the target groups are specified further per sector, it is more interesting to see how the policy measures are divided over the target groups for the different sector. This can be seen in Table 6.

The division of policy measures for the target groups per sector do not show unexpected results. The consumer target group is large for the built environment and the transport sector. In the built environment play private home owners a large role in the energy demand, and in the transport sector is the commuter travel from home to work a significant part of all transport activity on an average day. The consumer group for the energy sector is focussed on decentral renewable energy production, for example with solar panels on the roofs of houses. Within the multisector sector are most, ten out of fourteen, policy measures applicable to both the commercial and ETS-parties. The three measures in the consumer group of the multisector sector are applicable to all three target groups.

The commercial target group is for most sectors the largest group, as a large part of the energy demand is caused by commercial parties, it is expected that also a large share of the policy measures are applicable to commercial parties.

There are relatively little ETS-parties in the Netherlands compared to the commercial parties. However, as ETS-parties are defined as those that emit large amounts of greenhouse gasses in the energy, industry, and transport sectors it was expected that there would be a large share of policy measures regarding these parties in the energy, industry, and transport sectors.

Table 6: Number of policy measures per target group and per sector

Number of measures per target group and sector	Consumer		Commercial		ETS-parties	
	[#]	[%]	[#]	[%]	[#]	[%]
Multisector	3	10	13	43	14	47
Energy	3	9	18	51	14	40
Industry	0	0	5	42	7	58
Built environment	18	55	15	45	0	0
Greenhouse industry	0	0	8	100	0	0
Transport	22	49	22	49	1	2
Agricultural industry	0	0	12	100	0	0

4.3.3 Type

There are six types of policy measures identified: (1) regulatory - unilateral, (2) regulatory - multilateral, (3) financial - unilateral, (4) financial - multilateral, (5) informative - unilateral, and (6) informative - multilateral.

Examples An example of a unilateral regulatory measure is the policy measure focussed on CO_2 norms for personal mobility cars (no. 140, 'CO_2 normering personenauto's'). This policy measure determines the maximum emission of CO_2 in grams per travelled kilometre of a personal mobility cars (Ministry of Infrastructure and Environment, 2016).

An example of a multilateral regulatory measure is the Green Deal Zero Emission City Logistics (no. 147, 'Green Deal Zero Emissie Stadslogistiek'). This policy measure focusses on logistic operations in city centres and the emissions that these operations have. The aim is that in 2025 all city centres will only have zero emissions logistic operations (Green Deals, 2014).

An example of a unilateral financial measure is the Energy Investment Deduction measure (no.4, 'Energie investerings aftrek', or EIA), where tax deductions can be achieved for implementing energy efficiency measures or renewable energy production technologies (RVO.nl, n.d.-a).

An example of a multilateral financial measure is the Programme 'Truck of the Future' (no. 154, 'Programma Truck van de Toekomst'). This measure allowed commercial parties of the transport sector to try out alternatives to diesel trucks in practise. The participating stakeholders received a subsidy for the try out projects (RVO.nl, n.d.-a, n.d.-e; TNO, 2016).

An example of a unilateral informative measure is the Implementation act Wind energy at sea (no. 34, 'Uitvoeringswet Windergie op zee'). This is a measure that aims to integrate the processes of appointing possible sites for wind energy at sea and the application processes of permits by the developers of the wind parks for these sites (Eerste Kamer der Staten-Generaal, n.d.).

An example of a multilateral informative measure is the Centre of expertise on energy saving (no. 71, 'Expertisecentrum energiebesparing', or ECE). The ECE is and independent network and knowledge organization where awareness for energy efficiency measures is created for commercial parties through the utilization of a network for information exchange (ECEonline.nl, n.d.).

Results The policy measures be identified for more than one of the types, as some policy measures have more than one active mechanism that influences the system. The division of the policy measures among the six different types can be seen in Table 7.

Table 7: Number of policy measures per type

Type	Number of policy measures
Regulatory - Unilateral	43
Regulatory - Multilateral	16
Financial - Unilateral	43
Financial - Multilateral	2
Informative - Unilateral	13
Informative - Multilateral	9
Total	126

For the six types of the policy measures have 126 types been identified. There are no measures that have identified with more than two different types. This leaves seven policy measures that have been formalised for two different types. No pattern can be discovered in types of policy measures that go together often. All six types can be found among the seven policy measures that have identified with more than one type. Of the eighteen type identifications, three are for unilateral regulations, 2 for multilateral regulations, six for unilateral financial measures, one for multilateral financial measures, one for unilateral informative measures, and also one for multilateral informative measures. Of these six financial measures two unilateral regulations, and two with multilateral regulations, one with unilateral informative measures, as well as one with a multilateral informative measure. Due to the small number of measures with two types, no conclusions can be drawn.

An example of a policy measures with two types is the policy measure for the Programme Truck of the future (no. 154, 'Programma Truck van de Toekomst'). This programme allows for companies in the transport sector to implement fuel efficiency measures, by using alternatives for diesel trucks, on a project basis and provides the options for subsidies (TNO, 2016). This measures is therefore characterized as a unilateral and multilateral financial measure.

4.3.4 Sub-type

The different sub-types are categorised for the types, the different sub-types are indicated in Table 8. An example is given for each sub-type.

Examples There are six unilateral regulatory sub-types. The most well-known example of **permits** is the ETS-system (no. 14). The ETS-system obligates certain corporations to buy permits for their CO_2 emissions. The amount of available permits on the 'permit-market' is determined by an independent committee, therefore inducing a maximum on the CO_2 emissions by those corporations together (European Parliament, 2003a). A note here is that the permit-market is a permit and financial measure at the same time. The permits themselves restrict the CO_2 emissions of all corporations together. The presence of a market to buy and sell those permits is a financial incentive for individual companies to reduce their CO_2 emissions.

An example of a **design specification** is the measure for CO_2 norms for personal mobility cars (no. 140). Here the policy measure obligates car producers to adjust their products, the cars, to adhere to these design specifications of the emissions of consumer cars in grams per kilometre driven (Ministry of Infrastructure and Environment, 2016).

An example of a **maximum** measure is the increase in speed limits for the main road network (no. 174, 'Verhoging snelheidslimiet hoofdwegennet'). This policy measures determines the maximum speed of highways and provincial roads.

An example of an **obligatory implementation** measure is the measure for the Law on environmental protection (no. 12, 'Wet milieubeheer, activiteitenbesluit en –regeling'). This policy measure obligates corporations to include specified energy saving technologies when they build (or re-build) a building for their corporation (Overheid.nl, 2017).

An example of a measure influencing the **user-friendliness of a technology** is the Test regulation for air-conditioning systems in buildings (no. 89, 'Keuring airco: Beg en Reg') which influences the frequency of mandatory tests (RVO.nl, n.d.-b).

An example of an **enforcement** measure can be found for the same technologies that have been mentioned for the obligatory implementation sub-type, the intensification of enforcement of law for environmental protection (no. 70, 'Intensivering handhaving Wet Milieubeheer') (Overheid.nl, 2017).

There is one multilateral regulatory sub-type. An example of a **cooperative** is the Green Deal Zero Emission City Logistics (no. 147). This cooperative focusses on possible technologies for zero emissions logistic transport in city centres. The parties that are part of the cooperative have signed the agreement (Green Deals, 2012).

There are six unilateral financial sub-types. An example of a **cost** policy measure is the Investment Subsidy for Renewable Energy measure (no. 54, 'ISDE'). This measure allows consumer and commercial parties to receive a subsidy for a part of the investment costs for sustainable heating technologies (RVO.nl, n.d.-b).

An example of a policy measure for **financing options** is the extension of the amount of mortgage on a house for technologies that will increase the energy efficiency of the house that is being mortgaged (no.87, 'Verruiming hypotheekruimte voor het nemen van energiebesparende maatregelen') (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2014).

An example of a **return on investment** measure is the Stimulation for renewable energy (no. 31, 'SDE+') policy measure. This policy measure determines the revenue price per kWh of renewable energy production for those parties that are selected for this subsidy. If the market price for electricity is lower than the guaranteed price by the subsidy, the electricity producer will receive the difference in revenue from the government (RVO.nl, n.d.-c)

An example of an **insurance** measure is the policy measure Guarantee for geothermal energy (no. 43, 'Garantieregeling geothermie'). This policy measures allows for commercial parties to take out an insurance for when the quality of the heat form geothermal drilling technologies is less than preliminary research has indicated (Ministry of Economic Affairs, 2016b).

An example of a **tax** policy measure is the EIA measure (no. 4). This policy measure allows for a reduction of revenue taxes for corporation when those corporations have implemented sustainable technologies.

An example of a **price** measure has already been discussed, the energy tax including the raise for renewable energy (no. 20) influences both the electricity price and the natural gas price directly.

There is one multilateral financial sub-type. An example of a **project** type measure is the Programme Truck of the future (no. 154, 'Programma Truck van de Toekomst'). This programme allows for companies in the transport sector to implement fuel efficiency measures, by using alternatives for diesel trucks, on a project basis (TNO, 2016).

There are three unilateral informative sub-types. An example of an **administrative process** measure can be found in the Implementation act for wind energy at sea (no. 34). This policy measure aligns the tender procedure for sites at sea for wind parks with the permit process for building the wind park at that site, both processes require the same information. By integrating these processes the administrative burden on the wind park developer is decreased (Overheid.nl, 2015).

An example of a **stakeholder involvement** measure is the Behavioural code for wind energy on land (no. 37, 'Gedragscode windenergie op land') which determines the process of involving stakeholders, such as inhabitants of an area, into development processes of wind parks on land (SER, 2014).

An example of an **information supply** measure is the policy measure for the ISDE communication campaign (no. 55, 'Investerings subsidie voor duurzame energie communicatie campagne'). This measure includes a communication campaign to make both consumers and commercial parties aware of the possibilities of sustainable heat production (ECN, 2016a).

The last type, multilateral informative, contains two sub-types. An example of **information exchange** is the centre of expertise on energy saving (no. 71, 'Expertisecentrum energiebesparing'), this is an independent organisation that stems from the Energieakkoord (ECE, n.d.). The ECE uses this network to get multiple parties to discuss their energy saving approaches.

An example of a **support in implementation process** measure is the VNG facilitator for local and regional alliances for sustainable developments (no. 92, 'VNG facilitator op lokaal en regionaal niveau door ondersteunings-structuur inclusief regionale energieloketten'). The VNG is the association of Dutch municipalities (Vereniging van Nederlandse Gemeenten). The VNG for example supports rental corporations in making their housing stock more sustainable (VNG, 2014).

Results An overview of the sub-types and how many policy measures are characterised for each sub-type is shown in Table 8.

Three policy measures are characterised for two sub-types within the same type (cost and tax). One of these three policy measures is the shift in energy tax (no. 2, 'Verschuiving energie belasting') which is identified for two tax sub-types (for different target groups). The second of the three is the measure for the new F-gas regulation (no. 75, 'Nieuwe F-gassen verordening'), which includes a design specification and a user-friendliness regulation. The third policy measure with two sub-types of the same type is the measure for the fiscal incentives for ultra-low emission cars (no. 142, 'Fiscale stimulering ultrazuinige auto's 2016-2020'), which is identified for the costs and tax sub-types.

Due to the identification of two sub-types of the same type for three measures, is the total number of sub-types assigned three more than the total number of types assigned.

Table 8: Number of policy measures per sub-type

Type	Number of policy measures	Type	Number of policy measures
Regulatory - Unilateral	*44*	*Regulatory - Multilateral*	*16*
Permits	4	Cooperative	16
Design specifications	17		
Maximum	10		
Obligatory implementation	3		
User-friendliness of technologies	2		
Enforcement	5		

Financial - Unilateral	*45*	*Financial - Multilateral*	*2*
Costs	16	Projects	2
Financing options	3		
Return on investment	6		
Insurance	2		
Tax	15		
Price	3		
Informative - Unilateral	*13*	*Informative - Multilateral*	*9*
Administrative process	6	Information exchange	3
Stakeholder involvement	1	Support in implementation process	7
Information supply	9		
Total	102	Total	28

4.3.5 Direction

A policy measure can either increase or decrease for a sub-type.

Examples An example of a direction for a policy measure is mentioned for the administrative process sub-type. For the example of the Implementation act wind energy at sea (no. 34) is said that *"By integrating these processes the administrative burden on the wind park developer is decreased"*. This indicates the direction of decrease (of the administrative process) for this policy measure.

Results As the directions are assigned to the sub-types an overview of how many increasing or decreasing policy measures there are is not very informative. The direction will be analysed per sub-type. The overview of the directions per sub-type can be seen in Table 9. Not all sub-types are assigned a direction (see section 3.4.4). Only those sub-types that are assigned a direction are included in Table 9.

Table 9: Number of policy measures per direction and per sub-type

Number of measures per direction and sub-type	**Decrease**		**Increase**	
	[#]	[%}	[#]	[%}
Permits	4	100	0	0
Maximum	2	67	1	33
User-friendliness of technologies	1	50	1	50
Enforcement	0	0	5	100
Costs	14	87.5	2	12.5
Financing options	0	0	3	100
Return on investment	0	0	6	100
Insurance	0	0	2	100
Tax	12	80	3	20
Price	1	33	2	67
Administrative process	6	100	0	0
Stakeholder involvement rules	0	0	1	100
Information supply	0	0	9	100
Information exchange	0	0	3	100
Support in implementation process	0	0	7	100
Total	*40*	*47*	*45*	*53*

The only costs that increase are for the policy measures with a GHG emission process characterisation. The only taxes that increase are those on GHG emission and the use of energy processes. One policy measure is characterised to increase for the sub-type tax, this is the tax on one energy carrier (natural gas) and decreases the tax on another (electricity), therefore there is one more tax measure mentioned here, than in Table 8 for the sub-type representation.

4.3.6 Process

The six categories and their choices for the process characteristics are listed in Table 10.

Examples An example of a process characterisation of a policy measures is 'central renewable electricity production'. One of the policy measures that identifies for this process is the Implementation act Wind energy at sea (no. 34). The implementation act allows for an easier process of implementing wind parks at sea, contributing to the production of the energy carrier 'central renewable electricity'.

Results Also for the different process characteristics can the policy measures be identified with more than one of the option. The division of the policy measures among the 19 different process characteristics can be seen in Table 10.

Table 10: Number of policy measures per process

Category	Process	Number of policy measures
Production of energy carriers	Central renewable electricity production	10
	Decentral renewable energy production	10
	Decentral renewable electricity production	1
	Sustainable heat production	7
	Fossil fuel electricity production	1
GHG emission reduction	GHG emission	6
	CO2 emission	8
	GHG emission reduction	11
	CO2 emission reduction	9
Demand of energy carriers	Energy efficiency	47
Price of energy carriers	Electricity price	4
	Natural gas price	2
	LNG price	1
Transport of energy carriers	Electricity transport	3
	Electricity transport reliability	1
Efficiency of energy carriers	Fuel efficiency measures	8
	Energy efficiency	5
	Efficiency of vehicles, or of modes of transport for logistics	2
Total		*136*

The expectation is that different sectors influence different processes within the energy system influence. This can be analysed by looking at the number of policy measures per sector per process characteristic, this can be seen in Table 11. From Table 11 can be seen that the energy sector accounts for the most policy measures regarding production of energy carrier processes. The transport sector includes the most policy measures for emission processes. The demand and use processes of energy carriers have the most policy measures for the built environment. Policy measures regarding the transport of energy carriers are mostly present in the energy sector. And last, are the efficiency measures mostly found in the transport sector.

Table 11: Number of policy measures per sector and per process

Number of policy measures per sector and per process	Multi-sector	Energy	Indust.	Transp.	Built enviro.	Green. Indust.	Agric. Indust.
Production of energy carriers							
Central renewable electricity production		10					
Decentral renewable energy production	6	1			1	2	
Decentral renewable electricity production		1					
Sustainable heat production		4				3	
Fossil fuel electricity production		1					
GHG emission reduction							
GHG emission				1	1		4
CO2 emission	1			5		2	
GHG emission reduction			2	2			7
CO2 emission reduction				9			
Demand of energy carriers							
Energy efficiency	9	1	6	4	23	3	1
Price of energy carriers							
Electricity price	4						
Natural gas price	2						
LNG price				1			
Transport of energy carriers							
Electricity transport		2			1		
Electricity transport reliability		1					
Efficiency of energy carriers							
Fuel efficiency measures				8			
Energy efficiency				5			
Efficiency of vehicles or of modes of transport for logistics				2			

4.3.7 Specification

There are two possible types of specifications, technology specification and location specification.

Examples Technology specification key words differentiate the policy measures based on the technology that is used to carry out their identified actions. For the example of the Implementation act Wind energy at sea (no. 34), the identified process is 'central renewable electricity production'. The technology used to produce the renewable electricity is through wind energy at sea. Therefore the specifications assigned to this policy measure have to be 'wind energy' and 'at sea'. Here 'wind energy' is the technology specification, and 'at sea' is the location specification.

An example of a policy measure without a technology specification can be found for the previously mentioned policy measure of the Green Deal Zero Emission City Logistics (no. 147). This policy measure focusses on the policy goal of GHG emissions, and is based on emissions in logistic processes, but not on the efficiency of these logistic processes. Therefore the process identified for this policy measure is 'GHG emission reduction'. Here there is not one technology mentioned to achieve this reduction, but the mentioned location is in city centres, leading to the specification of 'city centres'.

Results The specifications that have been identified for the policy measures in this thesis project are shown in Table 12.

Table 12: Identified technology and location specifications

Technology specification	Location specification
Innovative energy efficiency measures	Buildings
Energy efficiency measures	Point sources
Decentral renewable energy production measures	Regional networks
Innovative solutions	(wind energy) on land
Innovative process efficiency measures	(wind energy) at sea
Coal fired electricity plants	Sport centres
Renewable production of electricity	(alternative fuel use) for climate systems
Wind energy (on land)	(isolation material) in houses
Wind energy (at sea)	Rental houses
Geothermal energy production	Greenhouses
Biomass electricity production	(new cars) per driven kilometre
Sustainable heat production	(new vans) per driven kilometre
Process efficiency	City (logistics)
Chain efficiency	Speed on highways
Alternative fuel use (for climate systems)	(electricity use) in rail transport
Lighting (in buildings)	(alternative fuel use) for inland shipping
Heating appliances (in buildings)	Sea vessels
Isolation material (in houses)	Trucks
Air-conditioning (in buildings)	Stables
Smart grids (for houses)	(ammonia use) for dairy cattle ranches
New household appliances	(phosphate processing) on pigs and poultry farms
Innovative research	
Research into geothermic applications	
Innovative systems	
Natural gas use	
New cars (per driven kilometre)	
New vans (per driven kilometre)	
EV's and PHEV's	
Fossil fuel use	
Alternatives to road transport	
Tire choice	
Charging infrastructure for EV's and PHEV's	
(city) logistics	
Car sharing technologies	
Alternatives for cars	
Clean two-wheelers	
LZV use	
Public busses	
Biofuel use	
Fossil fuel properties	
Tire pressure	
Electricity use (in rail transport)	
Air transport	
Fertilizer use	
Ammonia use (for dairy cattle ranches)	
Phosphate processing (on pigs and poultry farms)	

4.3.8 Policy goal

The three policy goals are:

1. Reduction in greenhouse gas emissions of 40% (compared to 1990) before 2030;
2. Increase of renewable energy production to a minimum share of 27% of the energy mix before 2030;
3. Increase in energy efficiency with a result of 27% energy savings before 2030.

Examples For each policy measure is the policy goal determined, most of the time the policy goal is clearly stated. For example for the energy tax measure, the policy documents state that the primary goal of the energy tax and renewable raise is an increase in energy efficiency (AWTI, 2016).

As explained for the general rules can some policy measures can identify with two policy goals. An example is the Energy Investment Deduction measure (no.4, 'Energie investerings aftrek', or EIA). Where investment costs for technologies that increase the energy efficiency and technologies that produce renewable energy can be subtracted from the revenue tax of the company that invested in the technologies (RVO.nl, n.d.-a). Here the policy measure aids both the policy goal of an increase in energy efficiency as well as the policy goal for an increase in renewable energy production.

Results Each policy measure can be appointed more than one policy goal. The division of the policy measures among the three different policy goals can be seen in Table 13.

Table 13: Number of policy measures per policy goal

Policy goal	Number of policy measures
GHG emission	52
Renewable energy production	33
Energy efficiency	46
Total	131

There are 131 policy goals identified, none of the policy measures has been identified for all three policy goals, indicating that twelve policy measures identified for two policy goals. These twelve policy measures all identify with both the renewable energy production and energy efficiency policy goals.

4.4 Initial identification of interference

The research by Simões states that two policy measures that focus on the same actors and have the same goal will interfere. Table 14 indicates the sets of policy measures that are believed to interfere based on the methodology proposed by Simões. The coloured boxes indicated expected interference.

In total there are 194 combinations of target group per sector and policy goals. As policy measures can have multiple target groups as well as multiple policy goals, the total number of target groups and policy goals combination is higher than the total number of policy measures (194 versus 119).

Of the 194 combinations, 182 are expected to be subject to interference according to the methodology as proposed by Simões. This means that 93.8% of all policy measure inputs included in this thesis project are subject to interference. This strengthens the assumed need for awareness of policy interference with policy makers, and the importance of interference within the energy system of the Netherlands. Almost all policy measure are subject to the effects of one or more other policy measures. This also indicates that it remains essential to be able to analyse the effects of interference in the energy system, as the methodology of this research aims to do.

Table 14: Expected areas for interference according to the methodology proposed by (Simões, 2013)

Number of measures per target group and policy goal	GHG emission	Renewable energy production	Energy efficiency
Multisector			
Consumer	1	0	2
Commercial	2	6	11
ETS-parties	3	6	11
Energy			
Consumer	0	3	0
Commercial	0	18	1
ETS-parties	1	13	0
Industry			
Consumer	0	0	0
Commercial	2	0	3
ETS-parties	2	0	5
Built environment			
Consumer	1	3	17
Commercial	1	0	14
ETS-parties	0	0	0
Greenhouse industry			
Consumer	0	0	0
Commercial	2	5	3
ETS-parties	0	0	0
Transport			
Consumer	21	0	1
Commercial	21	0	1
ETS-parties	1	0	0
Agricultural industry			
Consumer	0	0	0
Commercial	11	0	1
ETS-parties	0	0	0

4.5 Conclusion

Step 1 focusses on the system selection, as well as the boundaries and scope of this system. Once is known which system components are included in the system and which are seen as external variables, it is also known which policy measure are eligible for the case study of the Dutch energy system. In this case study is only national legislation included.

Steps 2 and 3 of the methodology focus on the collection of information and the processing of this information for use within the rest of the steps of the methodology. The policy goals and policy measures were identified, and the 119 policy measures have been characterised for eight characteristics. The next steps of the methodology, the composition of system factors, will be based on the characterisation of the policy measures in this chapter.

The results of the first three steps of the methodology have been discussed for the different steps and characteristics, as well as the guidelines on how to come to the results. The results from these steps enables that the approach of Simões can be applied onto the Dutch energy system. The application of the approach by Simões corroborated the assumption made in chapters 1 and 2, that interference is present in the energy system of the Netherlands. The application indicated that over 90% of all policy measures interferes with at least one other policy measure.

Chapter 5 will focus on creating insight into this interference by translating the accumulated data of this chapter into a system overview.

5

System analysis of the Dutch energy system

The fourth chapter of this report was the first of two chapters that discuss the case study of the Dutch energy system. This chapter continues where chapter 4 left off. Chapter 4 concluded with the characterization of all policy measures, chapter 5 uses this characterization to compose the system factors.

All system factors together form the system overview. Chapter 6 focusses on the validation and use of this system overview.

5.1 Step 4 – Composition of system factors

In chapter 4 have the policy goals and policy measures been identified. The selected policy measures were then characterised for eight different characteristics. These eight characteristics are; (1) sector, (2) target group, (3) type, (4) sub-type, (5) direction, (6) process, (7) specification, and (8) the policy goal that each measure aims to contribute to.

The different characteristics identified for the policy measures are used to compose the system factors, this is step 4 of the methodology. Eight system factors will be composed: (1) the starting factor, (2) behaviour factors, (3) implementation factors, (4) process factors, (5) target group goal factor, (6) sector goal factor, (7) policy goal factor, and (8) the cross-sectoral factors.

5.1.1 Starting factor

The starting factor of a policy measure is the first presence of the measures in the system overview. How to design the starting factors is explained in Box VII.

> **Box VII – Starting factor composition**
>
> The starting factor of a policy measures consists of the characteristics sub-type, direction, process, specification, target group and sector. The characteristics in this order make up a sentence that describes the policy measure and its initial influence within the energy system.
>
> One of the general rules of section 3.9 mentions that a policy measure has more than one starting factors if the measure has been assigned to more than one type or sub-type, as well as for more than one of the process characteristics. A starting factor will be composed for each type, sub-type, and process the policy measure is characterised with.

Below will five examples be provided on how to design the starting factors. These five examples will be used throughout this chapter, to illustrate the development of the policy chains and cross-sectoral factors.

Examples The five example measures and their identified starting factors are indicated in Table 15. The five examples are characterized for different types, sectors, target groups, and policy goals, and illustrate the process of designing the starting factors for all 119 policy measures.

Results A full list of all starting factors for all 119 measures can be found in Appendix B. The four policy measures identified only as a price measure do not have a starting factor, but are included in Appendix B to indicate the characterisation of these measures.

Some policy measures have identical starting factors, for these cases will the starting factors be represented only once in the system overview. It is also possible for policy measures to have more than one starting factor.

There are two policy chains integrated for four different policy measures, two policy chains integrated for three different policy measures, and eight policy chains integrated for two policy measures. Some of these policy chains however include two starting factors for all policy measures included in the policy chain. There are 99 policy chains identified. These 99 policy chains include 116 unique starting factors.

An example of a policy measure with two starting factors is the policy measure for the Programme Truck of the future, that has been characterized for two types in section 4.3.3. This policy measure has the following starting factors: (1) 'Projects for fuel efficiency for trucks in commercial transport', and (2) 'R&D cost decrease of fuel efficiency for trucks in commercial transport'.

Table 15: Starting factors for five example policy measures, numbers 34, 71, 85, 147, and 186

Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor
No. 34 - Uitvoeringswet Windergie op zee'	Administrative process	Decrease	Central renewable electricity production	Wind energy at sea	Commercial and ETS-parties	Energy	Administrative process decrease for central renewable electricity production with wind energy at sea for ETS-parties in the energy sector
No. 71 – Expertisecentrum energiebesparing	Information exchange	Increase	Energy efficiency	Process efficiency, chain efficiency	ETS-parties	Industry	Information exchange increase for energy efficiency due to process efficiency and chain efficiency for ETS-parties in industry
No. 85 – Btw-verlaging isolatie	Tax	Decrease	Energy efficiency	Isolation replacement in houses	Consumer	Built environment	Tax decrease for energy efficiency due to isolation replacement in houses in the consumer built environment
No. 147 – Green Deal Zero Emission City Logistics	Cooperative	-	GHG emission reduction	City logistics	Commercial	Transport	Cooperative for GHG emission reduction by city logistics in commercial transport
No. 186 – Besluit emissiearme huisvestingsystemen landbouwhuisdieren	Design specifications	-	GHG emission	Stables	Commercial	Agriculture	Design specifications for GHG emission of stables for in commercial agriculture

An example of two policy measures that integrate at the starting factor includes the measures for the Implementation act Wind energy at sea (no. 34, 'Uitvoeringswet Windergie op zee') and the measure for Appointing locations of wind energy at sea (no. 39, 'Aanwijzing gebieden windenergie op zee'). Both measures influence the administrative process of developing wind parks at sea. These two measures share the starting factor 'Administrative process decrease for central renewable electricity production with wind energy at sea for ETS-parties in the energy sector '.

5.1.2 Behavioural factor

How to design the behavioural factors is explained in Box VIII.

Box VIII – Behavioural factor identification

The behavioural factors are influenced by the starting factor of a policy chain. The three behavioural factors, attitude, subjective norms, and perceived behavioural control, are influenced by different sub-types of policy measures. The different sub-types of policy measures that influence the behavioural factors are depicted in Table 16 below.

Table 16: Behavioural factors for each sub-type of a policy measure

Behavioural factors per sub-type	Attitude towards behaviour	Subjective norms	Perceived behavioural control
Regulatory – Unilateral			- User-friendliness of technologies - Enforcement
Regulatory – Multilateral		- Cooperatives	
Financial – Unilateral			- Costs - Financing options - Return on investment - Insurance - Tax - Price
Financial – Multilateral	- Projects		
Informative – Unilateral	- Information supply	- Stakeholder involvement rules	- Administrative process
Informative – Multilateral		- Information exchange	- Support in implementation process

Not all unilateral regulatory policy measures influence a behavioural factor. Some of the sub-types for this category are not included in Table 16. These sub-types directly influence the implementation factors (for obligatory implementation measures) or the process factors (for permits, maxima, and design specifications).

Below will the same five examples as for the starting factors be used to illustrate how to design the behavioural factors of a policy chain.

Table 17: Starting factors and behavioural factors for five examples, numbers 34, 71, 85, 147, and 186

Policy measure	Starting factor	Sub-type	Behavioural factor
No. 34 - Uitvoeringswet Windergie op zee	Administrative process decrease for central renewable electricity production with wind energy at sea for ETS-parties in the energy sector	Administrative process	Perceived behavioural control
No. 71 – Expertisecentrum energiebesparing	Information exchange increase for energy efficiency due to process efficiency and chain efficiency for ETS-parties in industry	Information exchange	Subjective norms
No. 85 – Btw-verlaging isolatie	Tax decrease for energy efficiency due to isolation replacement in houses in the consumer built environment	Tax	Perceived behavioural control
No. 147 – Green Deal Zero Emission City Logistics	Cooperative for GHG emission reduction by city logistics in commercial transport	Cooperative	Subjective norms
No. 186 – Besluit emissiearme huisvestingsystemen landbouwhuisdieren	Design specifications for GHG emission of stables for in commercial agriculture	Design specifications	-

Examples The five examples and their behavioural factors are included in Table 18. As the behavioural factors are based on the sub-type characterization of the policy measures, are also the sub-types indicated in the table. A visualization of the behavioural factors is included in section 5.1.4.

Results Of the 117 identified starting factors are 28 starting factors for restrictive policy measures. These policy measures have no behavioural factors in their policy chains, leaving 89 starting factors to be assigned to a behavioural factor. Of these 89 starting factors influence 61 a perceived behavioural control factor. Next, 20 starting factors influence a subjective norms behavioural factor, and 8 starting factors influence an attitude behavioural factor.

The representation of behavioural factors is indicated in Table 18. All behavioural factors are presented in Appendix C.

Table 18: Number of behavioural factors for all identified starting factors

Behavioural factors	Number of behavioural factors
No behavioural factor	*28*
Attitude	8
Subjective norms	20
Perceived behavioural control	61
Total	89

5.1.3 Implementation factor

How to design the implementation factors is explained in Box IX.

Below will the same five examples as for the behavioural factors be used to illustrate how the implementation factors of a policy chain can be designed.

Box IX – Implementation factor composition

The implementation factor represents the implementation of technology or behaviour changes in the energy system. This factor is influenced by the behavioural factor of a policy chain, with the exception of the policy chains of one unilateral regulatory sub-type. For the sub-type obligatory implementation is the implementation factor directly influenced by the starting factor of the policy chain.

The implementation factor includes the specification, process, target group, and sector characteristics of a policy measure. As the implementation factor is focussed solely on the possible actions within the system, the implementation factor does not include the specifications of the policy measures themselves any more, therefore leaving out the sub-type and direction of the starting factor of a policy measure.

The general rules in section 3.9 mention that policy chains with identical system factors will be integrated. As the implementation factor is a generalisation step in the policy chains, it is possible that two or more policy chains will have to be integrated at the implementation factors.

There is one possibility for differentiation of policy chains at the implementation factor. If there is an implementation factor that includes two target groups and there is also an implementation factor identical to this first one, but for only one of the two target groups, the policy chain may differentiate at the implementation factor.

Examples The implementation factors of the example policy measures are compared with the starting factors of the same five examples in Table 19.

Table 19: Starting factors and implementation factors for five examples, numbers 34, 71, 85, 147, and 186

Policy measure	Starting factor	Implementation factor
No. 34 - Uitvoeringswet Windergie op zee	Administrative process decrease for central renewable electricity production with wind energy at sea for ETS-parties in the energy sector	Implementation of central renewable electricity production with wind energy at sea for ETS-parties in the energy sector
No. 71 – Expertisecentrum energiebesparing	Information exchange increase for energy efficiency due to process efficiency and chain efficiency for ETS-parties in industry	Implementation of energy efficiency due to process efficiency and chain efficiency for ETS parties in industry
No. 85 – Btw-verlaging isolatie	Tax decrease for energy efficiency due to isolation replacement in houses in the consumer built environment	Implementation of energy efficiency due to isolation replacement in houses in the consumer built environment
No. 147 – Green Deal Zero Emission City Logistics	Cooperative for GHG emission reduction by city logistics in commercial transport	Implementation of GHG emission reduction by city logistics in commercial transport
No. 186 – Besluit emissiearme huisvestingsystemen landbouwhuisdieren	Design specifications for GHG emission of stables for in commercial agriculture	-

As can be seen in Table 19 is no new information required when formulating the implementation factor for a policy measure. As the implementation factor is the first generalisation of information, there is less information present in the implementation factor than in the starting factor, it is possible that two policy chains have the same implementation factor. The general rules of section 3.9 determine that as soon as the policy chains include identical system factors, the policy chains will be integrated. An example of this integration is shown in Figure 11.

Figure 11 also indicates that for the policy chains that integrate at the implementation factor, it is possible that the behavioural factors also integrate. If the two policy chains that integrate also include the same behavioural factor for the same implementation factor, this behavioural factor is represented only once.

Results Integration of policy chains take place for implementation factors. There were 116 starting factors identified, these policy chains have integrated into 69 implementation factors. All implementation factors are present in Appendix C.

5.1.4 Process factor

How to design the process factor is explained in Box X.

Below will the same five examples as for the implementation factors be used to illustrate how the process factors of a policy chain can be designed.

Box X – Process factor composition

The process factor is influenced by the implementation factor of a policy chain, except for the policy chains of three unilateral regulatory sub-types (permits, maxima, and design specifications). For these policy chains is the process factor directly influenced by the starting factor of the policy chain.

Process factors focus on the influences on the six identified processes in the energy system. Process factors include the process, target group, and sector characteristics. As the process factors include less characteristics than the implementation factors, it is possible that policy chains have to be integrated at the process factors. This allows for the system overview to indicate which technologies (represented by the implementation factors) contribute to the same processes within the energy system.

It is also possible for differentiation within a policy chain to take place at the process factor. The general rules in section 3.9 indicate that policy chains with more than one identified target group will differentiate at the process factor.

Examples The process factors for the same five examples as mentioned above are indicated in Table 20. The policy chain for the unilateral regulatory policy measure, number 186, does not include an implementation factor.

Table 20: Implementation factors and process factors for five examples, numbers 34, 71, 85, 147, and 186

Measure	Implementation factor	Process factor
No. 34 - Uitvoeringswet Windergie op zee	Implementation of central renewable electricity production with wind energy at sea for ETS-parties in the energy sector	Central renewable electricity production of ETS-parties in the energy sector
No. 71 – Expertisecentrum energiebesparing	Implementation of energy efficiency due to process efficiency and chain efficiency for ETS parties in industry	Energy efficiency of ETS parties in industry
No. 85 – Btw-verlaging isolatie	Implementation of energy efficiency due to isolation replacement in houses in the consumer built environment	Energy efficiency in the consumer built environment
No. 147 – Green Deal Zero Emission City Logistics	Implementation of GHG emission reduction by city logistics in commercial transport	GHG emission reduction in commercial transport
No. 186 – Besluit emissiearme huisvestingsystemen landbouwhuisdieren	-	GHG emission in commercial agriculture

From Table 20 it is visible that no new information is required to identify the process factors of the policy chains. As the process factor is another generalisation of the system factors, more integration of policy chains may take place. This integration of policy chains for both implementation factors and process factors is shown in Figure 11, for the measures 31, 34, 39, and 47. The policy chain for measure 186 is also included in Figure 11. As measure 186 is a design specification measure, there is no behavioural factor or implementation factor in the policy chain for this measure. The first factor that a design specification measure influences is the process factor, as is depicted for measure 186.

Box X also mentioned a possibility for differentiation of policy chains at the process factor when the policy measure is characterised for more than one target group. An example of this differentiation is given in Table 21.

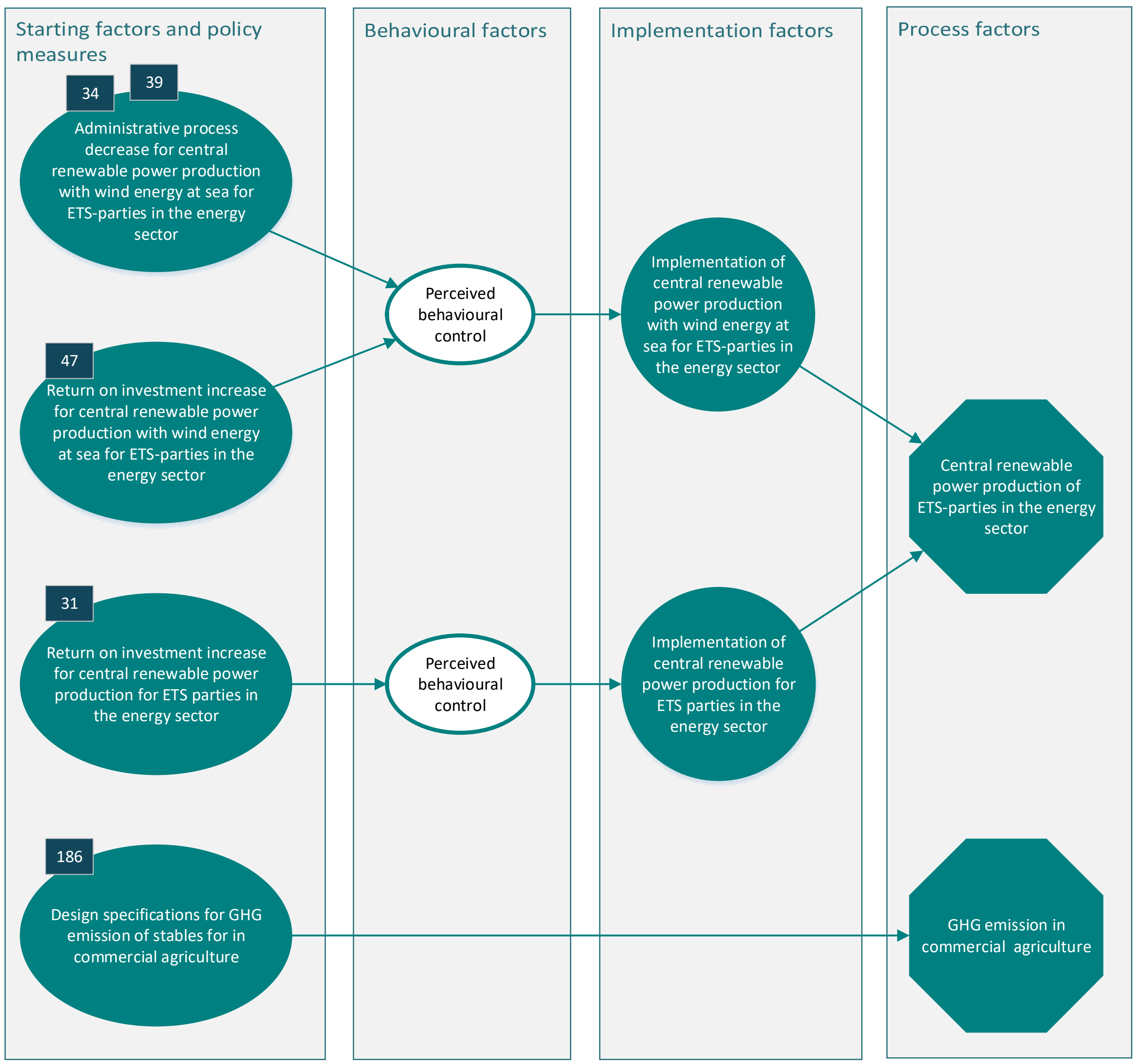

Figure 11: Policy chains for the starting factors through to the process factors for the measures 31, 34, 39, 47, and 186

Results There are 69 unique implementation factors identified. Of the 69 implementation factors include 35 two target groups. The other 34 implementation factors influence one target group. As the policy chains differentiate at the process factors for different target groups would these numbers indicate that there are 104 process factors. However, integration is also possible for policy chains at the process factor. After integrating identical process factors are 49 unique process factors identified.

5.1.5 Goal factors

How to design the goal factors is explained in Box XI.

Below will the same five examples as for the process factors be used to illustrate how to design the goal factors of a policy chain.

Box XI – Goal factor composition

The policy chains end at the identified policy goals. There are three types of goal factors included in the system overview. The first goal factors is the *target group goal*, the second goal factor is the *sector goal*, the last goal factors is the *policy goal*.

The **target group goal factor** is influenced by the process factor of the policy chain and includes the target group, sector, and policy goal. This is the first system factor where the policy goal is included. It is possible that the process factors and target group goal factors of a single policy chain are identical, as two of the processes are also identified as policy goals (GHG emission and energy efficiency). For these policy chains will the process factor be excluded from the policy chain.

It is also possible that a policy measure is characterised for more than one policy goal. The policy chain of these measures will differentiate at the target group goal factors.

The **sector goal factor** is influenced by the target group goal factor, and includes just the sector and policy goal. In the same way is the **policy goal factor** influenced by the sector goal factor. The policy goal factor only includes the policy goal.

Integration of policy chains may occur at the goal factors, as the goal factors all include a generalisation step.

Examples Table 22 shows the process factors and all three goal factors for the five policy measures that are used as examples (numbers, 34, 71, 85, 147, and 186). For policy measures 71, 85, and 147 are the process factors and target group goal factors identical. In the system overview will the process factors be excluded. The process factors are included in Table 22 to show the whole identification process of the policy chains.

Results Policy chains can differentiate at the target group goal factor if the policy measure(s) of the policy chain influences more than one policy goal. However, in practice for the energy sector of the Netherlands have all policy measures that are characterised for more than one policy goal also been characterised for more than one process. The characterisation for more than one process led to multiple starting factors for these policy measures. There are no policy measures identified with more than one policy goal for the same process characteristic, therefore the differentiation rule for the target group goal factors has not been utilised in this application of the methodology.

The target group goal factors are the first factors where the target group is the main identifier. For the multisector policy chains should the sectors in which the target groups are present be identified. The multisector measures that influence consumer and/or commercial parties influence all seven sectors. The multisector measures that influence ETS-parties, or ETS and commercial parties influence only those sectors which have ETS parties; energy, industry, and transport. There are two exceptions where multisector policy measures for ETS parties explicitly indicated that only the industry and transport ETS-parties are influenced (policy chains 3, and 4/5/6).

This indicates that the four identified target group goal factors for the multisector actually have to be divided over more than four system factors. Two of the multisector target group goal factors influence all six other sectors, and two only influence the industry and transport sectors. These four target group goals thus correspond with 16 system factors. The same principle is applicable to the sector goal factors.

Table 21: Implementation factor, process factor and goal factors for a policy measure with multiple target groups, number 54

Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
Investment cost decrease for sustainable heat production in the consumer and commercial energy sector	Sustainable heat production in the commercial energy sector	Renewable energy production in the commercial energy sector	Renewable energy production in the energy sector	Renewable energy production
	Sustainable heat production in the consumer energy sector	Renewable energy production in the consumer energy sector	*Renewable energy production in the energy sector*	*Renewable energy production*

Table 22: Process factors and all three goal factors for five examples, numbers 34, 71, 85, 147, and 186

Policy measure	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
No. 34 - Uitvoeringswet Windergie op zee	Central renewable electricity production of ETS-parties in the energy sector	Renewable energy production of ETS-parties in the energy sector	Renewable energy production in the energy sector	Renewable energy production percentage
No. 71 – Expertisecentrum energiebesparing	Energy efficiency of ETS parties in industry	Energy efficiency in ETS parties in industry	Energy efficiency in industry	Energy efficiency
No. 85 – Btw-verlaging isolatie	Energy efficiency in the consumer built environment	Energy efficiency in the consumer built environment	Energy efficiency in the built environment	Energy efficiency
No. 147 – Green Deal Zero Emission City Logistics	GHG emission reduction in commercial transport	GHG emission of commercial transport	GHG emission of transport	GHG emission
No. 186 – Besluit emissiearme huisvestingsystemen landbouwhuisdieren	GHG emission in commercial agriculture	GHG emission in commercial agriculture	GHG emissions of agriculture	GHG emission

For each of the goal factors is integration also possible. There have been 49 process factors identified. These process factors influence 32 target group goal factors (this number includes the above mentioned 16 system factors). The target group goal factors are indicated with an X in Table 23.

The 32 target group goal factors influence all possible sector goals, leaving 18 sector goals. The sector goals influence the 3 identified policy goals.

Table 23: Identified target group goal factors per policy goal and sector

Target group goal factors	GHG emission	Renewable energy production	Energy efficiency
Energy			
Consumer		X	
Commercial		X	X
ETS	X	X	
Industry			
Consumer			
Commercial	X	X	X
ETS	X	X	X
Transport			
Consumer	X		X
Commercial	X	X	X
ETS	X	X	X
Built environment			
Consumer	X	X	X
Commercial	X	X	X
Greenhouse industry			
Consumer			
Commercial	X	X	X
Agriculture industry			
Consumer			
Commercial	X	X	X

5.1.6 Cross-sectoral factors and relations

How to include the cross-sectoral relations in the system overview is explained in Box XII, the inclusion of cross-sectoral factors is explained in Box XIII.

Box XII – Cross-sectoral relation inclusion

The cross-sectoral relations are based on the technology specifications of the policy measures. The implementation factors of similar technologies for different target groups or sectors depend on each other. The available experience with technologies, the societal opinion on technologies, as well as the affordability of the technology depends on the implementation of the technology in the entire system, and not per sector.

The cross-sectoral relations are included for the influence of the implementation factors of the same technologies, applications, or infrastructures for the technologies to all three behavioural factors of the other implementation factor for the same technology or application.

Box XIII – Cross-sectoral factors inclusion

The cross-sectoral factors influence specific processes within the energy sector. The influence of the cross-sectoral factors within the system overview is therefore based on the process factors. Which process factors influence the cross-sectoral factors, as well as which process factors are influenced by the cross-sectoral factors is indicated in Table 24 below.

The cross-sectoral factors influence the perceived behavioural control factors of the process factors for the processes indicated in Table 24. The cross-sectoral factors are influenced by the process factors themselves.

Table 24: Cross-sectoral factors and their influence in the energy system based on process characteristics

Cross-sectoral factor	Processes that influence the cross-sectoral factor	Processes that are influenced by the cross-sectoral factors
Central electricity demand	- Energy efficency - Decentral renewable energy production - Decentral renewable electricity production	- Central renewable electricity production - Fossil fuel electricity production - Balance on electricity grid (cross-sectoral factor)
Central electricity production	- Central renewable electricity production - Fossil fuel electricity production	- Balance on electricity grid (cross-sectoral factor) - Electricity price consumer (cross-sectoral factor) - Electricity price commercial and ETS-parties (cross-sectoral factor)
Electricity price consumer	- Electricity price - Balance on electricity grid (cross-sectoral factor) - Central electricity production (cross-sectoral factor)	- Energy efficiency - Decentral renewable electricity production - Decentral renewable energy production
Electricity price commercial and ETS-parties	- Price - Balance on electricity grid (cross-sectoral factor) - Central electricity production (cross-sectoral factor)	- Central renewable electricity production - Central renewable energy production - Energy efficiency - Decentral renewable electricity production - Decentral renewable energy production
Natural gas price consumer	- Natural gas price	- Sustainable heat production - Energy efficiency - Decentral renewable energy production
Natural gas price commercial and ETS-parties	- Natural gas price	- Sustainable heat production - Central renewable energy production - Decentral renewable energy production
CO_2 price ETS-parties in industry and energy	- CO2 price	- CO2 emission - GHG emission - Fossil fuel electricity production
CO_2 price ETS-parties in transport	- CO2 price	- CO2 emission - GHG emission
Electricity transport reliability	- Electricity transport - Electricity transport reliability - Balance on electricity grid (cross-sectoral factor)	- Central renewable electricity production
Balance on electricity grid	- Central electricity demand (cross-sectoral factor) - Central electricity production (cross-sectoral factor)	- Electricity transport reliability (cross-sectoral factor) - Electricity price consumer (cross-sectoral factor) - Electricity price commercial and ETS-parties (cross-sectoral factor)

Examples An example of a price policy measure and its influence on the energy system of the Netherlands is depicted in Figure 12. The price factors influence perceived behavioural control factors throughout the system overview.

An example of cross-sectoral relations is shown in Figure 13 for EV's and PHEV's in combination with the charging infrastructure of EV's and PHEV's for the process of CO_2 emission reduction.

Results The addition of the ten cross-sectoral factors and the cross-sectoral relations have led to a more interconnected system overview. The system overview including all cross-sectoral factors and relations can be seen in Appendix D.

The addition of the cross-sectoral factors and relations also leads to the addition of extra behavioural factors. In the example of Figure 13 had only the behavioural factors of subjective norm for measures 146 and 148, and the perceived behavioural control factor for measures 142 and 170 been identified. The inclusion of cross-sectoral factors and relations has led to the identification of 34 new behavioural factors. The total number of behavioural factors for this system overview is therefore 123.

5.2 Step 5 – Typology of relations between system factors

How to include the different types of relations in the system overview is explained in Box XIV.

Box XIV – Inclusion of differentiation in relations between system factors

There are five different types of relations applicable between the different system factors. Between the process factor, target group goal factor, sector goal factor, and policy goal factor are the relations linear. These relations are only the addition of policy chains together, but from the process factor on there is no change in the value of system factors for a single policy chain.

The relations between implementation factors and process factors are non-linear, as the implementation of a technology does not guarantee the use of that technology to the same extent (e.g. frequency) for each person. The implementation is therefore not linear related to the effects the technology might have.

Between behavioural factors and implementation factors there is always a delay relation. This delay includes both the decision time as well as the implementation time required for the technologies.

The relations based on the cross-sectoral relations and cross–sectoral factors are non-linear relations, as both the effect of implementation factors, and cross-sectoral factors are dynamic, and non-linear.

The relations for the starting factors of policy measures of the four sub-types that directly influence the implementation factors are non-linear. The total effect of these regulatory measures is based on the amount of people implementing this technology, the (frequency of) use of this technology, and the restricted change in behaviour.

The relations between starting factors and behavioural factors are not as straight forward. The starting factors that influence either the attitude towards behaviour or the subjective norms are delay relations. It takes time for new information to be accepted and processed into an intention to implement a technology. It also takes time for subjective norms to change, the society has to grow into thinking a specific technology is valuable and necessary.

The starting factors that influence the perceived behavioural control are threshold relationships. A person perceives their business case or other resources as not enough up to a certain point. If the policy measures influence the perceived behavioural control, but not up to this tipping point, the intention and actual implementation of a technology will not occur.

Dependency relations are assigned when two policy measures include an implementation factor and design specification, or two technologies that depend on each other. The relations between the implementation factor (or design specification starting factor)and the process factor will then be identified as dependency relations.

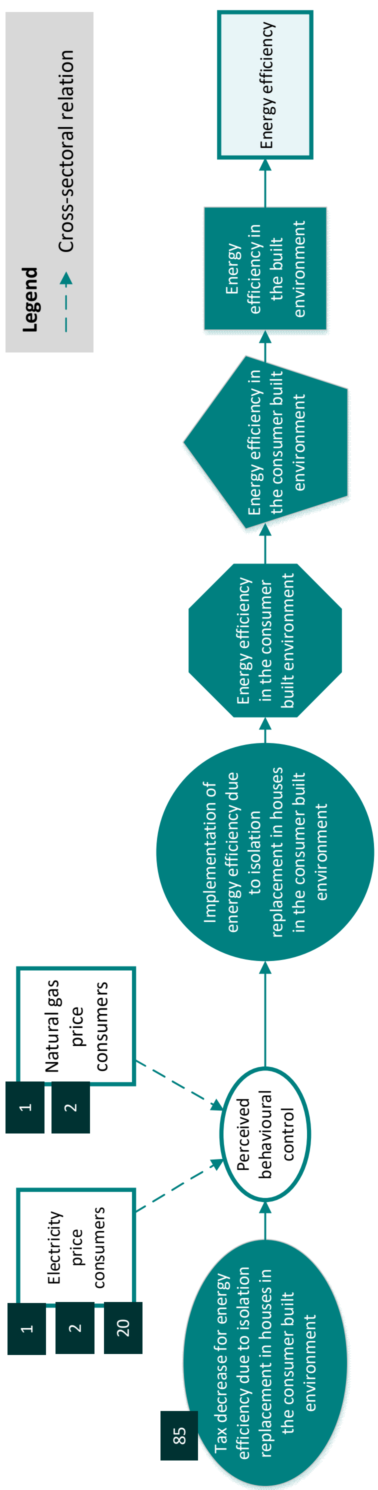

Figure 12: Cross-sectoral factors for consumer price measures numbers 1, 2, and 20 and their influence on a single

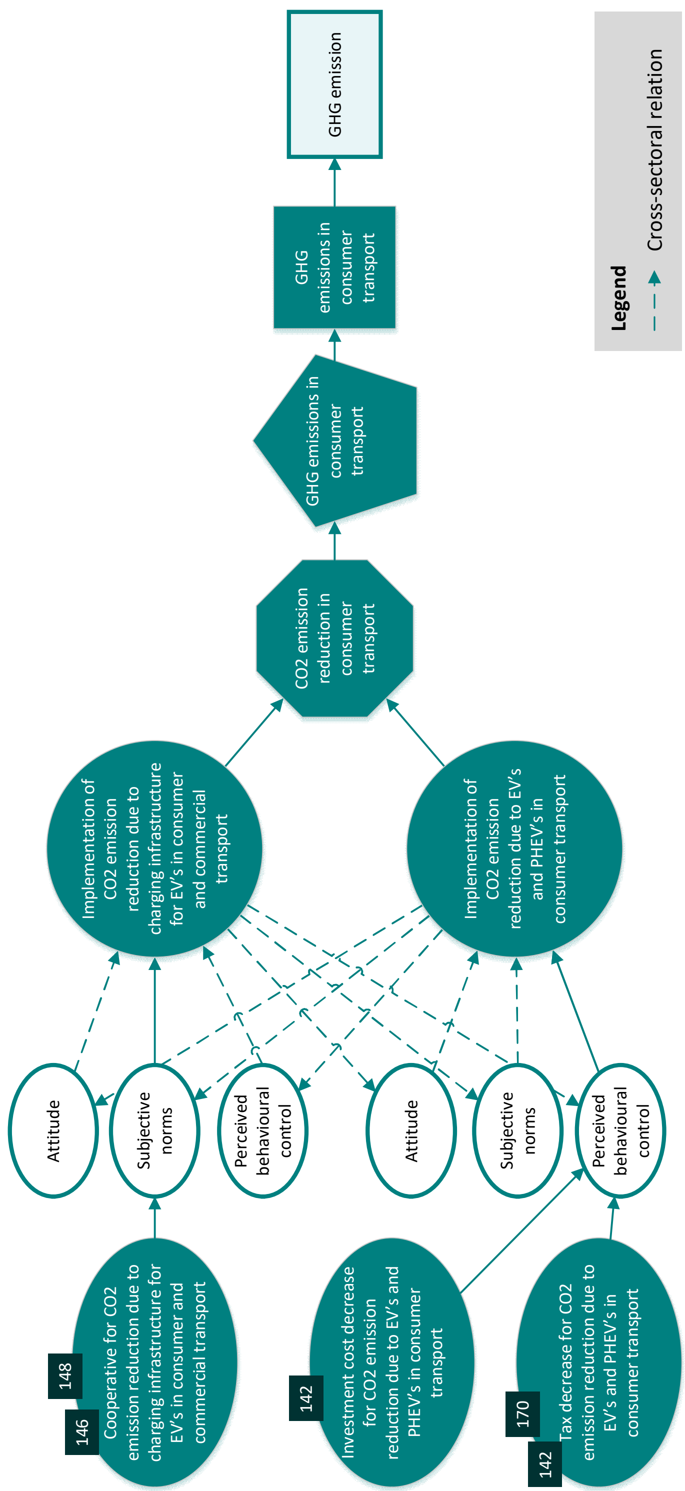

Figure 13: Cross-sectoral relations for EV's and PHEV's in consumer transport for the process of CO_2 emission reduction

Below will an example policy chain and the influence of a cross-sectoral factor be discussed which includes all possible relation types.

Examples In Figure 14 is a combination of two policy chains depicted. In these two policy chains are four of the five different relation types visible, as well as all different possible system factors. The policy chains include the previously mentioned measures for wind energy at sea (no. 34, 39, and 47).

The fifth relation type, dependency, is further elaborated in in section 6.2.3.

Result Each type of relation between two system factors is identified for the system overview and can be seen in Appendix D.

5.3 Conclusion - System overview

The execution of steps 4 and 5 have led to the identification of 544 system components (system factors and their policy measures) and their relation types. See Table 25 for the total numbers for the different system components. Step 6 will analyse the found and illustrated interference, and step 7 will interpret the results of this analysis.

The collection of system factors together make up the system overview. A small representation of the complete system overview is depicted in Figure 15. A readable version of the system overview is included as Appendix D.

Table 25: Total numbers of system components in the system overview

System components	Number of factors identified
Policy measures	120
Starting factors	116
Behavioural factors	123
Implementation factors	69
Process factors	49
Target group goal factors	31
Sector goal factors	18
Policy goal factors	3
Cross-sectoral factors	10
Total	539

The next phase of this thesis project is the validation of the methodology, this will be discussed in chapter 6.

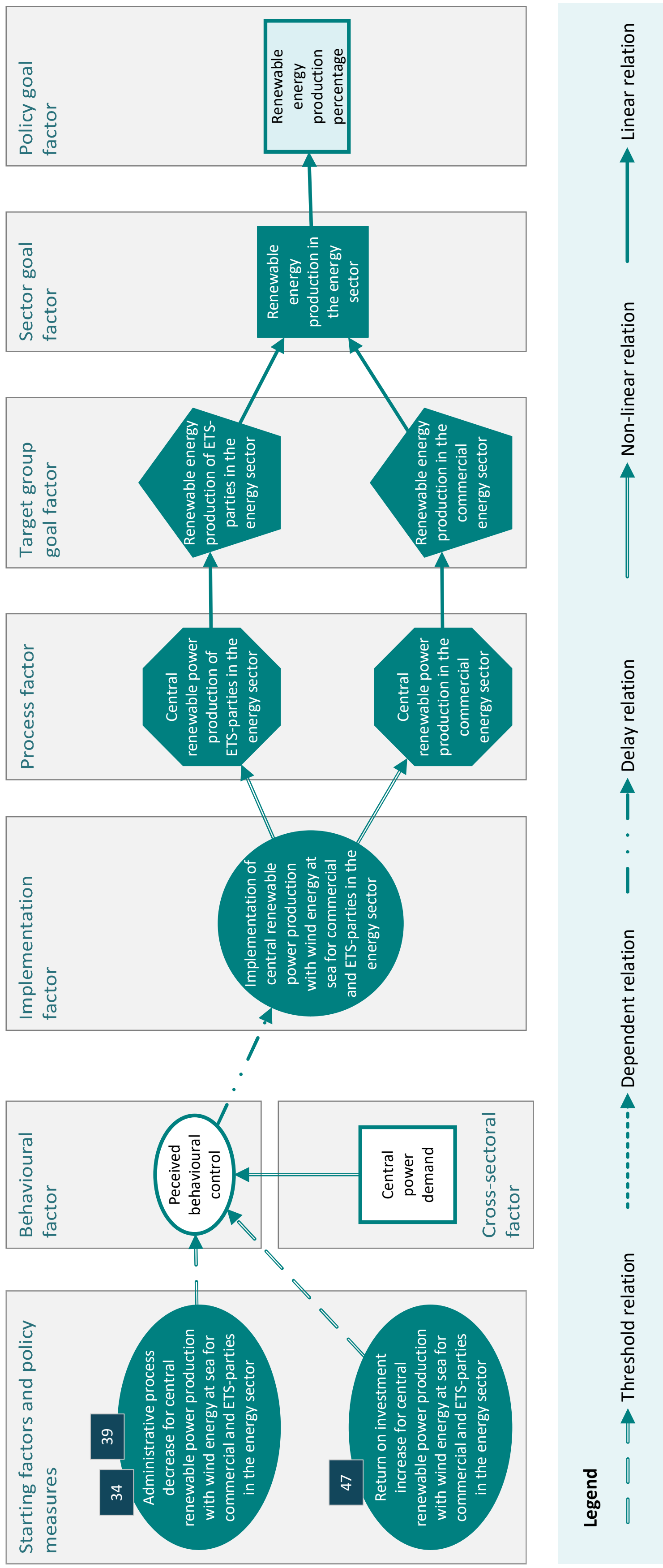

Figure 14: Policy chain of measures 34, 39 and 47 including all behavioural types

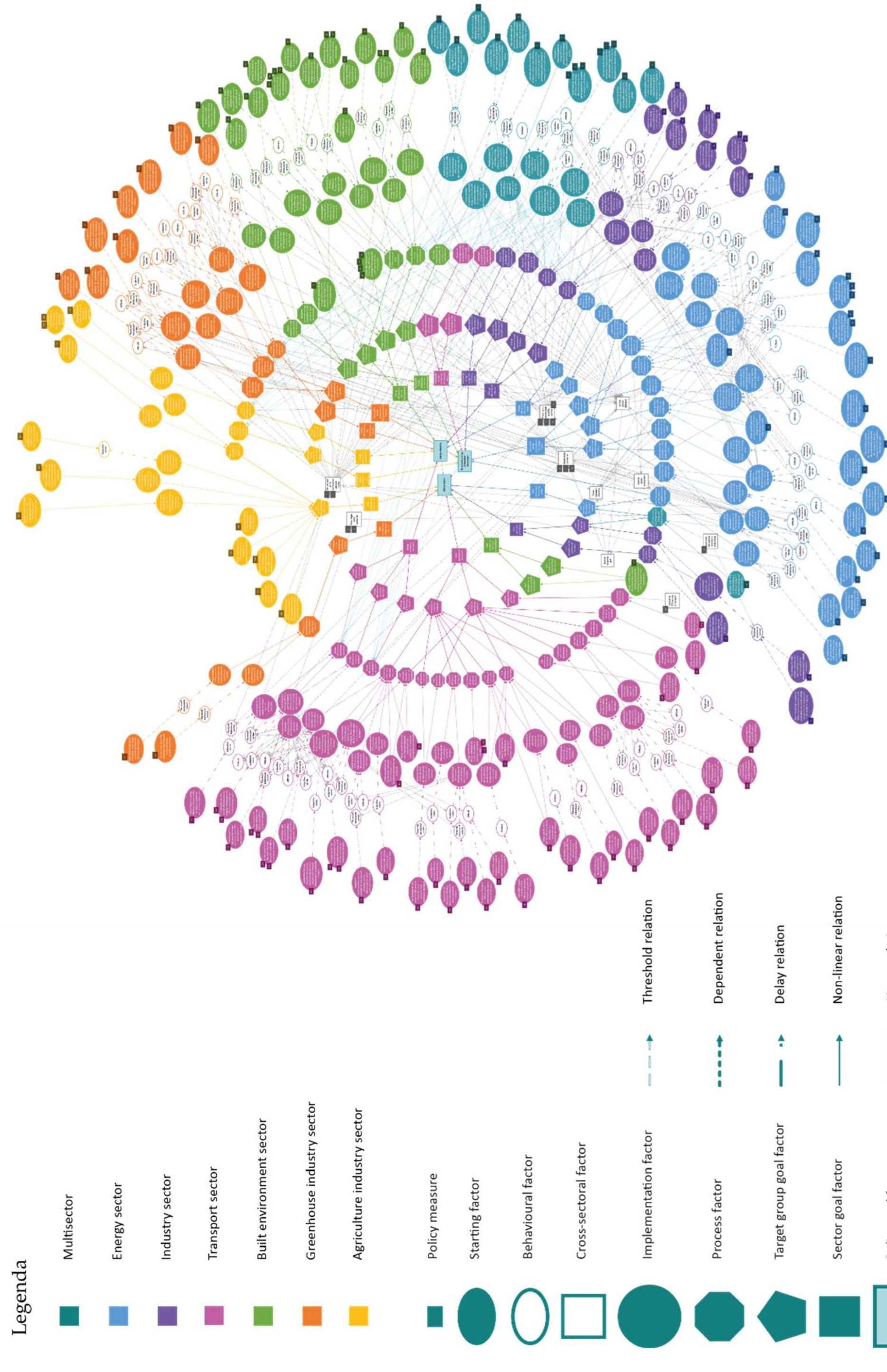

Figure 15: Small scale representation of the system overview

6

Validation and use

The system overview has been composed using the steps as described in chapters 3, 4, and 5. This system overview is essentially a schematic representation of the real world, a model. It is necessary to validate this model, to see to what extent the model is able to describe the real world for an intended purpose. The validation will focus on the inclusion of all system components, as well as the identification of interference where possible.

The validation of this model will be done based on two example cases that cover multiple sectors, as well as all target groups, types, processes, specifications, relation types, cross-sectoral factors, and policy goals. If the system overview withstands the test against these two cases it is expected that the model as a whole is validated. The two cases that will be used are Electric Vehicles (EV's) for consumer use, and Sustainable heat.

The validation for EV's is included in section 6.1. The validation for sustainable heat is approached in the same way and is included in Appendix E.

After the validation will the use of the model for the analysis and interpretation of interference be discussed in respectively sections 6.2 and 6.3.

6.1 Validation case one - Electric vehicles

The implementation of EV's in the Netherlands is seen as an essential step towards the long term sustainability goals. For EV's to be adopted by the consumers, there are some barriers that need to be overcome. The four main identified barriers for adoption of EV's by the general public are (1) a lack of knowledge and understanding of the benefits of EV's compared to 'regular' internal combustion engine (ICE) cars, (2) practical limitations such as range, and charging time, (3) insecurities in the use of EV's, for example accessibility of charging points, charging costs and life expectancy of the batteries, and (4) the high purchase price (Formule E-Team, 2016). Other than barriers for adoption of EV's by the general public are there also other uncertainties regarding the implementation of EV's in larges scales, such as the well-to-wheel efficiency, and the different possible methods of providing incentives for the purchase of EV's by consumers.

6.1.1 Public discussion

The four main topics that are visible in the public discussions are; the efficiency of EV's, the standardization of charging infrastructures in Europe, smart charging of EV's, and the different options for the government to incentivise EV purchases for consumer. These four topics will be discussed shortly below.

Efficiency The well-to-wheel (WtW) efficiency of personal mobility alternatives is based on the origin of the energy that the cars run on. Modern day cars can run on gasoline, diesel, natural gas, hydrogen, and electricity. Gasoline and diesel are both derived from crude oil. Natural gas cars run on a liquefied form of natural gas. Hydrogen can be derived from either natural gas or electricity. Whereas electricity can be either generated with fossil fuels (coal and natural gas), or renewable sources (solar, wind, and hydroelectricity). Then again can the fossil fuel electricity production be implemented with, and without, Carbon Capture and Sequestration (CCS) to filter out CO_2 of the exhaust fumes of the electricity plants. The possible options for energy for cars is shown in Figure 16 below.

The CO_2 and NO_x emissions are calculated for the different paths possible form energy source to car type in Figure 17. The calculations are based on the average electricity mix in the EU in 2007. The current electricity mix in the EU, and the Netherlands includes more renewable electricity generation than in 2007, making the emissions of Hydrogen and EV vehicles overestimated.

Figure 17 below indicates that the CO_2 emissions of EV's with the current electricity production already are lower than for fossil fuel ICE vehicles. The NO_x emission of EV's however is slightly higher than for Gasoline ICE cars, but the NO_x emission of diesel cars is already higher than for EV's. The further the electricity production in the Netherlands will become renewable, the lower the emission of EV's per kilometre will be. In Figure 17 are also the emissions and efficiency included for decentral electricity production options. For EV's decentral electricity production will increase the efficiency greatly. This is due to the decrease in transmission losses, and the fact that all decentral electricity production is assumed to be renewable. This analysis is only based on emissions and efficiency of the use of the cars, and not on the production process of the cars.

Standardization As there are multiple models of EV's, and there is differentiation in the electricity supply across Europe, it is important to develop a standard charging outlet and voltage in the EU. Without this standardization it will be less attractive for consumers to buy an EV, as they could not use the EV for their international journeys. Currently the EU has embedded the interoperability of the charging infrastructure for EV's in Directive 2014/94/EU for the deployment of alternative fuels infrastructure (Commissie voor Infrastructuur en Milieu, 2016; European Commission, 2014). This Directive aims to facilitate a market mechanism in charging infrastructures by determining the common technical requirements. The common requirements guarantee a more secure investment option for the implementation of charging infrastructures for alternative fuels, such as for EV's.

Aside from technical characteristics there are also requirements necessary for easy access to the infrastructure and easy methods for paying. This indicates that the user should not have to be a member of a certain organization to be able to use it, and that it should be possible to pay with a credit card or mobile app that is accessible to all. This last requirement for easy payment is a Dutch agreement, but not yet a European agreement, the Netherlands will advocate Open ICT Protocols to facilitate the easy payment methods (Commissie voor Infrastructuur en Milieu, 2016).

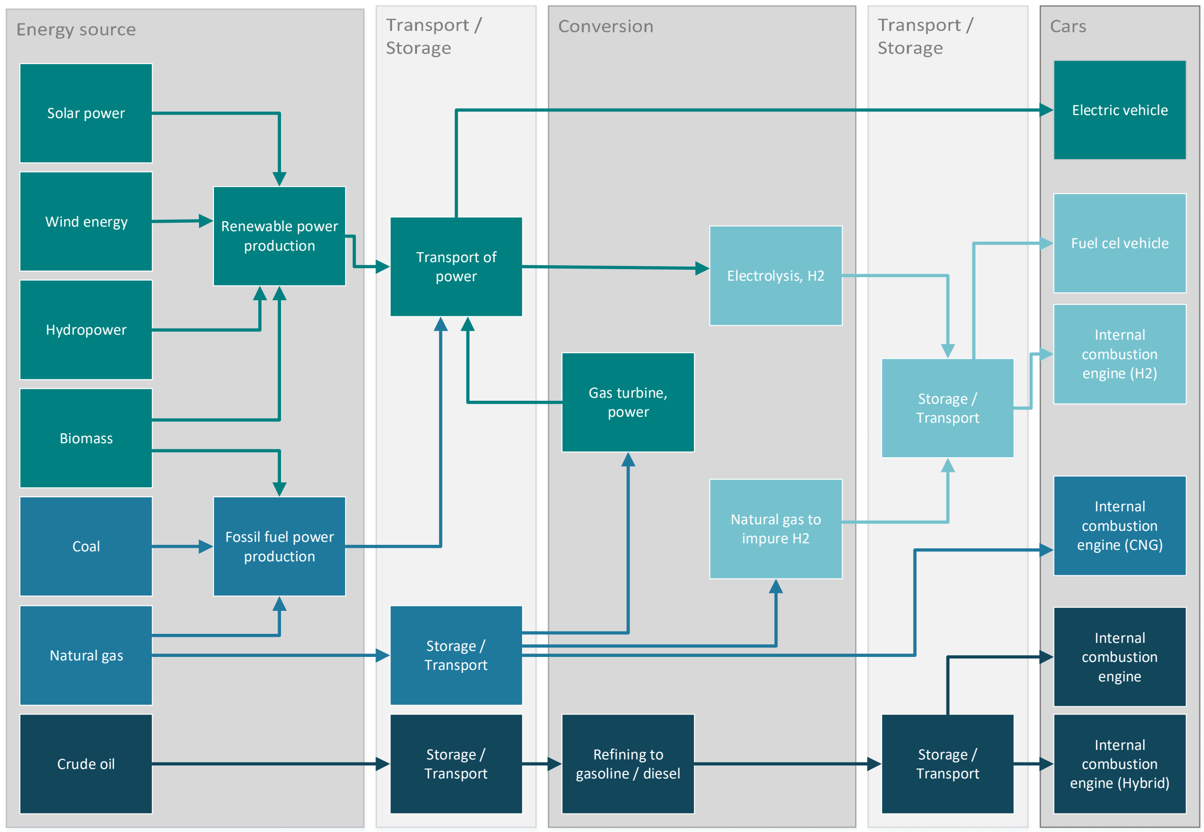

Figure 16: Well-to-Wheel paths energy sources personal mobility alternatives, based on (Mari Svensson, Møller-Holst, Glöckner, & Maurstad, 2007)

Smart charging Smart charging indicates the possibility for EV's to 'communicate' with the electricity grid. This communication can delay the charging of EV's to after the peak demand moments, or can use the EV's for short term storage. For example, if the EV's are connected to the distribution grid in a manner that the battery of the car can be charged and discharged on the distribution grid, the car can be used as a buffer for intermittent electricity sources in the area. However, if the EV's are only connect to the distribution grid in a manner that they can only be charged, like all other household appliances, they can increase the daily peak demand of electricity in the Netherlands (Commissie voor Infrastructuur en Milieu, 2016). This daily peak demand of electricity happens when people come home from work and turn on the lights, heating, and appliances such as the TV. At the same time would people arrive home and plug in their EV to charge. With smart charging the EV can wait with the charging of the battery till after the daily peak of electricity demand, and during the night the EV can be charged fully.

Smart charging also makes it becomes possible to state the minimum of battery capacity you require at a certain time. In other words, if someone drives to work every day and back, and only needs 50% of the battery capacity for the round trip (or he/she is able to charge the car at work) he/she can tell the car to charge to at least 70% capacity before 8 AM. Then the battery can be fully charged during the night, and used as a buffer for the morning peak demand of electricity when the Netherlands wakes up, makes coffee and showers. Smart charging is seen as one of the (transition) possibilities to move towards a electricity system with a high percentage of intermittent (renewable) electricity sources.

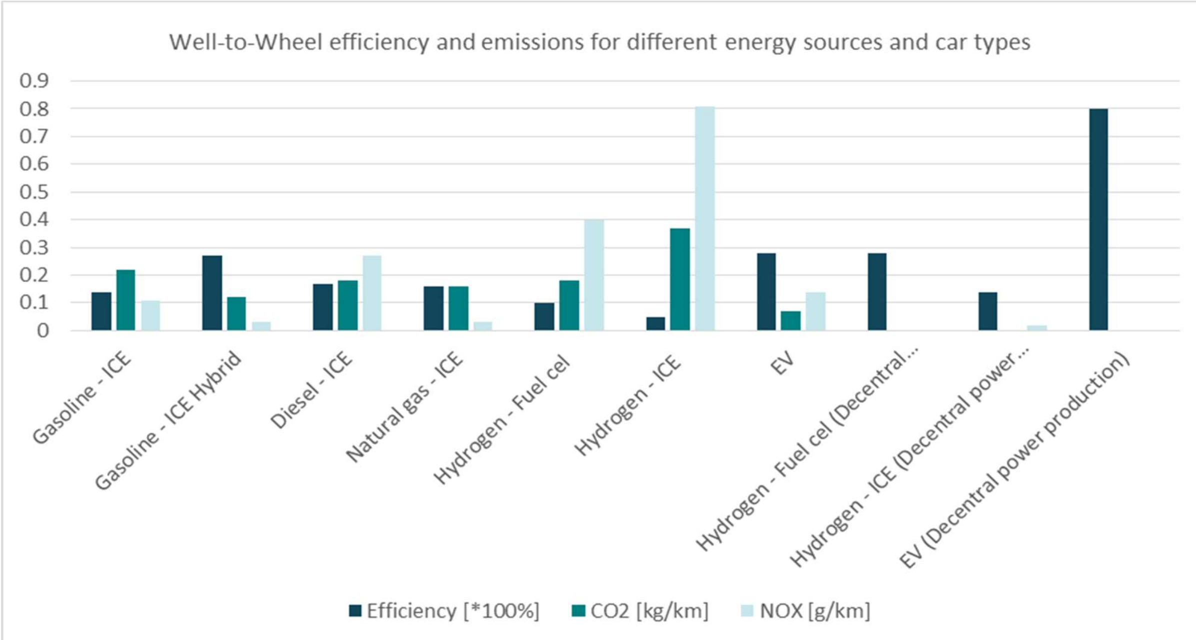

Figure 17: Well-to-Wheel emissions and efficiency for different energy sources and car types, based on (Mari Svensson et al., 2007)

Policy alternatives There are many possibilities discussed of incentives for consumers to purchase EV's. The discussion now focusses mostly on the long term financial needs, and the set-up of the second hand market for EV's. The policy alternative to allow only the sales of zero emission vehicles (mostly EV's) in 2025 is deemed as ineffective, as the market for EV's is growing slowly (Commissie voor Infrastructuur en Milieu, 2016, p.25).

The emissions of cars should be reduced in practice, and not only on paper, that is why the actual emissions of cars need to be reduced, instead of focussing on hybrids that *could* be clean, but might not be used that way. Policy measures that focus on emission norms also allow for a more equal market and provide long term assurance of the policy measures (Commissie voor Infrastructuur en Milieu, 2016, p.23).

The Netherlands is not in favour of road taxes, instead financial measures to stimulate EV's are preferred (Commissie voor Infrastructuur en Milieu, 2016, p.22). A research by the Formule E-Team advice committee shows that the largest barrier for consumers to buy an EV is the higher price of the car itself. The prices are expected to decrease, however this will not be fast enough to reach the set emission goals for transport in 2020 (Formule E-Team, 2016).

It is also important to provide financial incentives for the second hand market of EV's to develop. A method is to provide charging credit for EV's (and plug-in hybrids) for second hand cars (Formule E-Team, 2016). This will also help to keep the second hand EV's in the Netherlands, instead of a large export movement to other countries. If the EV's were to be exported, a part of the CO_2 reduction potential leaves the Netherlands (Formule E-Team, 2016).

6.1.2 Validation of the energy system

The political discussion as explained above will be used as a method to validate the constructed system overview of chapter 5. The policy goals, behavioural factors, and cross-sectoral factors that are mentioned in the political discussion on the *current* energy system for electric vehicles should be present in the system overview as well.

Policy goals If the implemented renewable electricity production capacity remains the same, and the electricity demand grows, the percentage of renewable electricity production of the whole electricity production in the Netherlands will decrease. If the renewable electricity production grows together with the implementation of EV's, decrease the GHG emissions significantly. However, even if the electricity for EV's is generated using fossil fuels, this emits less GHG's than a car running on diesel or gasoline. The link with renewable energy production is included in Figure 18.

Behaviour factors For the acceptance of EV's for consumers, a large infrastructure for charging EV's is required. The connection between the infrastructure and the EV's themselves is visible in Figure 18 where the implementation factor of the infrastructure influences the behavioural factors of the implementation of EV's.

More information on EV's is expected to have a beneficial effect on the adoption of EV's by consumers. Financial support is also believed to have a beneficial effect on the adoption of EV's. This is illustrated in Figure 18 with the behavioural factors of the implementation of EV's. As can be seen are not all the behavioural factors influenced by policy measures. It is indicated already that possible policy options include financial benefits and further enhancement of the infrastructure for EV's which influences all behavioural factors of EV's themselves.

Cross-sectoral factors The implementation of EV's will lead to an increase in electricity demand, and a decrease in fossil fuel demand. The relation between EV's and electricity demand as well as fuel demand is visible in Figure 18. Without Smart charging possibilities, the daily peak demand of electricity is likely to increase, requiring a larger grid capacity. This influences the electricity transport reliability. As smart charging is not yet part of the *current* system overview, this is not included in the system analysis. However the influence on the electricity grid is visible in Figure 18.

The storage of electricity with EV's should be included in the energy system once a policy measure is developed for this technology, or the technology is implemented without government aid and influences the transport of electricity on a national level.

6.1.3 Validation of interference

The analysis of the political discussion has not identified expected interference. The validation of interference is therefore based on the validation of the energy system. All expected factors and dynamics that are mentioned in the political discussion have been represented in the system overview. The definition of interference used in this methodology (the intersection of two or more policy chains) is not new (Simões, 2013). In the next validation case, sustainable heat, is interference identified in the political discussion, this interference will be tested in order to validate the methodology.

The identification of interference with the 7-step methodology is discussed in section 6.3. Also the interference for EV's is discussed within this section.

6.1.4 Conclusion

The validation analysis in this section as well as in Appendix E did not indicate problem areas. The identified factors, policy measures, dynamics, and (for sustainable heat) interference in the political discussion is also all identified in the system overview. However, the problem statement of this thesis project indicates that the presence and effect of interference goes mostly unnoticed by policy makers and in politics. It is therefore difficult to validate the identified interference in the system overview that is not recognized by the political discussions.

All identification steps of this methodology are required to identify, illustrate, and analyse the interference that is recognized in the political discussion, as well as the energy system as described by the political discussions. The expectation is that, as all steps are proven to be required, the interference that is found with this methodology is also present in the actual energy sector of the Netherlands, but not yet identified by policy makers as such.

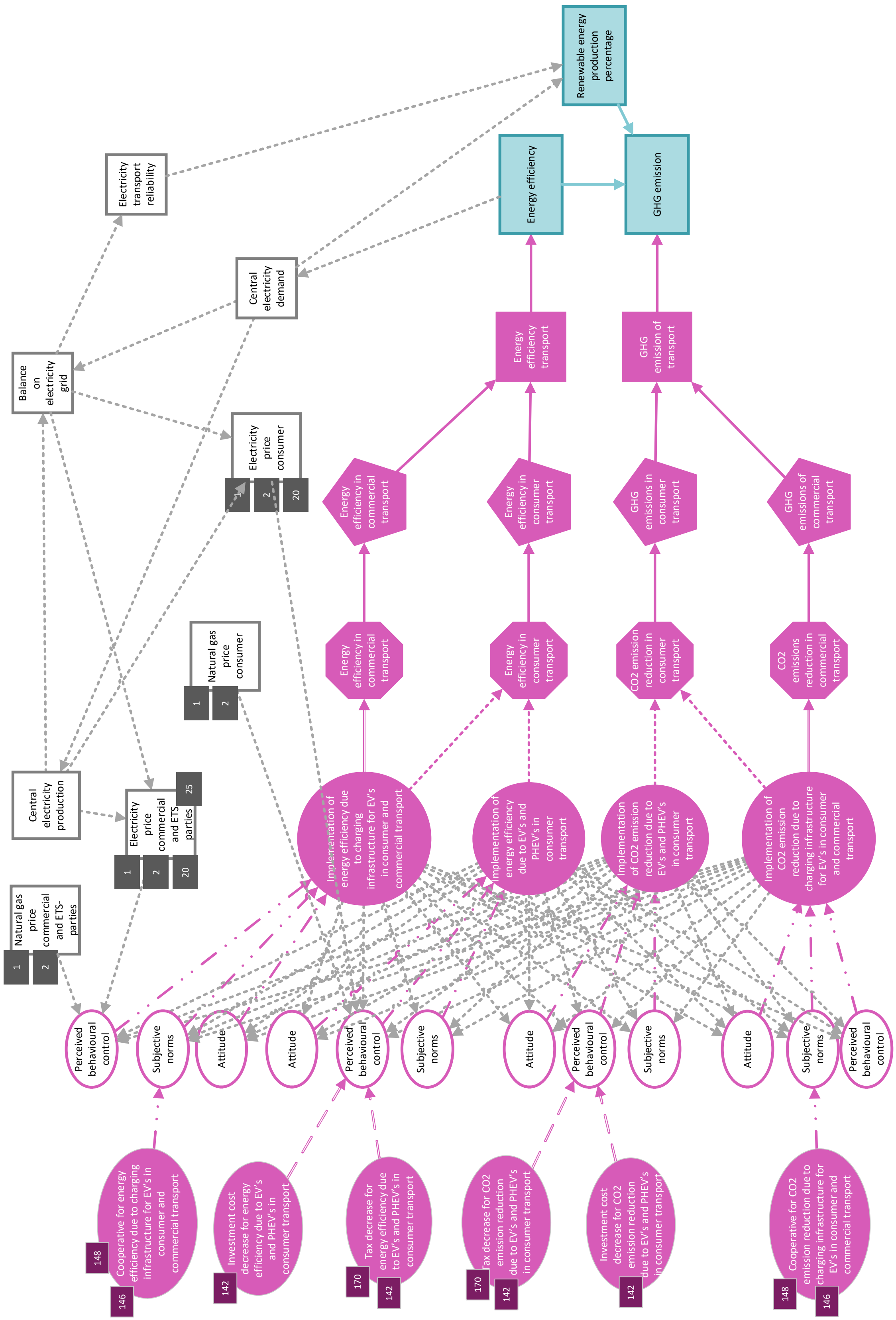

Figure 18: System overview for electric vehicles (measures 142, 146, 148, and 170)

6.2 Step 6 – Identification of interference

The sixth step of the methodology is the system analysis of interference. Box XV indicates how interference can be analysed for the five types of interference.

The five types of interference are: (1) interference that is caused by two or more policy measures that influence the same implementation factor, (2) interference that is caused by the cross-sectoral relations between behavioural and implementation factors, (3) interference that is caused by the cross-sectoral factors, (4) interference of policy chains due to dependency relations between these policy chains, and (5) due to the integration of policy chains.

Box XV – Identification of interference

The five types of interference are based on the system factors and/or the relations between system factors they include. For each of the types will be described how they can be identified.

Type one - Cross-sectoral factors Interference of type one is identified by the cross-sectoral factors that have an incoming arrow (and thus are influenced within the system) and the factors they influence (behavioural factors), or are influenced by (process factors).

Type two - Cross-sectoral relations Interference of type two can be identified by the cross-sectoral relations between implementation factors and behavioural factors. A group of interference is characterized as all policy measures that influence the implementation factors (through the behavioural factors), for those implementation factors that influence the behavioural factors of another implementation factor.

Type three - Dependency between implementation Interference of the third type is identified by dependent relations between two or more implementation factors, or between an implementation factor and a design specification starting factor, on a single process factor. A group of interference for type three is characterized by the implementation factors that depend on each other for a single process factor. There can be more than one group that influences a single process factor.

Type four - Two or more policy measures Interference of the fourth type can be identified by two or more policy measures that influence (the behavioural factors of) the same implementation factor. All policy measures that influence a single implementation factor interfere together.

Type five - Integration of policy chains Interference of type five can be identified by those policy chains that integrate at or after the implementation factors. The implantation factors that are included for type three of interference will not be included here, however these policy chains can still interfere after the process factors, and thus be included in this category is as well.

The five types of interference and their results will be discussed below. The interpretation of these results will follow in section 6.3.

6.2.1 Interference caused by cross-sectoral factors

Examples Interference caused by cross-sectoral factors is depicted in Figure 18. The adoption of EV's increases the energy efficiency, as an electric engine is more energy efficient than a combustion engine (see section 6.1.1). This decreases the emissions from an EV compared to a combustion engine, even if the electricity is generated with fossil fuels.

The increase in energy efficiency causes a decrease in central energy demand. However, even though energy demand decreases, increases the electricity demand. As fuels are replaced with electricity as an energy carrier. This increase in electricity demand influences the renewable energy production percentage policy goal.

If the use of EV's in the Netherlands increases, increases the electricity demand. This will lead to an increase in electricity production, but with the same amount of renewable electricity production capacity, the percentage of renewable electricity produced will decrease. Therefore does the implementation of EV's (if the rest of the system is constant) lead to a positive effect for the goals of energy efficiency, and GHG emissions, but to a negative effect on the goal for the renewable energy production percentage.

Cross-sectoral factors cause interference between policy measures due to their dynamic and independent nature. However, this is not applicable to all cross-sectoral factors. Only those cross-sectoral factors that are influenced by other factors within the system can cause dynamics. The cross-sectoral factors that are not influenced by other factors within the system (e.g. the natural gas prices) do influence the energy system, but do not create interference.

Another example of interference is based on the feedback loop between electricity demand, electricity production, electricity price, and efficiency measures. This feedback loop is depicted in Figure 19 and is further discussed in section 6.3.1.

Results There are 53 policy measures that interfere due to the cross-sectoral factors, including 51 policy chains. The effect of the interference caused by cross-sectoral factors will be discussed in section 6.3.1.

6.2.2 Interference caused by cross-sectoral relations between behavioural and implementation factors

Examples Interference of cross-sectoral relations is depicted in Figure 18. This interference is based on the effect the adoption of actions (or technologies) has on the behavioural factors for the society as a whole. The example in Figure 18 includes the interference between the charging infrastructure for EV's and the adoption of EV's themselves. If the adoption of EV's increases is the business case for charging infrastructure better, as more cars will use the infrastructure. At the same time leads a growing adoption of EV's to a change in subjective norms and attitudes towards infrastructure for EV's, as EV's become a regular part of society, will the charging infrastructure of EV's also be regarded as 'normal' or even as necessary.

The influence of the charging infrastructure for EV's on the adoption of EV's is similar. If there is an abundance in charging infrastructure, it is more attractive to have an EV, as the issue of where to charge it and the perceived barrier of range anxiety will decrease.

Results Cross-sectoral relations create ten individual areas of interference: (1) EV's, (2) alternatives for cars in consumer transport, (3) logistic efficiency in commercial transport, (4) decentral renewable energy production, (5) central renewable electricity production with wind energy, (6) process efficiency in industry, (7) chain efficiency in industry, (8) innovative solutions for energy efficiency in greenhouses, (9) innovative solutions for decentral energy production, (10) geothermal energy production.

There are 32 policy measures and 36 policy chains included in the ten areas of interference caused by cross-sectoral relations. The effect of the interference caused by cross-sectoral relations will be discussed in section 6.3.2.

6.2.3 Interference caused by dependent relations between implementation factors

Examples The third type of interference is the interference based on dependent relations in the system. An example of dependent relations is visible in Figure 22. Figure 22 includes only the energy efficiency policy chains for EV's and excludes the cross sectoral relations, to increase the readability of the figure for the other relations. The complete overview for EV's in the energy system of the Netherlands can be seen in Figure 22.

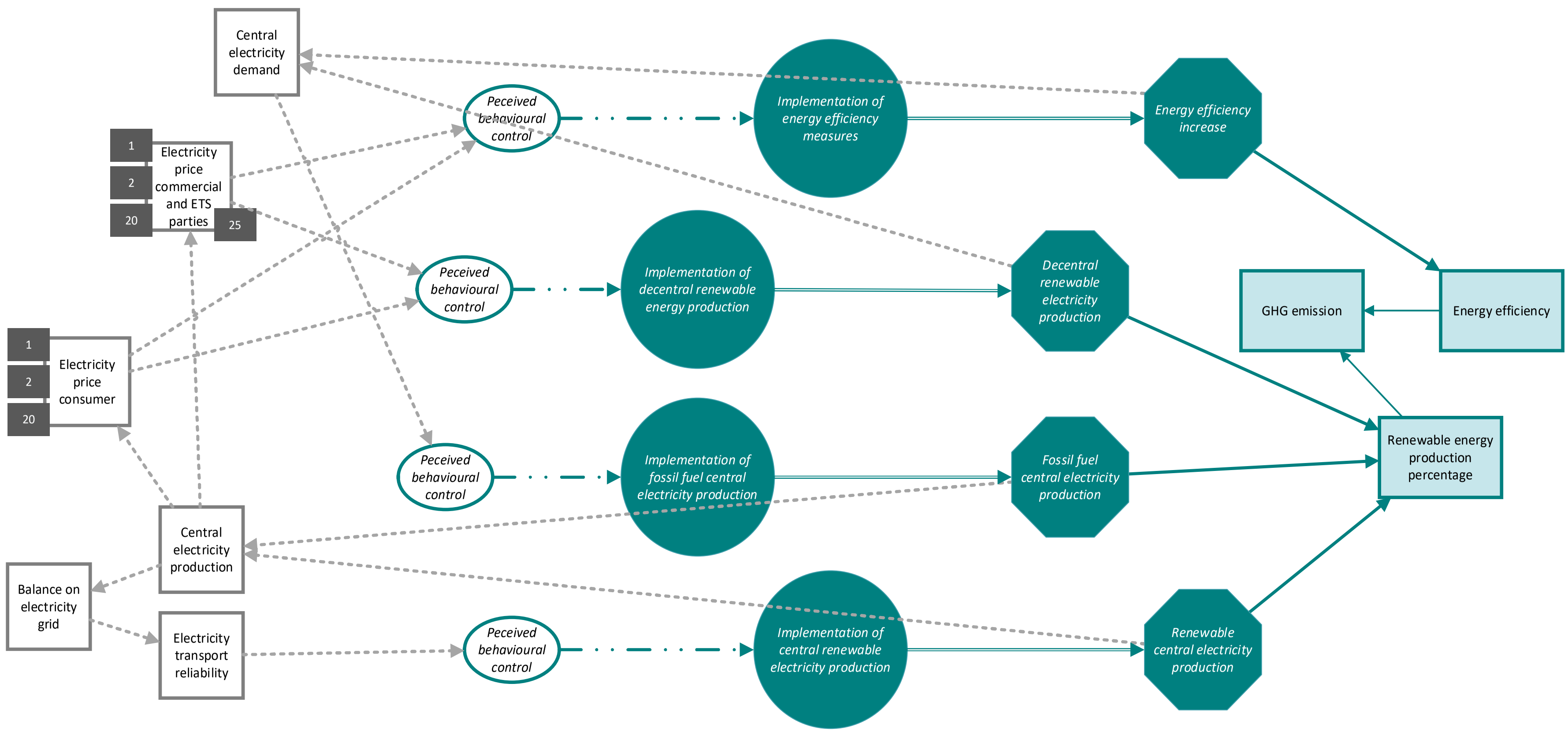

Figure 19: Interference due to cross-sectoral factors for general policy chains, including energy efficiency chains, and electricity production chains

The implementation of EV's is dependent on the implementation of the infrastructure for EV's, and vice versa. If there are EV's but you cannot charge them throughout the Netherlands, they will be used less (the total number of EV's can still increase, but the kilometres travelled with EV's is likely to decrease, as people will only use them close to where they can charge them). And if there is an infrastructure, but no EV's, the amount of kilometres travelled with an EV will also not increase.

This type of interference is therefore more applicable to hybrids than to full electric vehicles, as for hybrids each kilometre that is driven can be chosen to drive on electricity or on fuels. Whereas for full battery electric vehicles you either ca or cannot drive, based on the availability of electricity. The effect of EV's and its infrastructures alone therefore do not (significantly) influence the energy demand and emissions in the transport sector, but together they can have this influence.

Another cause for dependency is between an implementation factor and a design specification policy measure. An example for this dependency is depicted in Figure 20. Here the design specifications of what is seen as biomass, and what is seen as 'regular waste' influences which part of the incineration electricity production is seen as biomass, and therefore what percentage of this electricity production is regarded as renewable electricity.

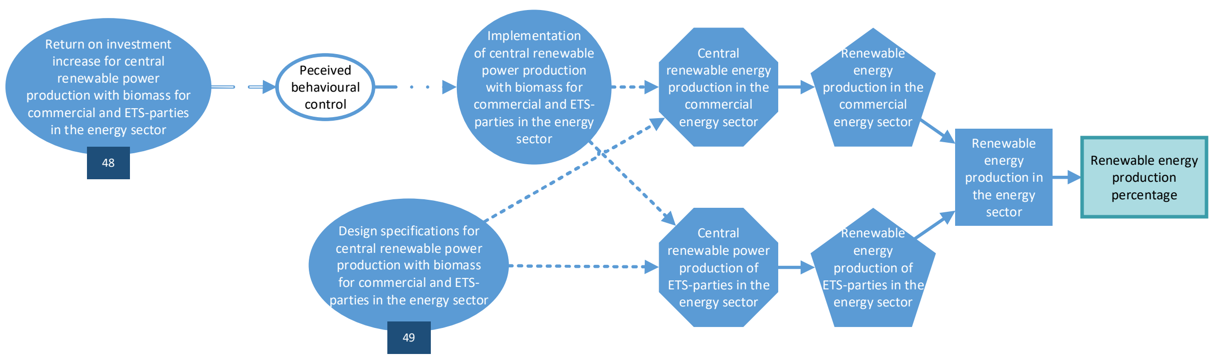

Figure 20: Example of interference caused by dependency of implementation factors for biomass electricity production (measures no. 48 and 49)

Results Dependency between implementation factors causes interference for five different cases: (1) Biomass electricity production, (2) Public transport, (3) Alternative fuel use, (4) Electricity transport for wind energy, and (5) EV's. Four of the cases of interference are based on the use of technology and the specifications of this technology. The fifth case of dependency includes a technology (EV) and the required infrastructure for this technology.

There are 14 policy measures in 16 policy chains subject to this type of interference. The effect of the interference caused by dependent relations between implementation factors and process factors will be discussed in section 6.3.3.

6.2.4 Interference caused by two or more policy measures that influence the same implementation factor

Examples When two or more policy measures influence the same behavioural factor, they can together account for an intention towards this behaviour. For example, in Figure 22 for EV's, can measure number 142 influence the financial business case for the implementation of an EV, but if the costs for using the EV regularly is still too high, it is possible the perceived behavioural control will not exceed its threshold value to create an intention and action to implement EV's. The measures number 170 and again 142 (this measure has two active components for two different sub-types) influence the costs of the use for an EV on a monthly basis. The interference of the two policy chains together can allow for an intention and action to be formed.

There are also policy measures hat influence more than one implementation measure, as is depicted in Figure 22. where the measures 142, 146, 148, and 170 all appear twice, once for the energy efficiency aspect, and once for the GHG emission aspect. Even though the policy measures are the same, the influence of the interference is not per definition the same, therefore do these four policy measures interfere twice.

It is also possible for a policy measure to have two starting factors that influence the same implementation factor. There are 39 policy measures with more than one starting factor that influence the same implementation factor, but there are only two cases where this policy measure does not interfere with other policy measures for the fourth type of interference. An example of one of these two instances is depicted in Figure 21. Here a policy measure both provides subsidies for R&D costs for new fuel efficiency measures for trucks, and offers projects for stakeholders to try these new fuel efficiency measures on trucks in practice. As there are no other policy measures that influence the same implementation factor, is no interference of the fourth type present for this policy measure.

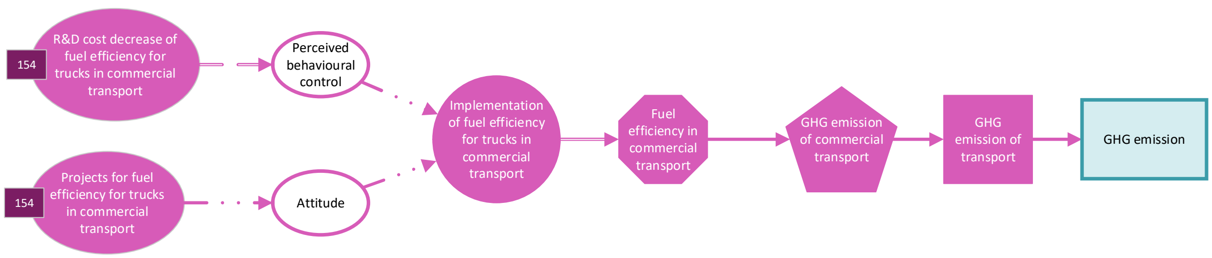

Figure 21: Example of two policy chains, including only one policy measure, that influence the same implementation factor for fuel efficiency of trucks in commercial transport (measure no. 154)

Results There are 39 policy measures with 40 policy chains that interfere in their influence on the implementation factors. The effect of the interference caused by two or more policy measures for a single implementation factor will be discussed in section 6.3.4.

6.2.5 Interference caused by the integration of policy chains

Examples Interference due to the integration of policy chains accounts for most of the interference in the energy system. The interference accounted for in the third type (dependency between implementation factors) is excluded from this fifth typology, as all both types are caused by the integration of policy chains at the implementation factor (or further down the policy chain). As the third typology is more specific, this characterization takes precedence over the fifth type of interference.

It remains possible for the policy chains included in the third type of interference to also interfere for the fifth type, as long as this interference takes place in the policy chain after the process factor. An example is provided in Figure 22, where two policy chains interfere for the sector goal factor.

Results The integration of policy chains causes interference that includes all policy measures in the Dutch energy system. The effect of the interference caused by policy chain integration will be discussed in section 6.3.5.

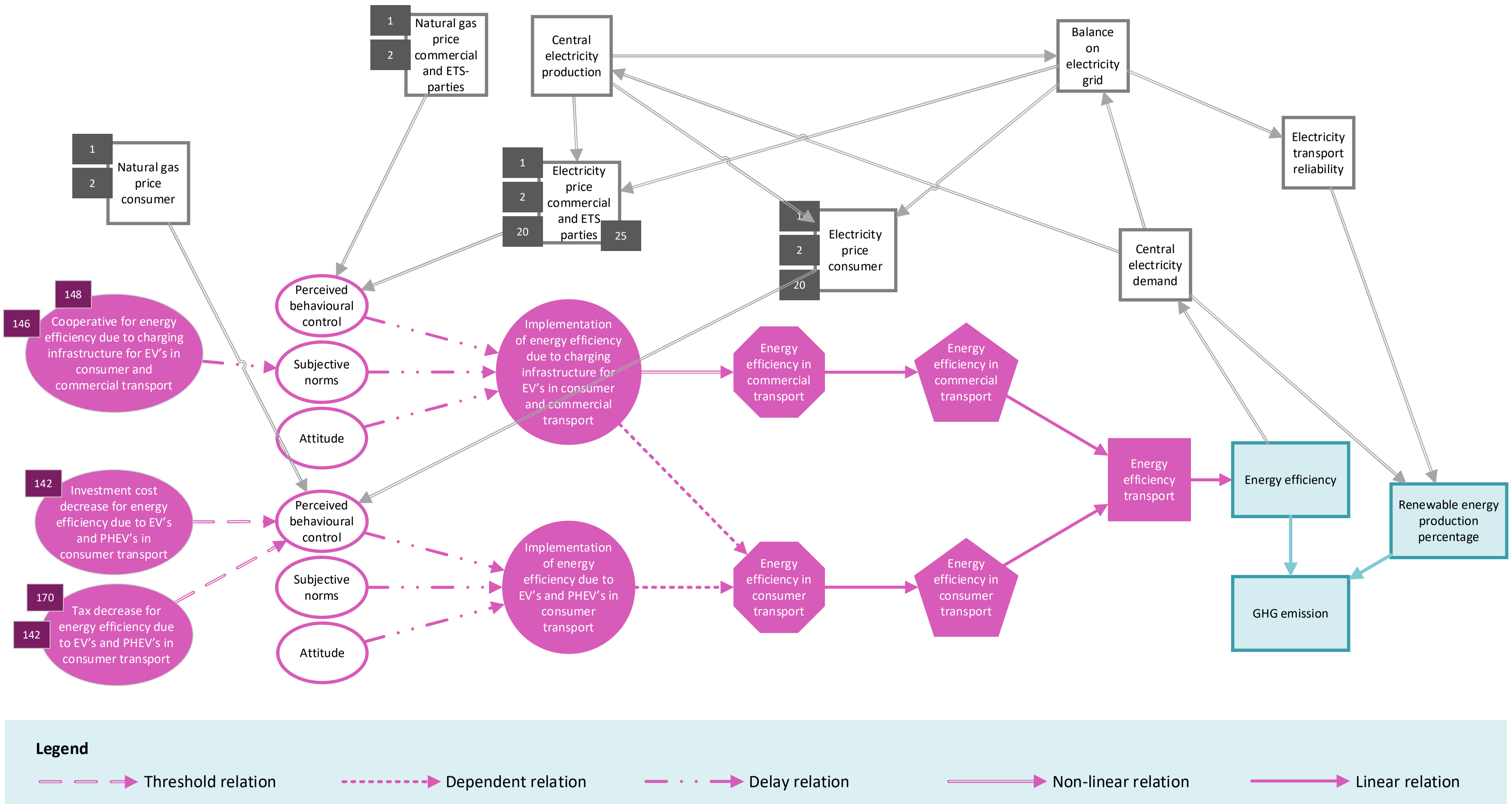

Figure 22: Example of interference for the energy efficiency aspect of EV's (measures no. 142, 146, 148, and 170), including cross-sectoral factors, excluding the existing cross-sectoral relations (see Figure 18 for the existing cross-sectoral relations and the GHG emission aspects of EV's)

6.3 Step 7 – Interpretation of interference

In Box XVI is explained how interference can be interpreted.

Box XVI – Interpretation of interference

The effects of the five types of interference are interpreted using three criteria, the size of the effect, the spread of the effect throughout the system, and the dynamics that are created by the interfering policy measures.

Size and spread The size of the effect is indicated by the number of policy measures that are subject to a single type of interference. The spread is then indicated by the sectors and policy aims that are represented in the set of interfering policy measures.

The number of policy measures can be counted after the interference of a type is identified throughout the system. Both aspects for the spread of the interference can be found by looking at the identified interference and gather the data on the identified policy measures: what sectors are they active in and what policy goal do they aim to contribute to.

Dynamics The dynamics include uncertainties and feedback loops. The uncertainties in the system are twofold, caused by behavioural factors, and caused by the implementation factors. Interference that reduces the uncertainty caused by the behavioural factors, is recognized by the inclusion of the behavioural factor in the identified groups of interference. The effect of this interference can be interpreted by adding all effects of the policy measures on the behavioural factors within a group. If the total positive influence of the policy measures on the behavioural factors of a single implementation factor is larger than for each individual measure, the interference reduces the uncertainty. If the total effect is lower than for one of the policy measures alone, the effect of interference is negative.

Feedback loops can be recognized by the path of the effects of a system factor or policy measure. If the path of this effect through the energy system ends up again at the system factor that was started with, a full loop is made through the system. The effect of the system factor is therefore 'never ending' as it keeps influencing the same circle over and over again. A feedback loop is negative when the initial effect of the policy measure on an implementation factor is counter acted after a full loop, and positive if the effect is enhanced after a full loop.

A positive feedback loop causes an increase in effect of a policy measure on the system factors that are present in the feedback loop. A negative feedback loop decreases this effect of the policy measure. This does not indicate that if the effect of a policy measure leads to (e.g.) an increase in the implementation of decentral renewable energy production, the feedback loop causes a destruction of this implemented production capacity. The negative feedback loop then can cause a decrease in the amount of newly implemented decentral production capacity in the future.

Four of the five types of interference have a relatively small, localized impact. The type of interference with the most system wide impact is the interference caused by the cross-sectoral factors.
The figures in section 6.3.1 till 6.3.5 that indicate the spread of the effect of the five types of interference indicate only those factors of the policy chains that are influenced directly by the interference. This does not mean that the effects are not present in the other parts of the policy chain, but in these parts are the effects no longer changing due to the specific type of interference indicated.

6.3.1 Interference type one - Cross-sectoral factors

Size and spread There are 59 policy measures that interfere due to the cross-sectoral factors, including 48 policy chains, and six cross-sectoral factors. The first type of interference is present in six of the seven sectors, none of the policy measures from the agricultural sector are included, as is visible in Figure 23

There are 20 policy measures that aim to contribute to the policy goal for an increase in renewable energy production, and 42 policy measures that focus on an increase in energy efficiency. One policy measures does not aim to contribute to any of the policy goals, but counteracts the goal of reduction on GHG emissions, this is the policy measure for the removal of the coal tax for electricity producers (no. 21).

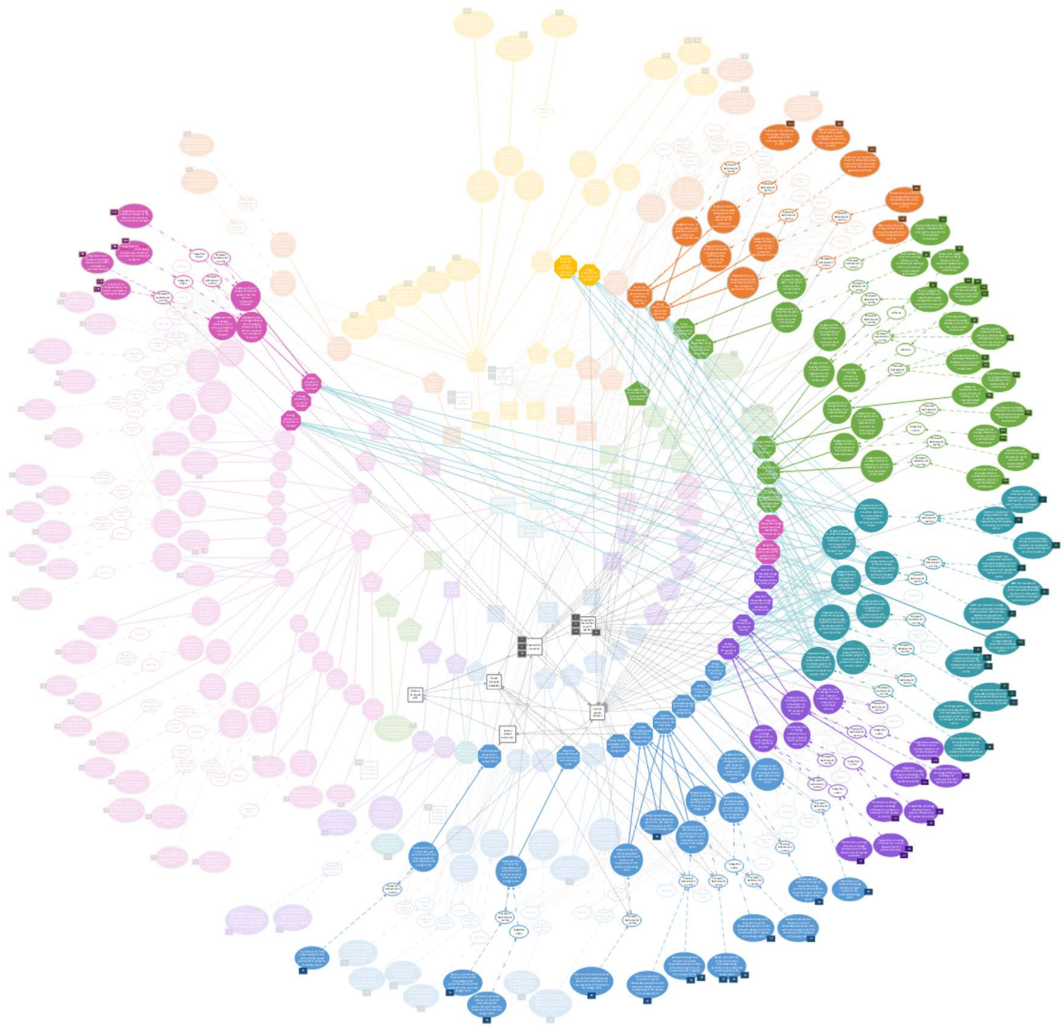

Figure 23: Overview of interference caused by cross-sectoral factors

The first type of interference is also the category where the relatively large transport sector is present the least, as can be seen in Figure 23. This is due to the small number of policy measures in the transport sector that focus on renewable energy production and energy efficiency. Except for the measures focussed on EV's and one policy measure focussing on the energy efficiency of rail transport, focus all other transport measures solely on the reduction of GHG emissions.

Dynamics The interferences caused by cross-sectoral factors creates a feedback loop throughout the system. For example, the feedback loop depicted in Figure 24 is negative on the short term, but can be positive on the long term. The feedback loop is indicated by the red arrows and is explained below.

If a policy measures influences the behavioural factors for decentral renewable energy production enough that more decentral renewable energy production capacity is installed (by the target group), there is a positive (increasing) effect on the implementation factor for decentral renewable energy production. This growth in implementation of decentral technologies leads to a growth in decentral renewable electricity (and heat) production, this is indicated with arrow 1. This growth in decentral electricity production decreases the central electricity demand, as stakeholders are providing in their electricity demand themselves, and thus need less electricity from the regional or national grids, this is indicated with arrow 2. A decrease in central electricity demand leads to a worsening of the business case for central electricity production, this is indicated by arrow 3. This worse business case can lead to the threshold for central electricity production to not be overcome by all stakeholders, and e.g. leading to a decrease in new fossil fuel central electricity production capacity, indicated by arrow 4. All central electricity producers together will produce less electricity if the demand is less, indicated by arrow 5.

Due to the economic mechanisms of the electricity sector in the Netherlands, are the short and long term effects of the electricity production on the electricity price different. On the short term, if the electricity production increases, increases also the electricity price. On the long term, if the central electricity production increases, is the business case to build more central electricity production better, and can new capacity (which often has lower production costs) lead to a decrease in electricity price. For example in Figure 24 where the central electricity production decreases, the electricity price decreases on the short term, however on the long term is the business case to build newer (and therefore cheaper) production capacity worse, leading to a possible scarcity in electricity production capacity, and increasing electricity prices. The relation between the central electricity production, and the electricity price is indicated with arrow 6.

The (central) electricity price then influences the financial incentives for stakeholders to generate their own electricity decentral, where a lower central electricity price leads to a smaller incentive to produce decentral electricity, as is indicated with arrow 7. This decrease in incentives can cause the threshold to be not overcome and therefore stall the further implementation of new decentral electricity production capacity on the short term, as indicated with arrow 8.

Due to the duality in effect of this feedback loop for the short term and the long term should the policy makers be aware of this tendency. In order to reach the long term effects, opposite dynamics may be presented on the short term.

The feedback loop in the energy system has three main consequences, as can be seen in Figure 24. The first consequence is that an increase of decentral electricity production leads, on the short term, to a decrease in electricity price, and therefore to a decrease in the implementation of additional decentral renewable electricity production.

The second consequence is that for an increase in decentral electricity production, the central electricity production decreases, and therefore the balance on the electricity grid also decreases. This decreases the transport reliability, and therefore also the business case of central (renewable) electricity production through the factor for perceived behavioural control.

The third consequence is that for an increase in decentral renewable electricity production, followed by a decrease in electricity price (on the short term), the incentive to implement energy efficiency measures also decreases. The decrease in energy efficiency measures leads to an increase of the central electricity demand (at least not a reduction, and assuming the average population in the Netherlands keeps growing, also an increase in the total energy demand of the Netherlands). The increase of energy demand also enlarges the decrease of the central electricity demand after the first full loop.

In practice occur these three feedback loops constantly and simultaneously, and there is not one starting point. The different consequences can counter act the consequences of another loop, or the same feedback loop, but then in a different phase. For example, the explanation of the first consequence of a feedback loop, at the top of section 6.3, starts with an increase in decentral energy production and ends with a decrease for the same factor. These two effects can be happening constantly, and simultaneously.

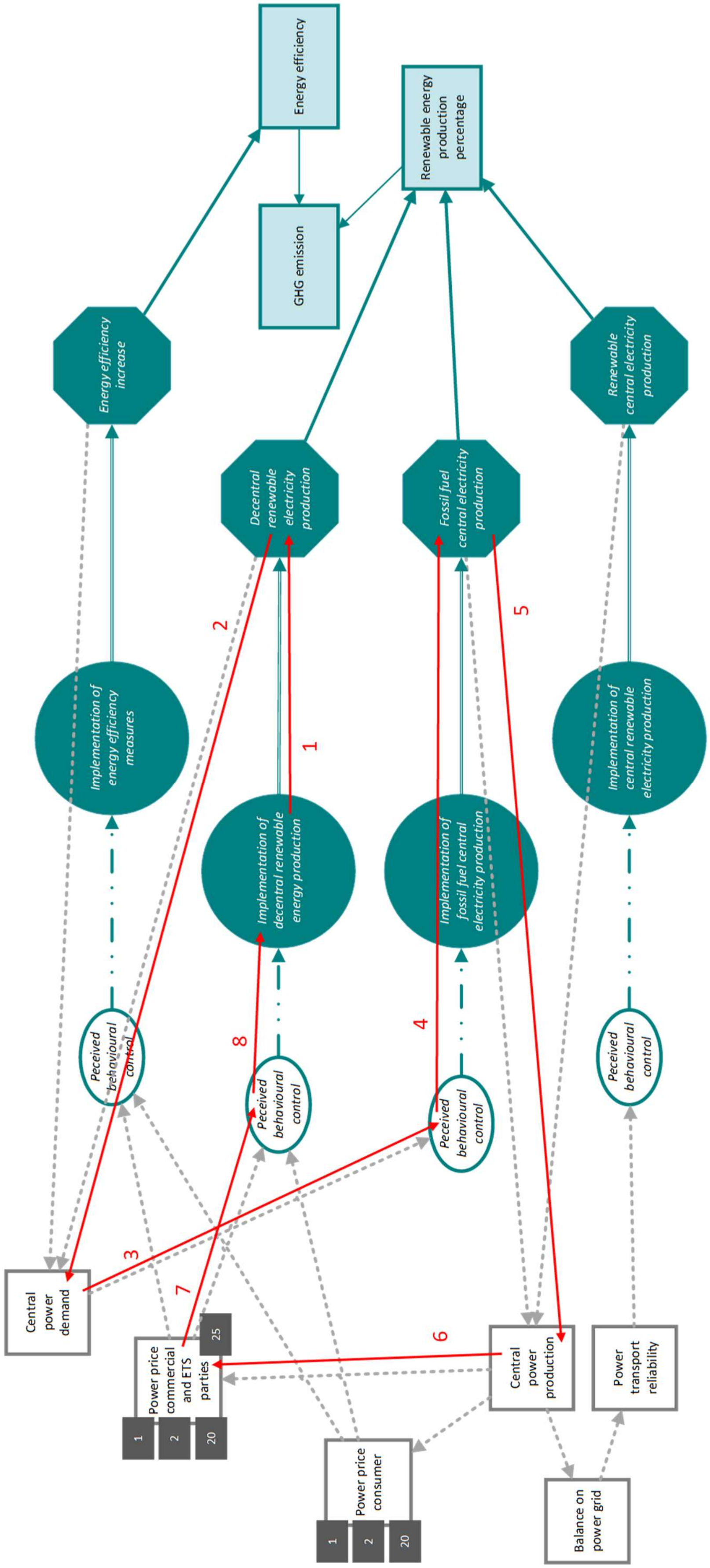

Figure 24: Feedback loop in the energy system of the Netherlands caused by interference with cross-

The feedback loop also influences (both increases and decreases) the uncertainty within the system. Due to the positive and negative feedback loops, the behavioural factors are also influenced both positively and negatively. For the negative feedback loops should be monitored when the decreasing effect of the feedback loop becomes larger than the positive effect of the policy measures (in the given example above, when the influence of the electricity price becomes larger than the incentives provided by policy measures for decentral renewable energy production).

The turning point should be seen as the moment to phase out the policy measures. However, remember that a long term vision is required for the energy systems, indicating that this phasing out should be clearly included in the policy measures.

6.3.2 Interference type two - Cross-sectoral relations

Size and spread There are 32 policy measures and 36 policy chains included in the ten areas of interference caused by cross-sectoral relations. Five of the seven sectors have interference due to cross sectoral relations, this is also visible in Figure 25. The multi sector has only one policy chain that interferes with two policy chains of the energy sector. The agricultural and built environment sectors do not include interference caused by cross-sectoral relations.

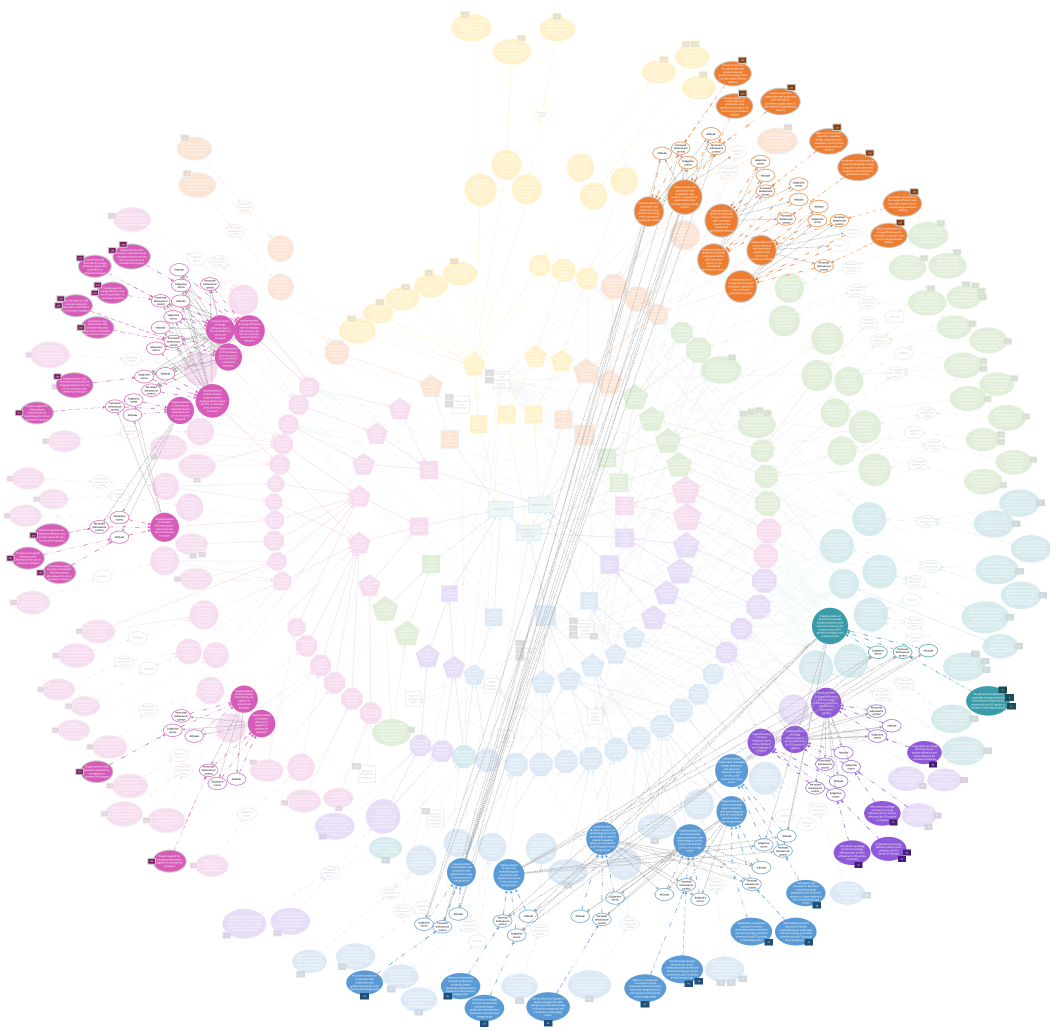

Figure 25: Overview of interference caused by cross-sectoral relations

There are fourteen policy measures that aim to contribute to the increase in renewable energy production, thirteen that aim to increase energy efficiency, and ten that aim to reduce the GHG emissions.

Dynamics The second type of interference, caused by cross-sectoral relations does include small feedback loops. The effect of the interference remains limited to the behavioural and implementation factors. However, as the implementation of the technology (e.g. geothermal energy production) is successfully implemented in the energy sector, this provides information, experiences, possible economies of scale or redevelopments that have a higher return on investment, as well as a more positive view of society on this technology, for all sectors. This again influences the behavioural factors for geothermal energy production in the other sectors, which leads to a decreased uncertainty in the overcoming of the threshold for intention in the other sectors. The implementation of geothermal energy in e.g. greenhouses could then lead to another positive effect on the behavioural factors for geothermal energy in all sectors. This is a small feedback loop with a positive effect, the additional effect however is expected to decrease as more geothermal energy production is implemented.

Once the majority of stakeholders has overcome their thresholds for implementation, the last part of the stakeholders is expected to be more difficult to influence. This expectation is based on the Technology Adoption Life Cycle. This cycle is based on the identification of six stages of technology adoption by Rogers (1983). Each of these stages were then linked to groups of stakeholders (potential technology adopters) by Moore (1999). These six groups of stakeholders all have different drivers and beliefs, which influences their adoption intention of new technologies. The six stages and their connection to stakeholder groups lead to the development of the Technology Adoption Life Cycle, depicted in Figure 26. Here the y-axis depicts the number of stakeholders that adopt the technology, and the x-axis depicts the general innovativeness of the stakeholders, based on their drivers and beliefs. Once the so called 'chasm' has been crossed will a large part of the majority follow. Those people that do not follow then, are likely not to adopt the technology at all. The cross-sectoral relations are therefore expected to aid in 'crossing the chasm' with their interference due to mutual enhancement of technology implementation incentives. Once the chasm is crossed, the added benefits of multiple policy measures for multiple stakeholders is expected to decrease.

It is therefore expected that incentives for the same behaviour or technology in multiple sectors at the same time, benefits most of positive interference at the start of the development/implementation of this technology in the Netherlands.

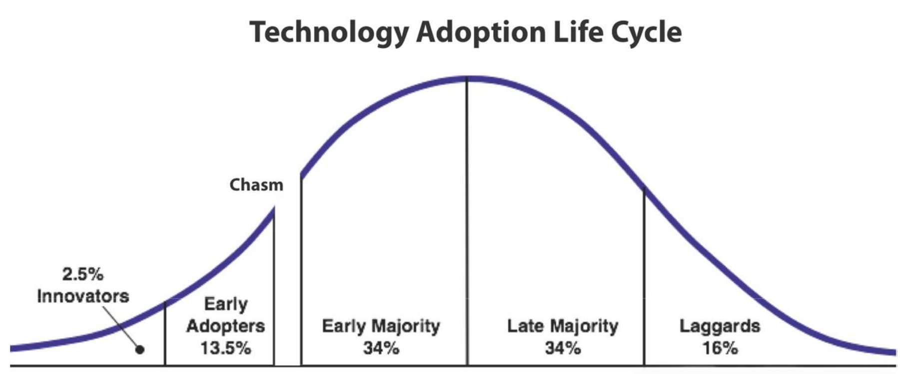

Figure 26: Technology Adoption Life Cycle curve, based on (Moore, 1991; Rogers, 1983)

The feedback loop between implementation and behavioural factors in different sectors decrease the uncertainty of the effect of the policy measures. The influence of the policy measures on the behavioural factors is enlarged through the feedback loop, increasing the stakeholder group that overcomes their behavioural thresholds and develops the implementation intention.

6.3.3 Interference type three - Dependency between implementation factors

Size and spread There are 15 policy measures that interfere due to dependencies between implementation factors, in 16 policy chains. Only three of the seven sectors are included in the third type of interference, these sectors are the transport, industry, and energy sectors. The spread is depicted in Figure 27. This low amount of sectors included is also due to the overall small number of policy chains included in this category of interference.

There are five policy measures that aim to contribute to the increase in renewable energy production, four that aim to increase energy efficiency, and eight that aim to reduce the GHG emissions.

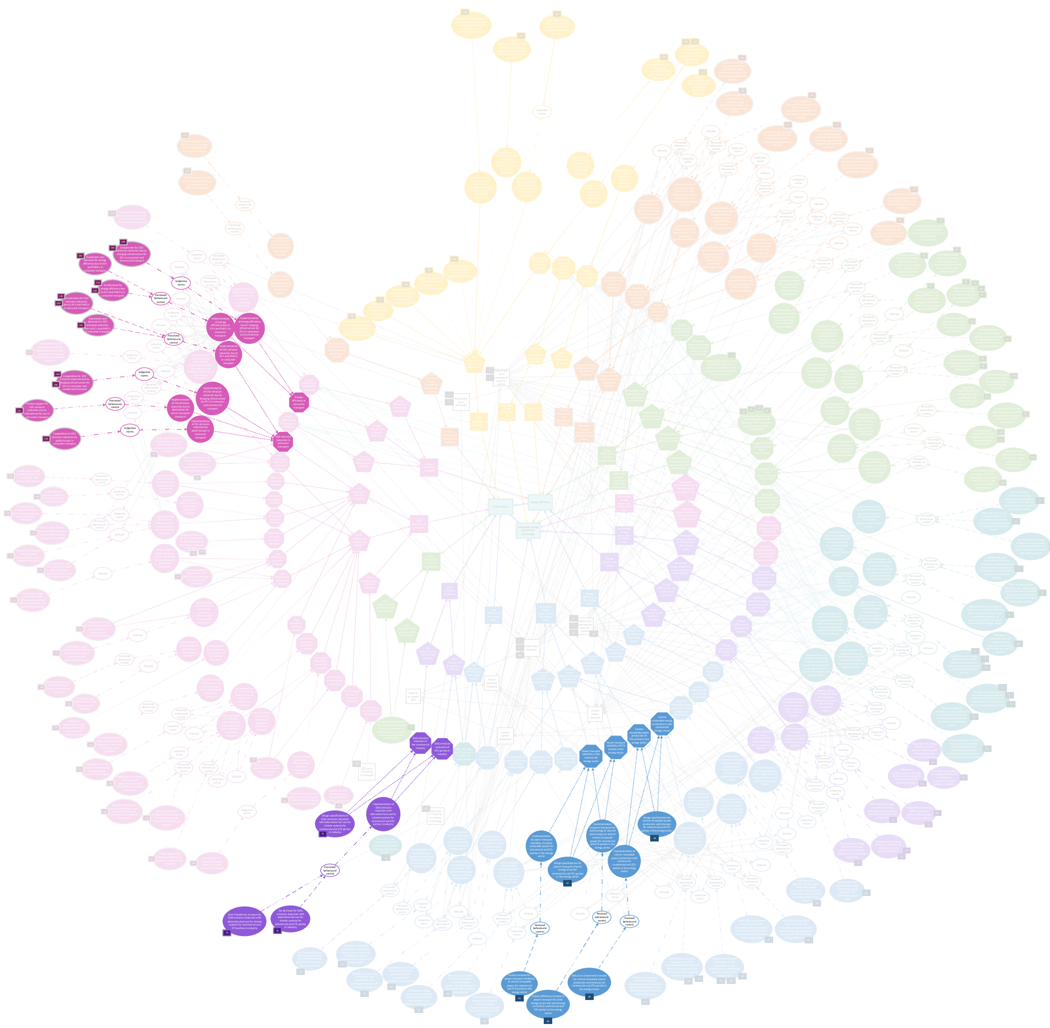

Figure 27: Overview of interference caused by dependency between implementation factors

Dynamics The third type of interference decreases the uncertainty in the system. This is due to the need of both aspects of a technology (or design of the technology) are required to reach the aims of each individual policy measure. Therefore, without the positive interference, it is likely that neither will reach their aims. In contrast to the influence of the cross-sectoral relations, that are expected to be mostly effective for the implementation of new or innovative technologies, is interference due to dependencies expected to be effective throughout the implementation phases of the technology. This is especially true for the dependencies based on design specifications of the technology. If the design specifications of the technology were to be removed after a period of time, there is a reasonable chance the technology will be designed differently, e.g. less energy efficient, as the more energy efficient method is mostly more expensive, otherwise no policy measure would be required to stimulate the energy efficiency variant of the technology in the first place.

6.3.4 Interference type four- Two or more policy measures that influence the same implementation factor(s)

Size and spread The interference caused by the presence of two or more policy measures that influence the same implementation factor(s) include 39 policy measures in 40 policy chains. Six of the seven sectors include interference of the fourth type. Figure 28 depicts where in the system overview two or more policy measures influence the same implementation factors. The agricultural sector is not included for the fourth type of interference.

There are 11 policy measures that aim to contribute to the increase in renewable energy production, 24 that aim to increase energy efficiency, and 9 that aim to reduce the GHG emissions.

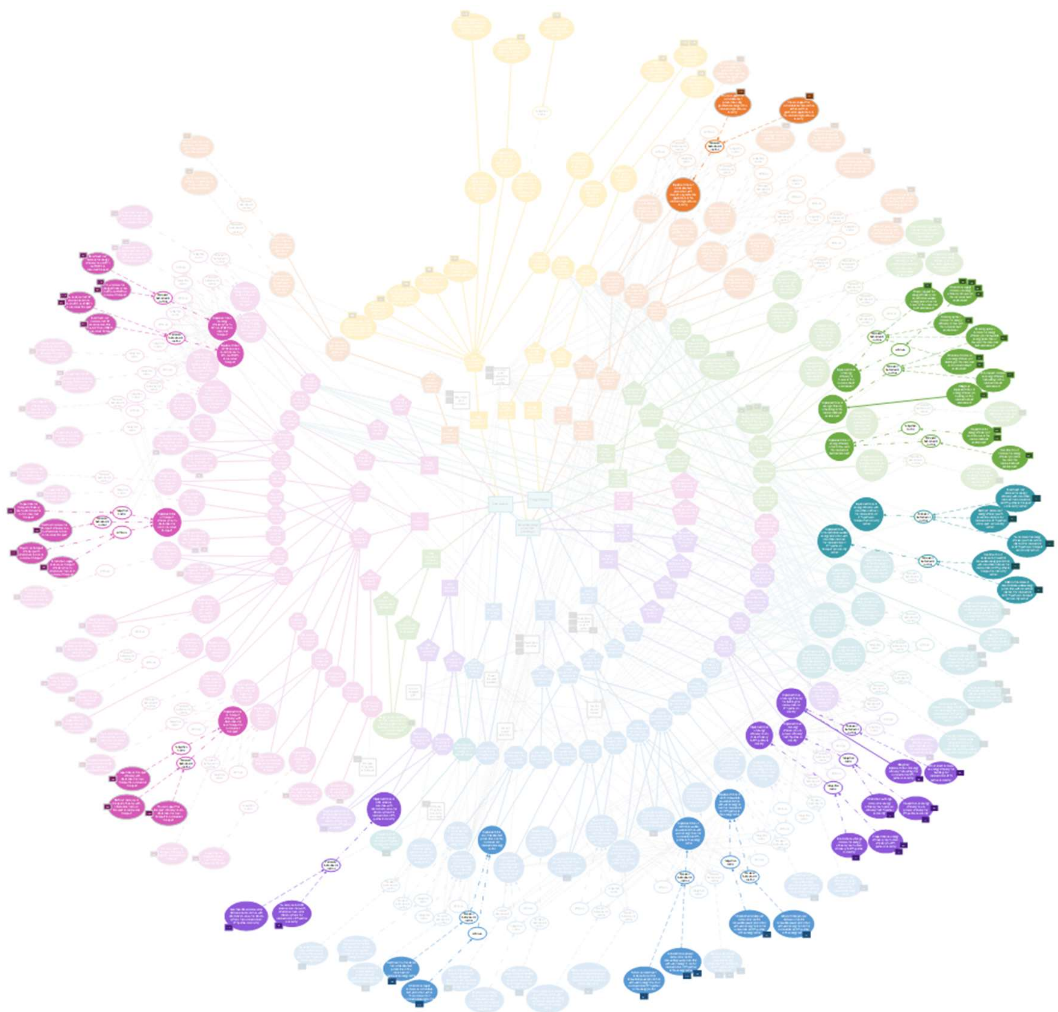

Figure 28: Overview of interference caused by multiple policy measures that influence the same implementation factor(s)

Dynamics The dynamics for the fourth type of interference influences the uncertainties in the energy system. As all policy measures included in this set have a positive influence on renewable energy production and energy efficiency, and a negative influence on GHG emissions, is the uncertainty reduced.

The influence of two or more policy measures on the same implementation factor therefore increases the incentives and reduces the uncertainty in the effects of both policy measures.

6.3.5 Interference type five - Integration of policy chains

Size and spread All policy measures are subject to the fifth type of interference. The 119 policy measures all contribute to three policy goals. As there is not one goal that is influenced by a single measure, all measures interfere somewhere along the path form policy measure to policy goal. As all policy measures interfere for the integration of policy chains, also all sectors are included.

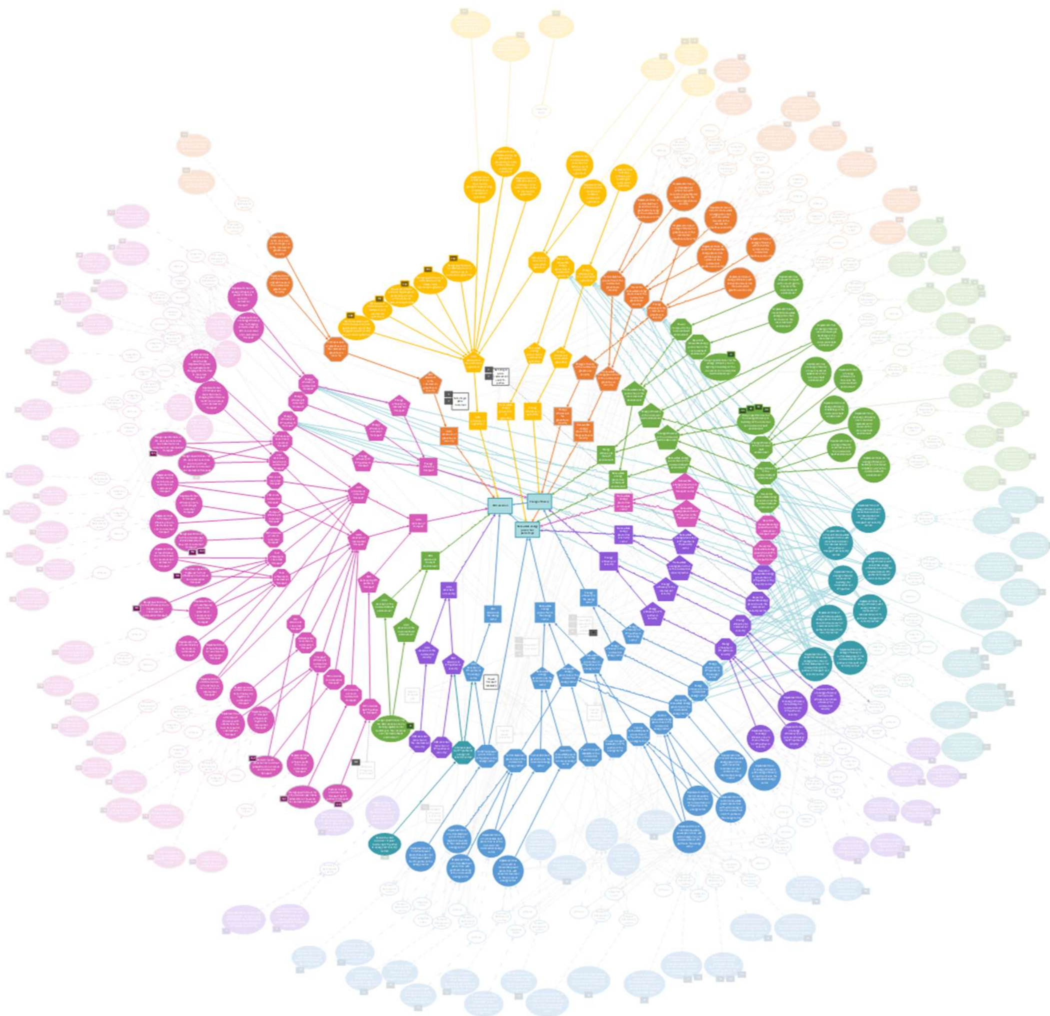

Figure 29: Overview of interference caused by the integration of policy chains

Dynamics Interference due to policy chain integration has the smallest effect. This integration occurs closer to the policy goals in the policy chain. It therefore does not decrease uncertainties (as this is present for the behavioural aspects and the implementation of a technology), neither does it create feedback loops within the system. The only interference that is caused is an addition of effects of policy measures after they have reached the system, into a categorization of policy goals.

6.4 Conclusion

The seven sectors do not all include each type of interference. The policy measures applicable to the agriculture sector do not interfere at all for the first four types of interference. Also the greenhouse industry and multisector policy measures interfere to a low degree, as can be seen in Table 26. The interference of the fifth type includes all policy measures, but has little effect. This type of interference is therefore excluded from Table 26 and Table 27.

Table 26: The number of interfering policy measures per sector for the first four types of interference

Number of policy measures for the four types of interference per sector	Cross-sectoral factors		Cross-sectoral relations		Dependency		Two or more policy measures		Total	
	[#]	[%}	[#]	[%}	[#]	[%}	[#]	[%}	[#]	[%]
Multisector	9	16.7	4	12.5	0	0	2	5.6	15	11.0
Energy	12	22.2	9	28.1	5	35.7	6	16.7	30	22.1
Industry	6	11.1	4	12.5	3	21.4	7	19.4	20	14.7
Built environment	19	35.2	0	0	0	0	10	27.8	29	21.3
Greenhouse industry	3	5.6	5	15.6	0	0	2	5.6	12	8.8
Transport	5	9.3	10	31.2	6	42.9	9	25	30	22.1
Agricultural industry	0	0	0	0	0	0	0	0	0	0
Total	*54*	*39.7*	*32*	*23.6*	*14*	*10.3*	*36*	*26.5*	*136*	*100*

Interference due to cross-sectoral factors has the largest effect. One group of interfering policy measures can include dozens of policy measures, and the whole is almost 40% of all interference of the first four types. This type of policy measures includes the most dynamics, and has different effects for different time scales. For the negative feedback loops should be monitored when the decreasing effect of the feedback loop becomes larger than the positive effect of the policy measures. This turning point should be seen as the moment to phase out the policy measures.

All policy measures in this overview, except two (the removal of the coal tax for electricity producers, no. 21, and the increase in maximum speed on the main roads, no. 174) provide sustainable incentives: the increase of renewable energy production, increase in energy efficiency, and decrease in GHG emissions. The policy measure on coal tax is present for the interference caused by the cross-sectoral factors (type one) and integration of policy chains (type five), and is not present in the other types of interference. The measure for the maximum speed on roads is included only for the fifth type of interference.

This indicates that the second and fourth type of policy measures, which are most important in uncertainty reduction, include only policy measures that provide sustainable incentives for the implementation factors. These two types of interference in this specific system therefore reduce the uncertainties. In systems where there are more policy measures that counteract the policy goals, uncertainty can be increased due to interference.

The influence of the removal of the coal tax for the interference of type one, due to cross-sectoral factors, starts with arrow 5 of Figure 24. The removal of the tax leads to a decrease in production costs, and thus an incentive for the implementation of new coal fuelled electricity plants. This new fossil fuel production capacity can lead to more balance on the electricity grid, which is an incentive to implement renewable energy production technologies. The extra central fossil fuel electricity production capacity has no direct effect on the electricity price, if there was not a shortage of central electricity production capacity to begin with. If there was a shortage of electricity production capacity, the new capacity will lead to lower electricity prices, which in turn will lead to lower incentives for decentral electricity production.

In the explanation of the feedback loop are mostly policy measures included for renewable energy production and energy efficiency technologies. This is based on the design of the fossil fuel electricity prices as external variables. These external variables are not influenced in the energy system itself, and can therefore not create feedback loops. Table 27 are all numbers of policy measures per policy goal indicated for the first four types of interference. As some policy measures influence more than one policy goal, are more policy measures mentioned in Tale 27 than in Table 26 (resp. 161 and 136).

Table 27 indicates that the policy measures for GHG emission reduction are subject to the least amount of interference. This is explained mostly due to the interference caused by cross-sectoral factors that focusses solely on electricity production and electricity demand. The large presence of policy measure for energy efficiency for the fourth type of interference can be linked to the large presence of policy measures for the built environment for the same type of interference. Most measures in the built environment focus on energy efficiency, and this leads to a fair amount of interference, and a reduction in uncertainty for the implementation of the incentivised behaviour for this sector.

The second and third type of interference are more evenly spread across the three policy goals.

Table 27: The number of interfering policy measures per policy goal for the first four types of interference

Number of policy measures for the four types of interference per sector	Cross-sectoral factors		Cross-sectoral relations		Dependency		Two or more policy measures		Total	
	[#]	[%}	[#]	[%}	[#]	[%}	[#]	[%}	[#]	[%]
Increase in renewable energy production	20	31.7	14	37.8	5	29.4	11	25.0	50	31.1
Increase in energy efficiency	42	66.7	13	35.1	4	23.5	24	54.5	83	51.6
Reduction in GHG emissions	1	1.6	10	27.0	8	47.1	9	20.5	28	17.4
Total	*63*	*39.1*	*37*	*23.0*	*17*	*10.6*	*44*	*27.3*	*161*	*100*

The timing of interference is also important. Interference of types 2 and 4 both reduce the uncertainty for the implementation of new or innovative technologies and are thus mostly relevant at the first phase of technology implementation in the Netherlands. The interference caused by dependent technologies (type 3) is beneficial throughout the lifetime of the technologies. Both the interference of types 1 and 5 are more difficult to stimulate specifically and have to be assumed to be present at all times.

7

Discussion

This chapter will place the results of the research back into the larger context of this thesis project. In chapters 4 and 5 has the application of the 7-step methodology to the Dutch energy system lead to the development of the system overview. Chapter 6 has analysed and interpreted the interference that is identified for the Dutch energy system.

Section 7.1 discusses the design of the 7-step methodology, section 7.2 discusses the use of this methodology, section 7.3 discusses use of the system overview, and section 7.4 discusses the identified interference of the system overview.

7.1 Design of the methodology

Three aspects of the design of the methodology will be further elaborated on below. These three aspects are the types of policy measures, the behavioural factors, and the relation types. The types of policy measures and the behavioural factors are two of the most influential components of the system overview, as well as for the analysis of interference. The relation types are not used as much in the analysis of the interference, thus will be explained why the relation types are included in the methodology.

7.1.1 Types of policy measures

The 7-step methodology focuses on the collection of information and the processing of this information in a certain way. The processing of this information allows the users to create insight into interference between policy measures, but also into the policy measures themselves.

In chapter 3 are the five types and twenty sub-types for policy measures discussed. This characterisation of type also influences the applicable behavioural factor of the policy chain. As mentioned in section 3.4.3 can the types of policy measures also be classified differently, in 'carrots' and 'sticks'. Where carrots stimulate good behaviour and sticks punish bad behaviour (Ministry of Economic Affairs, 2016a).

The twenty sub-types together with their direction can also be classified into carrots and sticks. This classification is indicated in Table 28, also the occurrence of this combination of sub-type and direction is indicated. Restrictive measures and voluntary measures do not have a direction. Restrictive measures by definition limit someone in doing something, this limiting can be seen as a punishment of wanting to do the wrong thing. Voluntary measures can never be punishing, as one can opt to not take part. For informative measures is it also impossible to be a stick measure. The supply of information on good behaviour stimulates this behaviour, but not to supply information or to supply information on wrong behaviour does not punish anybody.

Table 28: Classification of policy measures as carrots and sticks based on their sub-type and direction

Type	Carrots		Sticks	
	Sub-type and direction	*[#}*	*Sub-type and direction*	*[#}*
Regulatory - Unilateral			Permits decrease	4
			Design specifications	17
			Maximum decrease	3
			Obligatory implementation	10
	User-friendliness of technologies increase	1	User-friendliness of technologies decrease	1
			Enforcement increase	5
Regulatory - Multilateral	Cooperative	16		
Financial - Unilateral	Costs decrease	14	Costs increase	2
	Financing options increase	3		
	Return on investment increase	6		
	Insurance increase	2		
	Tax decrease	11	Tax increase	4
			Price increase	3
Financial - Multilateral	Project	2		
Informative - Unilateral	Administrative process decrease	6		
	Stakeholder involvement rules increase	1		
	Information supply increase	9		
Informative - Multilateral	Information exchange increase	3		
	Support in implementation process	6		
Total		*80*		*49*

Table 28 indicates that there are more carrots implemented than sticks for the energy sector in the Netherlands. The following quote from Al-Saleh and Mahroun illustrates the perceived preference of sticks for environmental policies (Al-Saleh & Mahroum, 2014, p.262):

> *"Regarding carrots and sticks, there seems to be an overwhelming consensus e in the literature at least e that carrots should be used for correcting positive externalities and sticks for addressing negative externalities (Wittman, 1984). When addressing environmental pollution, internalising the environmental costs or imposing a limit on the level of pollution makes more sense than subsidising pollution-reduction measures. The latter action could inject money into the industry and thus attract more polluters in the long run."*

Also the benefits of sticks seem to outweigh the benefits of carrots (Al-Saleh & Mahroum, 2014, p. 262-263):

> *"Both carrots and sticks come with their own cost burdens; carrots generate transaction costs relating to compliance, whilst sticks do likewise but in relation to violation. Following this logic, one could argue that theft should be penalised rather than non-theft subsidised because the former occurs less frequently (Geest and Dari-Mattiacci, 2013). […] There seems, however, to be unanimity of opinion that voluntary and incentive-orientated policy approaches are more likely to foster diffusion and compliance paths than rigid regulatory approaches (Sioshansi, 1994). There still remain the questions of how much penalty/reward is necessary and how it should be administered to induce certain behavioural change?"*

A case study on sustainable agriculture in Finland also indicated that the farmers that were influenced by the policy measures disliked stick measures and preferred motivating policies (carrots) (Rintamäkia, Rikkonena, & Tapiob, 2016). It is also reasoned that carrots should be implemented first, followed by sticks if the carrot does not reach its aim on its own. The downsides sf stick measures being described as (Coad, de Haan, & Woersdorfer, 2009, p.2080):

> *"Individuals are assumed to base their decisions on expected payoffs which can be expressed in monetary terms. Marginal increases in the relative cost of environmentally harmful behavior (the "stick") can, in principle, induce individuals to adopt cleaner technologies. The drawbacks of such an incentive system, however, are that people may begin to think of environmental issues by applying a market-based logic. If environmental protection is associated with extrinsic incentives, individuals may start to base their behavior on the presumption that they have the 'right' to pollute if they bear the associated financial cost. Any intrinsic motivation to care for the environment would thus be 'crowded out' by a financial logic."*

There is no clear benefit of carrots over sticks, and most articles mentioned argue that a combination of the two is best. The division of 80 carrots vs 49 stick in this thesis project is thus not surprising. Nor is it possible to provide concrete suggestions for future policy making. It is however informative to know the downfalls of carrot and stick measures, as this can lead to more understanding of the effects of policy making on the long run. The division of policy measures into subtypes and their directions rather than carrots or sticks has not led to a loss of information, as the carrot and stick analysis is still possible. The chosen method of characterising the type of policy measures is more informative than the carrot and stick analogy alone.

7.1.2 Influence of behavioural factors

One of the main theoretical additions of the application of the 7-step methodology and its resulting system overview compared to existing system analysis methods is the inclusion of behavioural aspects within the system overview. The inclusion of behaviour within the system overview is essential to the identification and analysis of interference. However, the behavioural factors can also aid the evaluation of the policy measures and their effects within the energy sector of the Netherlands.

The Theory of Planned Behaviour, on which the behavioural factors are based, states that all three attributes of attitude towards behaviour, subjective norms, and perceived behavioural control need to be present in order for the intention to perform the behaviour to form. The perceived behavioural control also needs to be high enough, or otherwise will the intention to perform the behaviour not be translated into the actual implementation of the behaviour. This role of the perceived behavioural control is not implemented as a factors, but is included in the relation types (see also section 7.1.3 below).

In the system overview are only those behavioural factors present that are influenced by policy measures. This does not indicate that the other behavioural factors are too low for the behaviour to take place, the behavioural factors are influenced by more than policy measures alone.

The behavioural factors are an important barrier for the effect of policy measures in the energy system. If the policy measures do not lead to the actual change in behaviour, their effect on the policy goals is zero. This system overview can therefore also be used to identify barriers within the policy chains and therefore barriers for the effect of policy measures on the energy system, as the behavioural components are strong barriers for the effects of policy measures.

The identified barriers for specific policy measures can then be more closely analysed and quantified to understand and increase the effects of policy measures on the energy system.

7.1.3 Relation types

The five different relation types have a smaller role in the methodology and system overview that the different system factors. However, interference is not based both on the types of relations as on the types of system factors included.

The relation types can also play a large role in the further development of the methodology and possible analyses that could be done with further developed system overviews. The relations include information in nature of the barriers that can be found in the energy system, these barriers can be thresholds, delays, as well as dependencies of multiple factors.

7.2 Use of the methodology

The 7-step methodology can be used by researchers or policy makers. Both applications will be shortly discussed below.

7.2.1 Use by researchers

The use of this methodology allows researchers to identify, illustrate, and analyse interference. It can be implemented when the institutional dimension of a system is (partly) unknown and the effects of the institutions should be research for the development of other models on the same system (e.g. scenario analyses or dynamic modelling approaches). Even though this methodology is not designed for prescriptive use, it can clarify the current system and indicate possible uncertainties for scenarios. Possible uncertainties can be the development of subjective norms factors, the thresholds of perceived behavioural control factors, the development of dependent technologies, and the occurrence of interference if a new policy measure is added to the system.

The methodology could also be applied to energy systems in other countries, or even to other socio-technical systems in general. However, it is possible some characteristics of policy measures need to include different or more options for the application of the 7-step methodology in another socio-technical system. The identified main process need to be adjusted to accommodate the main goods of the chose system. The identification of the main processes however can be done using the same line thought and theories as is used for the energy system. This is further elaborated on in section 8.2.

7.2.2 Use by policy makers

The 7-step methodology is also possible to be applied by policy makers themselves. I would recommend a smaller scale version of this methodology, for example focussed on a specific topic such as EV’s or sustainable heat production. The resulting system overview for this section can then be placed in an existing system overview of all policy measures. This exercise can create awareness of interference between policy measures and provide an interactive session that can facilitate a discussion among policy makers. Awareness of interference is essential for the development of long term policy strategies for the energy transition.

7.3 Use of the system overview

The system overview is essentially the result of the application of the 7-step methodology. From the system overview can be seen which groups are present of interfering policy measures, and what type of interference is occurring. The system overview does not include new information compared to the tables that contain all characterisations and policy chains.

The system overview is the illustration of the found information and therefore the illustration of the interference. Especially in the use for policy makers is the visual output essential for the understanding of the system and the creation of awareness. The presented results in this thesis report are not dependent on the visualisation.

The analysis of interference is easier with the system overview than with the tables, as the information is condensed into shapes and colours. You don't need to read all policy chains, you just need to scan for two incoming arrows or policy measures into the same depicted system factor.

7.4 Interference in the system overview

The interference that is present in the system overview is qualitative and not quantitative. The identified types of interference are based on the influences of policy measures on specific system factors, and/or with specific relation types. The type of interference that is identified as having the largest impact on the system as a whole is the first type of interference (due to cross-sectoral factors). This type of interference, as well as the interference caused by cross-sectoral relations (type 2), and caused by two or more policy measures for one implementation factor (type 4) are beneficial at certain times, and harmful at other times. This indicates that some policy measures can change from having a positive contribution towards having a negative contribution to the policy goals. This indicates again that some policy measures need to be phased out after a certain period of time.

However, it remains important for all policy types of interference to provide a long term policy vision. Even if after a while the technology is adopted by the majority of the stakeholders, or the negative feedback loop overpowers the positive influence of a policy measure. If the stakeholders do not have long term assurance that they can count on the policy measure (e.g. a subsidy) they will not implement the subsides technologies at all.

The phasing out of policy measures is just as important as their effects in the energy system and should be thought through carefully. It is most effective to implement a policy measure long enough so the technology can be adopted by the stakeholders, and short enough to try and prevent a negative feedback loop from developing, or to prevent costs for the government that are out of proportion with the gains of a policy measure.

One possible way of giving the long term assurance, but also being able to phase out a policy measures is by providing the time frame of the policy measure from the start. An example is the feed-in tariff in Germany, even though this policy measure has been amended four times after its implementation, it guarantees a fixed price for renewable energy producers for twenty years once a stakeholder receives the financial benefit (FuturePolicy.org, n.d.). This way stakeholders are therefore guaranteed a long term return on investment, but the policy measure can be amended and phased out, as along as the stakeholders that once started to receive the financial compensation, will receive it for the predetermined twenty years.

8

Conclusion and reflection

The last chapter of Part II of this report will elaborate on the conclusion of this research by answering the research question, and discussing the limitations and contributions of the research. This chapter also includes some recommendations for further research based on the conclusions of this thesis project as well as a reflection.

Chapter 9 is the first chapter of Part III and explains the research approach for the research into interorganizational collaboration between the ministries that develop and implement the policy measures in the Dutch energy system.

8.1 Conclusion

In chapter 1 has been explained that interference between policy measures is important for policy strategies as well as for the functioning of the system the policy measures are active in. An analysis of current methods to identify interference between policy measures, and methods to create insight into the interference between policy measures has led to the following main research question:

> **How can interference between policy measures in the Dutch energy system be identified and analysed in order to gain insights in the effects of policy measures on the energy system as a whole?**

This research designed a methodology that allowed for the classification of 'interference between policy measures' into five types. These five types, their effects, timing, and how (if) they can be stimulated or overcome are the first insights into this interference that can be obtained using the 7-step methodology. This conclusion partially answers the research question. The interference between policy measures can be identified, analysed and interpreted. However, there are still more insights into this interference that need to be obtained for policy makers to truly know how to tackle the complexities this interferences causes for effects of policy measures on the Dutch energy system. Some recommendations on how to obtain further insights, and what further insights are expected to be fruitful are explained in section 8.4. Even though the research question is not answered in full, this research provided the required first step into the analysis of inference of policy measures in the Dutch energy system.

Section 8.1.1 elaborates on the designed methodology, section 8.1.2 elaborates on the types of interference, and section 8.1.3 elaborates on the more practical understanding of this interference for policy makers. Sections 8.2 and 8.3 discuss the limitations and contributions of this research. Section 8.4 provides some recommendations of further research. The last section, section 8.5, includes a reflection on this research.

8.1.1 Methodology to identify and analyse interference

This thesis project has designed a methodology to identify interference between policy measures based on the characteristics of the policy measures, and the system these policy measures are active in. This methodology also allows for a first indication of the effects of interference on the system as a whole. The methodology is summarised in Figure 30.

Step 1 is the selection of the system that will be analysed and scale of the policies that are present in this system.

Step 2 is the identification of the relevant policy measures for this system and the policy goals. For the Dutch energy system this is based on the existing NEO 2016 model (*Nationale Energieverkenning*) by ECN (2016). The NEO model includes a list of policy measures that influences the energy system of the Netherlands, as well as the sectors these measures are active in.

Step 3 is a further characterisation of the list of policy measures. Based on policy documents (websites from governmental organisations, legislation, reports of governmental organisations, as well as the reports for the NEO 2016 model). The sector, target groups, types, sub-types, direction, process, specification, and policy goals are characterised for each policy measure. For each of the characteristics is a finite list of options provided to classify each policy measure. The eight characteristics and their options are summarized in Table 29.

Step 4 is the first step of creating a system overview for the chosen system. The policy measures, their sectors, target groups, sub-types, direction, process, and specifications together form the starting factor of the policy measure in the system overview. Then the methodology focusses on the identification of system factors that lead form the starting factor to the policy goals. For each policy measure is a *policy chain* identified. This policy chain includes the initial system factors that lead from policy measure to policy goal. The policy chains are developed to include the behaviour of the target groups, as well as the physical and economic dimensions of the energy system.

Step 5 is the last step in the creation of the system overview. There are different types of relations identified within the system overview. The types of relations can aid the explanation of the causes or effect of interference.

Step 6 is the of the identification of the illustrated interference within the generated system overview. The identification includes five types of interference. Which type the interference belongs to is based on the system factors and relations types that cause the interference.

Step 7 is the interpretation of the identified interference and its (qualitative) effect on the system.

Figure 30: 7-step methodology

8.1.2 Five types of interference

The sixth step of the 7-step methodology allowed for the grouping of interference in five main types. These five types influence the energy system of the Netherlands in different ways. The first type of interference, caused by the cross-sectoral factors in the energy system, creates a feedback loop of interference between all policy measures for an increase in energy efficiency and/or an increase in renewable energy production. This feedback loop can have both positive and negative effects for different system factors. This effect of the interference can also change over time.

A positive feedback loop on the long term can show negative effects on the short term. If the policy makers are not aware of this feedback loop, this initial negative effects can be misinterpreted. The misinterpretation of the effect of a policy measure can cause for incorrect (or ineffective) evaluations and follow-up measures. The timing of the interference and the analysis of this interference is therefore essential.

The second type of interference is caused by the cross-sectoral relations between behavioural factors and implementation factors in the energy system. This type of interference decrease one of the two main uncertainties in the energy system of the Netherlands. The first uncertainty includes the risk that the implemented policy measures are not enough for a large part of the target group to overcome their threshold for behaviour change. If a policy measure does not overcome this threshold, no intention towards an action is formed. This means that the effect of a policy measure is zero, there is no change in behaviour, or no change in implementation of technologies for this target group. The first type of interference enhances the chances of a new or innovative technology to be implemented, or a new behaviour change to be adopted.

The timing of the second type of interference is also important. Once a small part of the stakeholders adopts a new technology, the large majority will follow and also adopt the technology. This means that once the required small part of the stakeholders is convinced, the effects of the interference decrease, as the rest will follow on their own as well. It is expected that incentives for the same technology in multiple sectors at the same time benefits most of positive interference at the start of the development or implementation of a new technology in the Netherlands.

The third type of interference is caused by dependencies between two or more technologies or behaviour changes. These dependencies can be supported by implementing a policy measure for each of the intended technologies or behaviour changes. This type of interference reduces the second uncertainty in the energy system of the Netherlands. The second uncertainty is caused by an assumption that is intrinsic to each policy measure: a policy measure provides incentives for a behaviour change or implementation of a technology that is then expected to change the energy system in a way that contributes to the policy goals. The assumption that is made is that the incentivised behaviour or technology does indeed influence the energy system in the desired way. The interference of the third type decreases the uncertainty of the effects of the behaviour change or technology implementation on the energy system by creating guidelines (e.g. design specifications) or supportive technologies (e.g. infrastructure adjustments to accommodate new technologies) for the initially incentivised behaviour or technology. The interference between the policy measures for the two dependent technologies is beneficial throughout the duration of the support of both technologies. The dependent relation is expected to remain present for both technologies, the timing of this type of interference is therefore less essential for the interpretation of its effects.

The fourth type of interference is caused by the implementation of two or more policy measures for the same behaviour change or technology implementation. This type of interference has the same effects on the energy system as the second type of interference and reduces the uncertainties for behaviour change in the energy system. The same time dynamics are applicable as well, causing this type of interference to be most beneficial at the start of the implementation of innovative behaviour changes or technologies.

The fifth and last type of policy measures is caused by the integration of policy chains in the system. All policy chains integrate towards three policy goals. This type of interference is present for all 119 policy measures. However, the effects of this type of interference remains limited. There are no uncertainties reduced, or feedback loops created. The effects of the individual policy chains are solely 'added' and together influence the next system factor. This type of interference is not dependent on a time scale.

The policy measures that contribute to the policy goal of an increase in energy efficiency are subject to over half of the interference in the system. However, a large part of these policy measures are influenced by interference due to cross-sectoral factors. Therefore is the effect of this interference difficult to determine. The feedback loop that is created by the cross-sectoral factors can have both positive and negative effects simultaneously.

The reduction of GHG emissions policy goal is least influenced by cross-sectoral factors. The other four types of interference all have a positive effect. Therefore is the effect of interference for this policy goal easier to determine. How big these positive effects are depends on the timing of the interference for the different technologies, and cannot be determined solely based on the types of interference.

Table 29: The eight characteristics and the finite choices for each characteristic

Sector	Target group	Type	Sub-type	Direction	Process	Specification	Policy aim
Multi sector	Consumers	Regulatory - Unilateral	Permits	Increase	Produciton of energy carriers	Technlogy specifications	Reduction in GHG emissions
Energy	Commercial parties	Regulatory - Multil.	Design specifications	Decrease	GHG emission reduction	Location specifications	Increase in renewable energy production
Industry	Consumers	Financial - Unilateral	Efficiency in energy use		Demand of energy carriers		Increase in energy efficiency
Transport	Commercial parties	Financial - Multilat.	User-friendliness		Use of energy carriers		
Built environment	ETS-parties	Informative - Unilateral	Maximum		Transport of energy carriers		
Greenhouse industry	Consumers	Informative - Multilateral	Obligatory implementation		Efficiency of energy carriers		
Agricultural industry	Commercial parties		Enforcement				
	ETS-parties		Cooperatives				
	Consumers		Costs				
	Commercial parties		Financing options				
	ETS-parties		Return on investment				
	Consumers		Insurance				
	Commercial parties		Tax				
	Consumers		Price				
	Commercial parties		Projects				
	Consumers		Administrative process				
	Commercial parties		Stakeholder involvement				
			Information supply				
			Information exchange				
			Collaborative process supp.				

The goal for the increase in renewable energy production is represented relatively evenly in all categories of interference. The policy measures that contribute to the renewable energy production mostly (63%) belong to the energy sector. The energy sector is therefore important for the interference within the energy system, but is certainly not the cause for all interference in the energy system. It remains important to analyse the system as a whole, and not focus on a sub-0system of the large system alone.

8.1.3 Understanding interference

The first four of the five types of policy measures can be beneficial for the development of the energy system in the Netherlands. The second, third, and fourth types of interference decrease the uncertainty of the effects of policy measures in the energy system and can all be influenced relatively easily. These three types of interference are created by implementing a set of at least two policy measures for the same, or dependent, behaviour changes and technologies.

The first type of interference has both wanted and unwanted effects, often simultaneously. This type is also more difficult to influence, as there is a large group of policy measures influenced by the feedback loop that is created. It is not possible to influence this feedback loop with just a handful of policy measures, if it is even possible to influence the feedback loop at all. Even if this type of interference cannot be influenced directly by policy makers, it is essential to understand the effects of this type of interference, and the duality in both positive and negative consequences (simultaneously for different factors, or over different time periods for a single system factor).

8.2 Limitations of the research

This research proposes a methodology to identify and analyse interference between policy measures in the Dutch energy sector. This answers the posed research question for a large part, however there are also limitations to this research. The three main identified limitations will be discussed below.

The first limitation is the size of the resulting system overview for the 119 policy measures of the Dutch energy system. The vast majority of system factors and relations makes it hard to identify patterns and comprehend the system overview as a whole. There are two possibilities to make the system overview more comprehensible.

The first option is to include less policy measures. However, the added value of the 7-step methodology and the system overview is in the large amount of policy measures and their relations. If only a part of the policy measures is included, only a part of the interference can be identified and analysed.

The second option is the development of a software tool to build and analyse the system overview. This would also make it easier for policy makers to use the methodology for the creation of awareness of interference between policy measures. If there is a software tool that aids the organisation of information and can build the figures of the system overview itself, based on the input of policy chains and system factors, this would increase the usability enormously. The user would only have to choose the right options for each characteristics of each policy measure, and the software can then form its own system overview. Table 29 indicates the eight characteristics the user has to determine for each policy measure.

At the same time can the software tool be used to analyse the resulting system overview. For example, if the user clicks on a starting point (or policy measure) a pop-up or in screen text box can provide a short summary of the policy measure and the date of implementation. At the same time can the path of the policy measure to the policy goal(s) be highlighted in the system overview, and can be indicated which types of interference are present for this policy measure with which other policy measures. Perhaps it is even possible to input filters, where the different relation types, policy types, or other aspects can be indicated for the chosen policy measure or the entire system overview. Or can policy measures be grouped based on their different characteristic (e.g. per sector or type). An initial idea on how this tool could look can be seen in Figure 31.

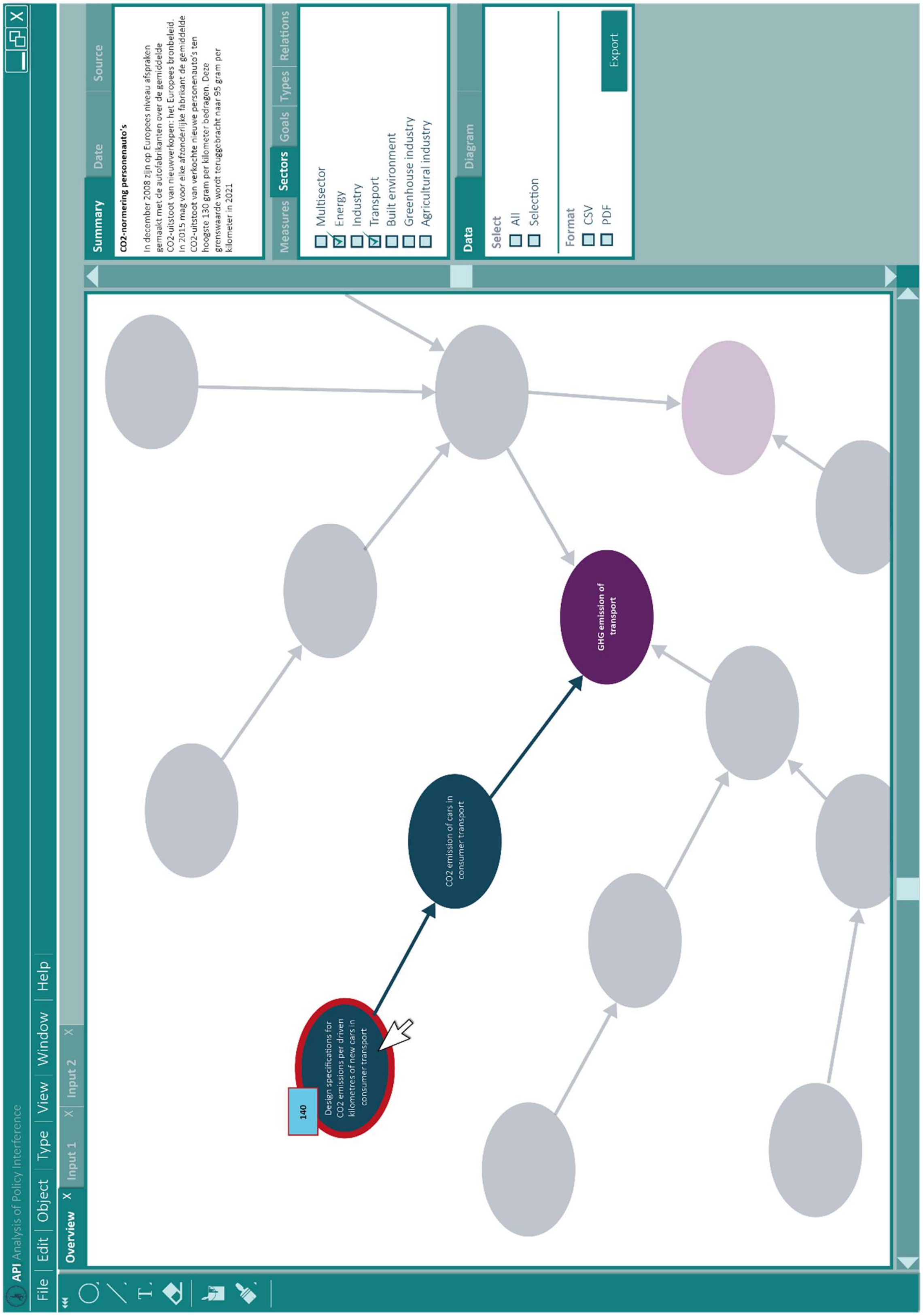

Figure 31: Initial idea for a software tool accompanying the methodology, the API tool

The tool needs to be developed in order to determine if it could work, but the expectation is that this is relatively easy to do for an expert on software development. This makes the second option more desirable than the first, and would be the recommended use of this methodology.

A second limitation of the research is the focus on the energy sector. While the 7-step methodology could be applied to other systems than the energy system as well, the possible choices for the characteristics of process, and specifications may need to be expanded for use in other sectors. However, a similar reasoning behind the possible options (based on the same theories of sub-systems, and socio-technical systems) can be applied to other systems as well.

An example of the reasoning that can be applied to other systems is the reasoning for the determination of the main processes of a system. Within the energy sector are the three main processes the production, transport, and use of energy carriers. The main processes in the educational system could be education, accreditation, and demand. The three dimensions of a socio-technical system can be applied here as well. The physical dimension could include a decrease in classroom space, and the educational facilities that are present (e.g. laboratories). The economic dimension could include the college fees, as well as the demand of education. Whereas efficiency measures can be described as process efficiency for students (e.g. the amount of students that finish their studies within the nominal time frame). The institutional dimension still includes the policy measures and behaviour of the socio-technical system.

The third limitation is the validity of this research. Testing validity for this research is difficult as the output of the model is the identification and analysis of interference where is stated that this interference is often overlooked. The application of the 7-step methodology in other sectors and the further development of the methodology can contribute to the validation of the methodology as well.

8.3 Contributions of the research

This thesis project contributes to society by making it possible for policy makers to identify and create insight into interference between policy measures. The societal contribution also includes a focus on a long term policy strategy to put the transition of the energy system on the right track. The analysis of the current system as well as a possibility for analysis of conceptual policy measures can contribute to more integrated policy strategies.

This thesis project contributes to science by addressing one of the identified knowledge gaps. The current body of knowledge acknowledges the possible influences of interference between policy measures, as well as a need for a methodology to identify and be able to analyse this interference. The methodology proposed in this research does not close this knowledge gap completely, but does lay the next layer of bricks for the bridge to be built upon.

8.4 Recommendations for further research

There are three areas for recommendations for further research. The areas are: (1) the further development of the 7-step methodology, (2) the application of the 7-step methodology, and (3) a recommendation for policy strategy developments. In total are six recommendations for further research mentioned.

8.4.1 Recommendations for further development of the 7-step methodology

1. The first recommendation is to test the methodology for another system. The iteration in use of the methodology can lead to better defined concepts for the characterization of policy measures, as well as a more elegant or efficient set of steps to be taken by the researcher.

2. The second recommendation is to further research the effect of the five types of interference. Especially the (quantitative) effects of the decrease in uncertainties, and the creation of feedback loops due to interference are difficult to pinpoint. Perhaps also a quantitative research can indicate the relative strengths of the effects of the different types of interference.

3. The third recommendation is to further research the effects of the different types of relations. What are the effects of a delay relation, how can the threshold relations be (quantitatively) be modelled, and how can 'non-linear' relations be further analysed. These and other questions need to be answered to further develop the 7-step methodology. Especially if a more quantitative approach is required.

8.4.2 Recommendations for the application of the 7-step methodology

4. The fourth recommendation for further research is the development of the proposed tool, API, see Figure 31. Once a beta version of this tool is available, the methodology can also be validated more easily, as the tool allows for a more comprehensible set of steps for the designer to undertake.

5. The fifth recommendation that will be mentioned here is the applicability of the methodology to other systems, such as the educational system within the Netherlands. The application of the methodology to other system can also contribute to the ease of use and clarity of definitions of steps and factors used within the methodology. At the same time is it my expectation that the energy system is not the only system in the Netherlands where interference between policy measures can hamper the evolution of the system. If this methodology could only help in other sectors a little bit with the development of understanding on policy interference it would already be an important step forward for the system.

   Once the methodology is further developed is it possible that the system overview could be used to test new policy measures. One could then add a new, conceptual, policy measure to the existing system to identify possible interfering policy measures and have a first idea of the influence of the conceptual policy measure.

8.4.3 Recommendations for the development of long term policy strategies

6. The last recommendation for further research is also the recommendation with the largest value for society. The negative feedback loops and behavioural aspects in the energy system can require policy measures to be phased out. This phasing out should be thought through before implementing the policy measures. It is therefore useful to know how to determine the required running time of specific policy measures. How to determine this should be further researched. This can aid in the development of a coherent, long term, policy strategy.

8.5 Reflection

In this section, I would like to reflect on the research and its conclusions. Three main topics will be discussed, first a reflection on the design of the methodology, followed by a reflection on the use of the methodology, and last a reflection on my initial expectations.

8.5.1 Theory for the design of the methodology

The 7-step methodology is designed based on three main theories, as is explained in chapter 3. The application of these theories influences the outcome of this research.

Socio-technical systems The first theory is based on socio-technical systems and systems thinking. Both approaches identify complex systems as interdependent sub-systems. These interdependencies between sub-systems are represented by the cross-sectoral factors and cross-sectoral relations. The interdependencies are limited by the chosen geographical scope. The fossil fuel demand, production, and prices are included as external variables, also the heat prices are included in the system as external variables. Also the ETS-system of the European Union is included as an external variable (cross-sectoral factor), and therefore does not induce feedback loops. The ETS-system in Europe can lead to carbon leakage on a global scale, carbon leakage occurs when energy intensive industries move from a region with more strict energy and emission polices, to a region with less strict policies to prevent having to adjust to more strict regulations. The application of the 7-step methodology on a continent or even global scale is required to gain more insights into the interconnectedness of the energy system, and for this to be integrated into the design of the methodology.

Theory of Planned Behaviour The Theory of Planned Behaviour (TPB) in this research is applied to both consumer parties (individuals) and commercial parties (companies, or other collective actors). The TPB is developed for individuals and not for companies. Even though there are some scholars who apply the TPB to companies, this is not yet a validated or widely accepted use of the TPB. In this research the TPB indicates the uncertainty as to whether a stakeholder will adopt the behaviour the policy makers aim to achieve by implementing policy measures.

The application of the TPB for companies in this research is based on the few studies that have used this application before, as well as other theories on organizational decision-making and the adoption of innovations by organizations. The application of the TPB to companies is not expected to have led to any faulty results or conclusions in this research. However, it remains important to be aware of the difference in meaning of the three attributes for the two different stakeholder groups. The subjective norms and attitude towards a behaviour for a company are developed differently than for an individual. Also the perceived behavioural control is developed differently, as even if one (top-)manager has the perceived behavioural control and intention towards a certain behaviour, the implementation of this behaviour is also dependent on the rest of the management and/or employees.

The differences in the developments of the behavioural factors in the system need to be accounted for in further research, especially if this research aims to quantify the results, or aims to provide insights into the development of the behavioural factors specifically.

This research, as well as the suggested future research for the use of the TPB for companies, could contribute to the more widely application of the TPB for companies. Or the future research can contribute to an adjustment of the TPB for companies, if some crucial differences are identified that cannot be overcome without an adjustment of the theory. In both instances is a contribution for a theory on the behaviour and decision making of a company possible.

Simões The research of Simões (2013) is used as a starting point for the characterization of policy measures. Her research uses the characteristics of target group and policy goal to identify interference between policy measures. This idea of utilizing the characteristics of the policy measures themselves as the basis for the analysis has led to the initial design of the 7-step methodology. The 7-step methodology, if accompanied by a tool similar to the proposed tool 'API' (see section 8.2), is essentially a classification of the policy measures for eight characteristics and then visualizing the gathered data with a tool.

Perhaps more characteristics can be added, if a more detailed system overview is required. However, it is important to realise that more data does not necessarily lead to more insights, if this data cannot be structured and visualised correctly.

8.5.3 Choices made and definitions used in the methodology

In the design of the methodology have some choices been made, and definitions been used, that can influence the outcome of the methodology. Three of the main design choices and definitions used are reflected on below.

Electricity production and price The main feedback loop in the energy system occurs due to the cross-sectoral factors of electricity production, price, and demand. The main dynamic between these factors is modelled as depicted in Figure 32. The central electricity production is only indirectly influenced by the electricity price, and directly by the central electricity demand. Whereas in practice the electricity price also directly influences the (business case) of the central electricity production. This modelling choice is based on an aim for simplicity. The economic principles behind the electricity price are complex, differ from a time frame of an hour (for price determination), to a time frame of twenty years (for business case calculations). To include all the different influences in the system would have made it too complex. However, it would be valuable to research the influence of this simplification before any quantitative research is based on the 7-step methodology. The qualitative influences remain similar, however quantitatively this modelling choice could lead to delays in the model that are not representative of the real world, or multipliers of the effect of the electricity price could be missed in the model (if the electricity price directly influence both electricity demand

and electricity production, and the electricity demand also influences the electricity production, the electricity price can have a larger impact on the electricity production than if only one of the two direct relations is included).

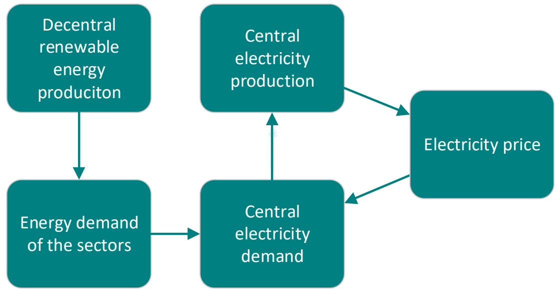

Figure 32: Modelled relations between electricity production, price, and demand

Behavioural and implementation factors for restrictive measures Some of the sub-types of the unilateral restrictive measures are modelled to directly influence an implementation factor or sometimes even a process factor. The sub-type that directly influences the implementation factor includes the obligatory implementation measures. In practice these measures also influence the behaviour of a stakeholder, by increasing the perceived behavioural control to a very high degree, and therefore 'forces' this stakeholder to change their intention of implementing certain behavioural choices. This behavioural component is excluded in the 7-step methodology in an aim for simplicity. The extra perceived behavioural control factors would have different uncertainties and different relations with, for example, cross-sectoral relations. The forced individual is not convinced of a certain behaviour, but is restricted in doing so. The implementation of the forced behaviour has therefore a different effect for cross-sectoral relations that is expected to be significantly smaller than for other behavioural factors. However, also for this design choice is it important to remain aware of the choice, and if a researchers would aim to further develop the 7-step methodology, this distinction needs to be incorporated, or also reflected on, in the adjustments.

The sub-types that directly influence the process factors are those sub-types that do not influence the adoption of a behaviour or technology, but influence the design or context of the behaviour/technology. They therefore do not influence the behaviour of the stakeholders, but do influence the outcome of the implementation of a behaviour/technology. An example of a design specification policy measure, is the measure that defines the maximum CO_2 emissions of cars (number 140), this policy measure influences the behaviour of car manufacturing companies, but these are outside the scope of the energy system in the Netherlands. However, this policy measure does influence the GHG emission of the transport sector for the Dutch energy system. These measures therefore are included, but without influencing a behavioural or implementation factor for the stakeholders in the Dutch energy system.

Definitions of the eight characteristics The methodology is based on the characterisation of policy measures into eight categories. The definitions of these categories, the options that are included in the categories, as well as how to identify which option to choose is essentially dependent on the definitions of these aspects. Any unclear definitions hamper the use of this methodology. For future use of the 7-step methodology should also be focussed on an evaluation of these definitions. The sharper the definitions are, the better the methodology works.

8.5.4 Use of the methodology

The designed methodology allows the users to create insight into the interference between policy measures while at the same time getting a feel for the energy system itself. The methodology is mentioned to be able to be used by two different target groups. Where scientists and researchers can further develop the methodology and possible analyses of interference, I hope that a similar software extension as I described above will allow also for a use in the societal context. The awareness of policy makers on interference is essential for developing one coherent policy strategy to guide the energy transition and allow for a sustainable and mature energy system.

There exists a software tool that allows the users to semi-quantify the effects of factors for different stakeholders in a network system. This tool is *Dynamic Actor Network Analysis*, DANA (DANA, 2004). This tool is not a possible replacement of the proposed API tool, but does include some additional features. In Figure 34 is a screenshot indicated of a trial with the three policy measures for energy efficiency with EV's. DANA allows the user to indicate the policy goals, and different actors applicable to the system. Also for all relations it is possible to input the expected effect of the influence. This is shown in the screenshot below, see Figure 33. The purple arrow is modelled to have a positive effect, where the size of this effect is unsure.

The features of DANA can provide a valuable transition of the qualitative 7-step methodology to a quantitative version of the methodology. However, it would take a long time to rebuild the whole system overview in DANA. Perhaps a tool can be designed that includes both the 'automatic' generation of the system overview (where users only have to input a policy measure and choose the right option for each of the characteristics) as well as the semi-quantitative analysis features of DANA.

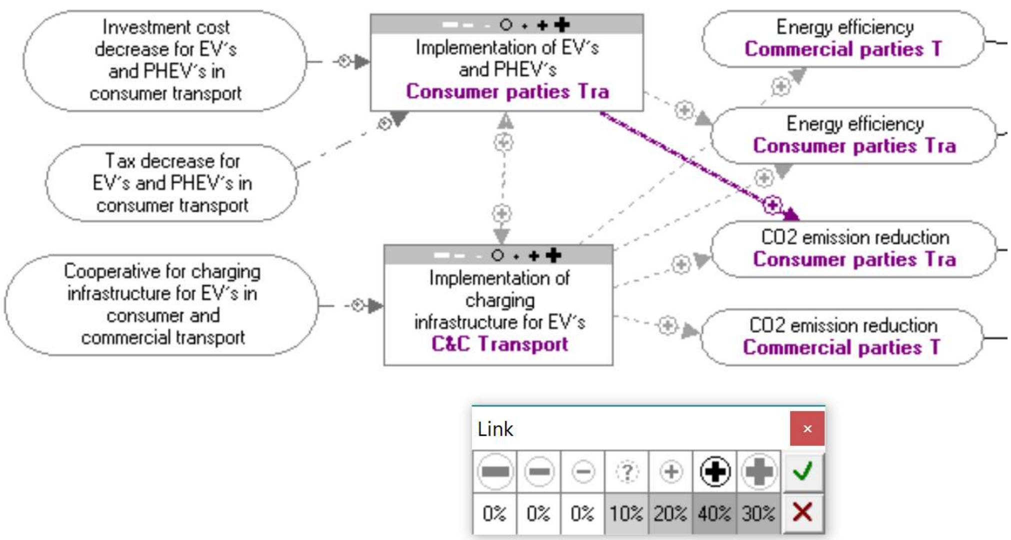

Figure 33: Example of semi-quantification of relations between factors in DANA

8.5.4 Initial expectations and results

At the start of this research project my expectations were that interference would be present in the energy system and could be contradictory in its effects on the stakeholders within the system. Also the timing of the policy measures was expected to be important in the interference. These expectations are also visible in the example of Box II, which has been one of the examples of interference from the start of the project.

It turns out that interference is present to a much higher degree than I initially expected. Even though I was aware of the interconnectedness of the energy system, I did not see through to the effects this would have for interference between policy measures.

However, the contradictions between policy measures are not as large as I would expect. This is also based on the current state of the energy system, the energy transition is still in the baby phase. Once the energy efficiency and renewable energy production levels have increased, they will start to interfere in a more contradictive nature. Then the increase in energy demand of sustainable options will interfere with the energy efficiency levels that are posed for the same target groups. However, currently there is still too much efficiency gains and renewable production possible without causing issues for the target groups in reaching both goals.

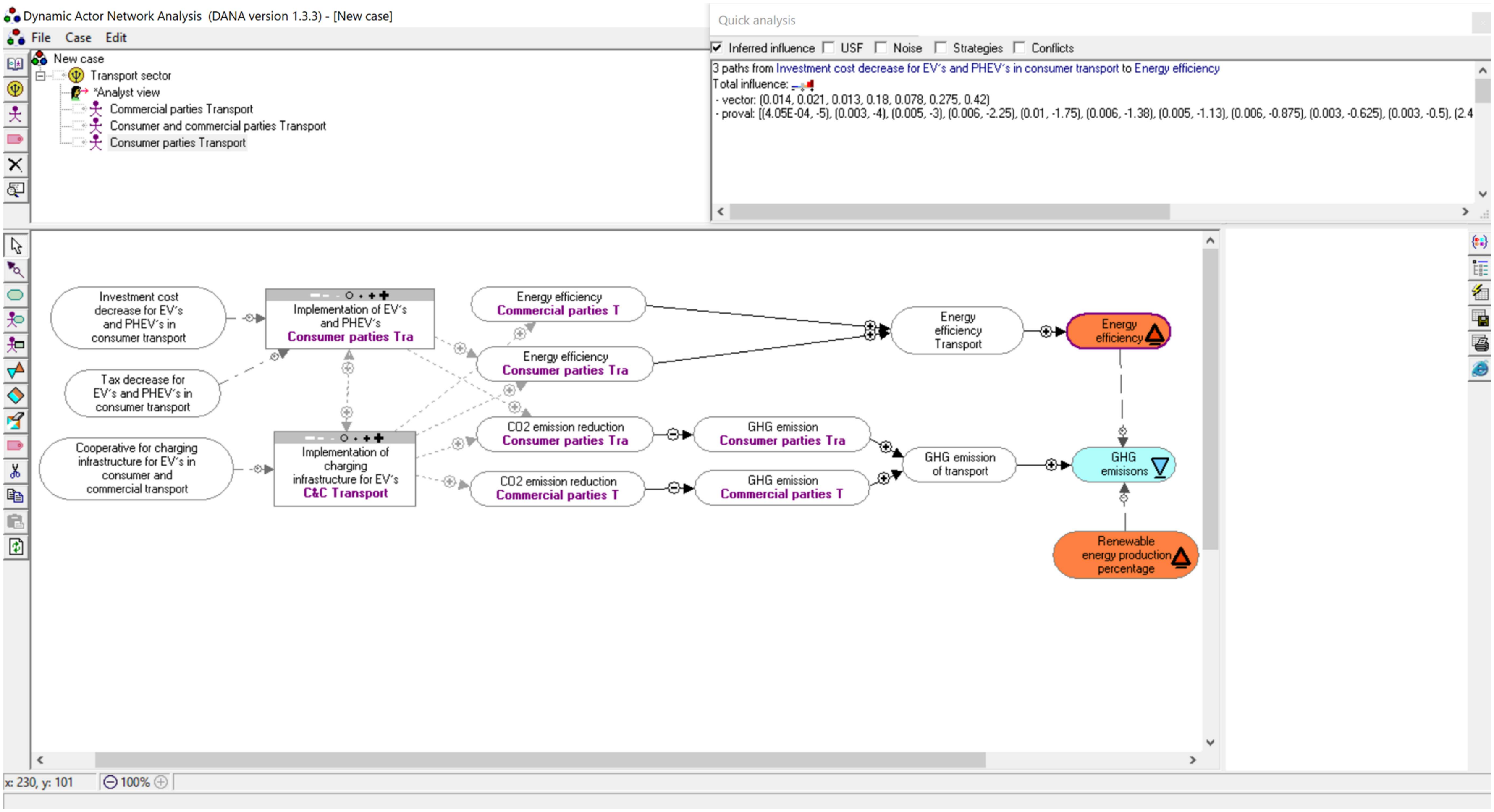

Figure 34: Trial of software DANA for a semi-quantitative approach of the 7-step methodology, applied to the policy measures for EV's

As for the timing of the policy measures, one instance has been identified where timing is a factor. This is also due to the less contradictive nature of the interference than I expected. The timing issue that has been found, is that some policy measures are the follow-up of another measure. This is the case for the MEP, SDE, and SDE+ measures (no. 29, 30, and 31), as well as for the CO_2 norms for cars (no. 140 and 157) where the second policy measure is the norm for after 2017. However, the timing in the analysis and interpretation of interference is more important than initially was expected, and is also important for the development of long term policy strategies.

After using the methodology and identifying areas of interference, it would be informative to go through another cycle of the methodology while identifying more concrete technology specifications. One of the largest groups of policy measures that create interference, are the energy efficiency measures. Most of these policy measures identify a list of possible technologies that can be stimulated. However, including all these technological specifications would have made the system overview even more incomprehensible.

We can safely say that my initial expectations were not completely correct. This also led to a new, more nuanced and personal idea on policy measures in the energy sector. Whereas it is important not to create a technological lock-in in this baby phase of the energy transition, it is necessary to create more strict measures in order for the energy transition to mature. Perhaps the analogy with a human life is also fitting for this idea. If you make it very clear which rules are present and stand by these rules when a child is a toddler, there will likely be less discussion in the teenage years. If the policy strategy for the coming ten years is clear and more strict than the policy measures are now, the energy transition can grow up to be a reliable and trustworthy system.

Even though restrictive measures can create some resistance on the short run, restrictive measures will aid the development of the energy transition on the long run, by forcing the energy sector to change, instead of incentivising short term sustainable investments while at the same time creating uncertainties that hamper long term changes.

Part III: Interorganizational collaboration between policy makers in the Dutch energy system

"I like working with people. I believe change can only come through collaboration."
- Alain de Botton

9

Research approach for interorganizational collaboration

In chapter 1 has been explained how climate change, an increase in policy measures, and the characteristics of the energy system increase the need for a coherent and long term energy vision. Part II of this this report has focussed on analysing the influences of a large set of policy measure in the Dutch energy sector, and how to identify and analyse the interference that is present between the policy measures. This analysis aims to contribute to the ability of designing a coherent long term policy strategy for the energy transition in the Netherlands.

Part III of this report focusses on a second requirement for a coherent long term policy strategy: collaboration. There are multiple governmental organizations involved in the design and implementation of policy measures in the Dutch energy system. In order for a coherent long term strategy to be successfully implemented, these organizations need to collaborate. This part focusses on interorganizational collaboration between public parties that are focussed on a sustainable and energy related topic.

This chapter will introduce the research context, research question, and research structure for Part III of this thesis report. First will the research context be discussed, including knowledge gaps. This contexts leads to the research questions, methodology, and design of this thesis project.

9.1 Research context

With the growing globalization and Europeanization, as well as a shift to more complex socio-technical problems, the energy system of the Netherlands is going through a transition. A transition is described as (Rotmans et al., 2001, p.15):

> *"A transition is the result of developments in different domains. In other words, a transition can be described as a set of connected changes, which reinforce each other but take place in several different areas, such as technology, the economy, institutions, behaviour, culture, ecology and belief systems."*

The increasing complexity due to the ongoing transition in the energy system also leads to different requirements for policy making in this system. Rotmans et al. (2001, p.22) describe the requirements for policy making in a transition system as follows:

> *"[..] insights about transitions can be combined into a management strategy for public decision-makers and private actors. Transition management is based on a different, more process-orientated philosophy that balances coherence with uncertainty and complexity. It can be summarized in terms of the following characteristics:*
> - *Long-term thinking (at least 25 years) as a framework for shaping short-term policy*
> - *Thinking in terms of more than one domain (multi-domain) and different actors (multi-actor) at different scale levels (multi-level)*
> - *A focus on learning and a special learning philosophy (learning-by-doing and doing- by-learning)*
> - *Trying to bring about system innovation alongside system improvement*
> - *Keeping a large number of options option (wide playing field)."*

The definition of a transition as used by Rotmans et al. (2001) indicates the implications of the energy transition for multiple areas. The influence on multiple areas is one of the reasons collaboration is essential to transition management for policy makers. Also the interconnected nature of the Dutch energy system, as explained in chapter 1 and throughout Part II, requires collaboration between policy makers in the Netherlands.

Knowledge gaps Research by Kożuch & Sienkiewicz-Małyjurek (2016) used a literature review to identify factors that drive interorganizational collaboration in the public sector. The difference between the public and private sectors is defined as (Kożuch & Sienkiewicz-Małyjurek, 2016, p.99):

> *"Compared to the private sector, public organizations management are marked by: higher authoritarianism, lesser autonomy of operations and decision-making, larger openness to impacts from the environment, enhanced formalization of functioning, broader array of tasks, and reduced or no pressure from competitors"*

The literature review identified 63 factors that influence inter-organizational collaboration, and divides these factors over five categories; (1) factors of external environments, (2) factors related to organizational characteristics, (3) factors related to people characteristics, (4) Instruments of inter-organizational collaboration, and (5) relational factors (Kożuch & Sienkiewicz-Małyjurek, 2016).

Even though the review by Kożuch & Sienkiewicz-Małyjurek (2016) clearly states the identified factors that influence interorganizational collaboration, their method of ranking and analysing these factors is based on a focus group with scholars. Whether or not all these factors are experienced in practice is not researched yet (Raisiene, 2011). There have been other researches that do include case studies or other research methods including parties from practice. However, to the authors knowledge include none of these researches includes a large set of factors. There is research that includes the experiences from practice, but these researches focus mostly on public-private collaborations and not on 'public-public' collaborations. As mentioned by (Kożuch

& Sienkiewicz-Małyjurek, 2016) differ public and private parties, inducing different factors, or different importance of factors for a public collaboration compared to a public-private collaboration.

The identified knowledge gap is the low degree of understanding on which factors that influence collaboration between public parties are experienced in practice by these public parties.

Research problem The identification of factors that are experienced by public parties for inter-organizational collaboration is important to facilitate policy makers in creating and implementing a long term policy strategy.

Research objective This thesis project aims to contribute to the knowledge on inter-organisational collaboration between public parties, by focussing on the factors that influence the collaboration between these public parties, as well as the relations between these factors. The deliverable will a revised theoretical framework for factors that influence interorganizational collaboration between public parties, and an analysis of the relations between these factors.

Relevance of the research The relevance of this research is explained in terms of the gains for society, and the gains for the scientific community.

In order to reach the climate change goals is it essential for public parties to collaborate to create and implement a long term policy strategy. This research will contribute to these collaborations by identifying factors that influence the collaboration and reflect on how these factors are influenced in the collaboration. This reflection can aid future interorganizational collaboration between public parties. The focus on the factors also includes a practical viewpoint by including a case study. The participants of the collaboration are more inclined to address the factors they actively notice (for example when they lead to problems), rather than factors which probably are present (according to literature) but are not noticed by the participants. This does not necessarily indicate that these factors are the most important for the collaboration. However, these factors are expected to be addresses first in practice. It is therefore valuable to know which factors are noticed, and how they influence each other. Why some factors are and others are not noticed by the participants is another research area altogether, which is also important for the interorganizational collaboration, but is not addressed in this thesis project.

The scientific relevance is in the contribution to the knowledge on factors that influence interorganizational collaboration in the public sector, as well as the which factors are experienced by the public parties themselves, and which factors are perceived as important. Also the relations between these factors can provide new insights in how an interorganizational collaboration works, and how some factors can (or cannot) be influenced more easily.

9.2 Research questions

The research question for the SEC thesis project is:

> **Which factors influence interorganizational collaboration between public parties in the Dutch energy system, and how do these factors relate to each other?**

The sub-question that need to be answered in order to be able to answer the main research question are the following;

1. Which factors influence interorganizational collaboration in the public sector according to literature?
2. Which factors that influence interorganizational collaboration in the public sector are perceived as important factors for the success of the collaboration?
3. What are the relations between the factors that are identified as important?

9.3 Research methodology

As this thesis project focusses on the factors for interorganizational collaboration between public parties, is a methodology appropriate that includes insights from practice as well as from literature. The research steps and their affiliation to the case study and literature are depicted in Figure 35. The methodology for each research step is shortly elaborated on below. The method of applying these methodologies is explained in the individual chapters indicated in Figure 35.

Case study A case study will be used to include insights from practice in this research. The case study includes the interorganizational collaboration between public parties in the Netherlands focussed on a topic related to the transition of the Dutch energy system into a sustainable system. Two interviews on how collaboration between ministries in the Netherlands is shaped provided the first context for the remainder of the research.

The case study that is used in this research is a 'best practice' the interorganizational collaborative team has identified their collaboration as effective and successful. The results of the analysis of their insights can create a benchmark for the required factors, and the required relations between these factors that can lead to an overall successful collaboration between public parties in the Netherlands. A more in-depth description of the case is included in chapter 10.

Literature research In order to answer the first sub-question, and to create the first form of a theoretical framework, a literature study was done. All literature studies for this research into interorganizational collaboration are systemic literature searches. Systemic literature searches focus on a search query, exclusion grounds, and eligibility criteria. Systemic literature search is chosen as this allows for the development of an overview of views that are present in the existing body of knowledge.

For example, a search query can be 'interorganizational collaboration'. The found results with this search are then limited by inputting a timeframe for the search (for example twenty years), as well as possible limitations to subject areas (e.g. health or space projects). The remaining results are then screened based on title and/or abstract. The articles that meet one or more of the exclusion criteria will be excluded at this stage. The remainder of the results after the screening is tested for eligibility based on full text. Those results that fulfil all eligibility criteria are then included in the research.

The first literature study is discussed in chapter 11, the second literature study for this research is discussed in chapter 14.

Interviews This thesis project uses two forms of qualitative research in the case study, interviews and a focus group. Interviews allow for the opinions and views of people from an interorganizational collaborative team to be analysed. The interviews are held with the participants of the collaboration of the case study, and are recorded, transcribed, and coded. This coding process is validated by an independent researcher. Chapter 12 discusses the interview setup and results.

Survey The results from the interviews will be validated with a survey. This survey will be held among the same participants of the interviews. A survey is in nature a quantitative method, but is here applied to receive the views on all participants on the same factors in a way that can be compared. This insight in the level in which the results are agreed upon by the different participants allows for the validation of the outcomes of the interviews. The setup and results of the survey are discussed in chapter 13.

Focus group A focus group is used when the researcher wants to gain insight into the discussion, collaboration, and communication process of the participants. In this research is a focus group used both to gain practical insights, as well as to see how the group works together. As the interviews are all conducted individually this group dynamic can hold additional insights into the same team. The setup and results of the focus group are discussed in chapter 14.

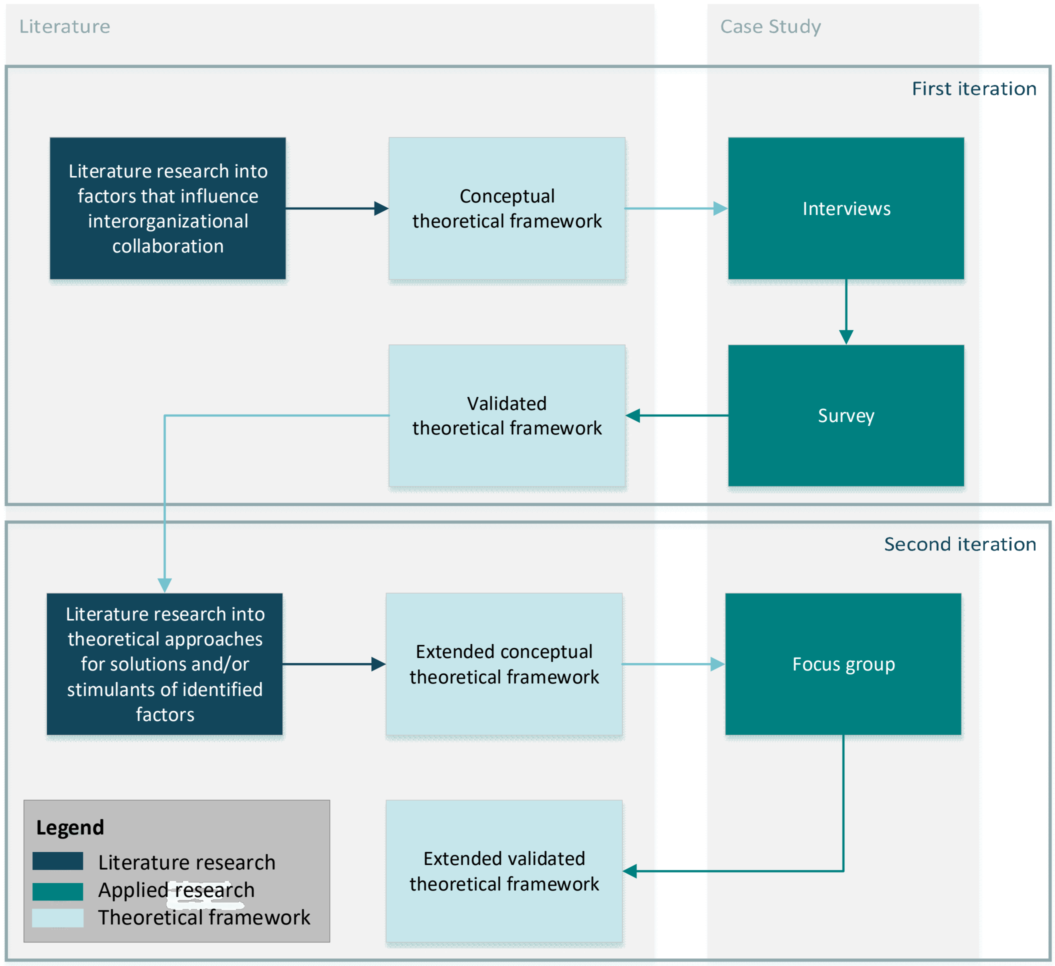

Figure 35: Research steps and their affiliation to literature and the case study

9.4 Research design

The research steps as explained above together form the research design, the following chapters in this thesis report will also follow the research design, as depicted in Figure 36. Chapter 10 explains the case study. Chapter 11 focusses on the literature study into factors of interorganizational collaboration. Chapter 12 includes the first iteration for the case study, the interviews are used to test the theoretical framework. Chapter 13 includes the validation of the first framework. Chapter 14 focusses on approaches to influence the most important factors, and the relations between these factors. Chapter 15 and 16 respectively include the discussion, and conclusion. Chapter 17 provides some reflective insights into the integration of the CoSEM and SEC thesis projects of this report.

The research steps indicate a linear process, however, the execution of these research steps has a more iterative character. The interplay between the literature and the case study is not one integral loop, but includes multiple smaller feedback loops. In chapter 15 is also reflected on the design of the research, and its iterative execution.

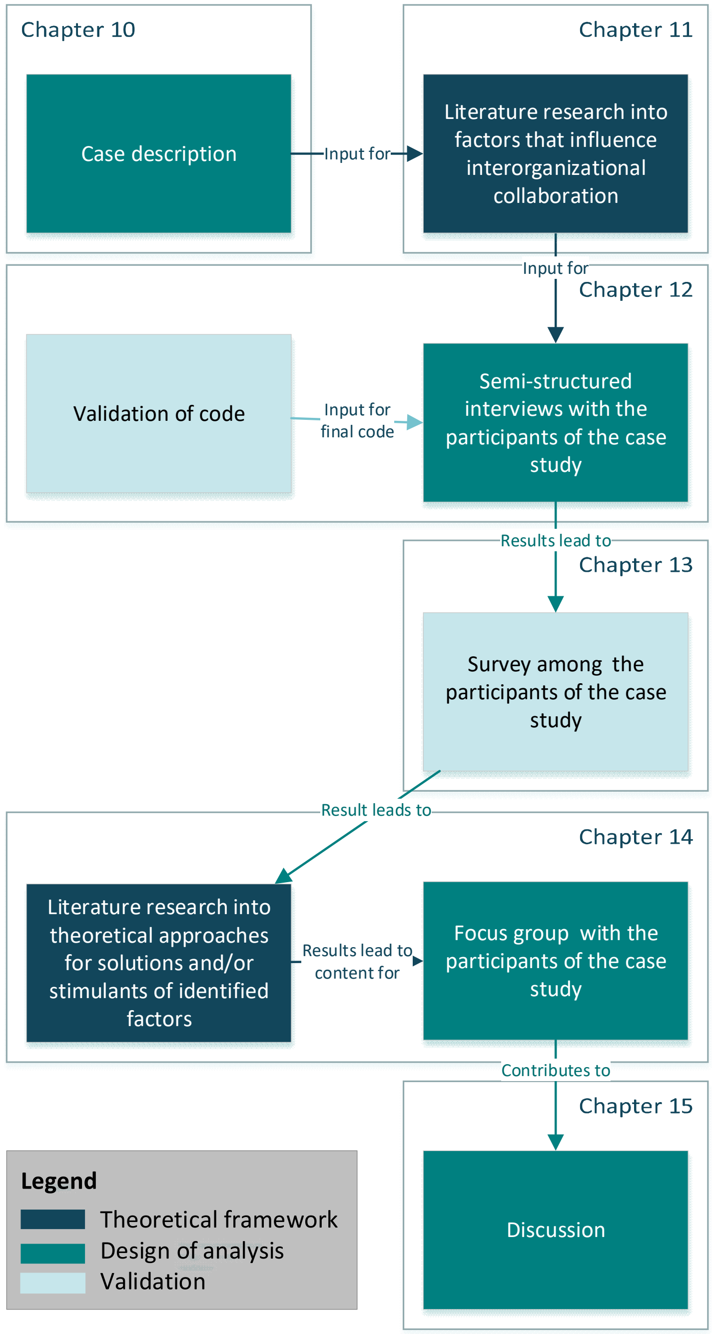

Figure 36: Interorganizational collaboration research design

10

Case description

The previous chapter provided the outline of the research project focussed on interorganizational collaboration between public parties in the energy system of the Netherlands. This chapter explains the case to which the research approach will be applied. Even though the selection of the case is explained in section 12.1, the case description provides some necessary context. This context is essential to the selection of literature and analysis of the literature search into factors that influence interorganizational collaboration between public parties which is presented in chapter 11.

The case study used in this research is an interorganizational collaborative team of four public organizations. The participants of this team generally perceive the collaboration as successful. The interorganizational collaborative team will be further explained in sections 10.3 and 10.4. The first two sections provide some context in the form of general information on the collaboration between government parties in the Netherlands.

10.1 Description of organizations included in interorganizational collaboration

In chapter 1 has already been explained that policy measures in the Netherlands are designed and implemented by ministries. These ministries are helped by the 'implementation organizations', these organizations form the bridge to society both in the front office (answering questions, offering support for subsidy application, etc.) as well as by feeding information back to the ministries in the form of researches and discussions with the relevant societal parties.

For the energy system in the Netherlands are multiple ministries responsible for development and implementation of policies. Two of these ministries are included in this thesis project. The ministries both have an organizational structure as is represented in Figure 37.

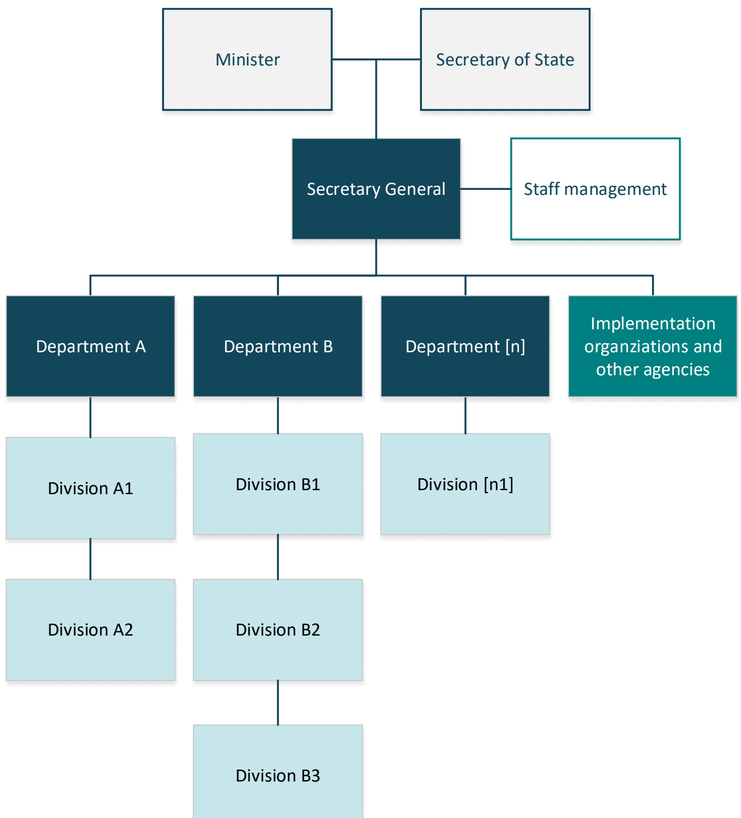

Figure 37: Basic organizational structure for ministries in the Netherlands (based on (Ministerie van Economische Zaken, 2017; Ministerie van Infrastructuur en Milieu, 2017))

10.2 Overall collaboration between ministries

In order to create a first overview of the collaboration between two parties was an explorative interview organized with a member of a management level in a department of one of the two ministries.

In this conversation the overall structure and history of the collaboration between the two ministries was discussed. Interorganizational project teams are implemented for specific topics, and not for departments or divisions as a whole. Two important developments were mentioned in this interview that lead to the notion that the collaborations have been going well lately.

The first development is the Energieakkoord (see chapter 1). The Energieakkoord was designed and is being implemented by multiple ministries, but there is no longer a political influence possible, as the agreement has been signed. This collaboration between ministries without the political pressure has created a shared goal for the ministries, as well as a shared responsibilities for the ministers to reach this goal.

The second development took place within the political arena, the political questions that are asked are of a high level, and the ministers collaborate well together. This higher level agreement, together with the Energieagenda (a document focussed on the shared 'lingo' between the ministries) allows for a better collaborative context of the interorganizational team.

Collaborations take place on all levels of the organizations, however interorganizational teams are not found at the higher management levels. Interorganizational team mostly focus on the development and implementation of policy measures and less on the political aspects of policy makers. The higher management levels do coordinate regularly and collaborate by keeping each other in the loop.

After the first explorative interview the interviewee mentioned a second employee of the ministry who would possibly be interested in this research. A second explorative interview was scheduled with this person. This employee was a project leader in another department of the same ministry. The second explorative interview was done over the phone due to scheduling reasons. This conversation focussed mostly on the team that could function as the case study of this research as well as some general notions of the collaboration. The interorganizational team is further discussed below.

10.3 Description of interorganizational team

The research uses the collaboration between two ministries in the Netherlands, as well as their implementation organisations, as case study. In order to warrant the anonymity of the participants will not be mentioned which organizations are included, and which topic the collaboration contributes to. This thesis report will use the terms ministry 1, ministry 2, implementation organization 1, and implementation organization 2. Here the implementation organization 1 is part of ministry 1, and the same holds for the second implementation organization and ministry. The anonymity of the participants was one of the main conditions that had to be met in order to interview the interorganizational collaborative team.

The interorganizational team that is interviewed is relatively small. There are five people included in the most structured collaboration form. Two other members of the collaborative organizations that are concerned with the interorganizational collaboration, but are not part of the team itself, are also included in this thesis project. Figure 38 depicts the participants of this research, their inclusion in the team, affiliation to one of the four organizations, as well as a general division in management level within the individual organizations.

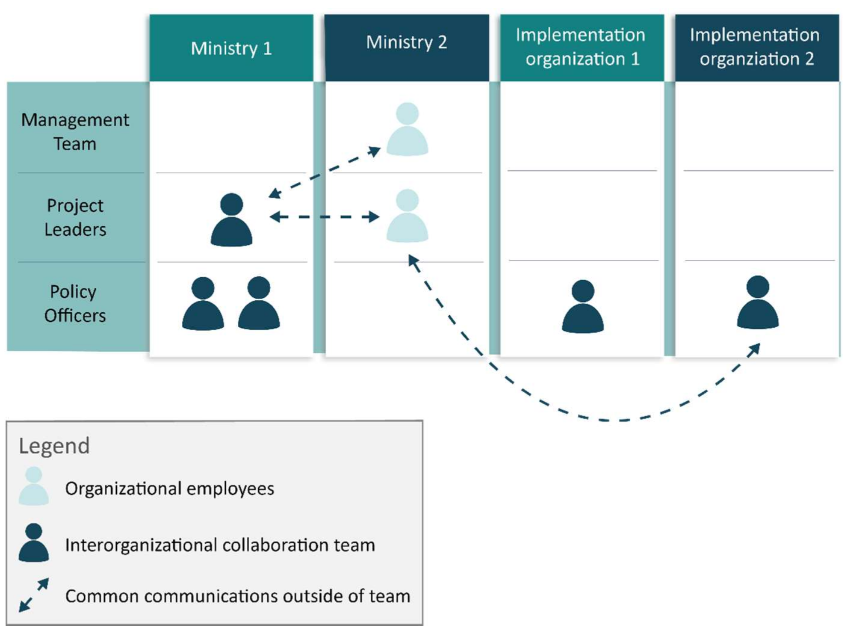

Figure 38: Participants of the research in the interorganizational team and the individual organizations.

Even though all ministries in the Netherlands have the same organizational structure, hierarchy, and division of power on paper, they are different from each other. In the interviews for this thesis project was also indicated that the organizational culture and methods of working differ between the ministries, as well as between a ministry and its' implementation organization. These differences in culture, organization of work, and informal networks indicates that the collaboration between ministries and implementation organization can be characterised better as inter*organizational* than as inter*departmental*.

Within this team are two participants leaving, as they have accepted other jobs. Even though the participants in the team are (on paper) not directly colleagues, the sentiment that they are saying goodbye to colleagues has been expressed. This feeling already indicates a strong connection between the participants.

10.4 Characteristics of the collaboration

This description of characteristics of the collaboration is based on the semi-structured interviews that will be discussed in chapter 12, as well as on the previously mentioned explorative interviews.

10.4.1 Development of the collaboration

The collaboration on this topic has been going on for many years, and is perceived as performing well.

The collaboration has been the responsibility of both the ministries involved in different periods of time. The topic has also been moved between divisions within one of the ministries. The last move was two years ago, and was from one division of ministry 1 to another division of ministry 1. This change in division within the ministry resulted in new participants of ministry 1 in the collaboration, whereas the participants form the other three organizations have been involved for a longer period of time, up to about ten years.

The collaboration is in a steady phase, the start-up phase (or change phase after the move) has passed. All participants have found their place in the collaboration, and indicate that the collaboration is performing well.

10.4.2 Topic of collaboration

Part of the positive experience in the collaboration is perceived to be derived from the intrinsic motivation and commitment all participants feel towards the topic of their collaboration. The collaboration aims to stimulate the development and implementation of a specific sustainable technology within the Netherlands. The sustainable topic is seen as a valuable and necessary development in the change towards a sustainable energy system. It can attribute both to the pollution of greenhouse gasses, as well as to the balance on the electricity grid. All participants have indicated that due to this sustainable and valuable nature of the subject for collaboration, the commitment of both participants and organizations is large. This also contributes to the stability of the collaboration, as most participants do not see an uncertain future for the collaboration, even now there is a new cabinet coming.

The participants expect the same drive for other collaborative teams that focus on sustainable topics, but also indicate that not all interorganizational collaborations between ministries and implementation organizations work as well as this specific case. The influence of the sustainable topic is expected to be large and had been indicated in the explorative interviews. As this thesis project focusses on the energy system of the Netherlands and the sustainable change that is needed, a sustainable context will be applied for the remainder of this thesis project.

10.4.3 Roles within the collaboration

The participants were asked which roles they perceived within the collaboration. Two differentiations were made on an organizational level; information provider versus policy developer, and translation of policies to politics versus innovation. Overall are the ministries seen as the policy developers and the bridge to politics (e.g. parliament debates), whereas the implementation organizations are seen as the information providers and the bridge to the innovations in practice (e.g. market parties and technological developers).

On an individual level were more different roles discerned, such as connector between people, critical thinker, advocate of the devil, representative of politics/innovation, information carrier, and linking pins. The division of these roles among the team members was not explicitly mentioned by all participants, but they all indicated that this variety of roles worked well together. Now two people are leaving the team it has also been mentioned that the roles these members have will be missed in the collaboration.

11

Identifying factors and relations

The case description of chapter 10 identified two main criteria for the literature research for the identification of factors and relations for this research. The first criterion is a focus in interorganizational collaboration rather than interdepartmental collaboration. The second criterion is a focus on a sustainable context of the collaboration.

The literature research into factors that influence interorganizational collaboration between public parties, and the relations between these factors will start with a search for review articles. Review articles provide a broad perspective and inclusive basis for a literature search. Then an additional literature search is done to gain more in-depth insights into the generated basis of the review articles. The results of the literature review will be interpreted and conceptualized into the first conceptual theoretical framework.

11.1 Systemic review article search

> *"It is very important to distinguish factors that determine inter-organizational collaboration from factors influencing this collaboration. In the first case these factors are associated with requirements that generate the necessity to establish collaboration. Whereas factors that influence inter-organizational collaboration refer to such requirements that affect the efficiency of the collaboration performed."* (Kożuch & Sienkiewicz-Małyjurek, 2016, p.105)

11.1.1 Method

The more recent a review article is, the more knowledge can be included in this article as the body of knowledge grows over time. The review article is therefore searched within a timeframe of the last 5 years (2013 through to 2017). Even though the factors that influence the collaboration are not expected to change a lot over time, the context of the public organizations, as well as the context for sustainability have changed to a relatively large degree. To allow for the most recent context of the review article, the time frame for the review article is limited to five years. For the remaining three searches (one for additional literature to accompany the review article, and the two parts of the literature search of chapter 14) will a time frame of the last twenty years be adopted (1997-2017).

Based on the review articles will additional articles be searched to provide context and understanding, as well as a sense of which factors are important, or well defined within the theoretical understanding of interorganizational collaboration between public parties.

The database used for the literature studies in this research is Scopus. The search term used for the review article included forms of the words interorganizational and collaboration, as well as synonyms for the word factor, and the term public. This can be summarised as follows:

> collaborat* AND (inter-organi* OR interorgani*) AND (barrier OR antecedent OR determinant OR variable OR factor) AND public.

The results of this search will be tested and excluded based on title and abstract for the following criteria;

1. A focus not on collaboration,
2. A focus on inter-professional collaboration,
3. A focus on private parties, or public-private-partnerships,
4. A focus on solely digital collaboration.

The remaining articles will be read fully and excluded based on the following grounds;

1. A focus on a small number, or one category of factors only,
2. A focus on a single aspect of collaboration only (e.g. knowledge sharing or dialogue),
3. A non-sustainable context.

Other search terms could also be applicable, but were chosen not to be used. For example alternatives for 'public' are governance or governmental. Although 'governance' is a term that is used widely in the social sciences for interactions with government organizations, the focus of governance is on interaction between government and civilian, and not *between* governments. As this research focusses solely on interaction between government parties is 'governance' excluded from the search terms.

An alternative for 'interorganizational' is 'inter-departmental'. However, in the exploratory interviews was already made clear that the different ministries, as well as their implementation organizations have different cultures, methods of working, and leaders. These differences are often excluded in literature focussing on inter-departmental collaboration. Therefore is the search term 'inter-departmental' excluded from this research.

The sustainable context is expected to have different drivers than (e.g.) medical or economical contexts, for example in the heterogeneity of the organizations that work together, which is larger for medical and corporate organizations than for public organizations. This is also indicated by the research into the interference between policy measures that is presented in Part II of this report. The energy systems and the sustainable transition in these systems are built upon long term investments, a necessity for public participation and a changing morale. A medical context is mostly focussed on inter-professional collaboration and accessibility to the public rather than on participation, and economical contexts focus mostly on monetary drivers, whereas sustainable change is mostly based on societal values and norms.

11.1.2 Results

The review literature search led to 56 results. Not all 56 hits were applicable as a review article for this literature research, in Figure 39 can be seen on what grounds articles were excluded and how many articles remained.

Some articles did not focus on interorganizational collaboration as a goal, but as a means (e.g. interorganizational cooperatives and relations to improve policy implementation (Wang & Ap, 2013)). Other articles focussed on inter-professional collaboration rather than interorganizational collaboration. Inter-professional collaboration can take place within or between organizations, but the main denominator is the different professions, jargon, and perspective of the participants. There were also results that did not focus on the viewpoint of public parties, as well as some that focussed solely on digital collaborations. There was also one article found twice.

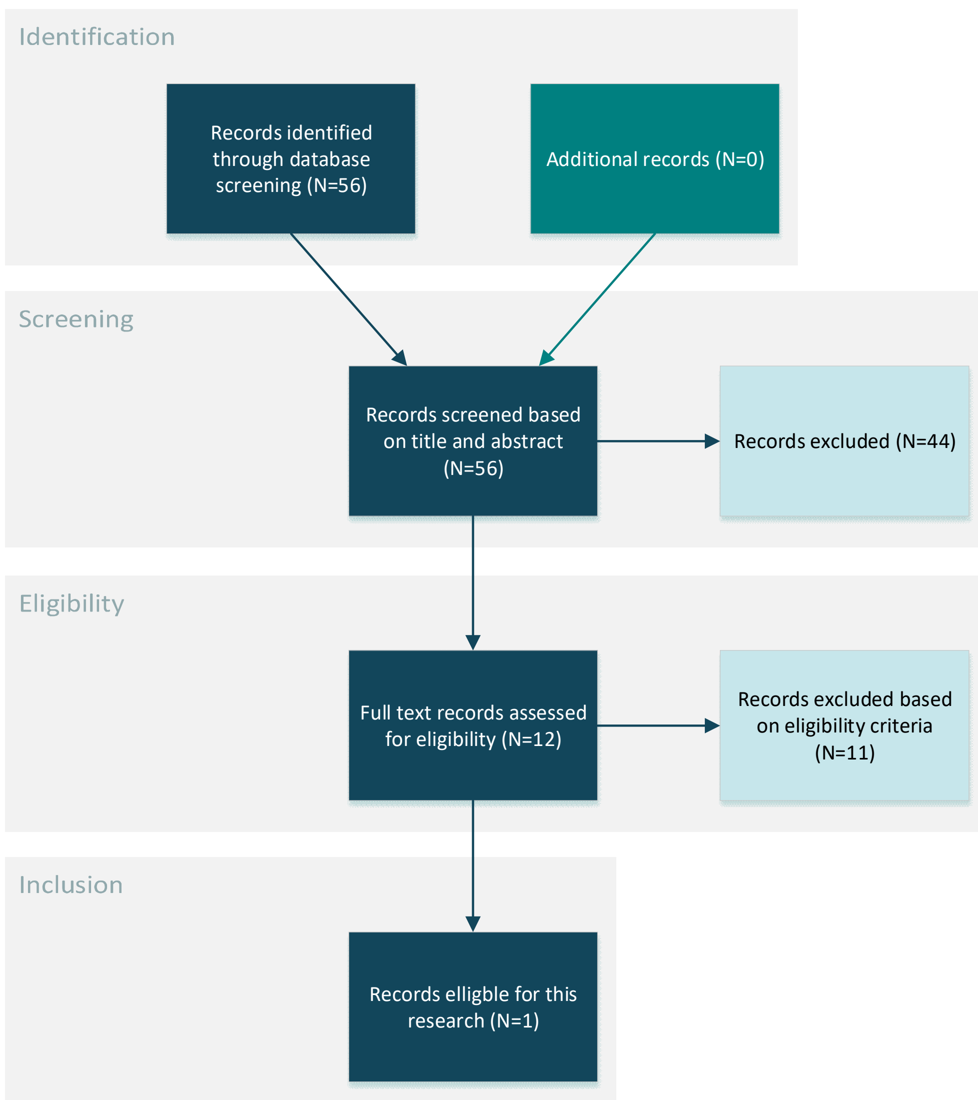

Figure 39: PRISMA flow diagram for a review article on interorganizational collaboration between public parties

As this literature research focusses on factors that influence interorganizational collaboration between public parties, which includes face-to-face contact (see chapter 10) all above mentioned characteristics led to the exclusion of these articles. This first exclusion step reduced the number of possible review articles with 36, to a total of 20 still eligible hits. These 20 articles all discuss factors for interorganizational collaboration between public parties, however not all are suitable as a review article and starting point for this research. The second exclusion step is also visible in Figure 39.

A few articles use a small number of factors as a starting point (e.g. ‘member relationships’ (Cooper, 2015) or ‘participants motivation’ (Kamitani, Ishida, Natori, & Nishimura, 2013)). A few others focus on only a single aspect of collaboration (e.g. information sharing (Sayogo & Gil-Garcia, 2014; Sayogo, Gil-Garcia, Widagdo, & Cronemberger, 2017)). Then there were articles that focussed on multiple factors and aspects of collaboration, but have a specific context that does not match with the case study of this thesis project and thereby limit the possibly applicable factors due to contextual limitations (e.g. crisis management situations (Ley et al., 2014; Tang, Deng, Shao, & Shen, 2017), smaller scale governments (Kozuch & Sienkiewicz-Malyjurek, 2016), and medical expertise (Contandriopoulos, Hanusaik, Maximova, Paradis, & O’Loughlin, 2016; Dadfar, Dahlgaard, Brege, & Javadian, 2014).

The exclusions of these articles left one article that is suitable for use as a review article that forms the basis of this theoretical framework. This article by Kozuch and Sienkiewicz-Małyjurek (2016) is titled *Factors of effective inter-organizational collaboration: A framework for public management* and lists 63 factors that influence interorganizational collaboration between public parties. The difference between private and public parties is described as (Kożuch & Sienkiewicz-Małyjurek, 2016, p.99):

> *“Compared to the private sector, public organizations management are marked by: higher authoritarianism, lesser autonomy of operations and decision-making, larger openness to impacts from the environment, enhanced formalization of functioning, broader array of tasks, and reduced or no pressure from competitors”*

The 63 factors form the basis of the first conceptual theoretical framework and are depicted in Table 1 below. Based on an expert focus group hosted by Kożuch & Sienkiewicz-Małyjurek (2016) are the factors also classified as having a strong, medium, or weak influence on interorganizational collaborations. The definitions of the factors can be found in Appendix G.

Table 30: Overview of factors that influence interorganizational collaboration between public parties from (Kożuch & Sienkiewicz-Małyjurek, 2016)

Type	Factor	Strong	Medium	Weak
External environment	governmental policy (central, regional and local)		X	
	legal regulations		X	
	development of social problems and needs		X	
	national/regional culture		X	
	social conditions in the region		X	
	economic conditions in the region (e.g. employment, recession, inflation, budget deficit)		X	
Organization characteristics	regulations in particular organizations	X		
	organizational, professional and social culture in individual organizations	(org and prof)	(social)	
	leadership with organizational and communication skills	X		
	team building		X	
	resources of individual organizations (finance, time, physical space, materials, equipment, working tools, appropriately skilled personnel)	X		
	type and structure of collaborative tasks	(struc)	(type)	
	structure of working groups (heterogeneity, size)	X		
	common ground of collaboration (vocabulary, values of interests, understanding of working practices and group norms)	X		

	collaborative technologies (e.g. communication technologies, information systems)			X
	adaptability to changing work requirements	X		
	flexibility and openness to changing circumstances of collaboration	X		
	organization of work in individual organizations			
	organizational structure of individual institutions	X		
People characteristics	experience in inter-organizational collaboration	X		
	professional competence of the employees from individual organizations	X		
	conflicts between personnel from individual organizations			X
	informal connections between personnel from individual organizations			X
	personality of the chiefs of individual organizations			X
	friendship between personnel from individual organizations			X
	respect between personnel from individual organizations			X
	commitment (willingness to cooperate) of particular organizations to collaboration	X		
	trust between personnel from individual organizations		X	
	understanding between personnel from individual organizations			X
Instruments of inter-organizational collaboration	professional and informal communication between personnel from individual organizations – I	(prof)	(inform)	
	communication in inter-organizational working teams – I	X		
	coordination of inter-organizational working teams – I	X		
	coordination of working in individual organizations – I	X		
	incentives to inter-organizational collaboration – I		X	
	organization of collaborative work (e.g. time pressured, competitive, rapidly changing, stable etc.) – I		X	
	level of shared inter-organizational knowledge – I			X
	learning processes between organizations – I		X	
	joint trainings – I		X	
	error management in individual organizations – I			X
	knowledge management in individual organizations – I			X
Relational factors	close links between organizations	X		
	conflicts between organizations	X		
	expectations of collaborating organizations	X		
	constraints in inter-organizational collaboration		X	
	shared mission, vision and goals			X
	interest in collaboration in fellow partners			X
	ability to compromise between organizations		X	
	self-interest of individual organizations from collaboration			X
	specialization of collaborating organizations	X		
	interdependence of the particular organizations	X		
	inter-organizational trust	X		
	equitable contributions to collaboration of each willing organizations			X
	uncertainty conditions of collaborative work	X		
	time of inter-organizational collaboration (time limits, cycles of collaboration)	X		
	iteration of inter-organizational collaboration		X	
	roles of particular organizations in collaboration	X		
	balance between dependence and autonomy			X
	inclusiveness to collaboration of needed organizations			X
	demands of collaborative tasks	X		
	performance of inter-organizational collaboration			X
	support within collaborating organizations			X
	management of inter-organizational collaboration (styles, transparency of decisions and guidance e.g.)			X
	joint decision making by organizations		X	

Kozuch and Sienkiewicz-Małyjurek (2016) also differentiate between five categories of factors, these categories are:

1. External environment (or context);
2. Organization characteristics;
3. People characteristics;
4. Instruments;
5. Relational factors.

The factors within the five categories also influence each other. These relations between the categories according to Kozuch and Sienkuiwicz-Malyjurek (2016) are depicted in Figure 40 below. They state (Kożuch & Sienkiewicz-Małyjurek, 2016, p.110);

> *"Principally, it resulted from the fact that these factors mutually complement and implicate. None of them taken individually guarantees that collaboration will produce significant effects. In the same way, none of them have sufficient power to entirely destroy projects executed within inter-organizational collaboration by their absence. However, the interplay of diverse factors and relationships occurring among them are pivotal for delivering outcomes for inter-organizational collaboration across public management."*

As both the factors themselves as well as their relation and interplay are important, both aspects will be included in the thesis project. The conceptual theoretical framework that is the outcome of the first literature study will include both the factors and their relations.

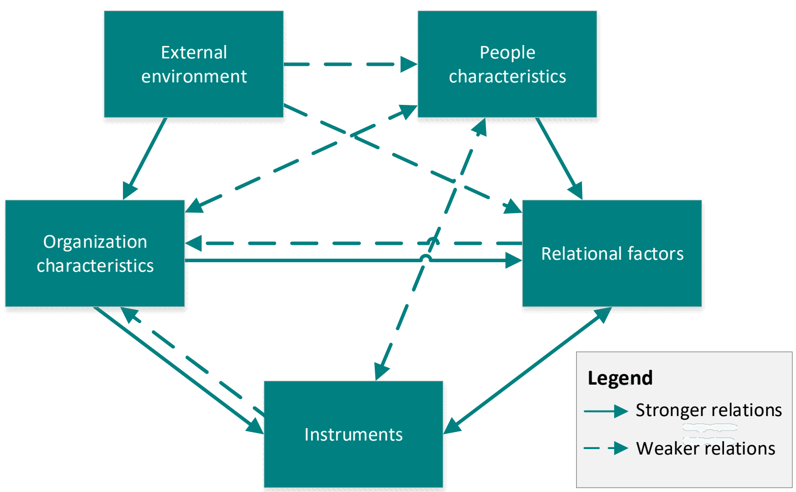

Figure 40: Relations between the five categories of factors from (Kożuch & Sienkiewicz-Małyjurek, 2016)

The review article by Kozuch and Sienkiewicz-Małyjurek (2016) does not provide a context for the collaboration between public parties. As this thesis project is focused on interorganizational collaboration between public parties for sustainable subjects, a focus of sustainable challenges is adopted for the next literature research step.

The article by Kozuch and Sienkiewicz-Małyjurek (2016) is relatively new and has been referenced only four times, two of those references are by the authors themselves. And two are by other researchers (Villamarin Garcia, 2015; Zhang, Zheng, Yi, & Ma, 2017). In one article is the framework only referenced to for the definition of interorganizational collaboration (Villamarin Garcia, 2015). The other article does refer to the factors that influence interorganizational collaboration as described by Kozuch and Sienkiewicz-Małyjurek (Zhang et al., 2017).

Even though there are very few references of the framework, the authors themselves are cited, often, and have a reasonably high h-index and i10-index. Barbara Kożuch is cited 1187 times (751 since 2012), has an h-index of 14 (11 since 2012), and an i10-index of 22 (15 since 2012) (Google Scholar, 2017a). Katarzyna Sienkiewicz-Małyjurek is cited 238 times (225 since 2012), has an h-index of 8 (7 since 2012), and an i10-index of 5 (also 5 since 2012) (Google Scholar, 2017b). The statistics of these two researchers are respectable, and do not provide a reason not to use their framework in this research.

11.2 Method - Additional literature search

To create a wider picture and more focussed context of the theoretical body of knowledge on inter-organizational collaboration will further literature research be done. This second step of literature research aims to create insight into the importance of certain factors and/or relations according to literature.

The search query, exclusion grounds, and eligibility criteria for this additional search are similar to that for the review article. The used search query, exclusion grounds, and eligibility criteria, as well as the number of hits for these search terms are explained in Appendix H.

11.2.1 Descriptive of the additional literature

The additional literature search resulted in the inclusion of thirteen articles. These thirteen articles include three different academic fields, and are spread out over the time period of twenty years that was used. The articles, their publication year, source, and academic field are visible in Table 2 below. The factors that are mentioned in the individual articles, and the representation of the categories the factors are divided in will be discussed below. This discussion focusses on overall numbers and statistics. In section 11.3 will the additional articles be analysed in more detail and based on their content.

Table 31: The year of publication, source, and academic field of the thirteen additional articles

Article	Year	Source type	Field
Barretta & Busco - Technologies of government in public sector's networks: In search of cooperation through management control innovations	2011	Journal article	Management Accounting Research
Berardo, Heikkila & Gerlak - Interorganizational engagement in collaborative environmental management: Evidence from the South Florida ecosystem restoration task force	2014	Journal article	Journal of Public Administration Research and Theory
Bouwen & Taillieu - Multi-party collaboration as social learning for interdependence: Developing relational knowing for sustainable natural resource management	2004	Journal article	Journal of Community and Applied Social Psychology
Conteh - Multi-party collaboration as social learning for interdependence: Developing relational knowing for sustainable natural resource management	2012	Journal article	Public Management Review
Dawes, Cresswell, Pardo & Durant - From "Need to Know" to "Need to Share": Tangled Problems, Information Boundaries, and the Building of Public Sector Knowledge Networks	2009	Journal article	Public Administration Review
Dorado & Vaz - Conveners as champions of collaboration in the public sector: a case from South Africa	2003	Journal article	Public Administration and Development
Esteve - Collaboration in the Public Sector: Do Chief Executives Make a Difference?	2013	Journal article	Journal of Public Administration Research and Theory
Fisher, Hunter & Macrosson - The structure of Belbin's team roles	1998	Journal article	Journal of Occupational and Organizational Psychology
Flinders - Governance in Whitehall	2002	Journal article	Public Administration
Imperial - Using Collaboration as a Governance Strategy: Lessons From Six Watershed Management Programs	2005	Journal article	Administration & Society
Knoben & Oerlemans - Proximity and inter-organizational collaboration: A literature review	2006	Journal article	International Journal of Management Reviews

Raisienne - Public servants' approach to the success factors of partnership in local government	2011	Journal article	Public Policy and Administration
Williams - The Competent Boundary Spanner	2002	Journal article	Public Administration

The division of the articles over the years and the three academic fields are depicted in Figure 41.

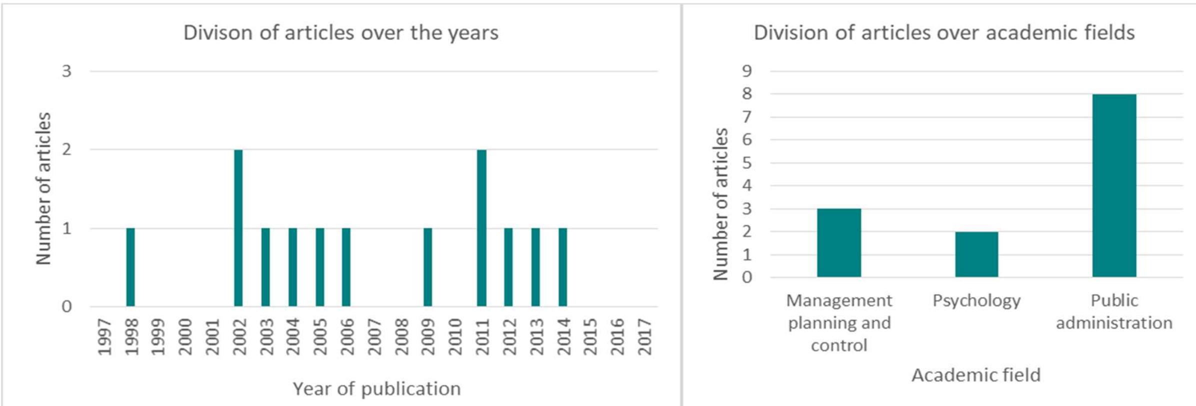

Figure 41: The division of the thirteen additional articles over the years and the three academic fields

As can be seen on the left side of Figure 41 are the articles spread out over the years. However, most articles are published between 2002 and 2014. The article of 1998 discusses the team roles of Belbin which are still used today and are therefore still relevant. The right side of Figure 41 shows that a large part (62%) of the found articles are published in journals that focus on research into public administrations. The other four articles are equally divided over the management and psychology fields.

Within the articles on public administration have two articles the term ‘governance’ in their titles. In section 11.1 is explained that the search term of governance is excluded due to a focus on interaction between government parties and civilians. These two articles however focus on both the interaction between public parties as well as the interaction between the public parties and third parties. The two articles were found as one mentions ‘inter-organizational collaboration’ (Flinders, 2002) and the other frequently mentions ‘collaboration’ (Imperial, 2005) in their abstracts. In comparison, 45 of the 47 articles that have been read entirely mention ‘governance’ in their abstracts, this includes eleven of the thirteen eligible articles. In 16 articles had governance a large role in the research, only 2 of those articles were eligible, as the other solely focussed on interaction of public parties with third parties.

There are academic fields that were expected to be represented in the final results, such as communication theory and sociology. Of the 47 articles that were read in full were 2 articles published in a journal focussed on communication academics. One of these two articles focussed on interactions of public parties with third parties, and one article focussed solely on digital communication. The other two academic fields were not present in these 47 articles at all.

There are five categories of factors, and the newly identified factors indicated as ‘additional factors’. In Figure 42 is depicted how often a factor of each category is mentioned by the individual articles.

In order to create a complete picture have the additional factors been placed within the other five categories. This division of the additional factors over the categories is explained in section 11.4. Figure 43 below shows the number of times each category is mentioned on the left side, and the normalized ‘size’ of the categories on the right side. The left side of the Figure 43 indicates the that the relational factors are mentioned most often. However, the relations category also includes the most factors of all categories (22 out of 66). The normalisation based on the total number of times a factor of a category is mentioned divided by the total number of factors in this category. This is similar to an average that each factor in a category is mentioned.

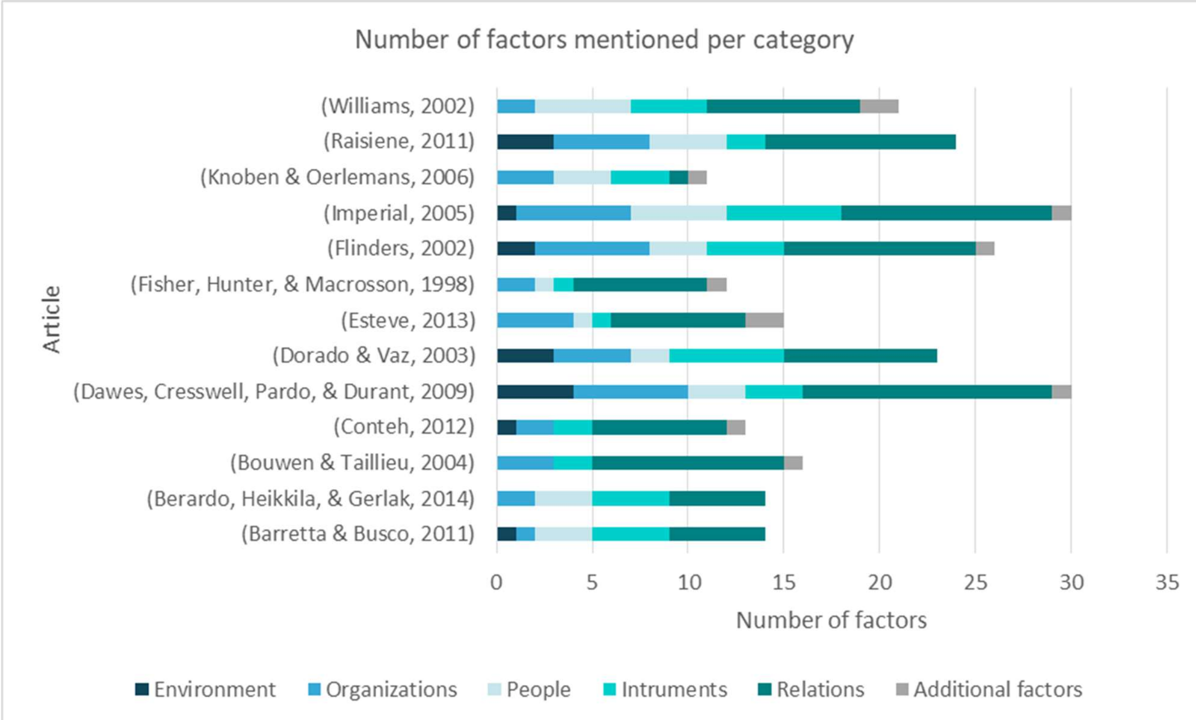

Figure 42: Number of factors mentioned per category for the thirteen additional articles

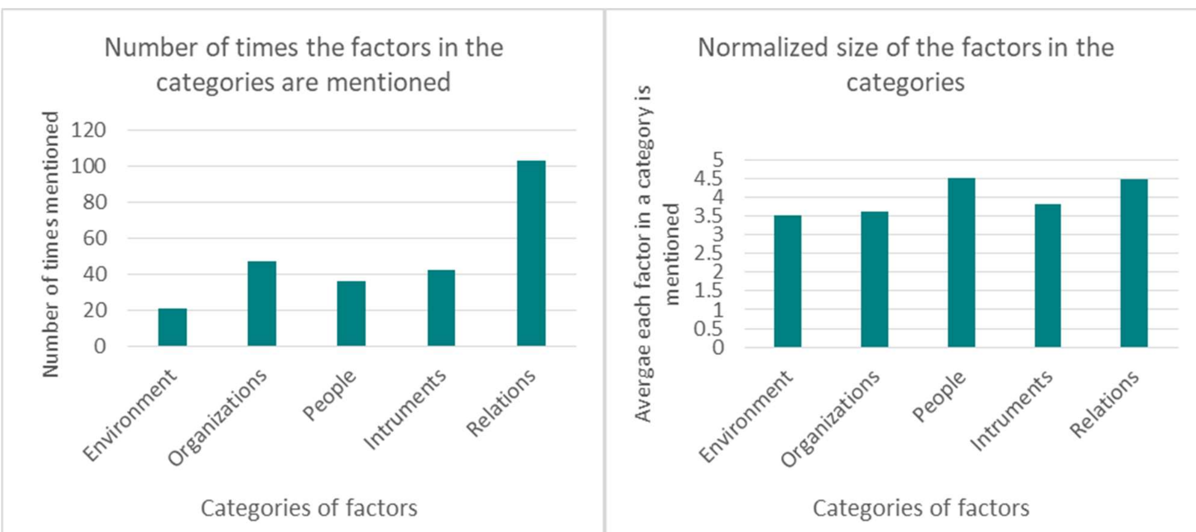

Figure 43: Representation of the categories of factors in the thirteen additional articles after categorizing the additional factors

Even though the additional articles do not use these five categories explicitly, there are no large differences in the representation of the factors in the categories. The category for relational characteristics is slightly over-represented, but not as much as the left hand picture of Figure 43 would indicate.

As the different articles represent different academic fields, it is possible the individual academic fields focus on different categories. Figure 44 depicts the normalized frequency of factors that are mentioned per category and per academic field.

The articles on management planning and control is the only category where the environmental factors are not the smallest category. This academic field focusses mostly on the instruments for collaboration, people characteristics, and environmental factors. The representation of instruments in this field could be expected, as management is based on the use of instruments to motivate and align al employees. Perhaps a larger representation of organizational factors was expected. This could indicate that from a managerial perspective it is thought that the individual people have a larger influence on the success, than the organizational characteristics.

The articles on psychology both focus on organizational psychology and applied social psychology. The journals the articles are published in both include an organizational perspective (Wiley Online Library, n.d.-a, n.d.-b). It is therefore not unexpected that the organizational and relational categories are most represented in the articles of this academic field.

The field of public administration focusses most on relational factors. Perhaps at first it could be expected that a focus on environmental factors might be bigger than on relational factors. As policy making in highly dependent on the environment the policy takes place in. This view however, seems not to be supported in the additional literature.

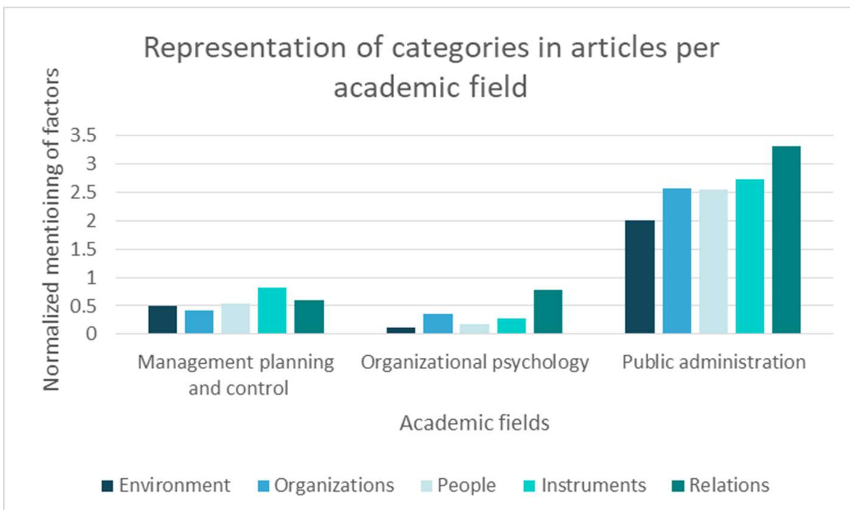

Figure 44: Representation of the number of times the factors per category are mentioned for the different academic fields of the additional articles

11.2.2 Relevance of the additional literature

The additional articles included in this literature research span over a large part of the indicated time-frame, and include the different categories of the factors to a reasonable equal extent. The main lack of the additional articles is the small representation of academic fields, and the over representation of the field of public administration. Perhaps the under-representation of social science fields indicates that different search terms could have been used, or that the social science fields do not often research interorganizational collaboration between public parties, and focus mostly on private parties, or public-private partnerships. This deficiency in the additional literature will be discussed in chapter 15.

The additional articles all adhere to the eligibility criteria, and include a reasonably complete picture of the identification of factors that influence interorganizational collaboration between public parties. Therefore are these articles seen as a relevant contribution to this literature research. The analysis and results of the additional articles will be provided in the next section, 11.3.

11.3 Results - Analysis of literature

Some factors have been combined to form a new factor based on the literature study. This is done for six factors, they will be discussed below.

Trust As one of the additional articles already mentions is inter personal trust and inter organizational trust not easily discerned in an interorganizational collaborative team (Williams, 2002, p.116);

> *"Trust is considered essentially to be a condition that is constituted in the relationship between individuals, although by implication and on the basis of the aggregated behaviour of individuals representing it, organizations can acquire a reputation for being more or less trustworthy. This evidences the difficulty of disentangling personal from institutionalized forms of trust."*

At the same time is the distinction between inter personal and interorganizational trust not specified for multiple other articles (Barretta & Busco, 2011; Dorado & Vaz, 2003) or mention both forms of trust in one sentence (Dawes et al., 2009; Imperial, 2005). The factors of 'trust between personnel from individual organizations', categorized as a personal characteristic, and 'inter-organizational trust', categorized as a relational factor, are therefore combined into a new factor of 'trust within the interorganizational team', categorized as a personal characteristics as trust is expected to grow between people, even though this trust can influence the perception of an entire organization.

Friendship Within the people characteristics category are two factors, 'informal connections between personnel from individual organizations' and 'friendship between personnel from individual organizations'. The factor for friendship is a specification of 'informal connections, if this factor is included, also other specifications of informal connections should be analysed for their presence in the interorganizational collaboration. Examples of other specifications are family, neighbours, or acquaintances.

For this research is it not important what the informal connection is between personnel of the different organizations. These two factors will be combined into 'informal relations between personnel from individual organizations', also categorized as a people characteristic.

Compromise Within the relational factors category are two factors, 'joint decision making by organizations' and 'ability to compromise between organizations'. Here a compromise is a form of collaborative decision-making and will therefore be included within the factor 'joint decision making by organizations'

The three combinations of factors leave a framework of sixty factors, however there are also factors mentioned in the additional literature that has not been included within the framework by Kozuch and Sienkiewicz-Małyjurek (2016). The factors that are not included in the original framework but are mentioned in the additional articles are;

1. The complexity of the issue (Bouwen & Taillieu, 2004; Conteh, 2012; Dawes et al., 2009; Esteve, 2013),
2. The personal and political incentives of ministers to collaborate (Flinders, 2002),
3. The reputation of the organizations (Imperial, 2005),
4. The power inequalities between the organizations (Williams, 2002),
5. Personality of the participants (Fisher, Hunter, & Macrosson, 1998; Williams, 2002),
6. The geographical proximity of the collaborating organizations (Esteve, 2013; Knoben & Oerlemans, 2006).

These six factors will be added to the theoretical framework. The complete overview of factors and the frequency of occurrence is depicted in Appendix I. The frequency of occurrence is based on the number of articles that mention this factor. The article does not have to mention the factor as 'the most important factor(s)' any mentioning of a factor is included in the occurrence data. This was done as many articles focus on a few factors only. However, the description of the influence of these factors often include other factors to be important as well. This interconnectedness of the factors is further discussed in section 11.4.

Based on the results were of each category the most occurring factors chosen to be included explicitly in the interviews. A factor 'occurs' if an article mentions this factor explicitly as influencing interorganizational collaboration. Each article that mentions the factor is counted as one 'occurrence', even if the factor is mentioned more than once within the article.

Below will be reflected on the contributions of the additional literature on these factors only. The selection is based on the most frequent occurring factor of each of the six categories. However, if this most occurring factor of the category was characterized as a 'weak' factor, see Table 29, then also the second factors of that category was chosen. This was done to increase the possibility for participants to recognize statements within the interview and therefore being able to reflect on their processes more. This recognition of factors is aimed to lead to associations with other factors. If the answer to each statements would simply be 'no' less information can be obtained than when the participant will explain their experiences with these factors. The statements and interviews are further elaborated on in chapter 12.

The chosen factors to be included in the conceptual theoretical framework play a larger role in the interviews are indicated in Table 32. With this method of selecting factors is the relational aspect overrepresented in the ten factors. However, as the relational factors are also the largest group within the framework this is not expected to influence the results of the interviews significantly.

Table 32: Occurrence of factors in additional literature

No.	Factor	Occurrence
	External environment	
1.	Governmental policy (central, regional and local)	5
	Organization characteristics	
11.	Resources of individual organizations	10
	People characteristics	
27.	Trust within the interorganizational team	8
	Instruments of inter organisational collaboration	
35.	Level of shared inter-organizational knowledge	8
36.	Learning processes between organizations	7
	Relational factors	
44.	Shared mission, vision and goals	9
46.	Self-interest of individual organizations from collaboration	9
59.	Management of inter-organizational collaboration	11
60.	Joint decision making by organizations	9
	Additional factors	
61.	Complexity of the issue	4

The ten factors will be elaborated upon below. These descriptions of the factors and their relation to interorganizational collaboration as well as to other goals will also be used when interpreting the results of the interviews, see chapter 12.

11.3.1 Governmental policy

The influence of governmental policy is mentioned in two different aspects, as the regulatory reason for collaboration (Barretta & Busco, 2011), and as an influence on the stability of the collaboration (Dawes et al., 2009; Flinders, 2002; Imperial, 2005; Raisiene, 2011).

Government as a reason to start a collaboration is expected to have multiple consequences, such as, a lack of informal relations that otherwise precede the collaboration, and a lack of mutual understanding due to the absence of a history together (Barretta & Busco, 2011).

Government as an influence on the stability of a collaboration includes a focus on the short term successes rather than on the longer term, as the minsters aim to be re-elected after four years (Flinders, 2002). At the same time can a topic that is politically supported thrive due to accessibility of resources such as time and money (Dawes et al., 2009; Imperial, 2005).

11.3.2 Resources of individual organizations

Resources of the individual organizations consist of time, money, resources, skills, and expertise. The most mentioned influence of resources is that if there is a shortage of resources it will be difficult to achieve the wanted results with the collaboration, as often there are more resources required than just convening and discussing (Berardo, Heikkila, & Gerlak, 2014; Bouwen & Taillieu, 2004; Conteh, 2012; Dawes et al., 2009; Flinders, 2002; Knoben & Oerlemans, 2006; Raisiene, 2011).

Bouwen and Taillieu (2004) recommend to organize and agree upon the use of resources as this is important for the successful continuation of the collaboration. The lack of (access to) a resource of an organization can also be a strong incentive to start a collaboration with an organization that does have access to this resource (Esteve, 2013).

11.3.3 Trust within the interorganizational team

The literature mentions trust as both an aspect that is useful for the development of the collaboration, as well as a result of other factors of collaboration. Trust as an antecedent of other factors is mentioned as a positive influence on management and control of the collaboration (Barretta & Busco, 2011; Dorado & Vaz, 2003), as well as for the creation of a shared understanding (Dawes et al., 2009). Trust as a result of other factors is influenced by decision making processes (Williams, 2002), as well as commitment (Berardo et al., 2014; Raisiene, 2011) and willingness to collaborate with specific partners based on the trust that has developed in earlier experiences (Esteve, 2013). The development of trust however takes time to build up, but the developed trust can be rather easily destroyed again (Imperial, 2005).

11.3.4 Level of shared inter-organizational knowledge

The level of shared knowledge is influenced by other factors while at the same time is the level of shared knowledge also an antecedent of other factors. The level of shared knowledge is influenced by the level of support from the individual organizations (Dorado & Vaz, 2003), and the compatibility of information management software programmes of the different organizations (Imperial, 2005).

Respectively does a higher level of shared knowledge lead to more commitment (Berardo et al., 2014), as well as to a better outcome, or performance, of the collaboration (Bouwen & Taillieu, 2004), whereas others mention the sharing of knowledge as the goal of interorganizational collaboration processes (Dawes et al., 2009; Knoben & Oerlemans, 2006)

The relation between trust and the level of shared knowledge is mentioned in both directions where Barretta & Busco (2011) mention that more trust leads to a higher degree of shared knowledge, Williams (2002) mentions that the sharing of ‘information not widely accessible in the public domain’ leads to the development of trust.

11.3.5 Learning processes between organizations

Also learning processes between organizations are described as outcomes and antecedents of other factors that influence interorganizational collaboration. Where Berardo et al. (2014), as well as Fisher et al. (1998) mention that peoples personality influences the learning potential of the team (among other factors), mention Knoben & Oerlemans (2006) that a geographical proximity is an important prerequisite of a learning process, and Imperial (2005) as well as Dawes et al. (2016) mention that the more knowledge and information is shared, the better the participants can learn from each other, which can lead to better decisions and outcomes of the collaboration process. On the other hand mention Bouwen & Taillieu (2004) that learning processes can lead to shared norms and cultures over time, others mention the influences of joint learning processes on the development of trust (Dorado & Vaz, 2003).

11.3.6 Shared mission, vision and goals

The development of a shared mission and vision is often mentioned apart from the development or presence of a shared goal.

The development of a shared mission and vision, as well as a shared goal is explained to be essential for the interorganizational collaboration between parties who have previously been competitors, or have not yet worked together before (Barretta & Busco, 2011; Bouwen & Taillieu, 2004; Raisiene, 2011; Williams, 2002). And Fisher et al. (1998) mention the need of specific personality traits of its team members for a team to be able to be goal oriented as a whole.

Others explain the presence of a shared goal to be intrinsic to a collaborative process, and that a process is not truly a collaboration if there is no shared goal (Conteh, 2012), whereas Dorado & Vaz (2003) mention that it is common for the missions of the individual organizations to be diverse.

Imperial (2005, p.282) goes even further by saying that both the mission and vision as well as the goals of the individual organizations can be competitive;

> *"although the polycentric structure of our federal system creates opportunities for collaboration, it simultaneously imposes constraints (e.g., competing statutory objectives, conflicting values or missions, budgetary responsibilities, resource constraints, turf, etc.) that limit practitioners' abilities to exploit an interorganizational network's collaborative capacity"*

This third view is supported by Flinders (2002) who states that the individual goals of the organizations can limit the analysis or collaboration space and therefore limits the possibilities for success.

11.3.7 Self-interest of individual organizations from collaboration

The factor of self-interest can both be a positive and a negative aspect. Where some reason that the interests of the individual organizations need to relate to the interests of the collaboration in order to receive the organizations commitment and to recognize their interdependence (Barretta & Busco, 2011; Berardo et al., 2014; Bouwen & Taillieu, 2004; Conteh, 2012; Esteve, 2013; Fedorowicz et al., 2014; Raisiene, 2011), while if the interests of the individual organizations are too strong compared to the collaborative interests, the collaboration can be put on a back seat while the individual interests receive most support and resources (Dorado & Vaz, 2003; Flinders, 2002)

11.3.8 Management of inter-organizational collaboration

The articles that mention the management of the collaboration all indicate an essential role for the management within the process (Barretta & Busco, 2011; Berardo et al., 2014; Dawes et al., 2009; Dorado & Vaz, 2003; Fedorowicz et al., 2014; Raisiene, 2011), and that there are many managerial forms and the choice of which one is most suitable is a complex endeavour. Factors that are mentioned to influence the possible management of interorganizational collaboration are power distribution (Bouwen & Taillieu, 2004), the skills of the management (Esteve, 2013; Fisher et al., 1998; Imperial, 2005), and organizational structures (Flinders, 2002).

11.3.9 Joint decision making by organizations

Joint decision making is both mentioned as part of the definition of interorganizational collaboration (Bouwen & Taillieu, 2004) or the collaboration structure (Esteve, 2013), as well as a key factor that influences the process of the collaboration (Flinders, 2002; Raisiene, 2011). Factors that influence the joint decision making ability of an interorganizational collaboration are communication within the team, e.g. face-to-face instead of through written comments (Berardo et al., 2014) and the personality of the leaders (Fisher et al., 1998). At the same time does joint decision making also influence the management of the collaboration (Dawes et al., 2009; Imperial, 2005) and the development of trust (Williams, 2002).

11.3.10 Complexity of the issue

The literature agrees that the more complex nature of public issues and projects, also due to the increasingly growing complexity of systems (such as the Dutch energy system) calls for interorganizational collaborations to be able to tackle the issue from multiple perspectives (Bouwen & Taillieu, 2004; Conteh, 2012; Dawes et al., 2009). These complex issues increase the interdependency of individual organizations to solve the public problems (Esteve, 2013). However this growing complexity of the issues also calls for a more stable collaborative environment while ate the same time remaining flexible (Conteh, 2012),

11.4 Relations between the factors

A relation between two factors is identified in literature when one factors is explicitly stated to influence another factor. This influence can be both positive or negative, as well as big or small.

The descriptions of the ten factors above indicate that most relations between factors are not as straight forward as Kozuch and Sienkiewicz-Małyjurek (2016) present it. This is also due to the fact that Kozuch and Sienkiewicz-Małyjurek (2016) have analysed the relations between the categories of the factors, instead of between the individual factors. The research presented in this report focusses on the relations between individual factors, rather than between the categories of these factors.

Even though some factors are described both as an outcome or antecedent of another factor, as is explained for the relationship between trust and the level of shared knowledge in section 11.3.4, are the different articles not necessarily contradictive. Both sides of the same coin have valuable arguments, and, as far as is currently known, there is not one study focussed solely on this relation that can determine the relation in one way or another. Both relations are therefore included in the analysis.

The relations that are identified within the additional literature for the ten explained factors are depicted in Figure 45 below. The six additional factors mentioned in section 11.3 were assigned to one of the five categories in order to analyse the relations between these categories, as it is that level of relations that can be compared with the framework of Kozuch and Sienkiewicz-Małyjurek (2016).

In this analysis is the factor ‘complexity of the issue’ categorized as an environmental factor. The nature of the issue itself is regarded as something the interorganizational team cannot influence themselves and therefore belongs to the context they have to work in.

The factor of ‘personal and political incentives for ministers to collaborate’ is categorized as a people characteristic as it includes a personal deliberation of motives and incentives.

The factor of the ‘reputations of organizations’ is categorized as an organizational characteristic as it includes views and assumptions that are applicable to an individual organization only and is not a construct of the relation between two or more organizations in principle.

The factor ‘power inequalities between the organizations’ is categorized as a relational factor. The distribution of power among the participating organizations is a characteristic of that collaboration only and is dependent on the relations between these organizations and not on a single organization only.

The factor ‘personality of the participants’ is categorized as a people characteristic, as a personality is intrinsically a property of an individual person alone and not of an organization, or relation between people or organizations.

The factor ‘geographical proximity of the collaborating organizations’ is categorized as an environmental factor, as the individuals within interorganizational teams cannot be expected influence the geographical location where their whole organization is hosted. Perhaps for smaller organizations there are exceptions, but this is not expected to be likely.

In Figure 46 are the relations depicted at the same level as Kozuch and Sienkiewicz-Małyjurek (2016) depicted them, based on the categories the factors belong to. The relations that differ from Figure 40 are indicated with a red arrow and will be discussed below.

The relations between the categories of factors are determined based on Figure 45. If one factor of a category influences one factor of another category, a relation between these two categories is adopted. However, this does not indicate that all factors of these two categories influence each other in the same way.

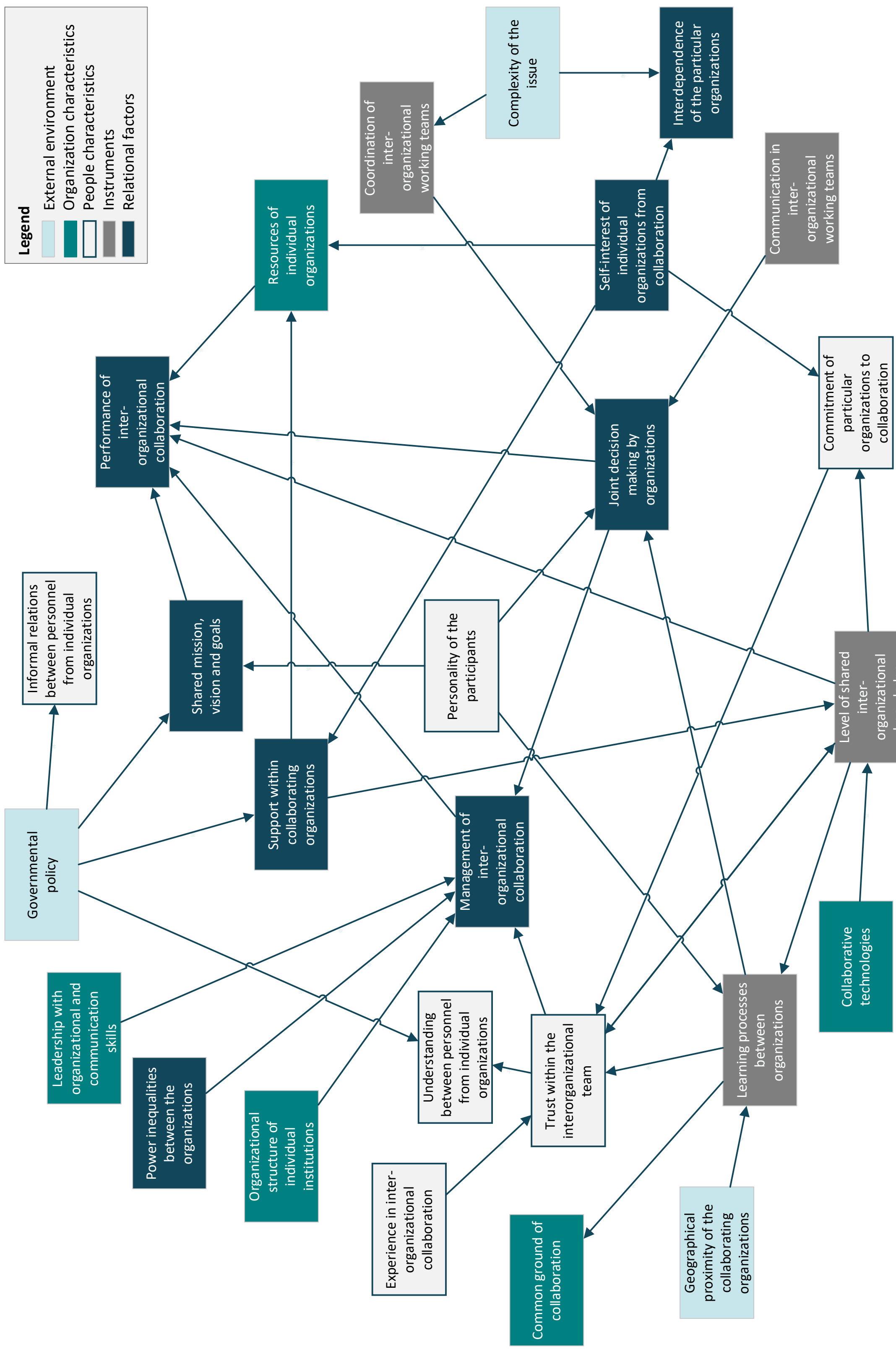

Figure 45: Relations between the ten most mentioned factors and their antecedents and influences

For example, in Figure 45 can be seen that the factor for the 'Personality of the participants' of the people characteristic category, influences the factor 'Joint decision making by organizations' of the relational factors category. This relation between the two individual factors led to the inclusion of an influence of people characteristics on relational factors in Figure 46. However this does not mean that all factors of the category people characteristics influence one or more factors of the relational category, or that all factors of the relational category are influenced by one or more factors of the people characteristics category. This is illustrated by the factor for 'Experience in interorganizational collaboration' of the category for people characteristics, which does not influence any relational factor. And the other way around is the factor for 'Interdependence of the particular organizations' of the relational category not influenced by any factor of the people characteristics category.

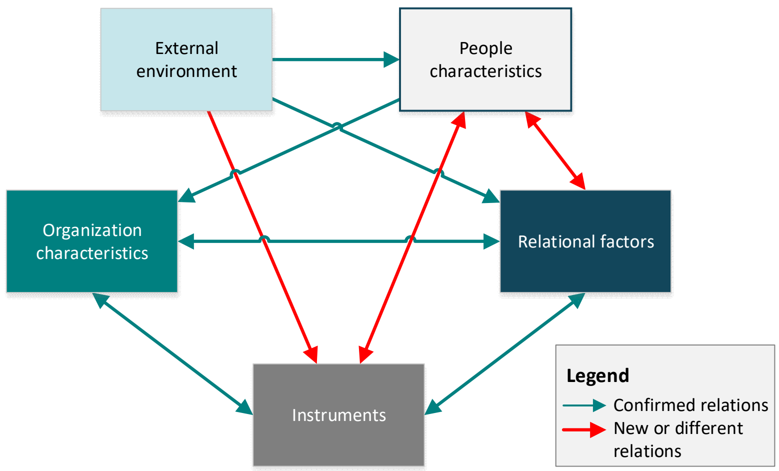

Figure 46: Relations between the five categories of factors according to the ten most frequent mentioned factors in the additional literature

The relation between the external environment and instruments of collaboration is not indicated in the framework by Kozuch and Sienkiewicz-Małyjurek (2016). This relation is built upon the influence of the geographical proximity on the learning process, and the complexity of the issue in the coordination if interorganizational working teams. As the factors of the geographical proximity and the complexity of the issue are both added to the framework of Kozuch and Sienkiewicz-Małyjurek (2016), it is not unexpected that their relations change the framework. The framework by Kozuch and Sienkiewicz-Małyjurek (2016) includes a relation between the external environment and organizational characteristics, which is not represented in Figure 46. However, it is possible that this relation is based on factors that are not included in 45 and can therefore not be excluded from the whole of the framework, but will not be represented in this new, partial, framework.

The relation between instruments and people characteristics is also included in the framework by Kozuch and Sienkiewicz-Małyjurek (2016), however, there it is a two way relation. For the influence of people characteristics on instruments holds the same explanation as for the relation between the external environment and the organizational characteristics; it is likely that the relation is based on factors that are excluded in this new, partial, framework.

The relation between relational factors and people characteristics in the new framework is a two way relation, whereas Kozuch and Sienkiewicz-Małyjurek (2016) only indicate an influence of people characteristics on relational factors and not the other way around. The influence of relational factors on people characteristics is based on the influence of the self-interests of individual organizations on the commitment of these organizations in the collaboration. This relation is indicated by seven of the thirteen additional articles, see section 11.3.7. Due to the relatively large representation of this relation in the additional literature it will remain to be included in the new framework.

11.5 First conceptual theoretical framework

The results of the analysis of the thirteen included is summarised in the first conceptual theoretical framework. This framework is depicted in Figure 47 and forms the basis on which the interview protocol will be build. These interview will test the validity of this theoretical framework in the case study.

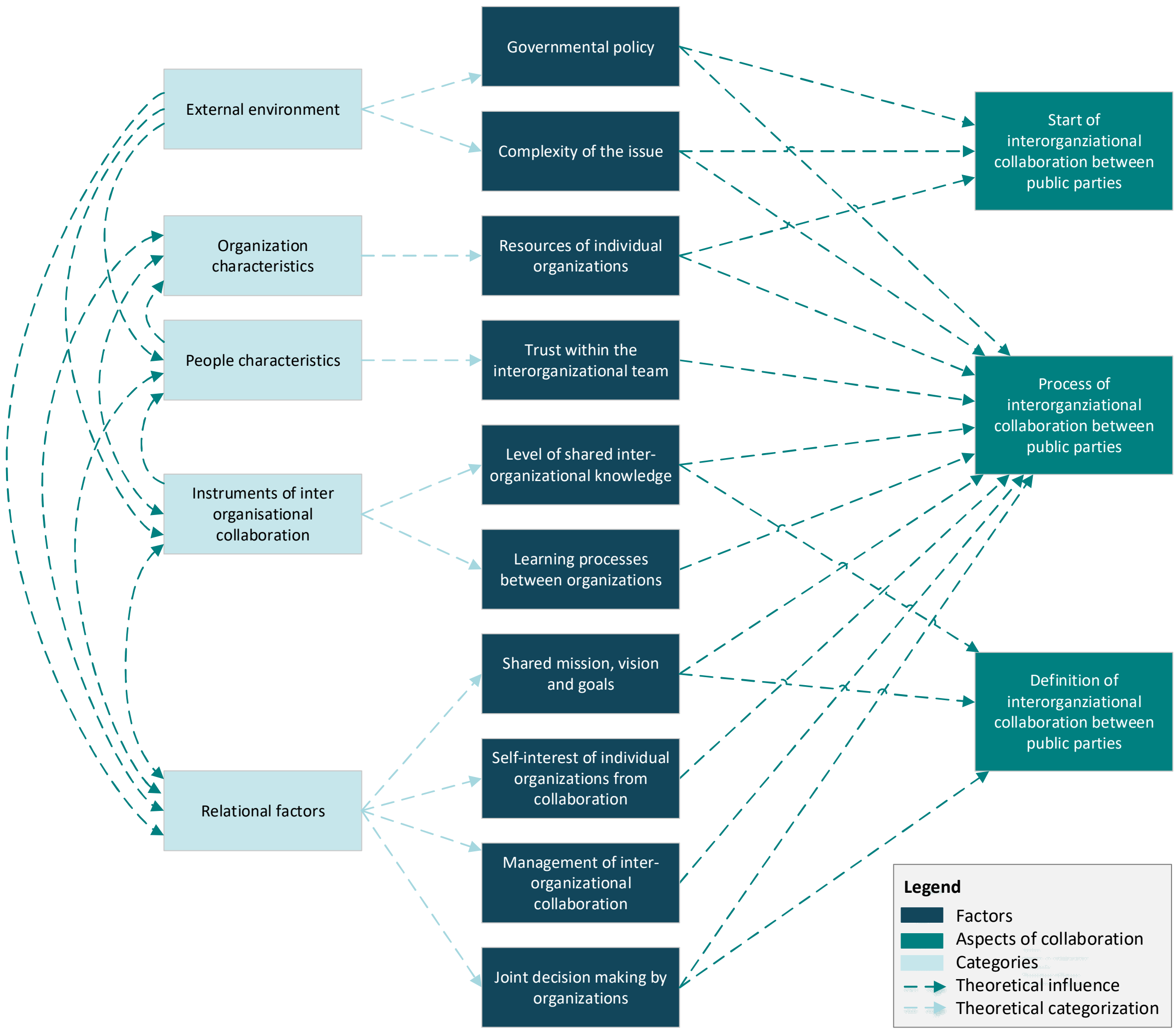

Figure 47: First conceptual theoretical framework

12

Perceived factors of interorganizational collaboration between public parties

The literature review of chapter 11 identified the initial factors that influence interorganizational collaboration between public parties in the Dutch energy system, as well as the initial relations between these factors. Chapter 11 concludes with a summary of the most important factors that influence interorganizational collaboration in the first conceptual theoretical framework.

This chapter will apply the theoretical framework as composed in chapter 11 to the case study. First will the research method of using interviews to gain insights into the case study be explained in section 12.1. Then will the application and results of the interviews be discussed in sections 12.2 and 12.3. Section 12.4 focusses on the identified relations between the factors. The results will be validated in chapter 13, a new theoretical framework for the most important factors will be constructed at the end of chapter 13.

12.1 Method – Semi-structured interviews

The testing of the first conceptual theoretical framework will be done with interviews among participants of an interorganizational collaboration between public parties in a sustainable context. Even though chapter 10 already explained the case, and the interviewed team, this section will focus on how the participants were selected, and which method of interviewing will be used.

12.1.1 Selection of sample group

The selection of participants for the interviews is based on a snowball sample. The first step was to ask participants of ministries in the Netherlands that include aspects of the energy system. Three employees of different ministries were contacted. One employee responded enthusiastically and an appointment was made. The other two employees did not respond. At the end of the explorative interview with the employee who responded, a new group of participants was proposed. This method of participant selection is called snowball sampling (Bryman, 2013, p.424):

> *"Snowball sampling is a sampling technique in which the researcher samples initially a small group of people relevant to the research questions, and these sampled participants propose other participants who have had the experience or characteristics relevant to the research."*

The next step was another exploratory interview with the team leader of the proposed participants. This interview lead to the appointment of the interorganizational team and a total of seven participants were selected. The interorganizational collaborative team is discussed in more detail in chapter 10.

12.1.2 Semi structured interviews

The interview method chosen is a semi-structured interview. Bryman (2013) mentions the two forms of qualitative interviewing; semi-structured and unstructured. Unstructured interviews allow for a lot of freedom for the participants and allows for a great range of topics discussed within the different interviews. However, as this research step aims to validate a theoretical framework it is important to make sure all participants at least are aware of the same context. This requirement of a list of topics to be discussed fits with semi-structured interviews, where the participants are asked questions on which they are free to elaborate and the interviewer can ask follow up questions, but an interview guide is used to make sure the main questions are asked in similar wording and in the same order (Bryman, 2013, p.471).

However, as the theoretical framework is only a partial framework (10 of out of 66 factors, and there might even be more in practice) the interviews also included a more unstructured part. The complete interview guide can be found in Appendix J. The interviews started with some general questions such as name, organization they work for, their role within this organization and how long they have been with this organization, as well as their role within the interdepartmental team, and the timeframe they have been involved with this team. The second part was the (somewhat) unstructured part. It was chosen to first have the unstructured part as to not bias the view of participants with the questions of the semi-structured part. Another reason is the ease of the questions of the unstructured part. The interview started with very open, non-threatening question as to ease the participants in the topic and the interview. The main questions of the unstructured part focussed on the experience of the participants, what do they think of first, which factors do they mention without a reference to the factor within the question? The questions entailed the goal of the collaboration, which elements make the collaboration a success, and which element can hamper the collaboration. Also more team related questions such as the roles of the participants and the structure of the collaboration were asked here.

The more structured part of the interview included nine statements in which the ten chosen factors of chapter 11 are included (knowledge sharing and learning were combined in a more general statement). All statements are included in the interview guide in Appendix J.

The participants could choose the location of the interviews. Most interviews took place at the ministries, either in a small room, or the cafeteria. By letting the participants choose they can opt for a location where they are at ease. For two of the interviews it was not possible to schedule a face-to-face meeting, so the interviews were done over the phone.

All interviews were recorded, transcribed, and coded. The coding of the interviews is discussed in the next section.

12.2 Interview process

The results of the interviews are based on the coding of the seven interviews. After the interviews were transcribed each interview was coded individually, after the validation of the coding process were the quotes compared for each code, to make sure the same definitions were applicable for each quote with the same code. This revision in coding is also indicated by Bryman (2013, p.568)

> *"Coding in qualitative data analysis tends to be in a constant state of potential revision and fluidity. The data are treated as potential indicators of concepts, and the indicators are constantly compared (…) to see which concepts they best fit with."*

The build-up of the code and the validation process will be discussed below. The results of the coding process will be presented in the next section, 12.4.

12.2.1 Build-up of code

Coding can be done in multiple ways (Bryman, 2013); (1) open coding is the exercise of looking for concepts within the interviews and labelling these, hereafter these labels are compared, grouped and defined, (2) axial coding makes use of an open coding strategy while afterwards grouping these codes based on context, consequences, interactions, and causes between these codes, and (3) selective coding is the grouping of codes based on a specific factor or topic. This research used selective coding where the extended framework of 66 factors is used as the base code.

Some critiques on using coding as a research method are that the context of the codes is lost in the process, and that coding results in fragmentised data and the narrative is lost (Bryman, 2013). In order to keep the narrative present in the codes were the answers to the questions coded as a whole (as general rule), this ensures the presence of the connection between the codes that is experienced by the participants. Answers were code in two or sometimes three parts only if it was clear that the participant made a mental leap and started discussing an aspect that was not in relation to the previously mentioned aspects.

12.2.2 Validation of coding process

After the first coding cycle of all interviews was the coding processes validated. The validation was based on a selection of parts of the transcripts together with a double degree master student, H.M.G. van den Ende, who also has background in the CoSEM energy domain and the SEC masters programme.

This validation process focussed on the continuity of the definitions of the codes and the interpretation of the transcripts. During the validation process it became apparent that to be able to code some answers the definitions of the codes had to be stretched to include the statements of the participants. It was this realisation that lead to the creation of additional open codes that were added.

At the start of the process were the factors also coded as stimulants (positive influences) and barriers (negative influences), giving each factor two codes. However, the validation process also indicated that this division between positive and negative was difficult to make for all codes, and was not as black and white as this difference indicates. The division into positive and negative factors was therefore excluded, leaving the identified factors together with the option for open coding.

After the validation process was a last coding cycle run through by reading the quotes assigned to a code rather than reading the transcripts from top to bottom. This last cycle made the need for strict definitions of the codes and the necessity for open coding extra clear. The definitions used during coding are included in Appendix G.

12.3 Results - Semi- structured interviews

Here the additional factors that were identified in the literature are categorized as explained in section 11.3. The additional factors identified through open coding are added at the bottom of the table. As not all 70 factors can be validated or discussed elaborately a selection mechanisms was chosen. Each factor that was mentioned 9 times or more, as well as all factors that are mentioned by all 7 participants will be included in the validation survey and will be elaborated on below. The factors that meet these criteria are indicated in Table 33. This selection mechanism was chosen as this guarantees that the factors all participants mention, as well as the factors that at least one participant feels strong about, are included in the validation process. The number of times, and the amount of participants, that mentioned all factors are indicated in Appendix I.

In the selection of factors has every participant an equal voice, this is not influenced by the organization they work for, or the role they have within the organization or collaboration. Each participant has an active role within the collaboration, and is therefore seen as a valuable contributor to this research.

Table 33: Results of the coding process for the nineteen factors that are most mentioned in the semi-structured interviews

No.	Factor	Total times mentioned	Number of participants
	External environment		
1.	Governmental policy	21	7
	Organization characteristics		
11.	Resources of individual organizations	19	7
19.	Organizational structure of individual institutions	12	5
	People characteristics		
21.	Professional competence of the employees from individual organizations	13	7
27.	Trust within the interorganizational team	10	7
	Instruments of inter organisational collaboration		
29.	Professional and informal communication between personnel from individual organizations	9	7
30.	Communication in inter-organizational working teams	13	6
34.	Organization of collaborative work	13	6
35.	Level of shared inter-organizational knowledge	13	6
36.	Learning processes between organizations	12	7
	Relational factors		
44.	Shared mission, vision and goals	11	7
46.	Self-interest of individual organizations from collaboration	18	7
47.	Specialization of collaborating organizations	14	5
48.	Interdependence of the particular organizations	14	7
57.	Performance of inter-organizational collaboration	9	5
59.	Management of inter-organizational collaboration	9	6
60.	Joint decision making by organizations	8	7
	Additional factors identified with open coding		
67.	Commitment of participants to collaboration	9	5
68.	System development in real world	9	6

There are two additional factors identified in the interviews. These two factors will be shortly explained.

The commitment of the participants of the collaboration indicates the willingness to collaborate of individual people. Here it is not an organization that is committed to the collaboration (as is applicable to factor 26), but an individual. An individual has different drivers of their willingness (such as pressures from home, or a personal connection to the team), than an organization (such as access to resources, or financial gains).

The factor for system development in the real world indicates that the system that is aimed to be influenced with the collaboration can change. These changes can influence the context of the interorganizational collaboration, and therefore can influence the collaborative process.

Table 33 does not include all ten factors of the literature review, the factor for the 'complexity of the issue' is left behind here and is discussed shortly to explain what has been said about this factor by the (few) participants that did mention it.

All four participants that mention the complexity of the issue as an influence on the process of their collaboration agree that due to the complexity it is difficult to find the right departments within the organizations of the ministries, as well as a dependence on the other organizations. These two relations were also found in literature. However, in the literature the complexity of the issue was also mentioned as a reason to start a collaboration, this idea is not reflected in the interviews. More over the reason to start the collaboration has not been mentioned once, also not in relation to other factors. The influence of the complexity of the issue as a factor of the interorganizational collaboration process is recognized in this team. This factor will be included in the validation of the theoretical framework, but will not be included in the remainder of this thesis project.

The selection of factors to focus on in the next research step led to a list of nineteen factors, of which nine have also been elaborated on in chapter 11. The interpretation of these nineteen factors will shortly be explained below in section 12.3.1. For those that were also discussed in chapter 11 will the differences or common aspects with the view in literature be indicated in section 12.3.2.

12.3.1 Interpretation of the interviews for the nineteen most mentioned factors

The views on the nineteen factors of Table 33 will be elaborated on in this section. Each of the nineteen factors will be discussed separately, in these discussion also the relations with the other factors will be included. To guarantee the anonymity of the respondents are the names and organizations the respondents work for not mentioned. Examples are sometimes provided with translated paraphrases of the respondents' answers.

Governmental policy (1) Governmental policies are seen as choices the participants of the collaboration cannot directly influence. They can only provide the information they believe is relevant. This perception also leads to the acceptance by most participants of governmental policies and their influence as a given. This acceptance is characteristics for this collaboration. All participants seem to adopt the attitude that even though it might slow their progress, they will not let it bother the continuation of the collaboration.

The influence of governmental policy is mostly mentioned as the attention that is given to the topic in political discussions and choices, the topic of this collaboration is mentioned as *'sexy'* (Respondent 1) creating a lot of attention for the topic in politics. This attention is perceived by three participants (Respondents 1, 2, and 4) to influence the available resources of the team, this influence however is both positively and negatively. A lot of political attention can increase the opportunity for larger budgets and teams, but at the same time is it perceived that political attention asks more time for preparations of political discussions of the team members, leaving less available time for the collaboration. At this point in the collaboration is the required time for preparations of political discussions one of the main explicitly mentioned barriers. However, as the governmental policies are seen as a non-changeable thing it is not experienced as a barrier per se. The team has the attitude to work with what they got, however they think it could go faster if they had more resources. Some participants (Respondents 1 and 2) mentioned that the formation of the new cabinet could lead to more available resources for this collaboration, but that this is uncertain at this point.

Also three participants (Respondents 6 and 7) mentioned that the developments in the real world system together with the political ambitions are perceived to create a tension within the collaboration, where both factors are perceived to influence which way they should go, but sometimes in different directions. One participant mentioned (Respondent 7) that all parties, political, market parties, and civilians, all have an opinion, and that combining those opinions in sound advice for political discussions is difficult. Two participants (Respondents 2 and 3) mention that the political cycle is perceived to create a short term character of the collaboration, where one participant perceives a possibility of changing personnel every four years (Respondent 2), and another perceives the political cycle to make it more difficult to create a long term shared vision rather than a short term vision (Respondent 3). This participant (Respondent 3) also mentions that the reluctance of politics to determine a clear vision (or choose a specific development path) is perceived to hamper the development of a shared vision within the team.

Two participants (Respondents 3 and 6) mention the perceived influence of cultural developments on political developments, also the influence of system developments on political developments is mentioned by two participants (Respondents 1 and 3). The Paris Agreement has been mentioned as an important motivator both for political parties and public concern, therefore is the change towards sustainability more and more a question of '*how*' and not of '*if*' (Respondent 6). At the same time is the energy system in the Netherlands (and internationally) making a choice for a specific technology, where the politics have not made a choice yet. This choice and the growing awareness of sustainability increase the pressure on politics to participate in the development of this sustainable technology.

Also two participants (Respondents 6 and 7) mention that the combination of political pressure and the organizational structure of ministries can lead to higher complexity of the collaboration, an example is that *'due to the hierarchical organizational structures in pillars always one party is responsible for the development of the topic. The views of the responsible party (in this case the minister of ministry 1) will therefore hold precedence over the views of the other governmental organizations, market parties, or civilians'* (Respondent 7). However, the consensus is that the current responsible minister and secretary of state can work together very well. This is experienced in the team as an important positive influence on the collaboration. The minister and secretary of state see the need for collaboration between the organizations and also the consequences and compromises required for this collaboration. Two participants (Respondents 6 and 7) also mention the influence of politics on the personal and political incentives of ministers to collaborate. The increasing attention for the subject of collaboration also increases the personal motivation of the minister and secretary of state to collaborate and profile this subject as an important development.

There is one contradiction where one participant (Respondent 2) perceives the election cycle to create uncertainties for the collaboration (how much budget will be present the next four years, who will be the responsible minster, etc.), whereas another participant (Respondent 1) explicitly mentions that there is no uncertainty as there is still policy to work with, even during the formation of a new parliament (due to the importance of electric transport in the Netherlands). As these two perceptions are opposites the relation between politics and uncertainty within the collaboration is not included in the further research of the relations.

Resources of individual organizations (11) The relations between he resources and politics that are perceived by the participants have already been discussed above.

The most frequently mentioned resources are people, time, and money. There is not an extreme view on the shortage or surplus of these resources. Most participants perceive the resources as too little, but also here adopt the attitude of working with wat you got. The shortage of resources is therefore not perceived as a huge obstacle, but more as a risk. One participant illustratively mentioned that *'there are enough resources for the collaboration itself to continue, but not for the collaboration to put into practice what they aim for'* (Respondent 2).

Two participants (Respondents 4 and 5) mention that even though there are not a lot of people in the team, the people that are involved are highly professional and competent, indicating that it is not just the amount of people but also the professionalism of people that influences the collaborations' performance. One of these participants is not directly included in the collaborative team itself, this participant sees the team as understaffed, but highly professional.

Organizational structure of individual institutions (19) Together with governmental policies are the organizational structure of the individual organizations, and the individual goals of the collaboration often mentioned as barriers in the collaboration. However, the participants do not experience these barriers as problematic. They know they cannot change the organizational structure and organizational goals and focus on what they can change.

Two participants (Respondents 3 and 7) mentioned that the organizational structure of the individual organizations influences which self-interest of the organization is of influence in the collaboration. One of these participants adds that *'fortunately'* there is some overlap in the interests and goals of the individual organizations that contributes to a shared goal (Respondent 7). Also two participants (Respondents 2 and 3) mention that due to the fragmented organizational structures it is perceived as more difficult to receive support of the individual organizations as a whole for the collaboration. For example, one participant said that *'due to the division within the ministries in pillars it is difficult to include all relevant parties'* (Respondent 2). Perhaps a collaboration between two ministries can be seen more as a collaboration between two divisions of two organizations, but not as between two whole organizations. Another participant (Respondent 1) mentioned that sometimes the colleagues at other organizations know more about what happens in a division of a ministry than the other divisions of this ministry.

Even though the factor of organizational structures is mentioned often, twelve times in total by 5 participants, there are many different perceptions of how this organizational structure influences the collaboration, for example through the personal incentives of ministers, the way these ministries organise their work, or the possibility of trust development between organizations as a whole. The influence of this factor on the collaboration process is therefore not in question, but there are few relations that are mentioned by two or more participants. This indicates an unclear or complex influence of the factor of organizational structures on the other factors.

Professional competence of the employees from individual organizations (21) The factor for professional competence has already been mentioned for the factor of resources and its essential role in the performance of the collaboration. A second aspect that is often mentioned (Respondents 3 and 5) is the importance of the professional competence on the level of trust within the team. This trust is said to be based on *'each other's abilities and skills'* (Respondent 3). As the people within the team are perceived as highly professional and competent there is also a high level of trust that the others will perform as expected within the team.

Similar to the factor for the organizational structure is also the factor of professional competence not as straight forward as others. For example, the factors of the commitment of individuals within the team or the organization to the collaboration are mentioned multiple times in the same reasoning as the factor for professional competence, but all in different relations to each other. For example, the professional competence of the team is illustrated in how everyone involves each other in the collaboration (Respondent 4), as well as that previous experiences in collaborations create more professionally competent and committed participants (Respondent 2). It is therefore not possible to identify a single influence of the professional competence of the employees on the collaboration itself or on other factors. Again this does not indicate that the influence of this factor on the collaboration is questioned, more that the way in which it contributes is unclear.

Trust within the interorganizational team (27) Trust has already been mentioned as an important factor in this section. The relation between trust and professional competence is described above. In this team perceive all participants, who mention trust, a high level of trust.

The participants that made a difference between trust between people and trust between organizations generally perceive that trust between organizations is developed by the development of trust between individuals. One participant stated that *'trust is always a people thing'* (Respondent 5). Or that *'an organization as a whole does not always want the same as the participants of this collaboration'* (Respondent 2), which was used to indicate that an organization as a whole is more difficult to trust than an individual. Two participants (Respondents 5 and 7) indicate that this trust between people is developed through their (informal) relations and personalities as *'each human is different'* (Respondent 7).

Two participants (Respondents 1 and 2) indicated that the level of knowledge and information that is shared is high, because there is a high level of trust. One of these two participants also mentions that *'the sharing of knowledge returns the favour by increasing the trust within the group'* (Respondent 1).

Professional and informal communication between personnel from individual organizations (29) The factor for communication between personnel from the individual organizations includes the communications between the different organizations that are not necessarily a direct result of the interorganizational collaboration team, e.g. between different employees of the same organizations, or one employee of the collaborative team and another employee from another of the four organizations but unrelated to the team.

The communication between employees of the organization is often influenced by the structure of the collaboration, even though there are other people involved. Most participants (Respondents 2, 3, 4, 5, and 7) perceive a clear structure within their collaboration and also perceive a positive influence of this structure on communications with other employees of the participating organizations. One participant mentioned *'linking pins'* (Respondent 2), where each member of the team is a linking pin between organizations, and another participant mentions the communications with their counterparts at the different ministries (e.g. in Figure 38 the two management employees of this case study, where only one is directly involved in the collaborative team).

Two participants (Respondents 1 and 5) mention that this communication between employees who are not directly involved in the collaboration increase the amount of knowledge and information shared within the collaboration as the collaborating team starts to function as an informative hub between the organizations. One participant (Respondent 1) mentions the need for consistency in their answers both to political and market parties, the sharing of information aids in this consistency.

Communication in inter-organizational working teams (30) Almost all participants perceive a high degree of communication within the team (Respondents 1, 2, 3, 4, 6, and 7). The different communication methods that are mentioned are face-to-face meetings, phone calls, emails, but also other activities such as workshops and trainings that coincidentally are participated in by two or more members of the team (Respondents 2, 3, and 4). This communication is perceived to contribute to the sharing of information and knowledge (Respondents 3 and 4), and is influenced by the organization of the collaborative work within the team (Respondents 3 and 4). One participant mentions the biweekly meetings as '*the place where they share all knowledge and skills'* (Respondent 3). The management of the collaboration is also seen as an important influence (Respondents 3 and 4), for example in the ambiance and feel of the collaboration, which then eases the communication within the team (Respondent 3).

Organization of collaborative (34) All codes concerning the organization of the collaboration have already been mentioned. The most important perceived influence of the organization of the collaboration is the increase in communication between the organizations both external and internal to the interorganizational team. This communication is based on the frequency and structure of the collaboration, all participants in the team see this structure as a positive aspect, even though they also see the benefit of ad hoc communications over the phone or email. The organization of collaboration is also perceived as an essential factor for the performance of the collaboration by two participants, where one participant mentions that *'both structure and the right people are needed in a collaboration'* (Respondent 2) and another participants indicates the stability of the team (where some participants have been involved for over ten years) as an added value to the collaboration (Respondent 1).

Level of shared inter-organizational knowledge (35) Also the level of shared knowledge has been mentioned already, the level of shared knowledge is perceived to be influenced by the communication between employees of the different organization both within and outside of the team. Also the perceived positive influence of trust on the level of shared knowledge has been discussed above.

Two participants (Respondents 1 and 2) also perceive the influence of the interdependence of the organizations on each other, to influence the level of shared knowledge. The perception is that the higher the level of interdependence, the more information and knowledge will be shared. The same holds for the specialisation of the organizations (Respondents 1 and 2). The perception is that the specializations of each organization require and also lead to a higher level of shared knowledge and information. One participant mentions that *'we cannot know everything that is happening, we are focussed on policy making, and sometimes we get a technical question, at these times it is important to know how to find each other to know how things work'* (Respondent 1).

The sharing of knowledge and the creation of understanding have been mentioned together often, but the perceived relationship between these two factors differs between the participants. For example the need for *'mutual understanding and appreciation of each other's knowledge'* and the influence of both knowledge sharing and mutual understanding on the coordination of work within the collaboration have been mentioned by the same participant (Respondent 2), but indicate different relations.

However, there is one participant that explicitly mentioned knowledge sharing (and to some extent mutual understanding) as the goal of the collaboration (Respondent 2). Other participants have implied the same goal, but have not made this explicit ('*afstemmen*'). This goal should be validated in the survey.

Learning processes between organizations (36) There is a difference in perception, where the participants both mention a learning process between organizations that is built on characteristics of the organizations (Respondents 2, 4, and 6), and a learning process between organizations that develops through the participants themselves (Respondents 1, 3, 5, and 7). Two participants (Respondents 1 and 4) also mentioned the perceived need for reflection in the organizational culture to be able to learn from each other, this reflection is seen as an aspect on an organizational level.

Two participants (Respondents 2 and 5) perceive the level of shared knowledge as an important antecedent of the possibility of a learning process where knowledge on processes and laws is mentioned as valuable, e.g. European legislative processes (Respondent 2), or the electricity law (Respondent 5). Also the differences in the way of working in the individual organizations are perceived by two participants to increase the possibilities of a learning process (Respondents 1 and 6). How the relations between the two ministries and their implementation organizations are shaped, is mentioned as an example of the possible differences in the organizational way of working (Respondent 6), as well as the different context the four organizations usually work with (e.g. budgets of projects, the depth of the detailed knowledge that is assumed in projects) (Respondent 1).

Shared mission, vision and goals (44) Most participants do not see a huge need for a shared mission, vision, or goal. However they do also mention that the shared mission and vision are *'lacking'* (Respondent 3) or *'implicit'* (Respondent 7) which again suggest that they do perceive a problem or barrier. Most also mention that the development of a shared mission and vision is pursued and that the nature of policy making also inherently leads to the development of shared missions, visions, and goals (Respondents 1, 2, 4, 6, and 7). One participant (Respondent 2) was very clear on the shared goals, in which the goal of the collaboration is knowledge sharing and the creation of mutual understanding.

Little to no factors are influenced by the development of a shared mission, vision, or goal. As well as only one factor (self-interest of individual organizations) that influences this development are mentioned by more than one participant (Respondents 3 and 7). One participant mentions that the interests of the responsible ministry is leading, and that this is reinforced by the pillar shape of the organizational structure (Respondent 7).

The development of a shared vision, mission, or goals is mostly mentioned alone, as a free standing factor. The influence of a shared mission, vision and goal is not yet clearly corroborated within the interviews and will need to be validated in the survey.

Self-interest of individual organizations from collaboration (46) Two aspects have already been found in the analysis of the previous factors; the organizational structure influences the self-interests of the individual organizations, and that the self-interests of the individual organizations influences the development of a shared mission, vision, and goal.

The factor for self-interests has been mentioned a lot by one participant (Respondent 3). This person was focussed on and aware of the different interests of the organizations and experienced this as a large barrier to reach their collaborative goals. This participant did not necessarily perceive this barrier in the collaborative processes within the team, but more in the influences of the individual organizations on the collaboration. For example, where one ministry focusses on the environment, focusses the other ministry on the possibilities for the energy system itself. All participants understood the origin of these different interests of the individual organizations, which seems to decrease their perception of this factor as an issue. Combined with the 'work with what you got' attitude is the self-interests of the individual organizations one of the factors that could be a barrier but is chosen to work around.

The real world developments of the system also influence the interests of the individual organization. Two participants perceive a growing alignment in the interests of the individual organizations the more the system is developing (Respondents 6 and 7). This is illustrated by one participant as *'when the dossier becomes more mature, the connections to for example renewable energy become more visible. First you start with a focus on the technical possibilities, [later] you focus on what is necessary for this technology. […] If the [..] sector demands more electricity, a lot more windmills have to be installed'* (Respondent 6).

Other influences are less clear and many factors are mentioned once as an influence of the self-interests of organizations. For example; *'the different interests of the organizations are more and more coming together and the same solution, […] can be applicable to all'* (Respondent 6) or '*the drivers in the region also affect the interests of the individual organizations. In Norway is [topic] heavily subsidized, as the government has a focus solely on environmental aspects. Whereas in the Netherlands we focus on a green economy as well, we want the market to develop […] and help when the market needs a little push'* (Respondent 1).

Specialization of collaborating organizations (47) As has been mentioned do the participants perceive an influence of the specialisation of the organizations on the level of shared knowledge. The more the organizations are specialized, the higher the need for knowledge sharing. This specialisation of organizations is also perceived to increase the interdependence between the organizations (Respondents 2, 3, and 6). This is illustrated by one participant as *'one organization focuses on the policies, and one organization focusses on what happens in practice, in the collaboration we can align the policies and their implementation in practice better'* (Respondent 2).

Also the coordination of work (division and clarity of tasks and responsibilities) both within the team (Respondents 1, 5) as well as in the individual organizations (Respondents 2, 3) are perceived to be influenced by the specializations of these organizations. One participant mentions that the division of work within the collaboration is based on the core tasks of the different organizations (Respondent 5).

The roles of the different organizations within the collaboration are also perceived to be influenced by these specializations. This has also been discussed in section 10.4.3, and is mentioned by one participant as *'there are multiple transitions going on, and from our core responsibilities we can combine these transitions, while each focusses on what they are good at [take their own role]'* (Respondent 3).

Interdependence of the particular organizations (48) The perceived influence of the specialization of organizations on their interdependence, as well as the influence of the interdependence on the level of shared knowledge have already been discussed.

The interdependence between the organizations is recognized by all participants. They also seem to agree on the influence of the interdependence on the collaboration. This is one of the first factors that is as similarly mentioned by all participants. It is not a question if these four organizations have to work together. They all see the need for this collaboration, which contributes to the commitment and motivation to collaborate.

Performance of inter-organizational collaboration (57) The participants that mention the performance of the collaboration explicitly have a positive perception of the performance. Examples are '*[the collaboration] on this level goes really well, if there are some issues they are at higher levels*' (Respondent 1), '*I have noticed I have been pretty positive in my answers […] and that the human side is important in the willingness to collaborate*' (Respondent 2), or '*I think that [the collaboration] goes fairly well, we do not really have any barriers*' (Respondent 5). However, they do not indicate whether or not this current performance influences the process of collaboration in the (near) future. This influence needs to be validated in the survey as well.

It is perceived however that the resources (Respondents 4, 5, and 7) and professional competence (Respondents 2, 4, and 5) directly influence the performance of the collaboration. The commitment of people to the collaboration has been said to be influenced by the performance of the collaboration (Respondent 7), but also the other way around (Respondent 1). Even though a relation between commitment and the performance of the collaboration is mentioned twice, due to the difference in directionality it is not clear which relation is perceived. One participant also says '*It all goes well, […] it is such an important subject that everybody works hard to make it happen*' (Respondent 1).

Management of inter-organizational collaboration (59) The management of the collaboration as a whole is perceived to function properly. The management is also perceived to contribute to the communication within the team (Respondents 3 and 4), as well as to the respect between the team members (Respondents 2 and 6). Examples of statements are '*[the project leader] is always working on the collaboration, […] which aids the ambiance within the team*' (Respondent 3), '*[the management is done] with a lot of sense for the worth of people as well as the roles they have to fulfil*' (Respondent 6), or '*we all benefit from a collegiate management of the collaboration, so that works well*' (Respondent 5).

Joint decision making by organizations (60) The coordination of the teams (the clarity and division of tasks and responsibilities) is perceived to influence the joint decision making processes. One participant mentioned that '*we try to find all options and arguments and are actively trying to come to one collective proposal, […] we often are in agreement, this is not the most difficult topic in that sense*' (Respondent 5).

The participants also perceive an overall preference of joint decision making, but also know that this is sometimes not possible due to circumstances. This is illustrated as *'unfortunately is one minister politically responsible and is the therefore decision sometimes (partly) dependent on the views of this minister'* (Respondent 7).

The view of all participants is therefore twofold. Some perceive the hierarchy of having one ministry as the responsible party as a barrier for joint decision making, but all (also) see that the focus is on agreeing as much as they can, while have to fulfil different interests of the organizations.

Commitment of participants to collaboration (67) Even though the commitment of the participants is perceived as high, and the factor is mentioned often, there is no consensus on how the influence on the collaboration is shaped. In other words, the perceived influence of commitment on the collaboration process is clear, but the relations with the other factors are not. One aspect that is mentioned multiple times is the intrinsic motivation of people '*as this topic is very important*' (Respondent 1) or '*to help make the transition to [the topic] a success comes with an enthusiasm and commitment from everyone*' (Respondent 4).

System development in real world (68) The influence of the system developments on the interests of the individual organizations, as well as on political developments have already been mentioned. The system developments are also perceived to influence the support of the individual organizations (Respondents 2 and 6). This is illustrated as a taking for granted of the growth of the technological innovation this collaboration is concerned with, '*there have been times when this subject was more important, […] [it] will grow in the Netherlands without support […] the involvement of the Netherlands as an industry party however is not yet secure*' (Respondent 2). Another participant mentioned that due to the interconnectedness of the technology with renewable energy production more interest and support from the individual organizations is created (Respondent 6).

The development of the system is perceived as a positive influence on the collaboration by those participants that mention the factor. One participant said '*that is what makes this topic fun to work on, everyone feels that there is still a lot to come. We want the market to perform well in the future, and at the same time we can see the market developing*' (Respondent 7).

12.3.2 Difference between literature and the case study

Of the nineteen discussed factors in section 12.3.1 have nine also been elaborated on in chapter 11. These nine factors are discussed below for the differences and similarities in the views of the case study and literature.

Governmental policy (1) In Figure 48 can be seen that there are three relations indicated by both literature and the interviews, two based solely on literature, and three based on the case study.

There is a positive influence of political attention to the resources which is found in the literature and is mentioned by the participants as the sexiness of the topic. As the public organizations are public, governmental parties the political developments also influence the support of the organizations for this collaboration. This is also tied to the political attention for the topic of the collaboration. The electoral cycle of four years is seen as an influence on the stability of the collaboration, as each four years the responsible minster and/or participants of the team can change roles or jobs. The electoral cycle is also seen as a reason for a short term focus from the government, which can form a barrier for a shared mission or vision in the collaborative. This influence of the electoral cycle is both recognized in literature and in the interviews. As there are two distinct aspects of government policy that influence the collaboration, these two aspects will be validated separately.

The two theoretical relations were mentioned as an effect of a governmental reason to start a collaboration. If the start of a collaboration is mandated top-down, it is likely that there are no informal relations yet between the team members, as well as a lack of mutual understanding due to the absence of a history together. As the reason to start a collaboration has not been mentioned at all by the participants, it is logical that these two relations are not mentioned in the case study.

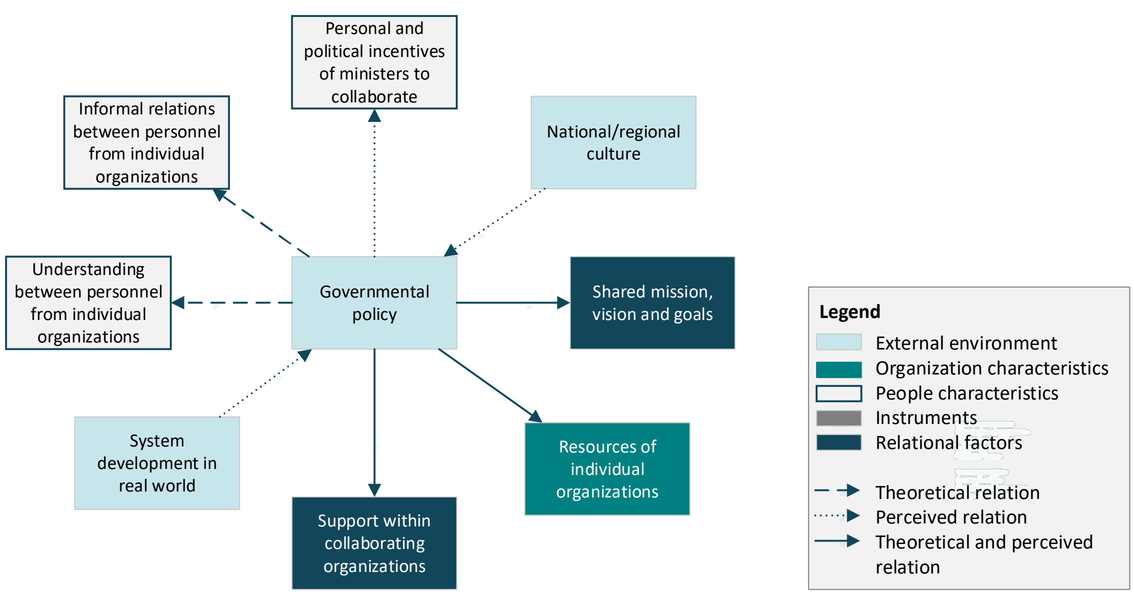

Figure 48: Governmental policy and its relations to other factors

Two of the practical relations are derived from developments in the system or the country the system is imbedded in. If awareness of the topic of the collaboration in the Netherlands grows, or awareness of the need for climate change mitigation grows, it is likely that the standpoints of the politicians also change. How these standpoints change is not perceived in the same way by all participants. Some say that development of the real world system creates a higher awareness of the topic in politics, and therefore more attention. However, it is also mentioned that when the system develops the politicians believe that governmental support might not be necessary anymore, decreasing the attention of politics for the topic of the collaboration in the Netherlands.

The last practical relation is based on a view that developments in the government also influence the ambitions and incentives of the ministers and secretaries of state. One minster is responsible, but this minister collaborates well with the secretary of state of the other ministry, both their incentives and ambitions can influence the collaboration.

The first two mentioned practical relations are based on an environmental factor that influences another environmental factor. This type of influence is not seen in the literature at all. Perhaps less attention is paid to how environmental factors develop as these factors are external factors and cannot be influenced by the collaborative party itself. The last perceived relation is based on a factor that was mentioned by only one article, and this article does not mention any relations to other factors (Flinders, 2002, p.56):

> *"However, probably the most significant challenge to cross-departmental working involves the personal and political incentives that ministers and their officials have in putting strategic ambitions above departmental aims."*

The participants did also mention this factor, in the sense that due to the hierarchical and pillar structure of the organizations there is a clear responsible party. The views and ambitions of this responsible parties can influence the collaboration, e.g. by in putting emphasis on certain aspects or developments.

Resources of individual organizations (11) The influence of resources on the performance of the collaboration is both recognized in literature and in the case study, as is indicated in Figure 49. Both bodies of knowledge also indicated that even though there might be enough resources to collaborate (meet and discuss), this might not be enough for the performance of the collaboration. The collaboration also needs resources to take on actions or start programmes within the collaboration, to reach their collaborative goals. The relation between the resources and governmental support has been discussed above.

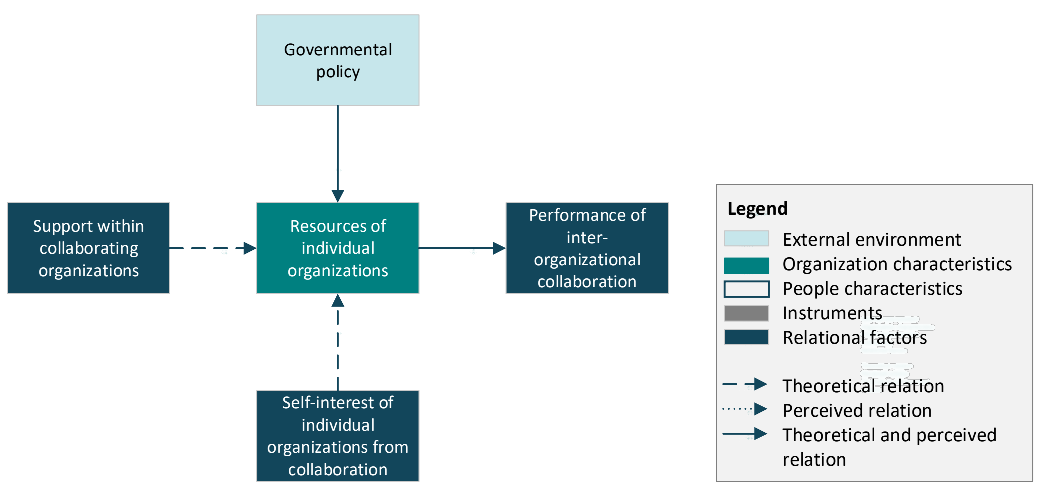

Figure 49: Resources and its relations to other factors

Literature also attributes the factor resources as a reason to start a collaboration, an individual organization might not have access to a specific resource that they do require. An interorganizational collaboration is then one possible method of gaining access to this resource. This reason to start a collaboration is likely to be supported by the organization that needs the resource, and is part of the self-interest of this organization. However, as the reasons to start a collaboration have not been mentioned by the participants at all, it is also logical that these two relations are not mentioned in the interviews.

Trust within the interorganizational team (27) Of the nine identified relations between trust and other factors that are depicted in Figure 50, only one is identified both in literature and in the case study. Literature identifies a bilateral relation between the sharing of knowledge and information and the development of trust. If the participants trust each other, it is expected that more knowledge will be shared. This sharing of knowledge is then seen as an act of trust, which increases the development of trust within the team. This bilateral relation has been mentioned by one participant, but only the influence of the sharing of knowledge on the development of trust is mentioned by two or more participants.

The two perceived relations characterise the perception that trust is built between people through their relations and personal/professional characteristics.

The five remaining relations are all theoretical. Most participants were reserved in their belief in a learning process between organizations, the relation between trust and a learning process will therefore be further elaborated on below. The other four theoretical relations are between two personal characteristics. Even though the participants mentioned a variety of people characteristics, each person perceives these characteristics differently. Perhaps some characteristics, such as mutual understanding, are implicit for the participants. There is no clear explanation of why these theoretical relations are not perceived in the case study.

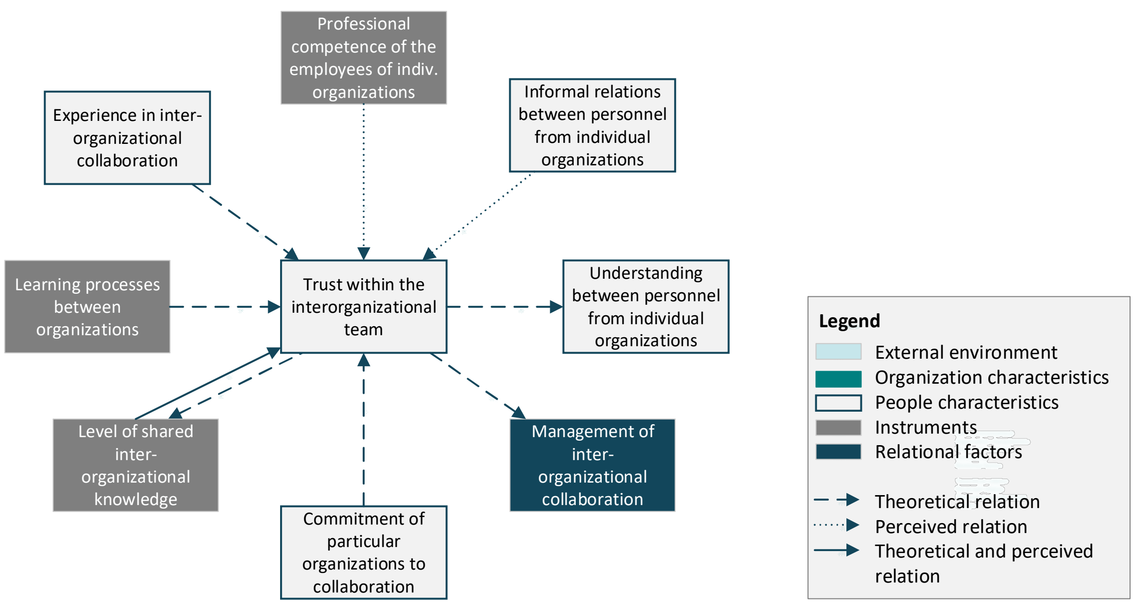

Figure 50: Trust and its relations to other factors

Level of shared inter-organizational knowledge (35) All relations between the level of shared knowledge and information and other factors are shown in Figure 51. The bilateral relation between the sharing of knowledge and information and the development of trust is discussed above. The other relation that is identified both in literature and in the case study is the influence of the sharing of knowledge and information on a learning process between the organizations. The idea that is corroborated in literature and interviews is that to be able to learn, you need to understand what and how the other organizations work on. This can only be accomplished if the organizations share this knowledge and information.

There are four factors that are perceived to influence the level of shared knowledge. Two factors concern communication between people, both within and external to the interorganizational team. This is based on the perception that in order to be able to share information and knowledge communication is essential. Communication can be seen as the carrier of this information and knowledge. This relation between communication and he sharing of knowledge and information is mentioned by those articles that mention communication as a factor, but not by those that only mention the sharing of knowledge, e.g. (Conteh, 2012). Perhaps this is due to the scoping of these articles.

The two other perceived factors are the interdependence and specialisations of the organizations. This can be seen as the reason or motivation to share knowledge. As each organization is specialised in different areas and tasks, they possess different knowledge and information. Ate the same time are these organizations dependent on each other and need to share this specialized knowledge and information to reach their mutual goals.

The four theoretical relations contain two factors that influence the level of shared knowledge, and two that are influenced by this factor. The factors that influence the sharing of knowledge and information are the support of the organizations and the technologies that are required for the sharing of knowledge. The role of the support of the organizations is described as (Dorado & Vaz, 2003, p.147):

> *"the two advisors acted as project champions by raising internal awareness and support for the project and the need for coordinated action between the departments. This enabled them to get the two departments to share information more readily and to coordinate their actions as they related to the project"*

This quote illustrates that if the collaboration is seen as beneficial by the individual organizations the employees will be more willing to share information. It is possible that the participants of this research do not see this relation, as they are able to decide to share information themselves, and do not necessarily need permission from their bosses to share most information. Sometimes confidential information cannot be shared due to political pressures, but this would not change if the support of the individual organizations would change.

The different technologies that are required to share knowledge and information are not mentioned in the interviews. It is likely that the participants are not aware of possible technological barriers, as all government organizations use similar information software.

The sharing of knowledge is also mentioned as a goal of the collaboration, both in literature and in the case study. This relation should also be validated independently of the importance of knowledge sharing for the continuation of the collaboration.

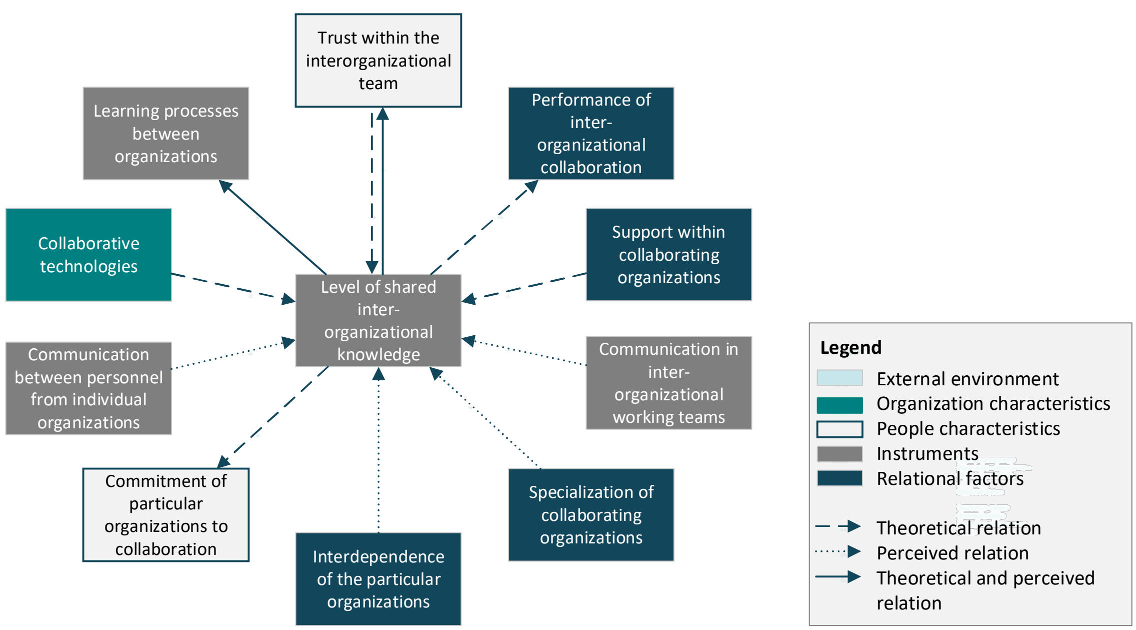

Figure 51: Shared knowledge and information and its relations to other factors

Learning processes between organizations (36) The relation between knowledge sharing and a learning process has been discussed above. There is only one other relation that is perceived in the case study, as is indicated in Figure 52. This is the influence of the organization of work in the individual organizations on the learning process. The participants have mentioned that there are two aspects of a learning process, the content of their work (knowledge and information) and how this work is done (the organization of work). The literature focusses more on how people learn rather than what they learn from, this is in contrast with what the participants mentioned. This could be the explanation of why the relation between the organization of work in individual organizations and the learning process is not identified in literature.

The two factors that influence a learning process according to literature are conditions of a learning process. Geographical proximity is required for the participants to meet face-to-face which aids a learning process. At the same time influence the personalities of the participant who is open to learning and who might be more defensive. The participants in this thesis project did recognize the influence of personalities on collaboration but have not mentioned this explicitly linked to a learning process. This might be due to the reserved views the participants have on a learning process in general. Most participants said that '*probably the organizations learn by collaborating*', but were not so certain of this statement. Some mentioned the need for reflection in the organizations before they can truly learn.

Literature also states that a learning process can enhance trust and a common ground for the collaboration. However, as a learning process is not fully recognized by the participants they also did not mention any possible consequences of this learning process.

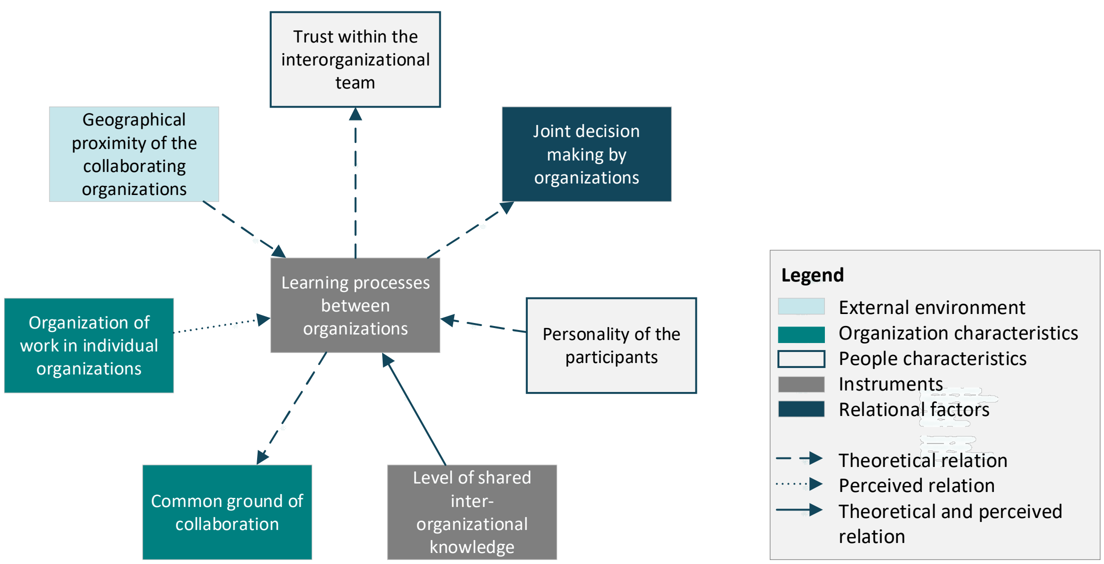

Figure 52: Learning processes and its relations to other factors

Shared mission, vision and goals (44) The influence of politics on a shared mission, vision and goal is already discussed. This relation and all other identified relations are depicted in Figure 53. There is one perceived relation that is not yet explained, this is the influence of the self-interest of the organizations on the shared mission, vision, and goal. Here the individual goals determine the way the shared goals can develop. As some participants do not see a need for an explicit shared mission, vision or goal, the theoretical influence of this factor in not on the performance of the collaboration is not corroborated in the interviews. Literature states that between previously competing parties a shared goal is essential. However these four organizations have not been true competitors, which could explain why a shared goal is not seen as essential to this collaboration.

The influence of the personality that is required to be goal oriented is not mentioned in the interviews. Perhaps also here the perception of personality is more implicit in practise, as for the learning processes.

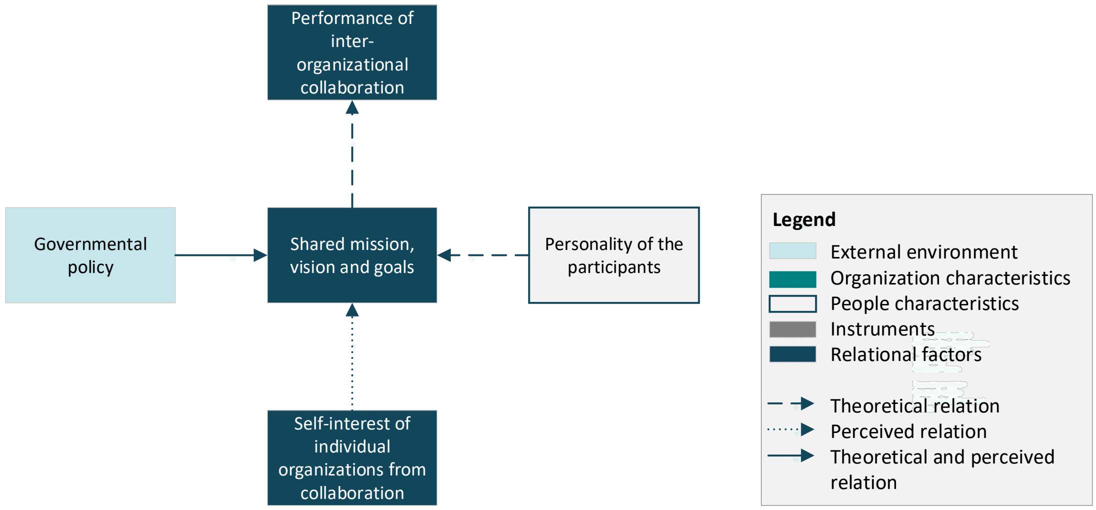

Figure 53: Shared mission, vision, and goals and its relations to other factors

Self-interest of individual organizations from collaboration (46) In Figure 54 can be seen that not one of the relations that are found are identified both in literature and in the case study. Literature only identifies factors that are influenced by the self-interests of organizations. Literature focusses more on the relational aspects of interdependence and commitment, whereas the case study is more focussed on the origins of these interests and thus more in the organizational characteristics. The commitment and interdependence of the organizations are perceived to be more of a given than a factor that is developed over time. Perhaps this can account for the absence of these relations in the interviews.

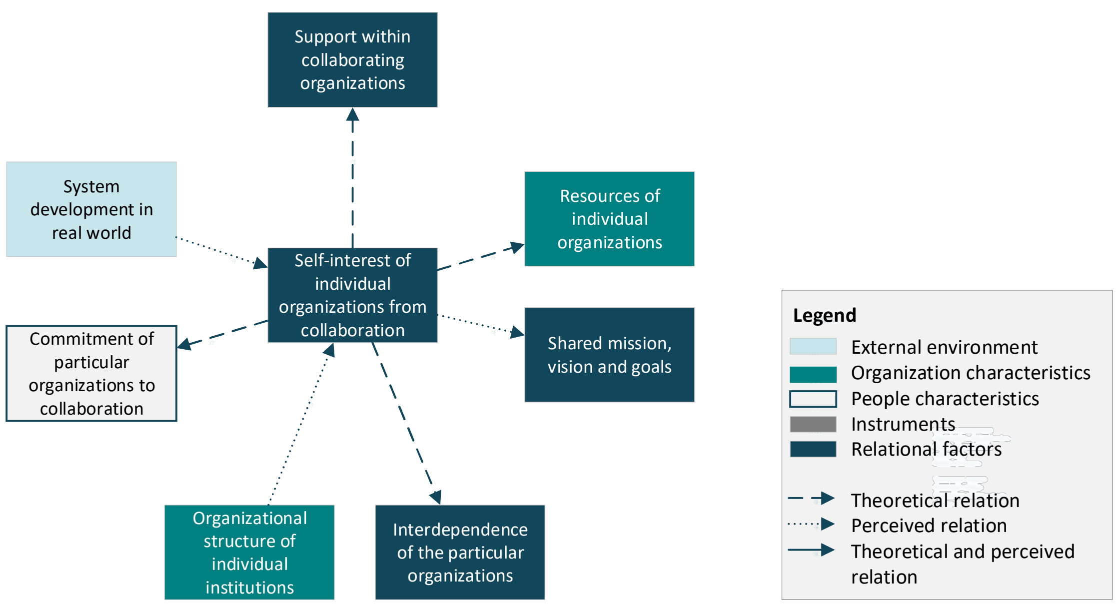

Figure 54: Self-interest of organizations and its relations to other factors

As the resources and support of organizations to the collaboration are mostly represented in the political debate and not in the individual organizations, the influences that are found in literature for the self-interest of organizations are in the case study assigned to political aspects.

There are two factors perceived to influence the self-interest. These two relations are based on the system development in the real world, combined with the organizational structures of the organizations. The organizational structures in strict pillars indicates that even though an organization as a whole has an interest, the different pillars also have different interests, so the department the politics is housed also influence the interests of the organization for this topic. The system developments influence the interests of the organizations as their goal is to change the system, each change therefore changes what to do next in the eyes of these organizations. This link between the system and the collaboration has not been identified in literature. Most literature on collaboration focusses on more network organizations than hierarchical pillar organizations. This could explain why the organization's structure was not mentioned as an influence on the self-interest of organizations.

The perceived possibility for a shared mission, vision and goal for the given self-interests has been discussed above.

Management of inter-organizational collaboration (59) There are no relations for the factor of management of the collaboration that are perceived both in literature and the case study. The relations that are found in literature *or* the case study are shown in Figure 55. The participants only mentioned factors that are influenced by the management, but did not specify what influences the management. Literature sees the management of a collaboration as a complex tasks, which is influenced by the dynamics within the team, such as trust, power inequalities, and decision making methods. Also two organizational characteristics are mentioned in literature to influence the management, the organizational structure and the leadership of the organization with organizational and communication skills.

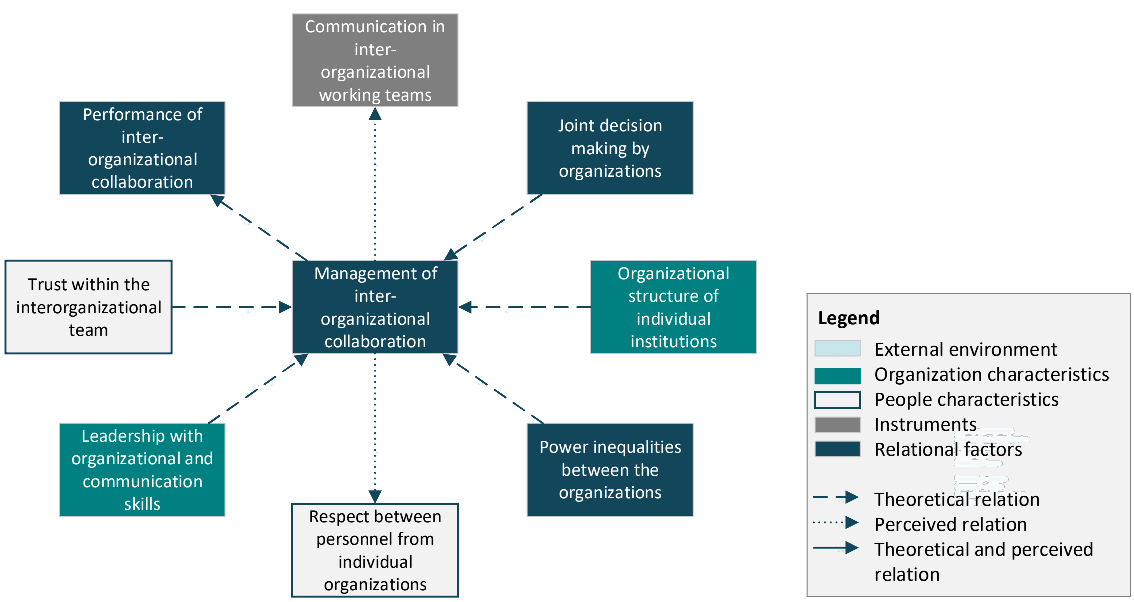

Figure 55: Management of collaboration and its relations to other factors

The participants generally did not elaborate on the way the collaboration is managed. The manager was also part of the participants, so perhaps this could have influenced the answers of the others. However all participants were instantly positive when asked about the management of the collaboration. Perhaps good management is not experienced as much as bad management, making most dynamics implicit for the participants. The participants did mention that due to the well-functioning management there is a lot of respect and open communication in the team.

It seems as if the literature focusses mostly on the difficulties of managing a collaboration and the case study on the positive consequences of the management.

Joint decision making by organizations (60) The relations between the factor for joint decision making and other factors that influence interorganizational collaboration are indicated in Figure 56. One relation is recognized both by literature and the case study, this is the influence of the coordination of the team on the joint decision making. Coordination includes the distribution of tasks and the clarity of responsibilities between the different parties.

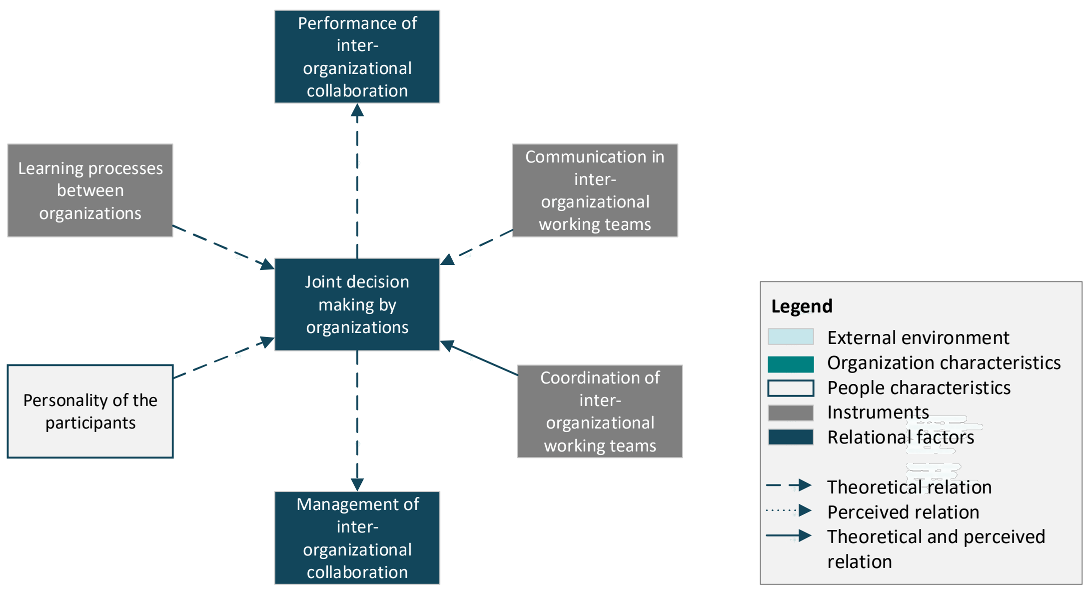

Figure 56: Joint decision making and its relations to other factors

The participants of the researched team do not have an explicit joint decision making mechanism, but the responsibilities and tasks are clear, and there is a high degree of communication and effort to align the views. However these communication and alignment efforts are not seen as joint decision making, but as regular collaborative actions.

In literature is joint decision making seen as a main aspect of collaboration. It is even mentioned as one of the conditions of a collaboration, in other words a collaboration does not exist if there is no joint decision making. This is not corroborated in the case study. Perhaps as there is generally a reasonable level of agreement among the participants there is no need for an additional decision making mechanism. This could also indicate why there is such a low recognition of relations from literature in the case study.

12.3.3 Interpretation of the results

There are two main interpretations or conclusions that stand out from the results and discussion of the 19 factors in section 12.3.1. The remarks are: (1) some factors have a greater need for validation than others, and (2) there is some discussion possible about the characteristics of some factors as a personal or organizational level process. The three remarks will be shortly discussed below.

First, all discussed factors will be represented in the validation survey. However, for three factors the need for validation has already been mentioned; (1) the level of shared knowledge as the goal of the collaboration, and the presence of an influence of (2) a shared mission, vision, and goal or (3) the current performance on the collaboration. The classification of the factor for knowledge sharing as a goal and the influence of the other two factors in the process of collaboration are unclear in the interview results. Their validation as a goal or an important factor is therefore more difficult to hypothesise as for the other factors of section 12.3.1.

Second, both questions in the interviews that relate to respectively the trust within the group and the learning process between the organizations were phrased on an organizational level. For example, the question relating to trust was phrased as ‘there is trust between the different organizations’. In both instances are the questions followed up by a question if this trust or learning process is developed on a personal level or an organizational level. The consensus in the interviews is that both aspects are personal process. However, for the development of trust the participants mention a range of personal characteristics (such as professional competence, mutual understanding, or informal relations) that influence the development of trust, whereas for the learning process only a few organizational characteristics have been mentioned. Perhaps this difference in perception is that the development of trust is a process they are more aware of and know better also on a personal level, rather than a learning process which may have never crossed their minds this explicitly. The personal character of the learning process should therefore be included within the validation survey.

Another remark is that in this interorganizational team the collaboration performs well, and the participants are all motivated to contribute. Together they also focus mostly on the aspects they can change (such as the sharing of knowledge and communication), whereas the aspects they cannot change (such as politics, organizational structures, and self-interest of the individual organizations) are perceived as a given and seen as the context they have to work in. This positive attitude indicates that it is not solely important to know which factors are perceived, and whether or not they are perceived as a barrier or a stimulants, but also how the team deals with these barriers.

The main difference between the results from literature and the results from the interviews in general is that literature focusses more on the reasons to start a collaboration and which context allows for the start of a collaboration, whereas the participants of the interviews mostly focussed on the process of the collaboration. As the collaboration has been going on for over a decade, the start of the collaboration is no longer an aspect for the process of the collaboration according to the participants. This difference is therefore not surprising, but does indicate that more research into the ongoing process of an existing interorganizational collaboration can be valuable.

12.4 Relations between factors

The relations between the nineteen factors, as well as for the theoretical factor for the complexity of the issue will be analysed in the same way as is done in chapter 11 for the theoretical factors only. The relations in Figure 57 differentiate between relations that were found in literature, in the case study, and in both. A perceived relation is included if it mentioned by two or more different participants. This is done to increase the reliability of these relations, even though they remain explorative.

The four open coded factors need to be assigned to one of the five categories to be able to identify the relations between these categories. The factor for commitment of the participants to the collaboration (67) is classified as a people characteristic as it deals with the commitment of the individuals themselves.

The factor for the system development in the real world (68) is classified as an external environment factor, as this development is seen as a process that cannot be directly influenced by the collaboration. Even though the collaboration is focussed on the development and implementation of policy measures which do aim to influence the development of the real world system, this effect is outside the scope of this part of the thesis, but is elaborately included in the second part of this report.

The factor for the tension between political concerns and concerns of the market parties (69) is seen as an external environment factor as well, as both the political parties and market parties are seen as external parties that cannot directly be influenced.

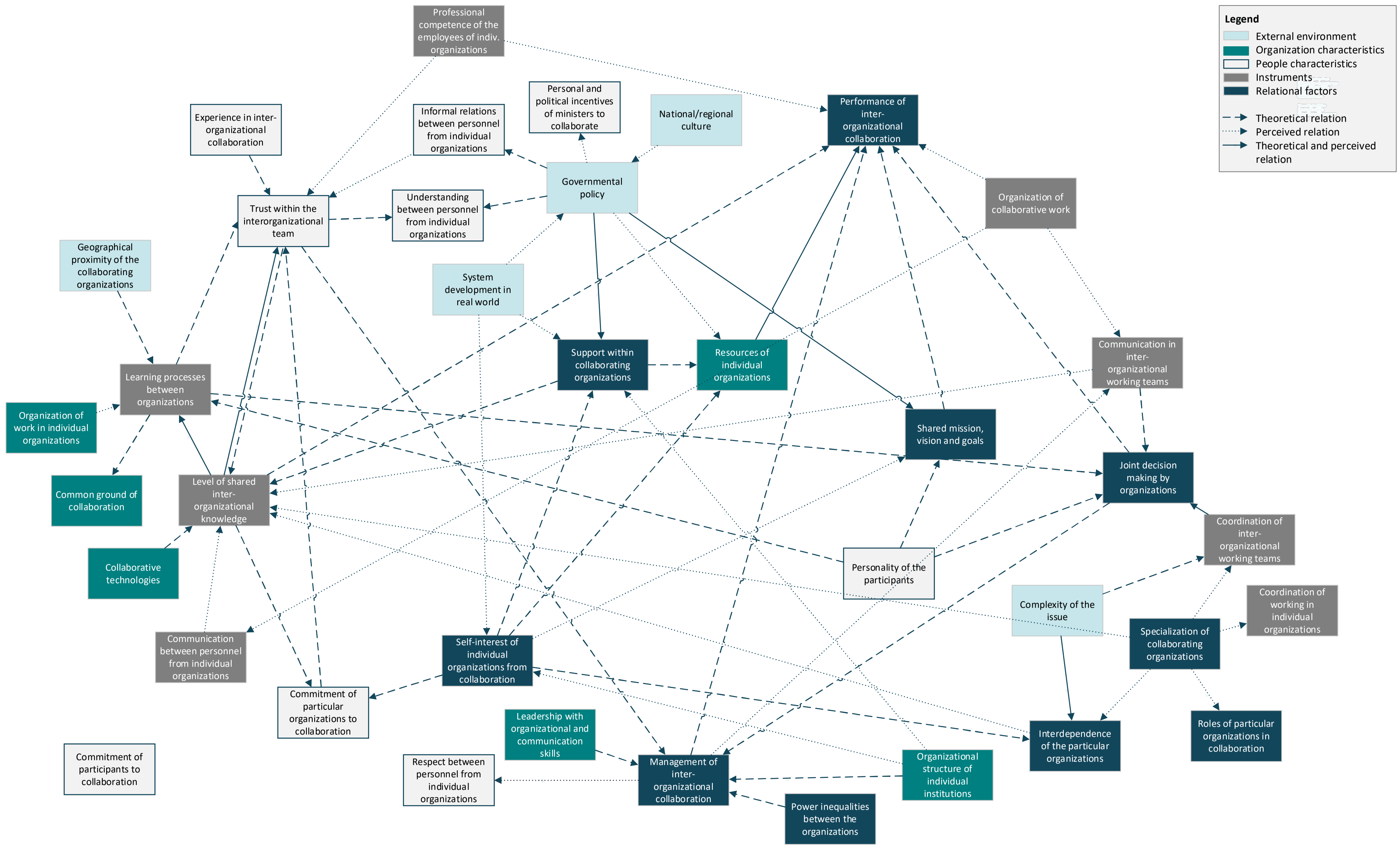

Figure 57: Relations based on the twenty identified important factors through literature and interviews

The last open coded factor for the availability of multiple networks of different organizations (70) is categorized as a relational factor, as this availability of different networks only occurs if the organizations have a relationship. This factors is not something one organization alone can alter, and is different for each relationship an organization has.

In Figure 58 are the relations depicted between the different categories. Here the types of relations, theoretical, perceived, and both, have all three been included as well. It is possible for all three types of relations to exist between two categories. First of all can the directionality of the relation be different. Moreover these relations are based on the relations in Figure 57. An example is the result that the factor for governmental policy (an external environment factor) influences the factor of support from the individual organizations (a relational factor) is both found in literature and is perceived in the case study. However, this does not indicate that all influences of external environment factors on all relational factors is based on literature as well as the case study.

There is one relation between two categories that exists in literature that is also completely perceived in the case study. This is the relation between the external environment factors and the relational factors. However, there have also been additional relation identified within these categories based on the interviews. Therefore there are still two types of relations presented in Figure 58 between the categories of external environment and relational factors.

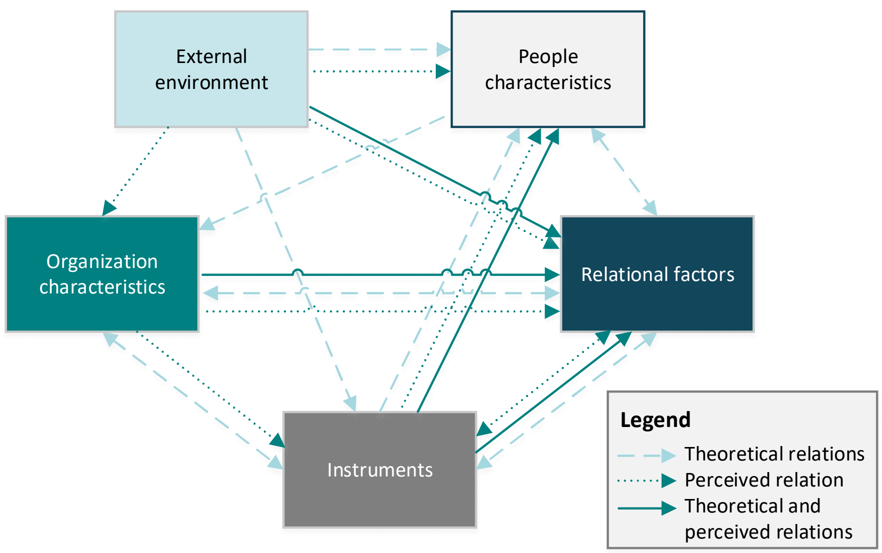

Figure 58: Relations between the five categories of factors according to the twenty identified important factors

12.5 Conclusion

The results of the interviews for the influence of the factors on interorganizational collaboration between public parties in the energy system of the Netherlands will be validated in chapter 13. Chapter 13 will conclude with the first validated theoretical framework. Chapter 14 then focusses on the extension of this validated theoretical framework for the relations between the most important factors.

There are the two types of complexity identified in the interviews. These types of complexities need to be further researched for the validation of the results. The types of complexities are (1) a strong interdependence between factors is perceived but the causality is unclear, or (2) a factor is perceived as important both in literature and in the case study, but the relations appointed to this factor are very different. Both complexities deal with the relations between factors. The first complexity includes only the perceptions, thus the results of the interviews, whereas the second complexity arises from the comparison between literature and perception.

This complexity is difficult to deal with. As is mentioned in chapter 11 is this research focussed on the identification of factors, and not on their relations. There are so many factors, creating even more possible relations, the vast number of options allows only for an exploratory research of these relations. Dealing with these complexities is therefore outside the scope of this thesis project

13

Validation of the factors for interorganizational collaboration

In chapter 12 is the first conceptual theoretical framework tested in the case study of this research. The interview results will be validated with a survey. Moreover, will the validated interview results lead to the first validated theoretical framework. This chapter explains the setup and result of the survey in section 13.1. The second section introduces the first validate theoretical framework.

The next chapter, chapter 14, will focus on an extension of this theoretical framework for the two most important factors of the theoretical framework. Which two factors these are is also explained in section 13.2.

13.1 Validation of the interviews with a survey

It is not possible to validate the influence of all identified factors of the interviews, as this would lead to a chaotic and enormous survey. As is mentioned in chapter 11 is the research into the relations purely exploration. The survey therefore focusses on the validity of the influence of factors on the process of collaboration, as well as the possible goals of the collaboration. As the participants have not questioned the reasons to start an interorganizational collaboration, their perception on this topic cannot be validated.

13.1.1 Survey set up

The survey includes nineteen factors that are represented with twenty statements. Two factors, knowledge sharing and governmental policy, have been divided into two statements. The factor for knowledge sharing is once represented as a factor that influences the process of collaboration, and once as the goal of the collaboration. The factor for governmental policy is divided into two statements due to the perceived dual influence of the factor between the political attention and electoral cycle.

The directionality of the statements, negative vs positive, is determined based upon the perceived directionality of the interview results. For those factors where the directionality was unclear, or both sides were mentioned, a positive directionality was chosen.

For each statement, except for the goal related statement, the same two questions were asked. The first question is 'If factor X is present, then this contributes to the positive continuation of the collaboration'. This question can be answered with a seven point scale ranging from 'completely disagree' to 'completely agree'. The fourth option is explained as the neutral option of 'do not disagree, do not agree'.

The second question was how often the consequences of the statement were experienced. Here the answer could be given as daily, weekly, monthly, yearly, or never. For both questions only one answer was possible.

These two questions were chosen as the perception of the importance of a factor is expected to be based both on how much the participants believe the factor contributes to the collaboration, as well as how often they experience this factor. For example, if the performance of the collaboration is perceived as having only a small influence on the positive continuation of the collaboration, but is experienced daily the impact of this factor is higher than if a factor is experienced as having a fairly large influence, but is experienced only on a year to year basis.

The result of this validation step will create an order of factors, the two most important factors will be researched more elaborately for possible methods that can enhance or better these factors within the collaboration. It is expected to be more beneficial to choose a factor for further research that is experienced regularly, as the willingness to enhance this factor will also come forward regularly.

For the goal related question ('the sharing of knowledge and information is the main goal of the collaboration') was only the first question asked. For the statement 'If more knowledge and information is shared, then this contributes to the positive continuation of the collaboration' were both questions asked.

The formulation of the statements was discussed with four Science Communication students. If the statements were unclear to them, or they interpreted them differently a new formulation was discussed and used. The order of the statements, as well as the introduction of the survey were discussed with É. Kalmár, teacher at the Delft University of Technology at the Science Education and Communication department.

Based on the conversation with É. Kalmár were the statements grouped into three categories in order to create a more coherent sequence of statements. The three categories are the organizational aspects, sensitive and conceptual aspects, and the rest. This grouping was used to determine the order of the statements. As the organizational aspects (specialisation and interdependence) were considered as non-sensitive this group of statements were placed at the beginning of the survey. The goal related question was the first question of the survey, as this question did not belong to any group and was also considered non-sensitive. The sensitive and conceptual aspects were asked last, to give the participants a chance to ease up on them. The other statements were put in between, and the statements belonging to the same category were placed together. This was done to try and create a coherent survey and not going from one end of the spectrum to the complete opposite and back. The more sensitive factors were introduced with a short message. This message introduced the last six more conceptual statements, in order to prepare the participant for the change in nature of the statements. Each statement was presented on a new online page, this increases the perceived ease of the survey and is generally regarded as more user friendly than having to scroll.

The complete survey can be found in Appendix K.

13.1.2 Results of the survey

The survey was answered by five of the seven participants, as two participants were still on vacation. The results of the survey will be discussed in three sections, first the validation of knowledge and information sharing as the main goal of the collaboration will be discussed. Then will the validity of the nineteen factors be discussed, the last section will provide a conclusion on the validity and the identification of the factors that are perceived as most important. These two factors will be discussed in the following two chapters.

To calculate the average responses were the answers translated into a numerical response. Table 34 indicates how the answers were translated.

Table 34: Translation of survey answers to values

Agreement with the statement	
Answer	**Value**
Completely disagree	1
Disagree	2
Somewhat disagree	3
Neutral	4
Somewhat agree	5
Agree	6
Completely agree	7

Frequency of experiencing the factor	
Answer	**Value**
Daily	5
Weekly	4
Monthly	3
Yearly	2
Never	1

Knowledge and information sharing as goal Four out of the five replies indicated that they agree with the statement that the goal of the collaboration is to share knowledge and information. The average value of the response to this question is five, which correlates to 'somewhat agree'. The division of answers among the participants is indicated in Figure 59.

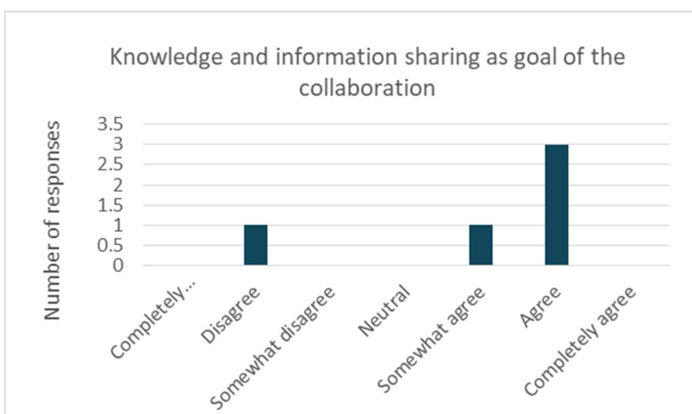

Figure 59: Survey answers to the statement of knowledge and information sharing as the main goal of the collaboration

This response does not definitively corroborate that for this interorganizational collaboration the main goal is knowledge and information sharing, but it does indicate that this is a possibility for interorganizational collaborations in general. The influence of the factor for knowledge and information sharing as the goal of an interorganizational collaboration will therefore be determined as validated for this research.

Validity of the factors The influence of a factor could be determined as valid if the average agreement has a value that is higher than 4 (the neutral value). This validation cannot be statistically determined, as the number of participants (n=7) is too low for any significance to be present. The small number of participants is further discussed in section 15.2.

In Figure 60 is the value of agreement that is higher than 4 indicated with the dark blue line. This possible validation criterion would indicate the factors for the learning process between organizations (36), the influence of the political cycle on the development of the long term vison for the collaboration (1b), and the influence of the individual political interest of the organizations (46) as not validated.

Figure 60 indicates the average responses of the participants. However, average values can obscure some essential information. For example, the factor 1b, indicating the influence of the political cycle on the development of the long term vison for the collaboration has an average value of 3, but has a range of 1 through to 7 (form completely disagree to completely agree), where the answers are [1, 2, 2, 3, 7]. Here the average and the range create a skewed picture. The same survey results as in Figure 60 are depicted for their median in Figure 61. The median indicates the 'middle' number in the list of answers when they are ordered from low to high. For the statement 1b, this is the value of 2. The median includes more information on the division of responses from the participants than the average value or range does.

If the same validation criterion for validation of an agreement value of higher than 4 is used for the median of the responses the same three factors will be indicated as not validated. This criterion for Figure 61 is again indicated by the dark blue line.

These three factors also have the lowest perceived frequency of experience, which indicates that the participants do not often run into the consequences of these factors.

There were two factors where the influence of this factor on the collaboration process was unsure, even though these three factors were mentioned often, the participants did not seem to agree on the importance or influence of these factors. These two factors were the influence of a shared mission, vision, or goal (44) and the influence of the current performance of the collaboration on the continuation of the collaborative process (57). These two factors will be more elaborated on specifically.

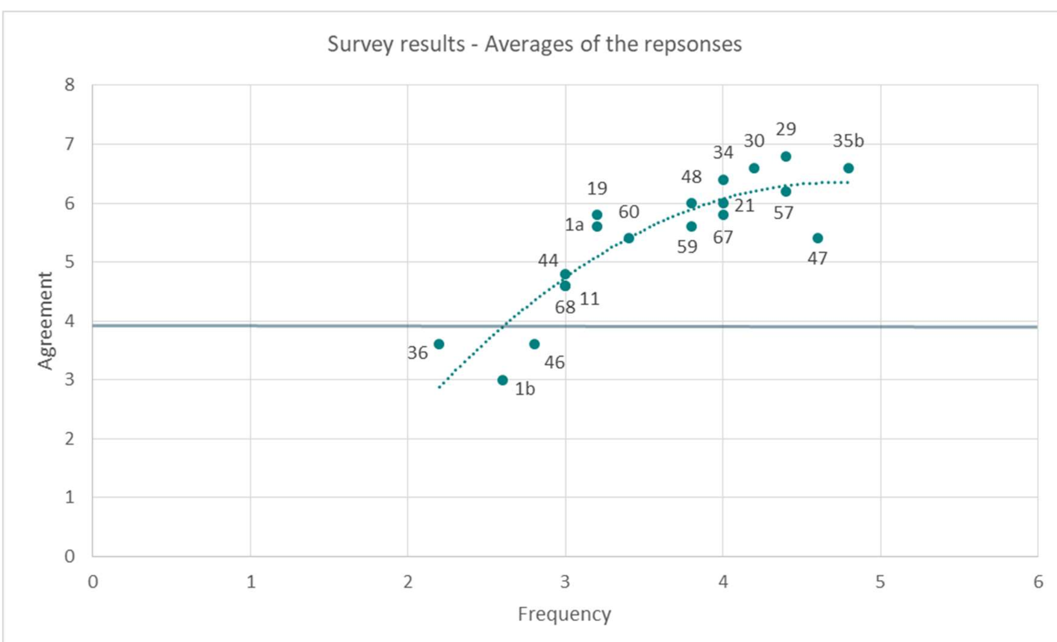

Figure 60: Overview of the results of the survey based on the average of the responses

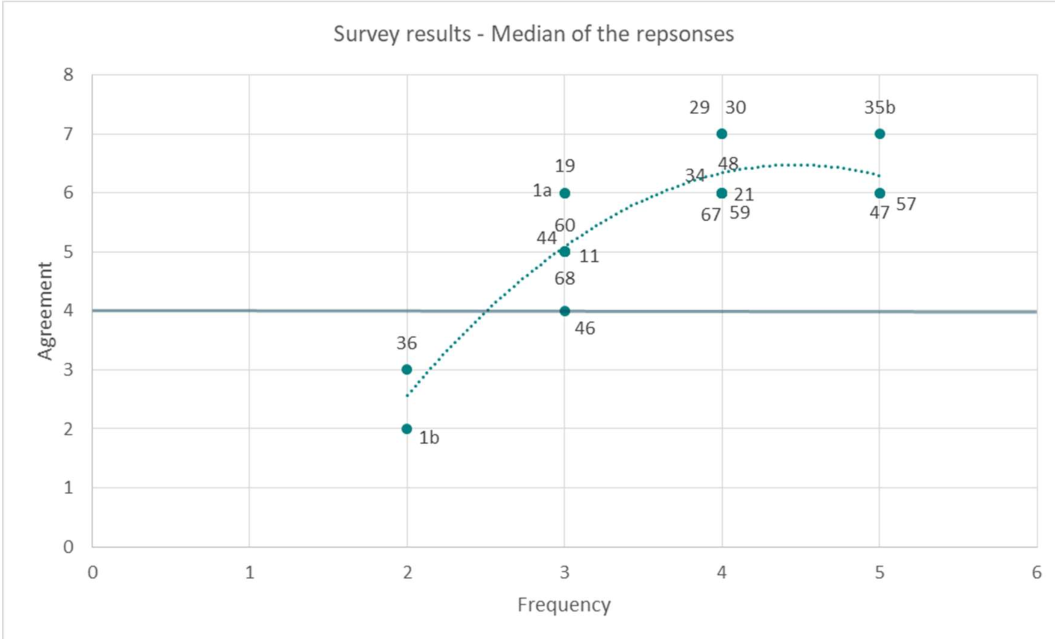

Figure 61: Overview of the results of the survey based on the median of the responses

Shared mission, vision, and goal (44) The factor for a shared mission, vision, and goal was mentioned often in the interviews, but the participants were not in clear in their expectations whether or not this factor is important. The shared mission and vision were mentioned as vague or once as lacking, but not one participant indicated that this was a barrier in their collaboration. Both based on average and median responses is the agreement value for this factor higher than four (resp. 4.8 and 5), but not by much. The responses of the participants also indicate a division for this factor where two participants do not perceive this factor to influence the collaboration, and three participants do perceive this factor to influence the collaboration. The individual answers of the survey for this statement are depicted in Figure 62.

Based on the validation criterion is this factor validated within the survey, and will be regarded as such in the remainder of this research. However, the consequences of this validation should be researched carefully for this factor.

Performance of inter-organizational collaboration (57) The interviews indicated a positive perception of the current performance of the collaboration, but did not indicate if this current performance is perceived to influence the continuation of the collaboration in the future.

All participants agreed (to varying degrees) that the current performance of the collaboration positively influences the continuation of the collaboration, as is indicated in Figure 62. Also the average and mean values for this factor are both higher than four (resp. 6.2 and 6). The influence of the factor for the performance of the collaboration on the continuing of the process of collaboration is therefore validated.

Additional remarks on the validity of other factors Besides the factor for a shared mission, vision and goals, there are four other factors that have answers of participants that correspond with disagreement as well as with agreement. The three not valid factors also have answers at both sides of the spectrum. Due to this difference in answers will the validation of the factors be divided into three groups instead of two (valid vs not valid). These three groups are: (1) validated, (2) cautiously validated, and (3) not validated. The factors that have a higher average and median agreement than four and all answers are in agreement, are indicated as validated. The factors that do have a higher average and median agreement than four, but have responses on both sides of the spectrum will be indicated as cautiously validated. The factors with an average and median of four or lower will be indicated as not validated.

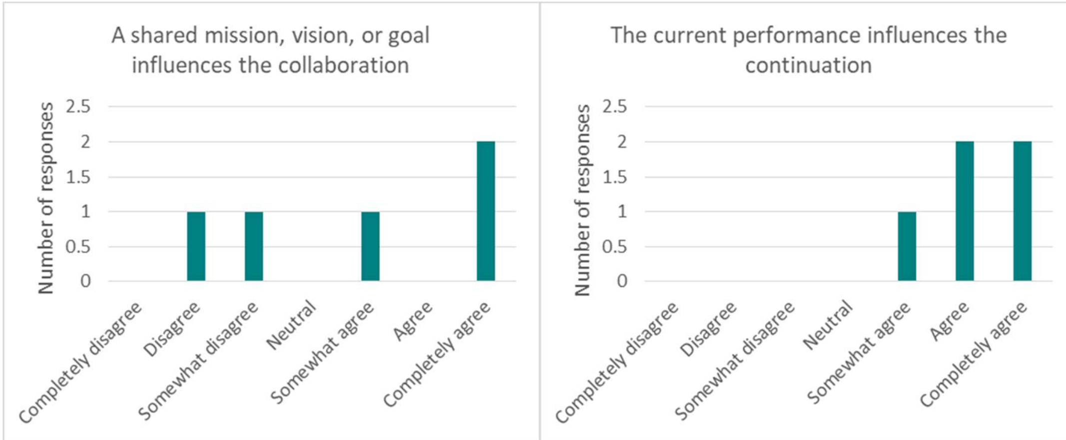

Figure 62: Responses to the statements for the influence of a shared mission, vision, or goal, as well as for the current performance of the collaboration on the continuation of the collaboration

The factors for the sharing of knowledge and information (35) and the influence of government policy (1) were divided into two statements.

The factor for the sharing of knowledge and information in the collaboration was both askes as the main goal of the collaboration, as well as an influence on the collaboration. Both aspects are determined as validated (see the beginning of this section for the validation of the goal). The factor for the influence of knowledge and information sharing is agreed upon by all participant to be of influence on the collaboration itself, as the average and mean values are both higher than four (resp. 6.6 and 7). Additionally is none of the responses for this statement lower than 4 (the minimum is 6) indicating that all participants agree.

The factor for the influence of government policy is divided into one statement that focusses on the influences of political tensions on the time left for the participants to collaborate (1a), and one statement that focusses on the influence of the political election cycle of for years on the ability to have a shared, long term, vision in the collaboration (1b). The first statement (1a) is validated both through average and median values, but does have answers at both sides of the spectrum, and is therefore listed as 'cautiously validated'. The second statement (1b) has already been discussed and is not validated. The asked influences of government policy were on other factors of collaboration instead of on the process of collaboration as a whole. This was done based on the large differences in views of the participants of the interviews. The identified relations will be included in the theoretical framework, see section 12.4.

Identification of the factors that are perceived as most important The perceived importance of the factors is dependent on both the agreement and frequency. If a factor is perceived as contributing to a great extent to the collaboration, but is only experienced once a year, the members of the interorganizational collaboration are likely to be less aware of these factors. Figure 63 and Figure 64 indicate the most important and most frequently experienced factors based on, respectively, the average and median results of the survey.

In both cases is the factor for the sharing of knowledge an information perceived as the most important factor to influence the collaboration process. As this factor is also perceived as the goal of collaboration it is difficult to know how much of the importance is based in the goal aspect, or based on the collaborative process aspect.

The factors that are agreed with on (almost) the same level as the sharing of knowledge, but are less often experienced are the factor for communication between personnel of the individual organizations outside of the team (29) and the communication within the interorganizational team (30).

The factors that are experienced (almost) as often as the sharing of knowledge and information, but are a little less agreed on by the participants are the factors for the performance of the collaboration (57) and the specialisation of the individual organizations (47). The five mentioned factors are perceived as the most important factors.

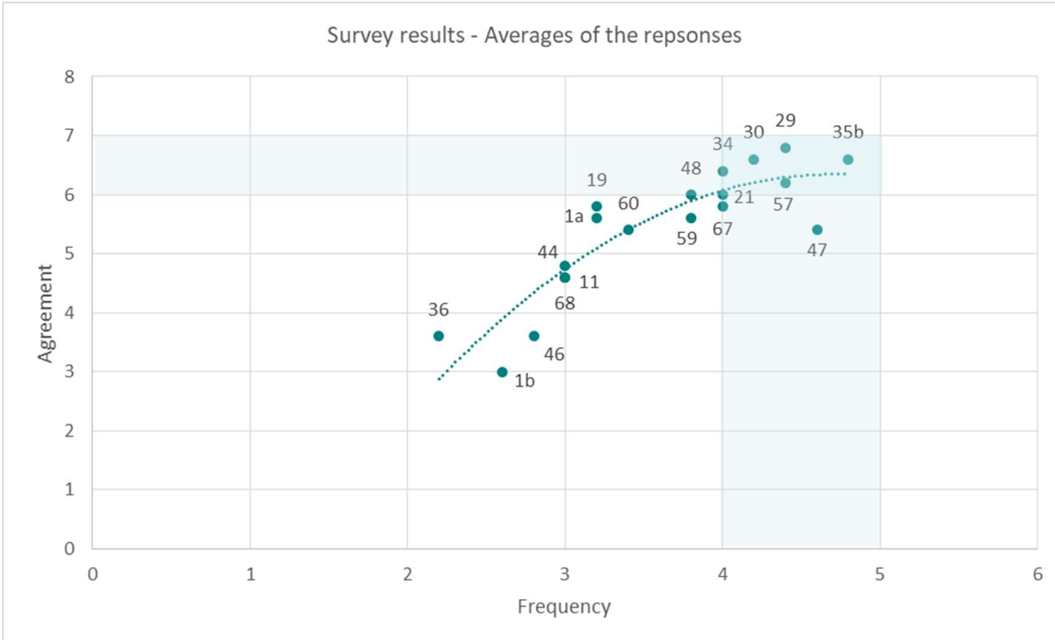

Figure 63: Important perceived factors based on the averages of the results of the survey

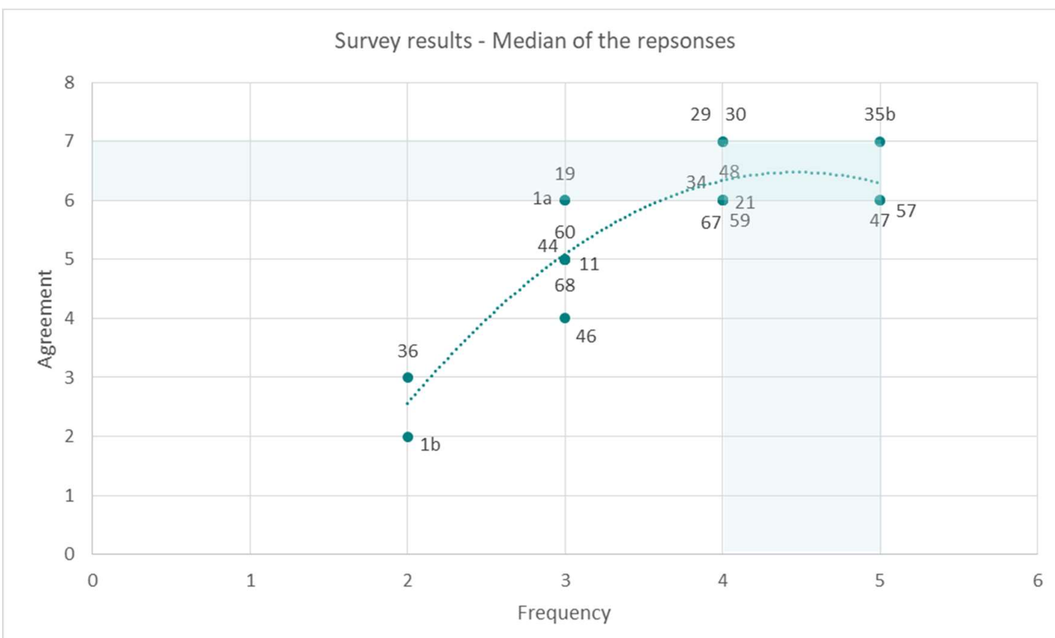

Figure 64: Important perceived factors based on the medians of the results of the survey

13.2 First validated theoretical framework

As is explained in section 12.5 are mostly the influences of the factors on the collaboration as a whole validated. The relations between the factors remain conceptual, except for the influence of governmental policy (1) on the available resources for the collaboration (11).

For the higher level relations, between the categories of factors, has the validated framework one additional relation between categories. This is the relation between the external environment and the organizational characteristics. This relation is perceived in the case study through the factors of government policy and the available resources for the collaboration. The relation between the external environment and organizational characteristics was also originally included by Kozuch and Sienkiewicz-Małyjurek (2016), but excluded based on the additional literature research.

The first validated theoretical framework is depicted in Figure 65. As the interviews did not discuss any factors that influence the motivation to start an interorganizational collaboration, this aspect of collaboration is excluded from the theoretical framework.

Based on the analyses of the survey results will two factors be chosen to be analysed further. Five factors have been identified as being perceived as important. These five factors are;

- Professional & informal communication between personnel from individual organizations (29)
- Communication in inter-organizational working teams (30)
- Level of shared knowledge (35)
- Specialization of collaborating organizations (47)
- Performance of inter-organizational collaboration (57)

The level of shared knowledge (35) is also perceived by some participants as the goal of the collaboration and is therefore more difficult to analyse. It is unclear to what extent this importance is based on the achieving of the goal of the celebration, or on the influence on the process of collaboration.

Both the factors for the specialization and the performance of the collaboration as a whole are difficult to be influenced by the participants if the interorganizational team. However, the communication within the team and with other employees of the individual organizations are possible to be influence by the participants themselves.

The analysis of the following two chapters focusses on possible methods of influencing the most important factors for collaboration. Due to time constraints both for the researcher as well as for the participants cannot all five factors be further analysed. As the following research steps will include the same participants as for the interviews and the survey, the two factors that can be influenced by the team itself will be chosen to be further analysed. These two factors are the communication between employees of the individual organizations both within the team (30) and outside of the team (29). The next chapter explains the literature research that was done to identify possible methods of enhancing these factors.

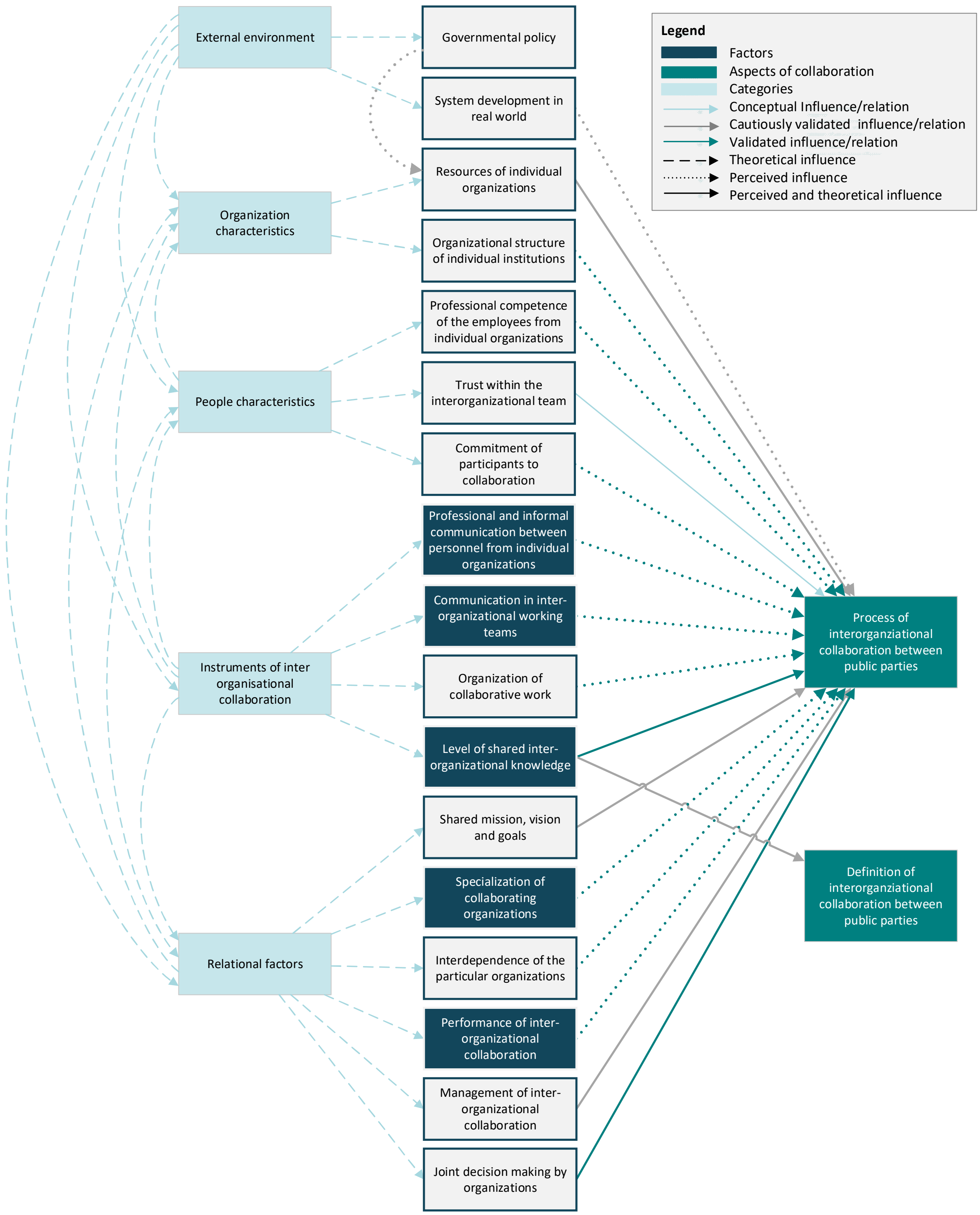

Figure 65: First validated theoretical framework of the twenty most important factors.

14

Methods of influencing communication in interorganizational collaborations

The survey results led to the identification of two factors that are perceived as important. These two factors are 'Communication in inter-organizational working teams' (30) and 'Professional and informal communication between personnel from individual organizations' (29). How the team can influence these factors is researched in this chapter. The research into how the different factors can be influenced focusses more on the relations between the factors.

In order to analyse how the communication, both internal and external to the interorganizational collaborative, can be influenced a second literature search is done to extend the theoretical framework for these factors. The literature search is presented in sections 14.1 and 14.2. The second conceptual theoretical framework is presented in section 14.3, and will be validated for this case study with a focus group in sections 14.4 and 14.5. The second validated theoretical framework is presented in the last section of this chapter, section 14.6.

14.1 Method – Literature research

This second literature search is focussed on possible methods to influence the communication within and outside the interorganizational collaboration team of public parties. The literature search is executed following the same principles as mentioned in chapter 11.

The initial literature search into the communication for interorganizational collaborations identified a single eligible article. This article focussed on online communication methods for collaborating parties. To gain more in-depth insights was also for this literature research an additional search done into the requirements of the design of online collaboration platforms.

The full description of the method for the literature search both for possible methods to influence the communication for interorganizational collaborations, as well as for the requirements of the design of online collaboration platforms can be found in Appendix H.

14.2 Results - Literature research

There are two aspects to communication, the form of communication and the content of communication. Both aspects will be discussed below.

The identified relations between communication and the factors of the first validated theoretical framework that identify collaboration are depicted in Figure 66. The literature of chapter 11 indicates the need for effective (Berardo et al., 2014; Conteh, 2012; Dorado & Vaz, 2003; Imperial, 2005; Williams, 2002) and efficient (Barretta & Busco, 2011; Raisiene, 2011) communication. The effectiveness of communication mentions the need for face-to-face communication. The need for efficiency of communication is supported in the interview results, where the shortage of time is indicated as one of the main barriers that the collaboration endures.

The overall perception is that the current method of organization of the collaboration is sufficient. There are biweekly meetings, and additional one on one (digital) contact between the participants.

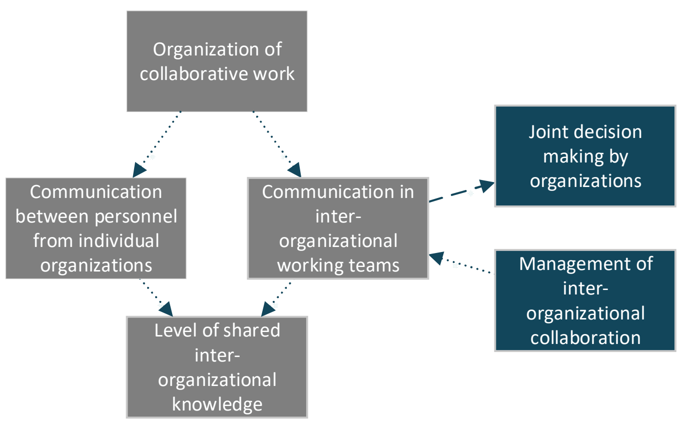

Figure 66: Identified relations for the factors for communication within the interorganizational team, as well as between other personnel form the individual organizations

14.2.1 Initial literature search of communication for interorganizational collaborations

The identified article in the initial literature search for communication in interorganizational teams indicates another form of communication. Agerdal-Hjermind (2015) mention the use of social media within governmental organizations, between governmental organizations and from governmental organizations to the public. The remainder of the article focussed on blogging as social media use for public organizations towards the general public.

The idea of online communication (of which social media is a part) can aid the efficiency of communication when time is scarce. This idea of digital communication was further developed into a previously researched area in one of the courses of the SEC master programme of a virtual platform for collaboration (Van der Sanden, 2016). A platform can both aid the communication between the members of the team, as well as between other employees of the individual organizations. The conceptual idea is a combination of platforms like 'Intranet' and 'Facebook'. The intranet aspect of the platform would be available to all relevant ministries and implementation organizations. This can be used for messages on new policies, a forum, and a 'smoelenboek' where each employee can indicate their specialty and a messaging service to decrease the threshold of contacting this employee form another organization. For the collaborative teams could there be an additional aspect to the platform that is similar to a 'Facebook group'. This part of the platform would be closed off from other employees of the organization, to provide more privacy in the communication within the team. This part of the platform can serve as an efficient method to communicate ideas with all participants ate the same time and can create overviews of the discussed topics more easily than saving email threads between all participants.

The joint decision making can then be (partly) based on the discussions and views that are represented on the platform, whenever there is no time to discuss the outcomes of the online discussion face-to-face. There remains a perceived influence of management on the (online) communication within the team. The online communication should also be managed, and evaluated in the face to face meetings once an issue occurs.

An additional search was done to identify key aspects of online communication and collaboration platforms. This search is further elaborated on in section 14.2.2 below. The additional literature search focussed on the requirements of the design of online collaboration platforms.

14.2.2 Additional literature search of communication for interorganizational collaborations

The article by Spagnoletti, et al. (2015) mentions three structures of online 'communities'; information sharing, collaboration, and collective action. The interorganizational collaboration discussed in this thesis project is similar to the definition of collective action groups (Spagnoletti et al., 2015, p.367):

> *"Actors follow a common goal and abide by common rules established by group membership. It represents a social interaction structure in which regulations are complex and a close coordination is required. Decisions made by group members prevail over personal interests. A strong internal cohesion typifies collective action so that the individual may identify herself with this social unit. While collaboration tends to focus on completing a task through division of labour and coordination among actors, collective action tends to focus on reaching a consensus, making a collective decision, and acting as a group with shared values and trust. Good examples are the applications of e-participation adopted by social movements, political parties, and governments."*

The digital collective action platform that Spagnoletti, et al. (2015) should engage the participants to exchange concrete information and provide coordination mechanisms. Examples are collective decision making processes, user identity management, ability to browse the history of their activities, and voting mechanisms. Each user should also be able to start a new information sharing process, or decision making process (Spagnoletti et al., 2015).

Spagnoletti, et al. (2015, p.376) also mention two requirements for the platform to work that will be included in the conceptual theoretical framework:

> *"Since trust and shared values and beliefs are key requirements for supporting collective decision-making in online communities, it is crucial to ensure the transparency of the overall process."*

The idea of an online communication platform as an organization form of the collaboration and which requirements the participants see for the communication platform will be discussed in the focus group meeting. The design principles as proposed by Spagnoletti, et al. (2015) will be used as discussion starters in the focus group. This will be further elaborated on in section 14.4. Also the identified relations of Figure 66 above will be researched in the focus group.

14.3 Second conceptual theoretical framework

The theoretical framework is updated to include the relations between the factors that are expected to be concerned with the communication between the organizations, both internal and external to the interorganizational team. The second conceptual theoretical framework is depicted in Figure 67. The theoretical influence of the organizational structure on communication is explained in chapter 11, and depicted in Figure 66 of this chapter. This figure also indicates three perceived relations, these relations have been explained in chapter 12.

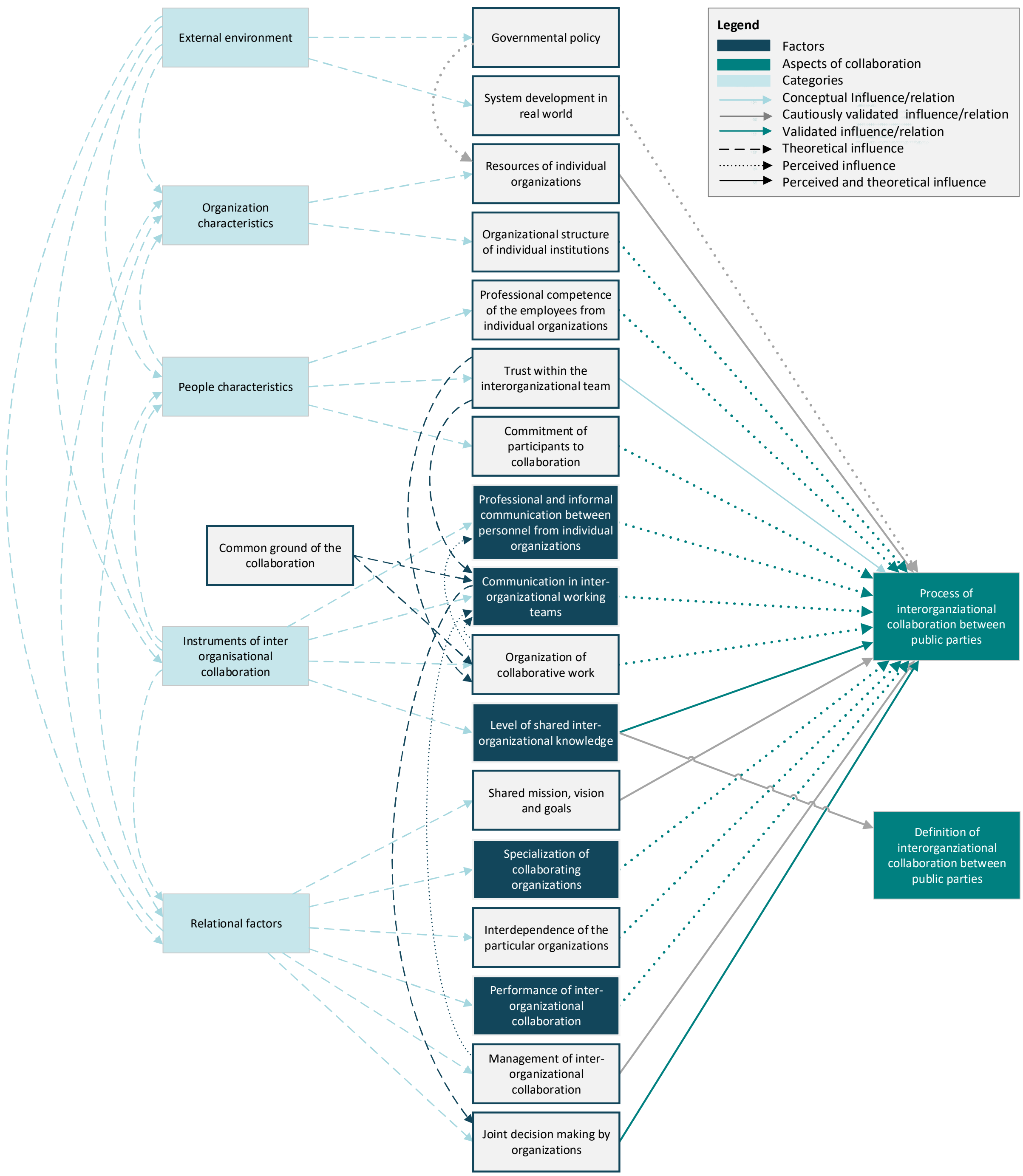

Figure 67: Second conceptual theoretical framework based on the influences on communication between the organizations, both internal and external to the interorganizational team

The theoretical influence of the factors for trust and common ground of the collaboration on communication are based on the analysis of the article by Spagnoletti, et al. (2015). The validity and explanation of the additional relations is researched in the focus group and discussed in the next sections.

14.4 Method – Focus group

The testing of the second conceptual theoretical framework will be done with a focus group. The second literature research focussed on how to influence or maintain the communication between the individual organizations, both within and outside of the interorganizational team. This section will elaborate on the used method for the focus group.

A focus group should not be confused with a group interview. A focus group is not only interested in the answers of the participants, but also how the discussion among the participants took place. In other words, how the answers were conceived. Bryman (2013, p.501) explains:

> *"Most focus group researchers undertake their work within the traditions of qualitative research. This means that they are explicitly concerned to reveal how the group participants view the issues with which they are confronted; therefore, the researcher will aim to provide a fairly unstructured setting for the extraction of their views and perspectives."*

This explanation of focus groups will be the guideline of the focus group for this thesis project. The discussion of the focus group will be recorded and transcribed.

14.4.1 Selection of participants

The same participants as for the interviews were invited for the focus group. They form an interorganizational collaborative team, and their views led to the identification of communication as an important factor for their collaboration. Discussing how to stimulate and/or maintain this communication will therefore also be discussed with them.

14.4.2 Intended role of the mediator and the general 'rules' during the focus group

The intended role of the mediator is as small as possible. The mediator will provide the necessary information at the beginning, will enforce the rules, will suggest ideas if the discussion falls silent, and will monitor the time.

The general rules during the focus group are; (1) one person will speak at a time, this is important for the recording of the focus group, (2) everyone's views are important, as this is just an open discussion on possible future collaborations, and lastly (3) there is no need to reach a conclusion or consensus on a topic, the content is more important than the conclusion.

Other conditions for the focus group are the anonymity of the results and that at the beginning of the focus group the content is introduced and the form of the focus group explained.

14.4.3 Content of the focus group

The focus group will discuss two topics. The first topic is the suitability of an online collaborative platform to maintain a high level of communication, and possibly include more people from outside the collaborative team. The second topic is based on Part II of this thesis report and includes the possible use of the 7-step methodology and proposed API (Analysis of Policy Interference) tool as a strategic discussion aid in interorganizational teams.

Online platform The explanation of an online collaborative platform will be based on the analysis in section 14.2. If the discussion falls silent the topics of organization of the platform, management of the platform, trust, common ground for collaboration, and the joint decision making possibilities of the platform can be mentioned by the mediator.

Which topic will be mentioned is dependent on whether or not the other topics have been mentioned or where the discussion was going to before it fell silent. However, if the discussion does not fall silent, the mediator will not interrupt the going discussion.

7-step methodology and API tool The discussion on the 7-step methodology and API tool will be explained after the discussion on the online platform, but will be mentioned at the start of the focus group when the programme is explained.

In the interviews was mentioned that the team has strategic discussion once or twice a year. These discussion focus on the sharing of ideas and hopes for the future as well providing the time and space for a non-content related discussion. The participants will be asked if they think the 7-step methodology combined with the API tool could be a valuable tool as a start to, for example, a strategic discussion. The tool can be used as a group exercise to get a feeling for the current system, as well as a tool to test new policy measures, or identify 'gaps' in the set of current policy measures. If and under what conditions a similar tool is useful will be the topic of this second part of the discussion.

14.5 Results – Focus group

During the focus group was mentioned that the governmental organizations can use a platform called Pleio. This allows the users to share files within a group and post news messages. The participants were less familiar with possible tools such as the 6-stpe methodology and API tool for the purpose of strategic discussions or idea generation.

The results of the focus group will be discussed for the two topics and the behaviour of the participants during the focus group.

Three participants were present during the focus group, and a fourth joined later on. The initial three participants represented one ministry and its implementation organization. The fourth participant was from the second ministry. The effects of the smaller sample of participants in the focus group, as well as the lack in representation of all organizations is further elaborated on in section 15.1.

14.5.1 Factors that influence the use of an online communication platform

The participants of the focus group mentioned seven of the already identified factors that influence the use of an online platform, and one newly identified factor. They all agreed that these factors influence the use of the platform. These eight factors will be discussed below for the adoption of an online platform, the use of an online platform, and possible effect of an online platform for communication.

Adoption There are three factors mentioned that play a role in the adoption of an online platform. Both the organizational culture and the personality of the participants influence whether or not a platform will be received positively by the participants. In this context mentioned two participants: 'perhaps I am a bit old-fashioned in that sense'. Which illustrates that the adoption of new technologies or other work methods are not received positively by everyone.

A third participant added that on a whole 'perhaps the government is old-fashioned in its adoption of new technologies'. It is important that the technology is institutionalised carefully into the organizational cultures, and people's preferences are included in the adoption of technologies.

One participant also mentioned that it takes a lot of time to adopt new technologies and that this time is something they do not have in abundance. The time it takes to learn and institutionalise a new work method is seen as another reason not to change.

Use There are five factors mentioned that influence the use of an online platform once it is implemented. One participant mentioned that in order for a platform to work effectively the collaboration has to perform well already. One participant said that in a previous collaboration programme where Pleio was used this did not provide any added value. The platform was only used because the use was expected of the programme leaders and was updated late and did not provide a stimulant for communication in that team. This participant added that 'perhaps if the collaboration itself had worked better, the use of the platform would also have been better'.

The participants mentioned that in order to keep using the platform people need enough time to institutionalise the platform within the collaboration as well. The experiences with Pleio of one participant were that people would post documents and other remarks on Pleio and then email the whole team that they did this. This method of using an online platform mostly increases the number of notifications the participants receive each day. The participants see the need for the use of the platform has to become instead of using email or calling, and not alongside the already existing communication methods. There are two factors mentioned to support this feeling, the extra time it takes to read or discuss things twice, and the number of notifications that increases by using multiple communication methods for one message.

Another factor that is mentioned is the need for commitment of a team to use the platform. The communication on an online platform and its benefits of having an easy accessible register of the history and developments in the collaboration only works if the team as a whole is committed to use the platform. One participant mentioned that 'you have to communicate, and you can choose which method to use, it [a platform] only works if people are enthusiastic about it'.

The last factor that is mentioned to influence the use of the platform is the management of the platform (*het beheer*). This management is perceived to take time, but that good management can reduce the number of notifications, and keep the platform functional for communications and as a logbook, without it being a burden on the team.

Effects The participants mentioned one possible effect of an online communications platform that could benefit the collaboration. This added benefit is the possibility to include other organizations in the collaboration more easy. One participant also mentioned that it could aid the sharing of information between the organizations as a whole, but that by following some people of these organizations on twitter this information is also received. This again points to the perception that an online platform would be on top of all the communication methods that are already used.

The influences mentioned in the focus group are depicted in Figure 68 below.

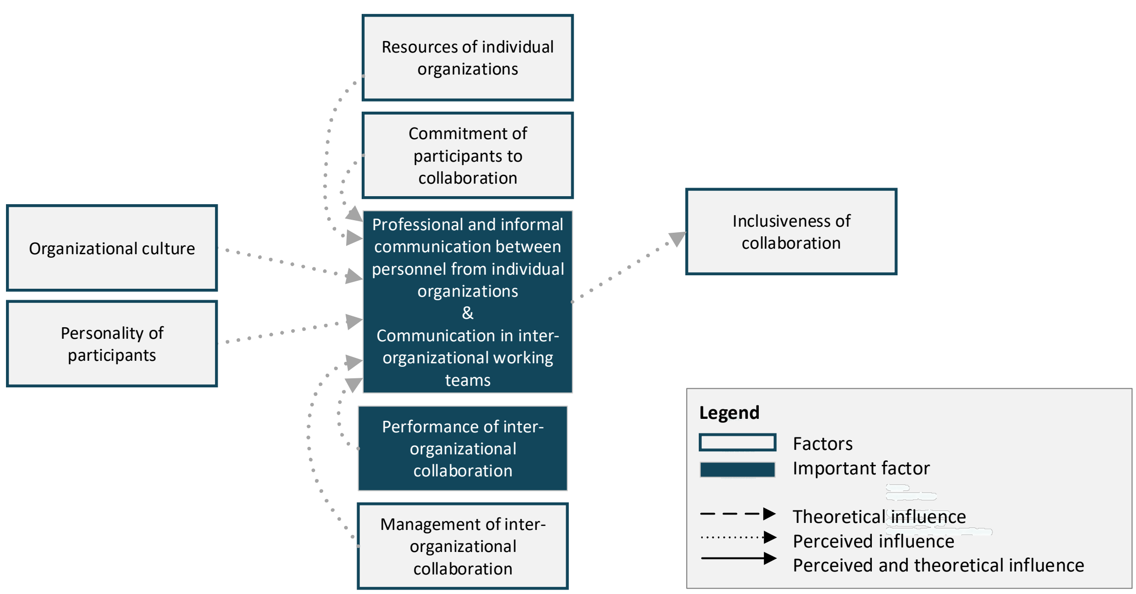

Figure 68: Perceived influences on communication within the interorganizational team, as well as between other personnel form the individual organizations

14.5.2 Use of the 7-step methodology and API tool

The introduction of the 7-step methodology and the API tool was more complex than the introduction for the online platform. The tool was presented as a possible method to start a discussion and as an interactive exercise to align the ideas of the participants on the system level of policies for EV in the Netherlands. For example, there could be a large ‘master file’ that contains all implemented policy measures of the Netherlands in a sector (or as a whole) similar to the results of the case in Part II of this thesis report. If this master file is present the team can look through the already present policies, and discuss their interpretation of the system, e.g. where are holes, where a lot of interference is, is this interference positive or negative, how can we manage this interference, etc. Another version can be that the participants create a smaller version of the system overview themselves as an interactive exercise to discuss the present state of the policy system. This does not have to be complete, or entirely correct, it is more the exercise that matters. After this exercise the result could be compared with the master plan to see what information they missed. This could the lead to new possible insights into why they missed this information, as well as how the (policy) system works. There were some positive reactions on the 7-step methodology and API tool, as well as some more reserved reactions.

Possible drawbacks are that the collaboration is mostly working on a higher level of detail than the presented methodology and outcome for EV in the Netherlands and the time it takes to use the methodology and tool. Even though this methodology could be applied to a higher level of detail, this should be tested first. The time it takes is dependent on the conditions of use. If there is a master file, it is possible to compare with and make us of this master file, decreasing the time that is required to follow the steps.

The positive aspects could be the interactive nature of the tool and the possible new insights that can lead to new discussions. However the participants had difficulties with looking past the (more practical) drawbacks, possibly due to the complexity of the methodology and tool and the limited time for explanation during the focus group.

14.5.3 Behaviour of the participants

The discussion among the participants was an open discussion, most of the time they would speak one person at a time, while the others listened intently. One participant often asked the opinions of the others during the discussion and whether or not the others shared the same views. Whereas another asked the more critical questions to the mediator, which sometimes seemed as a role of guardian of the team. The third participant was more philosophical and referred to the bigger picture more often.

Topics that were discussed were non-sensitive topics, and the participants did not seem to hold back. This is illustrated with some more personal answers as well, such as the ‘perhaps I am old-fashioned statement’ and the relatively equal participation of all participants.

The behaviour within the group is open, interested, and enthusiastic. This corroborates the general notion among the participants that the communication in the collaboration works well and is easy.

14.6 Second validated theoretical framework

This section will focus on the use of an online communications platform in interorganizational collaboration. Chapter 17 reflects on the second part of the focus group, the discussion on the use of the 7-step methodology and API tool.

The factors and relations discussed in section 14.5 differ from the results of the literature research in section 14.2. The most important differences seem to come from a more pragmatic focus among the participants. Literature indicated mostly conditions in which (online) communication can function, these conditions are trust and a common ground in the collaboration. The participants mentioned as a condition that the collaboration in itself should function properly for an online communications tool to function well. Perhaps in this more general condition the trust and common ground influences are included. However, the need for a common ground in the collaboration is not validated in the semi-structured interviews and survey.

The more pragmatic focus resulted in the influence of resources (especially time) and a day to day commitment of the participants to use the online communication platform. Also the organizational culture and personalities of the participants influence the use of the platform, as some organizations and individuals will be less inclined to change their ways.

Literature identifies one effect of online communication, an easier joint decision making process. This effect is not recognized in the interviews. However, another effect is mentioned, the possibility for a higher inclusion of organizations in the collaboration.

The final theoretical framework includes both the theoretical and perceived influences identified for (online) communication, although neither are validated due to the large differences in literature and the results of the case study. The second validated theoretical framework is depicted in Figure 70.

The most important factors and their influence can all be seen from a perspective of knowledge and information sharing as the goal of the collaboration. The specializations of the organizations create the knowledge and information that is required to be shared in order to successfully collaborate. The communication between the organizations, both within and external to the collaborative team, is the 'vehicle' that is used to share the knowledge and information. The level of shared knowledge indicates if this is enough and the performance of the collaboration is both a result of how the knowledge sharing is going now, as well as a motivator to keep collaborating in the future. These relations are also represented in the overview of all relations between factors. Figure 69 depicts the identified relations between the five most important factors for interorganizational collaboration between public parties in a sustainable context.

Even though the influence of the level of shared knowledge on the performance is not found in the case study, the level of shared knowledge is seen as the goal of the collaboration (in both literature and the case study). The *importance* of the level of shared knowledge for the performance of the collaboration is therefore validated in the case study.

The relation between the performance if the collaboration and the communication of the organizations was not identified in the interviews before, but was identified in the focus group. This is probably due to the focus on which factors influence the performance in the interviews.

Perhaps more research into the relations between the factors can identify more factors that are influenced by the performance of a collaboration, instead of the other way around.

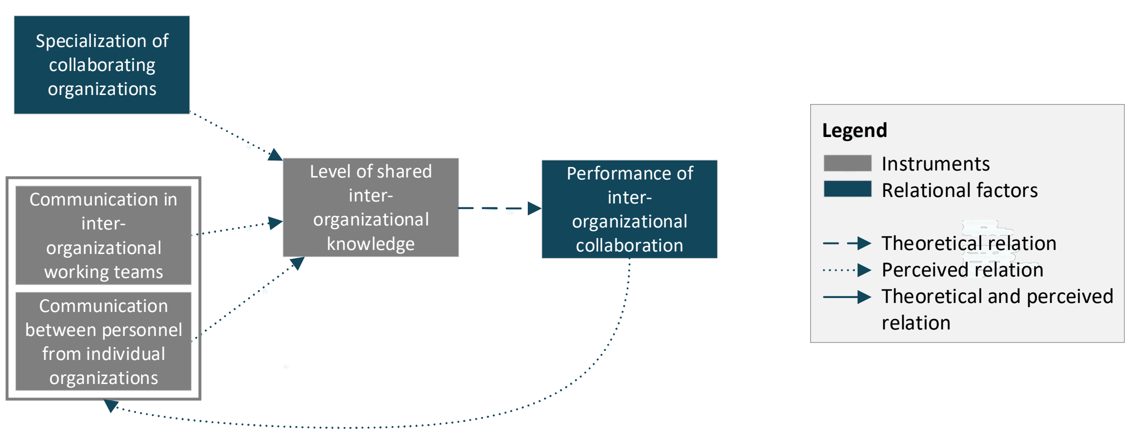

Figure 69: Relations between the five most important factors for interorganizational collaboration between public parties in a sustainable context

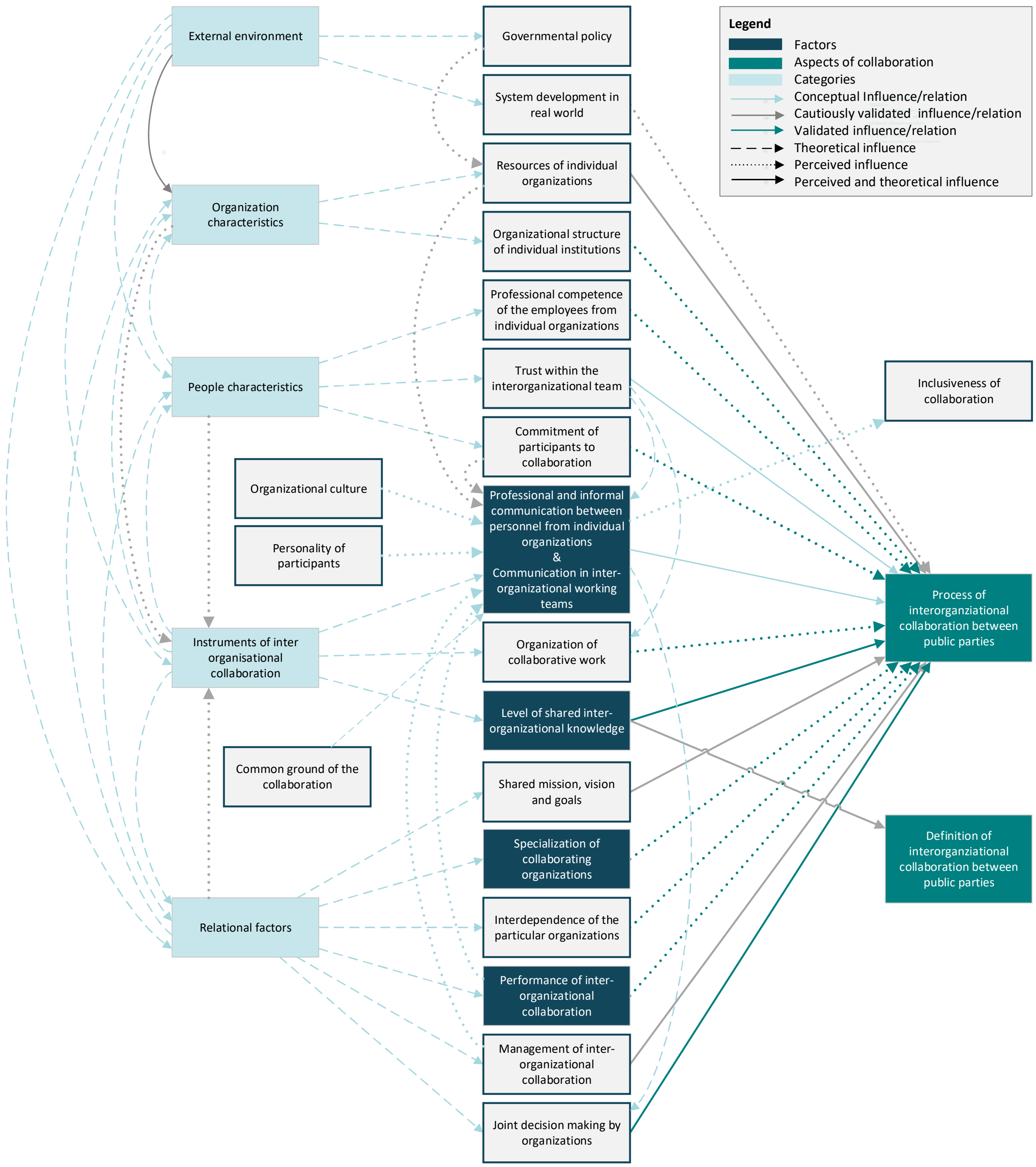

Figure 70: Final theoretical framework for factors that influence interorganizational collaborations between public parties in a sustainable context, with a focus on based on the communication between the organizations both internal and external to the interorganizational team

15

Discussion

The previous chapter concluded with the second theoretical framework. This framework, together with the identified relations between the factors are the main results of this research. This chapter will discuss the results of the thesis research. This discussion is composed of four parts, first will a critical reflection on the research approach be discussed. This is followed by the discussion of the case selection and generalizability of the results. Third is a discussion on the content of the results: are there any unexpected findings? Last will a discussion on the process of this research be elaborated on.

This discussion provides the context in which the results will be placed. The context together with the results will lead to the conclusion of this research. The conclusion, as well as the recommendations for further research are presented in chapter 16.

15.1 Research approach

In this section will the different research methodologies be discussed in the same order as they were presented in this report.

15.1.1 Literature research

The different literature researches throughout the report have been approached in the same way. The same database was used (Scopus) and in the same methodical manner were all abstracts and later full texts screened. However, a literature search is never complete. The use of other databases can provide different results, and a combination of databases could provide a more complete picture. The use of Scopus as only database was based on time constraints as the screening of hundreds of articles takes quite some time. Scopus is a user-friendly database which includes peer reviewed results only.

Including alternative databases, such as Web of Science, could have generated more results for the literature studies. It is recommended that for future research (also) other database are used.

The used search queries were chosen carefully and phrased as general and inclusive as possible. Perhaps the inclusion of synonyms for the term 'collaboration' could yield more results. Interorganizational collaborations have also been branded as interorganizational networks, interdepartmental collaborations, or interorganizational teams. Possible synonyms for collaboration were excluded, as most point towards a private party characteristic (as is the case for joint ventures, partnerships) or (research) collaborations with public and private parties (such as fellowships and networks). The exclusion of these synonyms was also based on time constraints, as it would have taken a lot of time to screen al the abstracts.

A short review of the top 20 articles identified as 'most relevant' by Scopus were included for three search queries in the same time frame 1997 - 2017. These queries were (1) collaborat* governance (N=584), (2) governance networks (N=436), and (3) (multi-level OR multilevel) AND collaborat* AND (public OR government*) (N=2705). The results for the two governance related searches and the multilevel related search will be discussed below.

Governance The first 20 results (sorted on relevance) for both "governance networks" and "collaborat* governance" indicate a focus on interactions of governmental parties with society or market parties. In a few articles also interactions between public parties are mentioned.

The factors identified in articles that focus on sustainability are similar to those identified by Kożuch & Sienkiewicz-Małyjurek (2016) (Charlie, Pearlman, & King, 2012; Hamilton, 2017; Klijn, Edelenbos, & Steijn, 2010; Koliba, Zia, & Lee, 2011; Montenegro & Bulgacov, 2014; Nova, 2011). Some additional factors are mentioned such as 'obtaining public input' and 'satisfaction among local stakeholders' (Zia & Koliba, 2015), as well as 'responsiveness' (Holmen, 2011), 'democratic legitimacy' (Holmen, 2011; van Meerkerk, Edelenbos, & Klijn, 2015), 'centrality' (Hartley, 2010), and 'transparency' (Bingham, 2011). Also 'shaming and other forms of informal social control' is mentioned as a factor that grows as government parties "*no longer have a central role, (…) [and] power is diffuse*" (Holley & Lawson, 2015, p.239).

Perhaps the number of times the factors are mentioned is different for the literature related to governance than the literature included in this thesis project. In a full literature study this could have indicated different factors as important as is now seen in chapter 11. An example could be technological and software differences, where all governmental parties use similar information systems, more heterogeneous parties are likely to use varying information systems, while at the same time the digital sphere allows for a greater participation and access to the collaboration (Gilman, 2017). Including articles from network governance or collaborative governance could be valuable in future research into interorganizational collaboration between public parties. However, it remains important to be aware of the difference in collaboration that are present between public-public collaboration and public-private collaboration.

This short research into governance literature has not put forward any factors that seem essentially relevant for this thesis project that have been missed. However, it is likely that including a wider selection of literature can lead to more insight in future research.

Multilevel collaboration Multi-level collaboration includes central regional and local governments (Sicilia, Guarini, Sancino, Andreani, & Ruffini, 2015), and a wider array of included organizations than on a pure central government level. Organizations such as schools, hospitals, and municipalities can be included. The term 'multilevel' is also often mentioned alongside 'governance' and indicates the added value of inclusion of citizens and private parties in policy making. This notion can be very valuable for policy making as a whole, but falls outside the scope of this research project.

Most factors that are mentioned to influence multi-level collaboration are also included in the framework by Kożuch & Sienkiewicz-Małyjurek (2016). Examples are resources (Biard, Croci, & Molteni, 2015; McAllister, 2015; Sicilia et al., 2015), technologies (Maldonado, Maitland, & Tapia, 2010), communication (Maldonado et al., 2010), organizational similarity (Gallemore, Di Gregorio, Moeliono, Brockhaus, & Prasti, 2015), and knowledge and information sharing (Gallemore et al., 2015; Hanberger, 2015; Van Der Meer, Torlina, & Mustard, 2013).

Other factors that have not been mentioned by Kożuch & Sienkiewicz-Małyjurek (2016), but are mentioned in literature on multilevel collaboration, include public participation (Sicilia et al., 2015), a goal oriented management style (Sicilia et al., 2015), diffuse authority (Maldonado et al., 2010), or lack of authority (Bauer & Steurer, 2014).

Concluding remarks on search queries Both governance and multilevel collaboration include similar factors as are included in the framework by (Kożuch & Sienkiewicz-Małyjurek, 2016). However, the occurrence of these factors in literature might be different. For example, software and technology issues are mentioned reasonably often, as well as power differences. There are also additional factors mentioned in literature on governance and multilevel collaboration that are not included in this research. However, the expectation is that most of these factors are not applicable, or applicable to a low extent in the context of central government organizations that collaborate. Examples of these factors are public participation, diffuse authority, and centrality.

The academic fields of these sixty articles contain management and public administration academics, just as the literature included in chapter 11, but does not include the academic field of (organizational) psychology. Additional academic fields of economics (2), information technologies (3), law (1) and innovation (2) are included for the articles on governance and multilevel collaboration. In chapter 11 is indicated that the academic fields of communication theory and sociology were also expected to be represented in the literature research, but were not present. These fields however, are also not present in this wider search for literature. Perhaps even more literature research can identify literature in these fields, or perhaps within these fields there is not (much) attention for interorganizational collaboration of public parties.

Eligibility The articles included in the thesis project were screened on multiple eligibility characteristics, the focus on interorganizational collaboration between public parties lead to the first three eligibility criteria of the literature research in chapter 11. These criteria were; (1) a focus on collaboration, (2) between organizations and specifically not between professions, and (3) a focus on public parties only, and not public-private-partnerships or private parties alone. The last two eligibility criteria were (4) a focus on real life collaboration (compared to digital collaboration) and (5) a sustainable context. These two criteria were based on the selected case study of this thesis: in interorganizational collaborative team for policy making in the energy system in the Netherlands. The influence of this case study on the research will be discussed in section 15.2 below.

The exclusion grounds for the literature research of chapter 13 were based on the same principles as those of chapter 11, for example was the eligibility criterion of a focus on public parties maintained. This view was supported by the reading of some articles that included public private partnerships (e.g. (Keyton, Ford, & Smith, 2008)). These articles put emphasis on the tensions between public and private goals, expected the team members to not know each other beforehand, and assumed large power differences. Whereas this team and the organizations involved do have a long shared history, and are power inequalities not perceived as an important influence on the collaboration (see also Figure 67).

The use of a sustainable context limits the generalizability of the research to other areas of policy making. Even so, this eligibility criterion was applied as sustainability as a dossier has different characteristics than for example education, or health care. Sustainability issues are becoming an everyday topic. However, not every individual in the Netherlands sees the threats of non-sustainability, whereas all can think of problems if the health care falters. All individuals in the Netherlands need to work together in order to reach the sustainable policy goals for the Dutch energy system. Issues that can be present for a sustainable context and that can be less applicable in different dossiers are awareness of the civilians, as well as a low(er) perceived importance by the civilians. A possible driver that is present for sustainable contexts that are not present for other contexts are the international legislation, which provides a strong framework and back-up for political attention to sustainable contexts.

Even though the choice of using a sustainable context as an eligibility criterion limits the generalizability of this research, it is still seen as a valuable criterion. The sustainable context can differ from other context, making other contexts less relevant. However, it would also be valuable to research interorganizational collaborations between public arties in a different context altogether to see what the differences are in important factors for the two contexts.

15.1.2 Semi-structured interviews and a focus group

This research focussed on the factors for interorganizational collaboration, as it is considered that for the participants to be willing to change their collaborations for the better, they have to feel the barriers or possible options for enhancement of the collaboration. To be able to research the factors that are important for the success of a collaboration, a practical aspect was required in this research. This practical aspect can be researched in different ways.

The first distinction is quantitative versus qualitative. Qualitative and quantitative research differ in multiple ways (Bryman, 2013, p.380):

> *"it was suggested that qualitative research differs from quantitative research in several ways. Most obviously, qualitative research tends to be concerned with words rather than numbers, but three further features were particularly noteworthy:*
>
> 1. *an inductive view of the relationship between theory and research, whereby the former is generated out of the latter (though see the section below on abduction as a qualification of this view);*
> 2. *an epistemological position described as interpretivist, meaning that, in contrast to the adoption of a natural scientific model in quantitative research, the stress is on the understanding of the social world through an examination of the interpretation of that world by its participants; and*
> 3. *an ontological position described as constructionist, which implies that social properties are outcomes of the interactions between individuals, rather than phenomena 'out there' and separate from those involved in its construction."*

To the author's knowledge is interorganizational collaboration in this specific context with a focus on the practical side, not yet qualitatively researched. This indicated that quantitative research would be difficult to achieve. A quantitate approach could yield more generalizable results, as the results could be statistically significant, and include a wider context of applicability. Quantitative research often makes use of surveys. Within these surveys a wider range of questions can be asked to a larger group of people than with interviews. But if it is not yet known which factors are perceived as important, how do you know which questions to ask? The qualitative approach of this research now aims to identify which factors are perceived as important. It would be interesting and it is recommended to test these results in a more generalizable quantitative study. The generalizability will be further elaborated on in section 15.2 below.

The choice for a qualitative study then leads to a new array of options. As mentioned in the quote of Bryman on the previous page are four aspects important in qualitative research; (1) the use of words, (2) in inductive view of the relation between literature and the case study, (3) interpretation of the results, and (4) a view on individuals rather than societies.

The first aspect, the choice of words, is mostly important in the contact with the participants, and is included in this research by choosing a semi-structured interviews rather than an unstructured interview, where all participants hear the same questions with the same wording. Also the wording of the survey was carefully constructed and discussed with fellow SEC students.

The second aspect is the relation form the case study to literature. This loop is made twice in this research, once for the factors of interorganizational collaboration and once for possible methods to enhance two of these factors., which focusses more on the relations between factors than on the factors themselves.

The third aspect, the interpretation of the results, is not as straight forward. Even though the interpretation of the interviews in their coding has been validated an checked twice, there is always an influence of the researchers personality, beliefs, and knowledge on the interpretation of the results. This is also one of the reasons the generalizability of this research is difficult.

The last aspect is the influence of individuals on societal developments. This aspect has two dimensions. It is one of the reasons qualitative research is a good fit for this thesis project, as the involvement of individuals is important to be able to understand societal constructs. Even though at the same time it is the main reason this research is not easily generalized. This research focusses on the views of individuals, and not on the views of society, although the issue is a societal one. The generalizability will be further discussed in section 15.2 below.

Often used research methods are ethnography, participant observation, interviews, and focus groups (Bryman, 2013). Ethnography and participant observation both require a submergence within the team and a long time span of research. Moreover, interviews allow for the views of the participants to be analysed without influences of the opinion of others. Whereas a focus groups allows for a discussion to arise and a comparison of perspectives within the group. Due to time constraints are ethnography and participant observation not possible. These two methods allow the researcher to experience what is happening in the real world, whereas interviews and focus groups can only identify what the participants remember and experience, rather than the true workings in reality. As this thesis project is focussed on the practical experience of policy makers, interviews and focus groups are both possible methods of research in this thesis project. Both methods are applied in this project.

The difference between an individual interview and a focus group (a group interview with usually at least four participants) are explained as (Bryman, 2013, p.501):

> *"Three reasons are sometimes put forward to suggest a distinction.*
> - *Focus groups typically emphasize a specific theme or topic that is explored in depth, whereas group interviews often span very widely.*
> - *Sometimes group interviews are carried out so that the researcher is able to save time and money by carrying out interviews with a number of individuals simultaneously. However, focus groups are not carried out for this reason.*
> - *The focus group practitioner is invariably interested in the ways in which individuals discuss a certain issue as members of a group, rather than simply as individuals. In other words, with a focus group the researcher will be interested in such things as how people respond to each other's views and build up a view out of the interaction that takes place within the group."*

The first and last reason are the ones that lead to the choice for a focus group for the second iteration between literature and the case study. As the group as a whole is expected to need to deal with possible changes in their collaboration, it is useful to research how the group as a whole discusses these topics. Some discussion points on both the semi-structured interviews and the focus group will be elaborated on below.

Semi-structured interviews The semi-structured method for the interviews has been explained in chapter 12. This method is still regarded as the right way of conducting these interviews due to the possibility of similar wording of the questions but still being free to ask follow up questions where necessary. The semi-structured interviews were conducted face-to-face as well as over the phone. Some issues mentioned for telephone interviews are that it is easier to terminate the interview over the phone than face-to-face, and it is not possible to observe body language during the interview (Bryman, 2013).

The two interviews that were held over the phone both answered all questions, and were not in any rush. One of these two participants however moved to another room half way during the interview, to find a more quiet spot. The question during which this move took place was still answered in full as far as can be determined afterwards.

The duration of the interviews, as well as the number of codes that are linked to the transcripts (the amount of data retrieved from the interviews) are indicated in Figure 71.

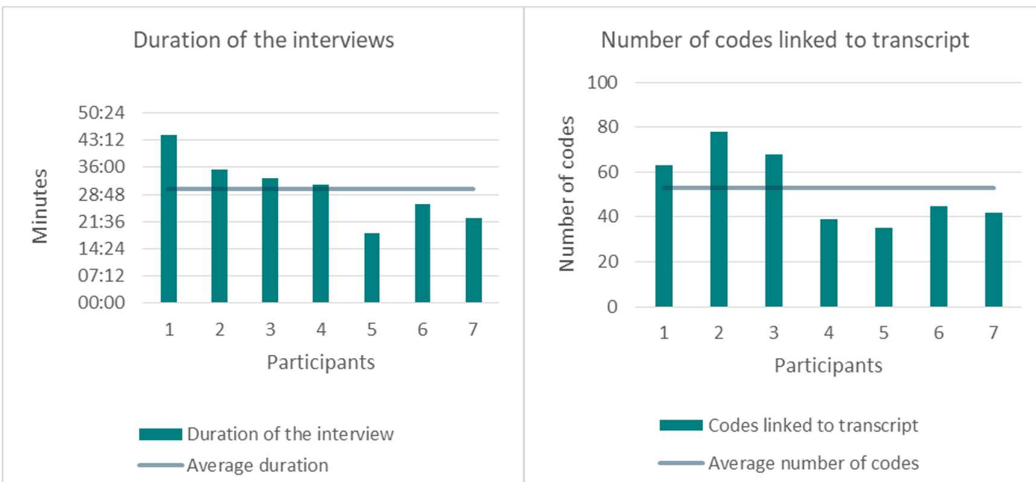

Figure 71: The duration of the interviews, as well as the number of codes that are linked to the transcripts

The two interviews that were held over the phone are indicated with the numbers 4 and 6. These two interviews were neither the shortest, or led to the least number of codes. In both instances are the interviews with number 5 and 7 lower or around the same value. These two interviews were held face-to face at a location of the participants choosing. For one of these participants it was the last meeting before a vacation, which could have influenced the eagerness to make it short.

The interview identified with number 1 was by far the longest interview. This was due to the tendency during the interview that the conversation regularly went of topic from the collaboration itself to the content (the topic) of the collaboration. After this realisation this tendency has been tried to be limited in the interviews that followed.

The body language of the participants during the face-to-to face interviews indicated was beneficial as this provided clues to their understanding of the question and their initial feelings or mood by the different topics. This could then be used in the follow up questions. During the telephone interviews these body language clues were not available. To compensate was explicitly mentioned at two points in the interviews that if anything was unclear the participant should say so and anything could be repeated or elaborated upon. The need for the repetition of questions was low, and only a few times was additional clarification asked. As the body language could not help in the choice for follow-up questions were the content related clues (that were also available in the face-to-face interviews) complemented with the follow-up questions that were most often asked in other interviews.

Even though there are some limitations to the use of semi-structured interviews and the way they were conducted it is still believed that this method and implementation are sufficient. There are no key issues that should be dealt with in this regard if the research would ever be conducted again. Of course it would be preferred to have al interviews face-to-face but the solution of telephone interviews with two participants is not expected to have influenced the results of the interviews significantly.

Focus group Two topics were discussed in the focus group, the possibilities for an online communications platform for government organizations, as well as the possible use of the 7-step methodology and API tool for policy makers. The online communication platform was easily explained as a similar feature is already available for government organizations. The second topic was more difficult to explain as the participants have no experience with a tool similar to the 7-step methodology and API tool.

The presence of an online platform for government parties made it more difficult to discuss the different forms of the platform as the participants kept comparing the proposed idea with the existing platforms, even though a platform can have widely varying forms and content.

The difficulties in explaining the 7-step methodology and API tool in a few minutes lead to a multitude of questions of the participants. This part was therefore not as much a discussion among the participants as it was more a mutual conversation, including the moderator.

The focus group took place in a cafeteria of one of the implementation organizations. Even though this was a public space, the participants did not seem to hold back. The discussion was open, and all participants contributed to the discussion. The topics discussed were also non-sensitive, this contributes to the ease of discussing among the participants.

One drawback was that only three participants were present during the focus group, representing two organizations, one ministry and its implementation organization. A fourth participant, form the second ministry joined the group near the end when the discussion was already almost finished. Even though not all participants were present, and not all organizations were represented the focus group lead to interesting results. The generalizability of these results is discussed in section 15.2.4.

15.1.3 Validation - online survey

The content of the online survey has been discussed in chapter 13. When developing the online survey there was a lot of attention for the wording of the statements as well as the order in which they were asked. However, one statement still left too much room for interpretation. This was statement number 16: *"Door de samenwerking leren de medewerkers van elkaar, waardoor de organisaties ook leren. Het is daarentegen niet mogelijk voor een organisatie op zichzelf staand om te leren van de samenwerking."* This statement could be answered on a seven point scale of 'completely disagree' to 'completely agree'. However the answers that indicated that the participant did not agree could indicate two different opinions. The first is that the individual organizations do not learn from the collaboration, the second possible opinion is that the organizations do learn from the collaboration, but that this learning process is not dependent on individual people and that organizations can learn as a whole. This ambiguity can possibly explain the large differences in responses of the participants. The results of the survey will be further discussed in section 15.3.

The last question of the survey left room for questions and/or remarks. None of the participants used this space to leave some thoughts. During the focus group meeting was one remark made in relation to the survey. One participant indicated that the question on the communication between employees of the different organizations external to the team was interpreted differently. The other participants seem to agree with the interpretation of this first participant. The question was interpreted as containing the communication between members of the interorganizational collaboration, but not all at the same time (such as bilateral meetings between two members). Therefore is the influence of the factor for communication of other employees of the same organizations not validated.

One other remark is that in the survey one factor, the factor for trust, was accidentally left out. How this happened will be reflected on in section 15.4 below. This did not have any influence on the survey itself, but does influence the validity of this factor.

15.2 Case selection and generalizability of the research

The selection of the case has been discussed in section 12.1. The selection of this case influences the generalizability of this research. The theoretical parts of this research are not as much influenced by this specific case, but more by the overall sustainable and energy related view of the thesis project. The practical results are to a higher extend influenced by the case selection.

15.2.1 Dynamics specific for this case study

The characteristics of the members of the case study can be expected to influence the generalizability of the collaboration. Therefore will some team dynamics and personal characteristics be discussed here.

The collaboration as a whole has been going on for years. About two years ago, the responsibility for the collaboration moved dividends within a ministry, leading to new participants in the collaboration for this ministry. However, the other participants remained. The collaboration is no longer in the start-up phase that was present after the move. The collaboration is also not coming to an end any time soon. As far as is known now, can the collaboration continue for the coming years.

The careers of the individual people at their organisations range from two years to around twenty years. Also the involvement of the participants within this interorganizational team range from over ten years to close to two. This range indicates that there are both fresh opinions and experience within the team. During the interviews were both aspects mentioned by some participants as beneficial to the collaboration.

An interesting fact to mention is that at the time of the research two of the seven participants were in their last weeks of working for this interorganizational team. One of these two participants mentioned that due to this change there was already some personal reflection going on with respect to the collaboration. The other participant that was facing a change of teams did not mention any influence at all. Even though this fact is not expected to influence the outcome of this research, this cannot be proven.

15.2.2 Representativeness of the case to the ministries

The two explorative interviews (of which one was with one of the participants of this research) into the overall collaboration of the ministries did generally indicate the same developments and issues as the semi-structured interviews. These views are that the collaboration is bettering and that even though the organizations have different interests and goals all employees (on all levels of the organizations) more and more see the urgency and are more willing to collaborate. The main barrier that has been mentioned in both the explorative interviews and the case study is the availability of resources such as time and money.

During the interviews was asked whether or not they thought the nature of the topic of their collaboration was different from the other topics within the ministries that this influenced their collaboration. The overall consensus was that the issue was complex and has a relatively high dependence on two ministries, but so do many other topics for which interorganizational collaborations are installed.

It was also mentioned in the case study, both during the interviews and the focus group, that the interorganizational team of the case study is an exceptional team, where the collaboration goes well. This is not per se true for all interorganizational collaborations between public parties.

This view would argue that this team could not be representative for most teams of interorganizational collaboration with these four organizations, but can function as a benchmark for the other team. However, the sample of seven participants is too small for any of these statements to be statistically significant. The expectation is that the topic in itself is not a large influence on the collaboration, but the political attention for this topic, as well as organizational support, and the individual people of the teams do influence the collaboration as such that it cannot be representative for the other teams. As both factors for available resources and the commitment of individual people to the collaboration are identified and validated as an important influence on the collaborative process, it can be concluded that this case study is not representative of all collaborative processes between the four involved organizations.

15.2.3 Influence of the personal aspects of the researcher

As large parts of this research into the interorganizational collaborations between public parties is based on the interpretation of qualitative data, the researcher itself is also important. This research is performed by an engineer with a system perspective. This perspective includes a view of systems, sub-systems, and links between these systems. This view leads to a structure of connections, causalities, and complexities. It is likely that this fuelled the inclusion of the relations between the identified factors within the research. Even though this aspect can only be exploratory, it is seen as essential to understanding interorganizational collaboration. This is also indicated in the presentation of the interview results, where the focus is more on their influence on collaboration as a system, with goals (performance indicators) a process (time dependency) and a start (the problem identification and the design of collaboration as a solution), than on the exact content and definition of the factors as is perceived by the participants.

The implication of this description of the researcher is that if any other researcher would have had access to the same literature and the same people, it is likely that different results would have been found. This does not indicate that the found results in this project are faulty, it merely states that they could never be complete.

15.2.4 Influence of the roles

The influence of the roles of the individuals in the collaboration can be mostly attribute to the roles of the organizations. The implementation organizations are further away from the political discussion than the ministries, and therefore have a more critical attitude towards the political discussions. The team members that work for the implementation organization were also the ones most aware of a need for a long term policy strategy. Whereas the team members that work for a ministry are more understanding of the political process, and feel the political pressure more. The employees of the ministries were also less critical of political influences than those of the implementation organizations.

A remarkable dynamic in the intergenerational collaborative team is the understanding of each other's roles. The employees of the implementation organizations all indicated that even though they might not always agree with the more political focus of the employees of the ministries, they understand that this is part of their roles as policy employees.

15.2.5 Influence of politics

The influence of politics on the interorganizational collaboration team are difficult to understand. Some participants have voiced that the formation of a new cabinet that is currently going on in the Netherlands leads to uncertainty for their collaboration. However, others have mentioned that no matter what the results of the formation of the cabinet are, their collaboration is important enough to remain important for politics, these participants even expected the importance of the topic of their collaboration to increase.

Also the influence of the four year election cycle is not straightforward. Some participants experience a longer vision for the ministries (this vison is shared for employees of the ministries as well as for the implementation organizations). However, other participants do experience a short term vision, and difficulties in developing a more long term plan, due to the election cycle (also this view is supported within ministries and implementation organizations).

The initial expectation that politics would be a large influence on the collaboration is not completely unjustified. Even though the influence of politics on the collaboration are much more complex than was initially envisioned. The influence of politic on the development of a long term policy strategy is therefore one of the recommendations for further research. All recommendations for further research are summarized in section 16.3.

15.2.6 Overall generalizability

The case study has been determined as not representative for the collaboration between the two ministries and their implementation organizations. Moreover are the collaborations between these two ministries probably also not representative of the collaborations between all ministries involved in the energy system of the Netherlands. This was also corroborated in the focus group, where the participants mentioned that not all collaborations between government parties function as well as this case.

This does not indicate that the identified factors are not relevant, but the perception of these factors, or which one are most important, as well as which relations are present between the factors, could be different for other teams. For example, in a team where the collaboration is going less well, the lack of share vision an mission might be more important than it is perceived in the case study, where the team members generally agree and need a shared mission an vision less.

The theoretical aspect of this thesis project is focussed on sustainable policy making and is therefore possible to be generalized to other sustainable topics rather than just this single topic of the case study.

The results of the literature research were used as a starting point for the research into the case study. This choice in research approach could have led to an early exclusion of factors that are not immediately thought of by the participants, but they do experience. However, as it was impossible to include all 66 theoretical factors in the interviews a choice had to be made. This research is therefore neither complete in the interpretation of the results (see section 15.2.3) or the inclusion of factors within the theoretical framework.
In order to prove the generalizability additional research is required. This additional research should focus on two dimensions, qualitative and quantitative research. Additional qualitative research can indicate the factors for other collaborative teams between the same organizations, as well as between other ministries and their implementation organizations. The approach of these qualitative research projects could be similar to the approach used in this thesis project, but would also need to focus on (some of) the factors that were excluded before the first conceptual theoretical framework presented in this report.

Afterwards can qualitative research among the employees of all ministries and their implementation organizations test the statistical significance of the findings of the qualitative research project. This would prove the generalizability of the results for the Netherlands. Whether or not this is also generalizable to other countries is another discussion altogether and is outside the scope of this research.

In other words this thesis project is not per se *not* generalizable, however it is also impossible to prove the generalizability of the results at this point.

15.3 Unexpected results

The results of this research will be discussed in three sections, first the outcome of perceived factors for interference are discussed, then the identified relations between these factors. Third will the focus group and the results on communication between the individual organizations, within and outside of the team, be discussed.

15.3.1 Identified perceived factors for interorganizational collaboration

The survey results indicated two factors that were not validated, four factors that were cautiously validated, and eleven factors that were validated. These factors are summarized in
Table 35.

These results were not entirely surprising. The factor for the self-interest of the organization was mentioned a lot by one participant, but very little by the others. And most participants were hesitant towards a learning process between individuals. The formulation of the statement for the factor of learning between organizations was formulated ambiguously (as has been reflected on in section 15.1.3). It is not completely clear if learning at all is not important for the collaboration, or that this learning is expected to take place between organizations rather than people. However based on the interview it is expected that learning processes are perceived to run through people, and the low agreement of the participants on this factor is based on the low influence of a learning process on the collaboration.

Table 35: Validation of factors based on survey results

Validated	Cautiously validated	Not validated
Organizational structure of individual institutions (18)	Governmental policy (1)	Learning processes between organizations (36)
Professional competence of the employees from individual organizations (21)	Resources of individual organizations (11)	Self-interest of individual organizations from collaboration (46)
Professional and informal communication between personnel from individual organizations (29)	Shared mission, vision, and goals (44)	
Communication in inter-organizational working teams (30)	Management of inter-organizational collaboration (59)	
Organization of collaborative work (34)	System development in real world (68)	
Level of shared inter-organizational knowledge (35)		
Specialization of collaborating organizations (47)		
Interdependence of the particular organizations (48)		
Performance of inter-organizational collaboration (57)		
Joint decision making by organizations (60)		
Commitment of participants to collaboration (67)		

The validated factors are by no means a complete list, first of all were not all seventy identified factors included in the interviews, or the survey. However, the interviews all (except for the interview identified with number 1, due to time limitations) ended with the question if something was missed, or the participants wanted to add or ask something. None of the participants mentioned a factor that had not been mentioned before as well. This indicates that at least the most present factors for this team are included in the theoretical framework.

Shared mission, vision, and goals At the start of this research was expected that a shared mission and vision were crucial within the collaboration. However, the case study only cautiously validated this factor, indicating that not all participants regard a shared mission and vision as important. Most participants seem to experience the lack of clear vision in parliament as more problematic to their collaboration, than the lack of an explicit vision within the team.

This can also be explained by the successfulness of the collaboration. The team members generally agree with each other on where to go. This high level of agreement can make an explicit shared mission and vision less essential for the collaboration.

15.3.2 Identified relations between the factors

The identification of relations between factors was based both on literature as well as on the case study. The relationships that are identified from literature were all included in the theoretical framework as conceptual relations. The relations indicated by the interorganizational team were included as conceptual relations only if two or more participants mentioned the relationship between two factors, with the same directionality, in the interviews. The relations that were mentioned during the focus group were included as validated relations in the fourth and final theoretical framework. The result of the selection criteria for relations having to be mentioned by two participants in the case study is depicted in Figure 57, in chapter 12.

What if the relations were included after only one participant had mentioned them? The diagram of relations would look different, as can be seen in Figure 72. The relations that were mentioned once are indicated with the red arrows in Figure 72. The number of identified relations would increase enormously.

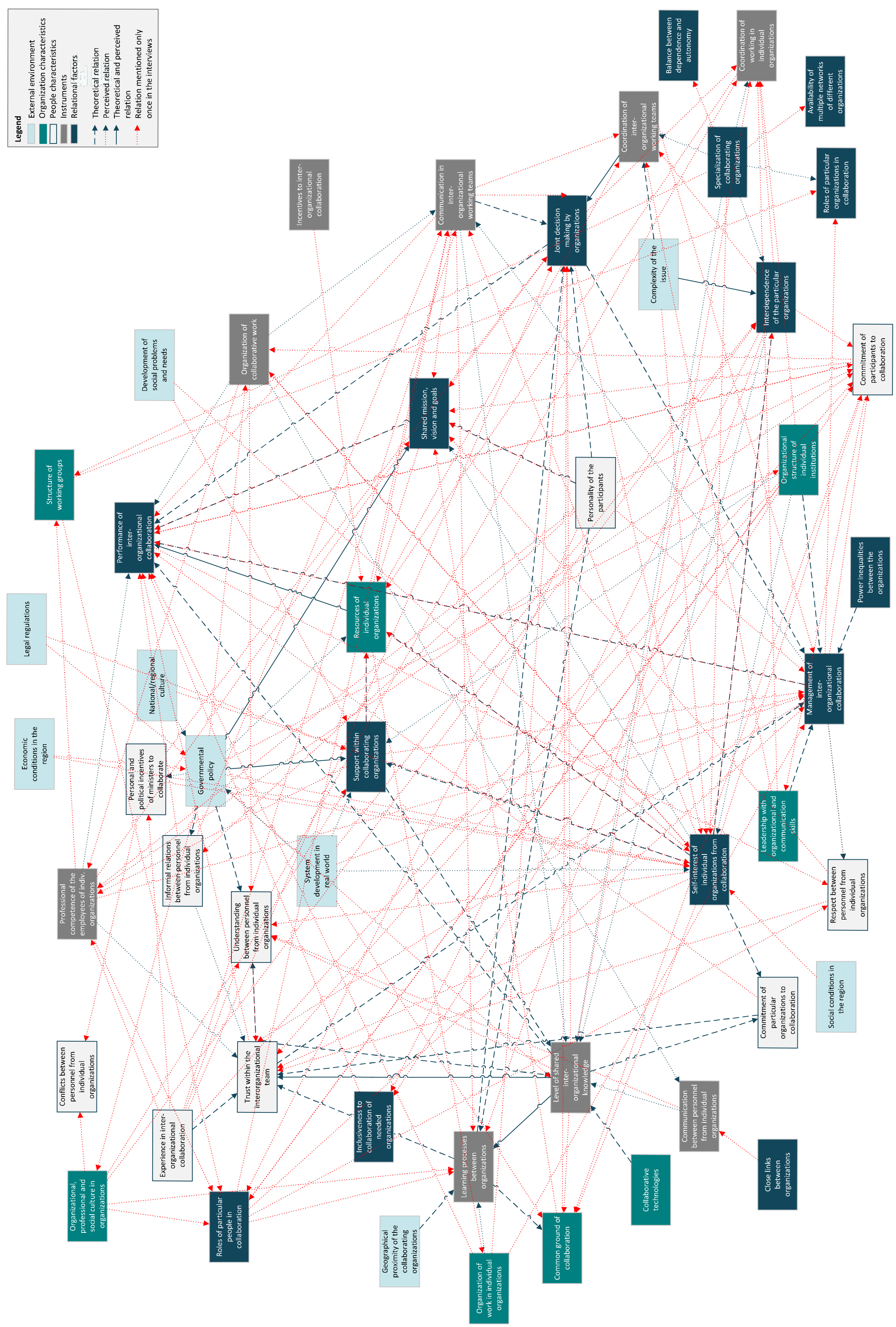

Figure 72: All perceived relations between factors by participants without the selection criteria for a relation to be mentioned by two . .

This is an example where it is likely that more is not necessarily better. The perceived relations in Figure 72 are all links that participants subconsciously make. The relations that are mentioned twice are already explorative, as most are only based on the causality as is explained by someone unaware of this causality, and unaware of the implications of identifying this causality.

It is therefore concluded that the selection criteria of two individual participants mentioning the same relation is already explorative, and including all relations that are mentioned once will not lead to additional insights.

The relations between factors do not necessarily indicate a numerical increase or decrease. For example, the factor for 'Organization of work in individual organizations' influences the factor for 'Learning process between organizations'. For this example there is no such thing as 'more organization of work' or more learning processes', but the way the work in individual organizations is organized influences whether or not learning process can be applicable, and if they are effective or not.

This also indicates that if in the future a quantitative approach is desired to calculate the effects of different factors on the performance of a collaboration, the factors need to be further specified into measureable variables.

15.3.3 How to influence communication

The theory and the case study on the benefits of an online platform for communication between government parties, as well as within the interorganizational team were completely different. This could be caused due to the low number of articles that were eligible in the literature research, and additional literature research could identify a more solid theoretical basis.

At the same time did the literature that was found focus more on the conditions of online communication (such as trust, and a common ground for the collaboration), whereas the participants focussed more on the practical aspects of an online communication platform (such as time and management).

The management of the online platform does not necessarily have to be executed by the manager of the collaboration. This could also be allocated with another team member, for example if this person has more time. It is important however, that the manager of the collaboration monitors the online platform as his/her views on the collaboration itself should be present in the online platform as well.

As both the literature and the case study differ, and a validation was not executed due to time constraints, the results of the focus group are not validated. As the results do include interesting relations and information they will be kept as conceptual relations in the theoretical framework. Additional research is required to validate these relations and perceptions.

15.3.4 Expectations for different contexts

Collaborations between public and private parties, or among private parties, as well as for other topics of the collaboration can expect different important factors, and different relations between these factors. Both dimensions of the context will be shortly discussed below.

Private parties For collaborations including private parties it is expected that power differences, as well as the self-interest of the individual organizations will be important factors that can create barriers for the collaboration. Private parties are expected to have larger differences in their individual goals than among public organizations. For private parties a shared mission, vision, and goal can therefore be more important than for collaborations between public parties alone.

Sustainable topics In section 15.1.1 has been reflected on using a sustainable topic as an eligibility criterion for the literature studies. Even though this limits the generalizability of the research, it is still recommended to use a specific context in the research. A literature search that is more general than the case study can create misinterpretations of the interviews, or a too general approach for the interview guides. The field of interorganizational collaboration is already a broad field, where many different approaches, contexts and theories are present. For this research it has been helpful to have limited the scope to the context of the topic and thereby limiting the views.

However, it is therefore valuable to also research different contexts, and perhaps in a later stage to compare the different results for the different contexts.

15.4 Research process

The process setup of this thesis project was already depicted in Figure 35, in chapter 9. However, this figure shows a linear process. The actual process in which the research has been performed was much more iterative than that. Figure 73 represents the same research steps but indicates the more iterative process in which they have been completed.

As is mentioned is a large part if the SEC research interpretive and have the interpretation steps of this research known multiple cycles. Each cycle some changes were made to the theoretical definitions and/or to the interpretation of these definitions in the qualitative data.

This iterative process as positive and negative aspects. The positive aspects are mostly the increase in clarity in the definitions and results with each cycle that is completed. One of the negative aspects ha shortly been mentioned in section 15.1.3, with the exclusion of the factor for trust in the survey. Each additional cycle from the case study to literature and back lead to slight changes in the coding of the interviews and focus group. However, at a certain point the survey had to be send to the participants to give them enough time to complete the survey. Before the survey was setup the cycle from the case study to literature was completed, and the results were finalised. These results were used to create the survey. However, after the survey was send and the second theoretical framework was composed an additional iteration between the case study an literature happened, where some last factors were merged together. One of these merged factors were the two original factors for trust (trust between personnel and interorganizational trust) that are presented in the framework by Kozuch and Sienkiewicz-Małyjurek (2016). The merging of these two factors created a new factor for trust that suddenly fulfilled the inclusion criteria for the survey that was already sent to the participants.

The main drawback of an iterative research process is the constant changing outcome. As the research approach of this thesis project is extremely linear, in the sense that one research steps determines the basis for the next research step, so each research step *should* be completed before the next is begun. This trade-off for the linearity of the research design in the interpretative nature and the dependency on previous research steps proved difficult to manage. Unfortunately this led to one of the factors to not be validated.

15.5 Concluding remark

Even though Part III of the thesis report has fully focussed on the need for interorganizational collaboration, and this assumed need is often supported in literature, collaboration alone is not (always) the best way to go. There are some drawbacks that could occur if the collaborations between public parties goes well and is developed further. These drawbacks are aptly summarized by Bardach (1998, p.17) as is quoted in (Imperial, 2005, p.311):

> *"We should not be impressed by the idea of collaboration per se. That collaboration is nicer sounding than indifference, conflict, or competition is beside the point. So, too, is the fact that collaboration often makes people feel better than conflict or competition. I do not want to oversell the benefits of interagency collaboration. The political struggle to develop collaborative capacity can be time consuming and divisive. But even if no such struggle were to ensue, the benefits of collaboration are necessarily limited."*

Yes a collaborative approach is suspected to contribute to the issues in the developments in policy making, but collaboration alone is not a solution. This critical remark should be seen more as a notion that the concepts in this thesis are useful, but not extensive. In the world of interconnected and integrated systems, some conflict and competition is also required to be able to change and learn.

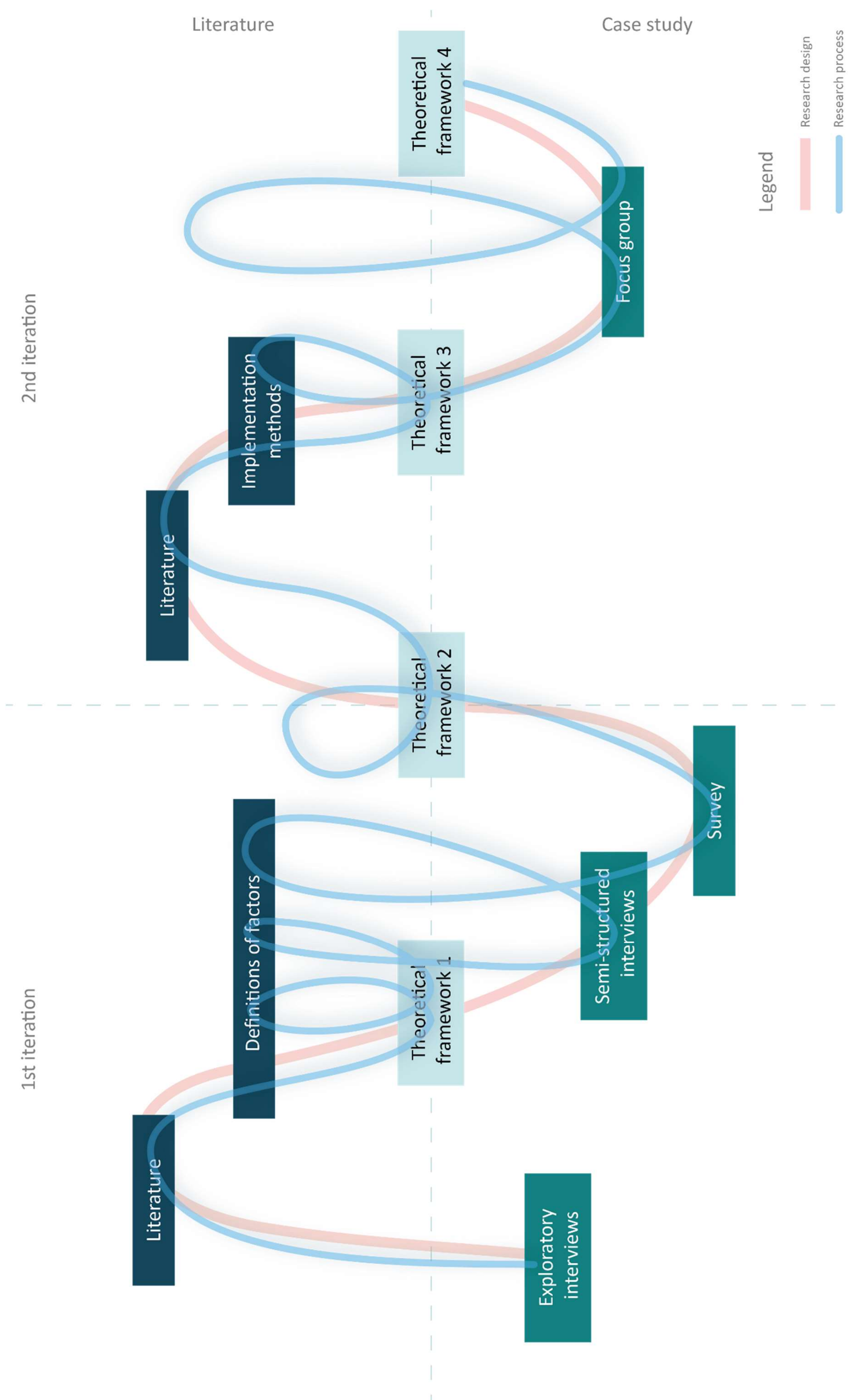

Figure 73: Research design and the iterative execution of this design (adapted from (Bohm, 2017))

16

Conclusion

The previous chapter focussed on the context of the results and also includes the limitations of the research. This chapter will elaborate on the conclusion of this research by answering the research question in section 16.1, the contributions of the research are explained in section 16.2. Section 16.3 offers some recommendations for further research. Section 16.4 provides an initial reflection on the results of the research of Part III of this thesis project.

The following, and last, chapter will reflect on the integration of both research projects of this report and the contributions they can provide to each other.

16.1 Conclusion

In chapter 1 has been discussed that in order to implement a long term policy strategy, interference between policy measures should be researched, as well as the development and implementation of these policy measures as a whole. As the policy measures are developed and implemented by multiple public organizations, these organizations need to collaborate. An analysis of the influence of complex systems on the need for collaboration for policy making and the factors that influence this interorganizational collaboration between public parties has led to the following main research question:

> **Which factors influence interorganizational collaboration between public parties in the Dutch energy system, and how do these factors relate to each other?**

This thesis project has researched which factors influence the process of interorganizational collaboration and what the relations are between these factors. Also for two of the factors perceived as most important is researched how they can be influenced according to the participants of an interorganizational team. This last part also focussed on the relations between the most important factors.

The first identification of factors that influence interorganizational collaboration between public parties was based on literature. Systemic literature research identified 66 factors that could influence interorganizational collaboration between public parties. Based on this literature review were the ten factors that were most agreed on in literature chosen to form the basis of the semi-structured interviews with the participants of an interorganizational team between two Dutch ministries and their implementation organizations focussed on a sustainable and energy related subject. This interorganizational collaboration could be used as a benchmark, as the collaboration performs well.

The interviews identified four new factors, leading to a total of seventy identified factors that can influence interorganizational collaboration between public parties. Of the initial ten chosen factors nine were also often mentioned by the participants. These nine factors were combined with eleven additional factors that were either frequently mentioned, or mentioned by all participants during the interviews. These twenty factors were then validated with a survey among the same participants as the interviews. Out of these twenty factors were seventeen validated.

The seventeen validated factors are depicted in Figure 74 below. This figure also indicates if these factors influence the process, or the conditions of interorganizational collaboration between public parties.

The validation of this theoretical framework with a survey also indicated the perceived importance of the factors by the participants. The five factors with the highest perceived importance are;

- Professional, informal communication between personnel from individual organizations (29)
- Communication in inter-organizational working teams (30)
- Level of shared knowledge (35)
- Specialization of collaborating organizations (47)
- Performance of inter-organizational collaboration (57)

Two of the most important perceived factors, factors 29 and 30, were further researched to analyse how these factors can be maintained, and supported for the continuation of the interorganizational collaboration. This analysis led to the extension of the theoretical framework as presented in Figure 74. The extended theoretical framework is depicted in Figure 75.

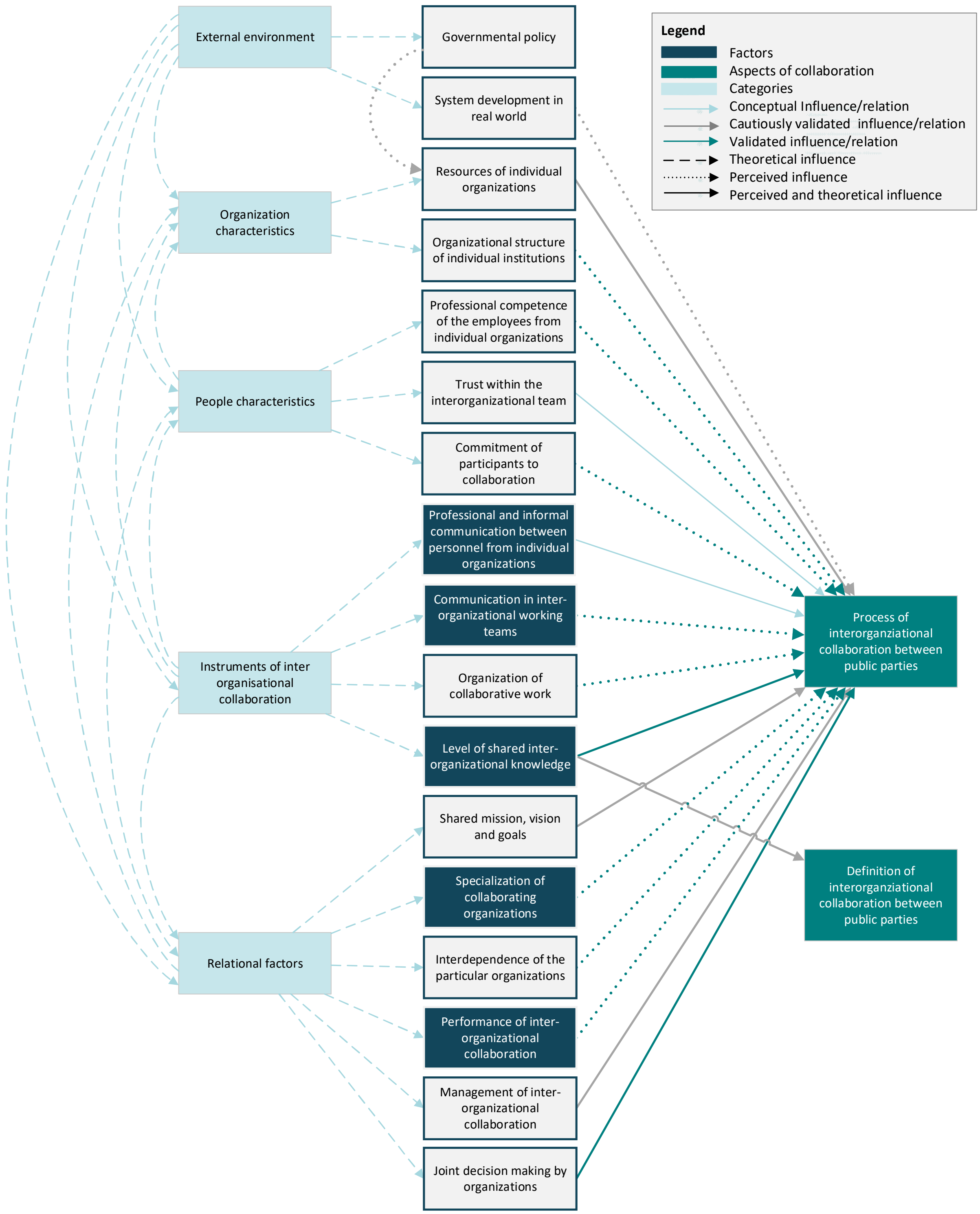

Figure 74: First validated theoretical framework

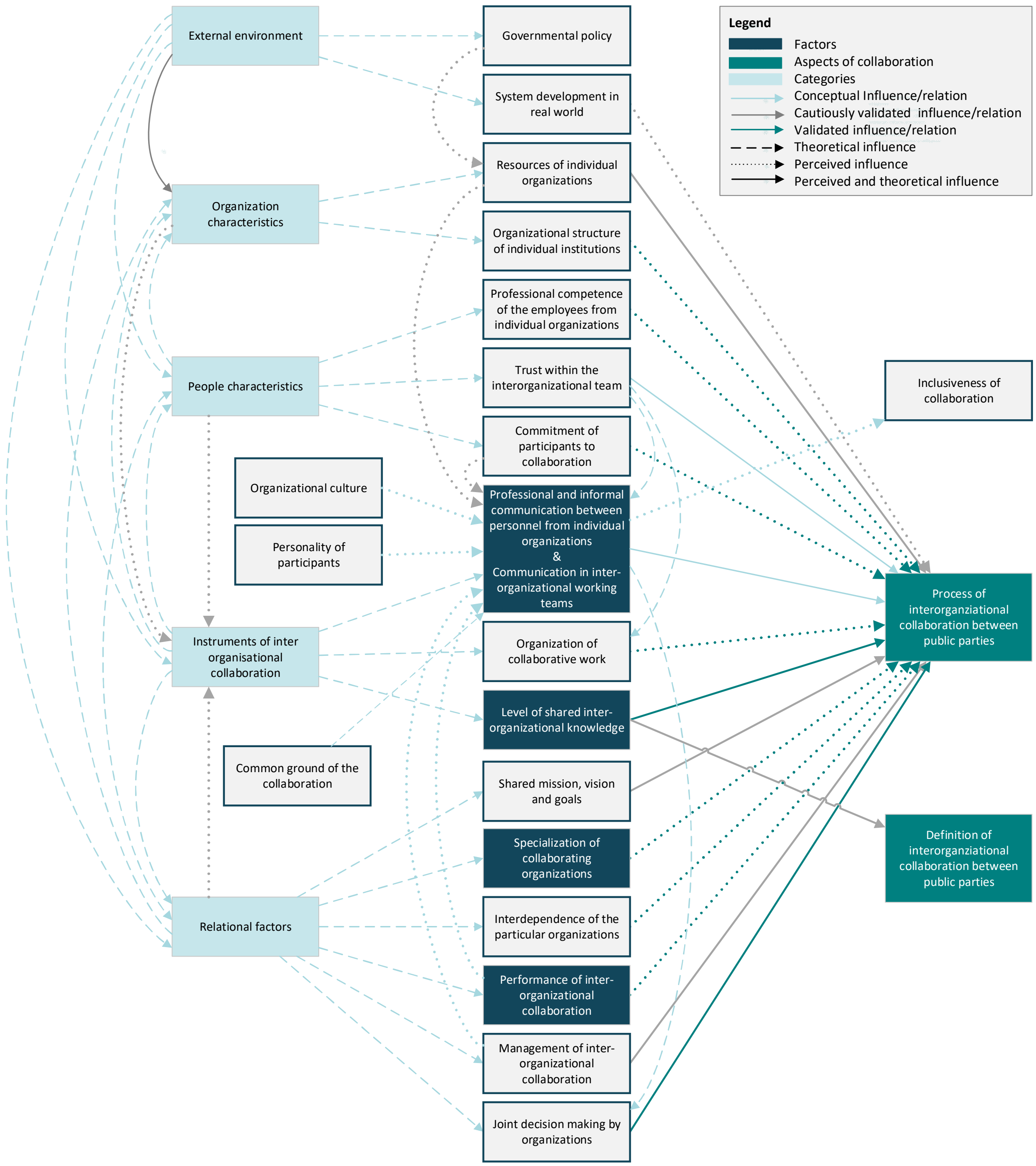

Figure 75: Second validated theoretical framework

Chapter 15 discussed the results as well as the process of this research project. The identified factors that influence interorganizational collaboration between public parties are not generalizable based on this research alone. Additional research is required to be able to draw generalizable conclusions. However both the identified factors, as well as their explorative relations provide a basis for further research. Some recommendations for further research have been mentioned in chapter 15, and are summarized below in section 16.3.

The identified relations between the factors are depicted in Figure 76. Some relation between factors have been validated for this research, these are represented in the final theoretical framework of Figure 75. All identified relations are visible in Figure 76. These relations are not validated, but are based both on literature and the case study. This research indicated that a system approach of factors that influence interorganizational collaborations has not been done before, but can shed light on the developments and dynamics of interorganizational collaborations.

In chapter 14 are the relations between the five most important factors explained. One of these relations was not identified until the focus group, this was the relation between the performance of the collaboration and the communication factors. The late discovery of this relation might indicate that the interviews focused mostly on what influence the performance of a collaboration, and not on the role of the performance of the collaboration on the future development of the collaboration.

The relations between the factors indicate that it is not as straight forward to identify important factors as it sometimes seems. Sometimes literature and the case study identified contradicting causalities of the relations, other times the different literature sources and participants all mentioned other causes for the same effects. If it is unknown what de causalities are, it is difficult to know how interorganizational collaborations can be influenced for the better. Further research into the relations between the factors is therefore just as essential as further research into the factors themselves. Some suggestions for further research are mentioned in section 16.3.

16.2 Contributions of the research

The limitations of the research have already been discussed in section 15.1. This section will focus on the contribution that this research does have to science and society. This thesis project contributes to science by addressing part of the identified knowledge gap. The knowledge gap focusses on the understanding of which factors are perceived to influence the collaboration between public parties. Although this research alone is not an answer to this knowledge gap, it does provide a theoretical basis and practical approach to keep researching this knowledge gap.

This research also contributed to another aspect of science, where a focus on the 'system' of interorganizational collaboration includes both factors and the relations between these factors. This system approach is new for research into interorganizational collaborations, and is expected to be able to contribute to the societal relevance of future research into collaborations as well. Knowing the relations between the factors will make it easier to identify approaches to enhance interorganizational collaboration processes.

This thesis project contributes to society by drawing attention to the need of collaborations within the context of a coherent policy strategy. Even though the need for collaboration is only one aspect, and the development of long term strategies under political pressures should also be researched, it does draw attention to the need for coherency and collaboration between policy makers and developers.

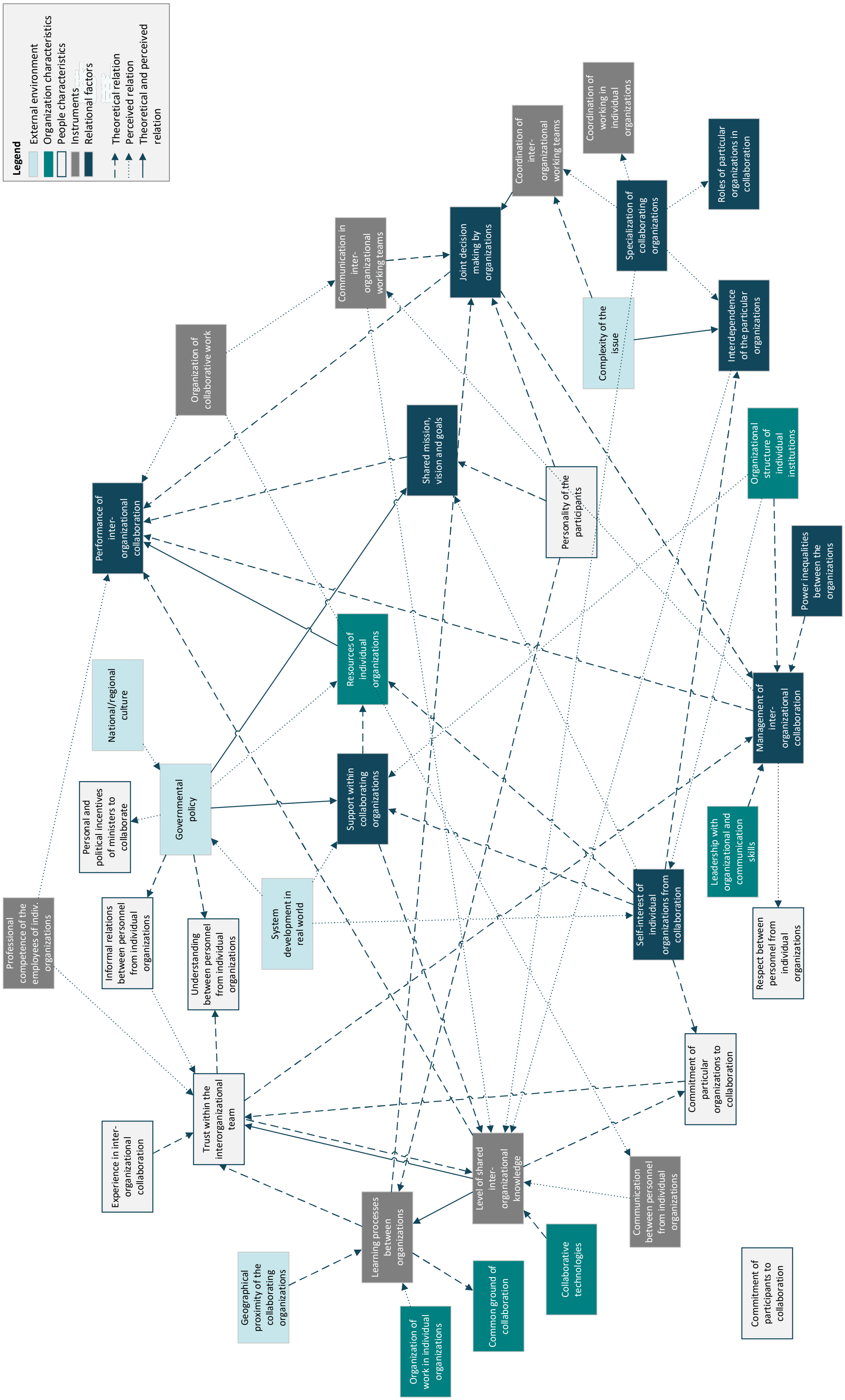

Figure 76: Relations based on the twenty identified important factors through literature and interviews

16.3 Recommendations for further research

Some recommendations for further research have already been mentioned in chapter 15. These recommendations focussed on the generalizability of the results and are summarized below.

1. To qualitatively research the differences between interorganizational teams for the Dutch ministries that focus on sustainable policies.
2. To qualitatively research the perceptions of the other identified theoretical factors that influence interorganizational collaboration between public parties in a sustainable context.
3. To quantitatively confirm the perceptions of these factors, in order to create a generalizable outcome.

However there are also additional recommendations for further research that look further than the generalizability of the results of this thesis project. There are two additional recommendations for further research that are addressed below.

4. To research the development of policy visions and what drives the policy makers to the short term vision that we see in the Netherlands. As well as how this can be changed to facilitate the development of long term policy strategies.
5. To fully understand the relations between the factors and thus collaboration as a system, a lot more research is required into the relations between all factors. A system perspective of these relations could shed more insight into the knowledge gaps that are concerned with this aspect of interorganizational collaboration.

It is expected that the body of knowledge on collaboration between public parties will grow over the coming years, as many scientist already see the need for increased collaborations due to the increase in complexity of the issues.

16.4 Reflection

Three topics will be briefly reflected on, these three topics are the focus on collaboration, the system perspective, and the context of public organizations. A more extended reflection on relation between the energy system and the collaboration the is part of chapter 17, which focusses on the integration of the two theses researches of this report.

16.4.1 The focus on collaboration

This research focussed on interorganizational collaboration, and aims to contribute to the ability to develop a long term policy strategy. However, there are also other aspects that contribute to the development and implementation of long term policy strategies. For example, the political culture that focusses on a four year cycle and how to reach all stakeholders in the energy system (e.g. all households) are also challenges.

Perhaps is collaboration not the most essential focus for a research that aims to contribute to a long term policy strategy. However, even though other challenges remain, if the government organizations do not collaborate, solving any of the challenges will be more difficult. The two examples above, for the political culture and the reaching of all stakeholders also benefit from successful collaborations of public organizations. Not one organization alone can change a culture, or can reach all individuals and companies in the Netherlands. Each organization has to focus on their priorities, and collaboration between the organizations can maintain a vision on the bigger picture.

16.4.2 The system perspective

The system perspective that is applied for 'interorganizational collaboration' as a system has been valuable for this research. Even though it might be counterintuitive to see 'interorganizational collaboration' as a system, it has many of the same characteristics. There is a physical dimension (meeting rooms, computers, phones, etc.), and institutional dimension (culture, norms, and values), as well as an economic dimension (transaction costs of collaboration, and the allocation of resources such as time).

The factors within this system influence each other and therefore influence the dynamics and results of the system as a whole. By researching the relations for the successful case study of this research, can a benchmark be developed. Future research can contribute by analysing the relations that are identified in a (more) unsuccessful collaboration between public organizations. The growing body of knowledge can contribute to designing strategies of how to influence the collaboration processes for the better.

The vision remains that the relations between the factors of the system of interorganizational collaborations are just as important and insightful as understanding the factors themselves.

16.4.3 Public organizations

This research focussed on collaborations between public organizations. It is expected that the same research approach, but for private organizations (or public-private-partnerships) will yield different results.

For example, the online communication platform that is researched in chapter 14, as a method to ease the communications between the organizations and within the interorganizational team, is expected to be more complicated when private parties are involved. The individual goals of private parties are expected to differentiate more, as well as the power inequalities within the team (e.g. based on available resources) and a more difficult development of trust. However, this does not indicate that an online platform does not help interorganizational collaborations, but rather that different ground rules have to be implemented alongside an inline platform for private parties, than for public parties.

17

Integration of the two research projects

In chapter 1 has the general introduction led to a combined problem statement for two research questions. This problem statement focusses on the need for coherent long term policy strategies in order to aid the energy system to develop into a sustainable sector. The investments that are required for this change have large upfront costs and long pay back times. These characteristics of the investments warrant a clear policy vision that look around 20 years ahead. Together with the interconnected and interdependent nature of energy systems leads this need for clarity on the long term towards a complex issue. This report contains two perspectives on this issue that will be reflected on below.

Part II of this report focused on the system analysis of the energy systems and policy measures interfere. The system perspective indicates the need for a coherent set of policy measures rather than multiple individual measures.

Part III of this report has focused on the collaboration between two ministries and their implementation organization. In order to be able to implement the long term set of policy measures, the different departments need to collaborate.

This chapter reflects on the integration of the two parts of this thesis. Both aspects are expected to be necessary for the energy transition to mature. Of course there are more requirements than these two aspects, but they aim in the right direction.

17.1 What did CoSEM contribute to SEC

For the contributions of CoSEM to SEC will the theoretical contributions and practical contributions be discussed separately.

17.1.1 Contributions from literature to literature

The CoSEM research indicates the need for collaborations when the systems itself become more integrated. This collaboration, albeit on a higher level, is also illustrated by the following quote from CoSEM literature (IPCC, 2007, p.252):

> *"Energy access for all will require making available basic and affordable energy services using a range of energy resources and innovative conversion technologies while minimizing GHG emissions, adverse effects on human health, and other local and regional environmental impacts. To accomplish this would require governments, the global energy industry and society as a whole to collaborate on an unprecedented scale."*

Even though this collaborations is on a higher scale, between governments as a whole, the industry, and society, this high scale collaboration cannot be achieved if *the government as a whole* does not exist. To achieve this unity within the government the individual organizations of the government need to collaborate as well. This multi-level idea can complement the system view of collaboration as is applied in Part III of this research. Not only can collaboration in general be seen as a system, it can also be seen as multiple sub-systems that together make up a whole. In this comparison would the collaborations between governmental organizations be the sub-systems of the sector wide collaborations between governments, industry and society.

17.1.2 Contributions from literature to practice

The CoSEM research was started first. The insights in the system of policy measures in the Dutch energy system aided the identification of participants for the SEC research. The system insights also proved to be valuable during the execution of the interviews, as the context in which the participants worked was understood to a higher degree.

The CoSEM research suggests a software tool to be developed, the API (Analysis of Policy Interference) tool, in order to increase the usability of the 7-step methodology. The API tool can be used by other researchers to look at other (sub-)systems and to further develop the 7-step methodology. However another use pf the API tool and 7-step methodology was also mentioned. As the integration of the policy measures is suspected to increase, or at least is suggested to need to increase, it will also become more and more important that the policy makers are aware of the interference between these policy measures. The API tool and 7-step methodology could be used to create awareness with policy makers of this integration and interference between policy measures. The use of these methods for policy makers was shortly discussed in the focus group (see chapter 14 for the design and additional results of the focus group).

The insights of the focus group were that the methodology was perhaps a bit detailed for use by policy makers, but that the research divisions of the national government could perhaps use the insights created. The 6s-tep methodology could work as an interactive team exercise if a less detailed approach could be used with the methodology and/or tool.

17.2 What did SEC contribute to CoSEM

The contribution form SEC to CoSEM is more theoretical than practical. But the contributions are derived from literature as well as the case study. Both will be discussed below.

17.2.1 Contributions from literature to theory

The notion that the complexity and interconnectedness of the energy systems can lead to unintended interference is also supported in the collaborative body of knowledge. For example, Bouwen & Taillieu (2004, p.139) mention on the complexity of collaboration processes:

> *"Given that organizations and societies live in a complex and highly interconnected world, independent actions from each can produce non-anticipated, and uncontrollable consequences for all."*

An article on interorganizational collaborations between British government organizations explains that the need for collaborative approaches derives from the characteristics of policy measures as well. In this article does Flinders (2002, p.61) explain the need for a more radical approach to collaboration by mentioning a set of characteristics of policy making. These characteristics are what is also seen in the CoSEM research, confirming the underlying assumption that policies of different departments can indeed conflict, as well as that collaboration is a method to handle this (Flinders, 2002, p.61):

> *"A typology of the circumstances in which a cross-cutting approach between departments and agencies might be needed (Cabinet Office 2000a, p. 15)*
>
> - *Strategic policy outcomes requiring a top-down approach led by the centre in order to deal effectively with trade-offs and/or issues affecting several departments;*
> - *Optimizing the benefits of policy outcomes across a range of departments and agencies; Achieving the best trade-off between conflicting policy outcomes;*
> - *Improving the delivery of complementary outputs and services; and,*
> - *Improving the implementation of shared tasks and processes to deliver common or different outcomes."*

A second assumption in the CoSEM research is the indirectness of the influence of policy measures on the system. This assumption is supported in the following quote from SEC literature (Imperial, 2005, p.293):

> *"Rather than having a direct effect on the real world, individual or collective policy-making activities determine, enforce, continue, promote, enhance, constrain, or alter actions at the operational level"*

In this quote mentions Imperial (2005) that policy making influences the activities of others and not the system directly. Based on this assumption was the behavioural level added to the system overview of Part II.

Part II of this thesis ends with a reflection. In this reflection is the energy transition compared to the development of a human. This comparison illustrated the authors perception that the policy measures in the energy system should be more strict by saying: 'If the policy strategy for the coming ten years is clear and more strict than the policy measures are now, the energy transition can grow up to be a reliable and trustworthy system' (section 8.5.2 of this report). The same idea of the need for strict and clear messages to be able to fully change on the long term is supported by the previously mentioned article on collaboration in the British government (Flinders, 2002, p.52):

> *"The article concludes by suggesting that the current plans may be insufficiently radical and that they risk producing a range of unintended consequences."*

The similarity of these two concluding statements, one from a socio-technical perspective, one from a collaborative perspective, contribute to the mutual understanding of change in systems. The desired change needs to be clear, radical, and supported for a longer period in time. The *parents* in the human life analogy need to stick to these plans and see them through in order for the system to be able to anticipate on what is coming in the future and be ready when that time comes.

17.2.2 Contributions from the case study to literature

Two participants of the research into interorganizational collaboration have indicted the complexity of policy making and development in their interviews.

One participant mentioned that the sum of multiple policy measures form different ministries that contribute to the breakthrough of an innovation. This participant continues to explain that sometimes these policy measures do not seem to influence each other when looked at on paper, but that when the whole system in the Netherlands is pictured it can have a relatively large impact and it becomes difficult to know which policy measure caused the breakthrough.

It is this interconnectedness that the research into interference between policy measures aims to analyse. The perception of this interconnectedness is essential for the analysis of the interference to be accepted and adopted by policy makers.

Another participant has mentioned that expectations from market parties on a coming policy measure were not met when the policy measure well through. This setback for the market parties, caused by policy makers, then made the collaboration process between the policy makers and market parties more difficult for a while. This indicates that not only that market parties have certain expectations, and the policy makers should be clear in meeting or not meeting those expectations on forehand for the system to be able anticipate and grow. As well does this account by the participant indicate that the lack of clarity or a clear long term vision can hamper the day to day work of policy makers.

17.3 The bigger picture

From the above two sections can already be seen that the CoSEM and SEC approaches support some of the key assumptions and insights of the two research parts. This enhances each research as an individual entity, but also contributes to the idea that both aspects are required in order to make the change towards an sustainable energy system in the Netherlands. As is mentioned at the beginning of this chapter are those two aspects not the only requirements for the development of the energy system. The dot at the horizon is an integrative long term approach to policy making for the Dutch energy system. The integration aspect is discussed in this thesis project. Both the system analyses of the socio-technical and collaborative aspects focus on the need for integration and how this can be supported within policy making. However, the long term character of the envisioned end goal (the dot on the horizon), is not included in these analyses.

The possibility to develop a long term vision is the responsibility of those on a higher and more political level. As one participant of the SEC research mentioned, could the interorganizational team try to influence the long term visions more by mentioning the need of the market for stability and clarity on the long run. This opportunity was not fully used during the new formation of the cabinet according to the participant. Even though the team that is used as a case study cannot influence the development of a long term vision directly, they can increase the awareness of politicians for the need of a long term vision. As the policy strategy, as explained in chapter 1, both needs collaborating employees, and a long term vision, has the latter been more difficult to research with the chosen case study.

The need for a long term element not only for system developments but also for collaborative processes is supported by the following quote (Bouwen & Taillieu, 2004, p.140):

> *"The earlier developments in business, public service or natural resource management led to growing awareness of the dysfunctions of ignoring interdependencies […] Also, on the one hand, the time perspective has changed in scientific orientations, by actively moving towards long-term perspectives with concepts as sustainability in public affairs and ecology, and on the other hand, by moving away from one-shot approaches in problem solving, decision-making, negotiation and change, towards recognition of the continuous character of these processes."*

The reason for the need of a long term element in collaboration is explained by another article as (Imperial, 2005, p.310):

"Public managers should also remember that once trust and interorganizational relationships have developed, they must be maintained. Some effort is required to socialize new participants to the norms, values, and routines of collaborative processes (Leana & Van Buren, 1999). Other-wise, trust and relationships will erode, especially when there is high staff turnover, when agency leadership changes, or when new organizations join the effort."

17.4 Aim of the thesis project

The aim of this thesis project was to contribute to the awareness of policy makers and to try and contribute to literature and the case study. There are many different aspects and perspectives that can be valuable to research. The combination of interference between policy measures and interorganizational collaboration is based on the idea that both the system, as well as the human individuals behind this system influence the energy transition.

As mentioned in chapter 15, are both researches based on a view of the world in systems and for both is searched for links between sub-systems. Finding the link between the technical energy system and the collaborations required in policy making was based on this system perspective. These two topics are invariably linked together. The integrations in the energy system increase the need for collaboration, whereas collaboration can increase (the effectiveness of) the integrations in the energy system.

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Appendices

"I've starred in a lot of science fiction movies and let me tell you something, climate change is not science fiction. This is a battle in the real world and it is impacting us right now."

- Arnold Schwarzenegger

Content

A

Description of policy measures

This appendix briefly describes the 119 selected policy measures. Also the starting dates are mentioned for each policy measure.

A.1 Overview of selected policy measures fort his thesis project

Each selected policy measure is identified with the number the NEO 2016 model gave it. This means that the identification numbers run from 1 to 194, but not all numbers are included.

1. Energiebelasting

Belasting over het verbruik van elektriciteit en aardgas voor de consument en industrie (Rijksoverheid.nl, n.d.).

Datum van implementatie: 1-1-2008, laatst gewijzigd: 1-1-2010

2. Verschuiving energiebelasting eerste schijf

Met de schuif in de energiebelasting van elektriciteit naar aardgas komt de energiebelasting meer in balans in verhouding tot de energie-inhoud en CO2- uitstoot waarmee wordt bijgedragen aan de verlaging van de CO2-uitstoot (Ministry of Finance, 2016).

Datum van implementatie: 1-1-2016

3. Vamil/MIA

Aftrekken van energiezuinige en/of innovatieve investeringen, die niet verplicht worden door de wet, van de belasting (Ministry of Infrastructure and Environment, 2017; Overheid.nl, 2014a, 2017a).

Datum van implementatie: 1-1-2001 (MIA), 1-1-2009 (Vamil)

4. EIA (Energie investerings aftrek)

Het doel van de energie-investeringsaftrek (EIA) is het stimuleren van investeringen in energiebesparende bedrijfsmiddelen of in duurzame energie. De regeling is bedoeld voor ondernemers die in Nederland inkomsten- of vennootschapsbelasting betalen (Overheid.nl, 2017j; RVO.nl, n.d.-h).

Datum van implementatie: 1-1-2001

5. Wijziging Uitvoeringsregeling EIA

Het aftrekpercentage voor investeringen in energiebesparende bedrijfsmiddelen of onderdelen daarvan is komend jaar verhoging naar 58% met een budget van € 161 miljoen (Overheid.nl, 2017j).

Datum van implementatie: 1-1-2016

6. Verhoging aftrekpercentage EIA van 41,5% naar 58%

Voor de EIA geldt op dit moment een aftrekpercentage van 41,5%. Bij dit percentage wordt de belastbare winst verminderd met 41,5% van de waarde van de investering, hetgeen bij een vennootschapsbelastingtarief van 25% een voordeel van circa 10% betekent. Door de voorgestelde verhoging van het aftrekpercentage naar 58% loopt dit voordeel voor vennootschapsbelasting-plichtigen op naar maximaal 14,5%. Het budget van de EIA wordt hiervoor met € 60 miljoen verhoogd tot € 161 miljoen (Overheid.nl, 2017j).

Datum van implementatie: 1-1-2016

7. TopSector Energieregelingen (TSE)

Voor innovaties die duurzaam en economische groei aan elkaar koppelen, komt u in aanmerking voor subsidies energie-innovatie. Deze subsidies zijn een onderdeel van de Topsector Energie. De Topsector Energie biedt jaarlijks 100 miljoen euro subsidie aan projecten en onderzoek op het gebied van energie-innovaties. Hiermee versterken we de Nederlandse concurrentiekracht, werkgelegenheid en welvaart (Overheid.nl, 2017h; RVO.nl, n.d.-a).

Datum van implementatie: 20-6-2014

8. Tender Duurzame Energie Innovatie (DEI)

De regeling Demonstratie energie-innovatie (DEI) is bedoeld voor innovatieve ondernemers die met hun project net vóór marktintroductie zitten. Het gaat om producten of diensten die energie besparen, duurzame energie opwekken of de toepassing van duurzame energie stimuleren. Een nieuw product wordt vaak als een risico gezien en acceptatie is niet vanzelfsprekend. Het demonstreren op ware schaal en in praktijkomstandigheden maakt dit makkelijker (Overheid.nl, 2017h; RVO.nl, n.d.-e).

Datum van implementatie: 11-7-2014

9. MIT (MKB Innovatiestimulering Topsectoren)

Een mkb-ondernemer kan namens een samenwerkingsverband een aanvraag indienen voor een R&D-samenwerkingsproject. Een MIT-R&D-samenwerkingsproject is gericht op de ontwikkeling of vernieuwing van producten, productieprocessen of diensten. Het project bestaat uit industrieel onderzoek en/of experimentele ontwikkeling, voor gezamenlijke rekening en risico uitgevoerd door een samenwerkingsverband van minimaal 2 mkb-ondernemers (Overheid.nl, 2017h; RVO.nl, n.d.-r).

Datum van implementatie: 20-8-2014

11. Regeling groenprojecten

De overheid geeft belastingvoordeel aan 'groene' spaarders en beleggers. Daardoor kan de bank een lening voor een lager rentetarief aanbieden aan een investeerder met een groenproject. Zo'n investeerder heeft hiervoor een groenverklaring nodig. De Regeling groenprojecten 2016 is sinds 1 april 2016 van kracht. De regeling is geschikt voor de nieuwste ontwikkelingen in milieutechnologie en de huidige hoofdpunten van milieubeleid. De veranderde regeling biedt nieuwe projecten een kans op groene financiering. De systematiek is onveranderd gebleven, zoals de vereiste samenwerking tussen beleggers, banken en projectbeheerders (Overheid.nl, 2016; RVO.nl, n.d.-w).

Datum van implementatie: 1-1-2016

12. Wet milieubeheer (Wm) / activiteitenbesluit en –regeling

Het Activiteitenbesluit onderscheidt drie verschillende typen inrichtingen:

1. Type A-inrichtingen betreft de inrichtingen van het activiteitenbesluit met een ‘licht regime'. Deze inrichtingen hoeven bij oprichting of wijziging geen melding te doen aan het bevoegde gezag.
2. Voor Type B-inrichtingen geldt geen vergunningplicht (meer): ze komen geheel onder het activiteitenbesluit te vallen. Deze bedrijven moeten bij oprichting of wijziging van de inrichting wel een melding doen.
3. Type C-inrichtingen zijn nog steeds vergunningsplichtig. Wel zullen de verschillende voorschriften uit hoofdstuk 3 van het activiteitenbesluit voor deze inrichtingen gaan gelden.

Onder het Activiteitenbesluit zullen meer bedrijven vallen dan onder de voormalige 8.40-AMvB's. De nieuwe algemene regels en hun grotere toepassingsbereik moeten tot een verbeterde uitvoering en handhaving leiden en daarmee tot een doeltreffender bescherming van het milieu. Tegelijk wordt een efficiencywinst beoogd in de vorm van een aanzienlijke reductie van de administratieve lasten, waarbij de bestuurlijke lasten niet mogen toenemen. Op 1 januari 2008 zijn het Activiteitenbesluit en de ministeriële regeling (grotendeels) inwerking getreden. Nadien is de werkingssfeer meermaals uitgebreid (Overheid.nl, 2017b).

Datum van implementatie: 1-1-2008

14. Europese CO_2-emissie handel (ETS)

Op 1 januari 2013 is de derde fase van het Europese systeem van emissiehandel (EU ETS) van start gegaan. Deze fase duurt tot 2020. In Europa nemen circa 10.000 bedrijven deel aan het EU ETS, waarvan ongeveer 450 Nederlandse bedrijven. Het gaat om industriële sectoren en bedrijven uit de energiesector. Naast deze sectoren neemt sinds 2012 ook de luchtvaartsector deel. Het doel van het ETS is om de Europese CO2-uitstoot van deze sectoren in 2020 met 21% te verlagen ten opzichte van 2005. Het is de bedoeling om na 2020 de uitstoot nog verder te laten dalen (European Comission, 2017; European Parliament, 2003; NEA, n.d.).

Datum van implementatie: 1-1-2013

17. Expertisecentrum Warmte

NEW geeft informatie over de volgende onderwerpen (Rijksoverheid.nl, 2009; RVO.nl, n.d.-u):

1. Restwarmte en warmtenetten

2. De hernieuwbare warmtebronnen, kansen en mogelijkheden
3. Instrumenten waarmee u een afgewogen keuze kunt maken tussen verschillende warmte- en koude voorzieningen
4. Prestaties van warmte- en koudetechnieken

Datum van implementatie: 16-4-2009

20. Energiebelasting + opslag duurzame energie

Onder de naam energiebelasting wordt een belasting geheven op aardgas en elektriciteit.
Voor de toepassing van dit hoofdstuk en de daarop berustende bepalingen wordt als aardgas mede aangemerkt elk product dat direct of indirect is bestemd voor gebruik, wordt aangeboden voor verkoop of wordt gebruikt als aardgas. Onder de naam opslag duurzame energie wordt een heffing geheven op aardgas en elektriciteit (Overheid.nl, 2017k, 2017m).

Datum van implementatie: 1-1-2013

21. Afschaffen Kolenbelasting

De Unierechtelijke energierichtlijn (Richtlijn 2003/96/EG) kent als hoofdregel een vrijstelling. Om deze vrijstelling af te schaffen zou heffing van kolenbelasting het milieu moeten dienen. De Nederlandse wetgever heeft de vrijstelling per 1 januari 2013 afgeschaft in het kader van een begrotingsakkoord en om een financieel gat te dichten. Uit de wetsgeschiedenis en de marktomstandigheden toentertijd volgt dat de wetgever wist dat met de heffing van kolenbelasting het gebruik van kolen niet zou verminderen. Om de financiële opbrengst van de afschaffing van de vrijstelling te realiseren was ook noodzakelijk dat het gebruik van kolen niet zou verminderen. Per 1 januari 2016 is de vrijstelling van kolenbelasting weer heringevoerd. Uit de wetsgeschiedenis van deze wijziging blijkt onomwonden dat de wetgever weet dat de heffing van de kolenbelasting niet kon bijdragen aan een beter milieu. De afschaffing van de vrijstelling van kolenbelasting per 1 januari 2013 is in strijd met de energierichtlijn. Het hof stelt X bv in het gelijk en oordeelt dat zij de op aangifte voldane kolenbelasting terugkrijgt (Overheid.nl, 2017k; Sociaal-Economische Raad, 2013).

Datum van implementatie: 1-1-1995

22. Congestiemanagement

Op 9 februari 2010 is de Tweede Kamer akkoord gegaan met een wijziging in de Elektriciteitswet. Het voorgestelde artikel 24a, lid 8, van de Elektriciteitswet 1998 bevat een delegatiebevoegdheid ten aanzien van het vaststellen van nadere regels met betrekking tot congestiemanagement. Dit betekent dat de netbeheerder congestiemanagement toepast om te zorgen voor transportcapaciteit voor de producenten van duurzame elektriciteit. De minister van EZ heeft een systeem voorgesteld dat tijdelijk voor verkeersagent kan spelen om duurzame elektriciteit voorrang te geven (Overheid.nl, 2011; RVO.nl, n.d.-g).

Datum van implementatie: 9-4-2011

25. Regeling Indirecte Emissiekosten ETS

De subsidieregeling Indirecte emissiekosten ETS (Emissions Trading Scheme) compenseert bedrijven die hogere elektriciteitskosten hebben door emissiehandel. De regeling valt onder de Regeling nationale EZ-subsidies (RNES) (Overheid.nl, 2017h; RVO.nl, n.d.-ab).

Datum van implementatie: 20-8-2014

29. MEP-regeling

De MEP-subsidie (Milieukwaliteit van de Elektriciteitsproductie) is verleend aan elektriciteitsproducenten met wind-, zon- en waterkracht en biomassa. Producenten konden tot 18 augustus 2006 een subsidieaanvraag indienen. Sinds 1 januari 2009 voert Rijksdienst voor Ondernemend Nederland de nog resterende MEP-projecten uit.

MEP: de subsidie verstrekt ten behoeve van de productie van duurzame elektriciteit, klimaat neutrale elektriciteit of elektriciteit die is opgewekt door middel van warmtekrachtkoppeling op grond van artikel 72m van de Elektriciteitswet 1998 (Overheid.nl, 2003, 2015; RVO.nl, n.d.-q).

Datum van implementatie: 5-6-2003

30. SDE-regeling

Voorloper SDE+, zie 31.

Datum van implementatie: 18-3-2015

31. SDE+ regeling

Bedrijven en (non-profit) instellingen die hernieuwbare energie (gaan) produceren, kunnen gebruik maken van de subsidieregeling SDE+. De subsidieregeling is bedoeld voor hernieuwbare energietechnieken en is onderverdeeld in de categorieën Biomassa, Geothermie, Water, Wind (land, meer en dijk) en Zon. De SDE+ categorie Wind op Zee heeft haar eigen budget en aanvraagprocedure (RVO.nl, n.d.-z; Staatscourant, 2014).

Datum van implementatie: 27-2-2016

32. Rijksstructuurvisie windenergie op land

In de Structuurvisie wijst het kabinet 11 gebieden aan die het meest geschikt zijn voor grote windmolenparken (minimaal 100 megawatt). In deze gebieden waait het relatief vaak en hard. Ook zijn de gebieden dunbevolkt. De gebieden zijn gekozen na overleg met de provincies. Provincies wijzen zelf plaatsen aan voor kleinere windparken met minder dan 100 megawatt (Ministerie van Infrastructuur en Milieu, 2014; RVO.nl, n.d.-s).

Datum van implementatie: 28-3-2014

33. Investeringsuitrol net op zee vanaf 2017 e.v.

De netbeheerder moet zijn investeringen in de aanleg van het net op zee kunnen terugverdienen, voor zover deze efficiënt zijn. Zodra het net op zee in gebruik is genomen, toetst ACM of de kosten die de netbeheerder maakt, efficiënt zijn.

Met de gekozen uitrolstrategie is TenneT in staat de aansluiting van Wind op Zee op een toekomstgerichte manier te faciliteren. De modulaire opbouw van het netontwerp maakt het mogelijk dat TenneT op het juiste moment de landaansluiting voor de voorziene OWF's realiseert. De netbeheerder op zee kan hierdoor substantiële financiële en technische voordelen realiseren bij toekomstige ontwikkeling van OWF's en andere mogelijke vormen van energieopwekking. Het past bij de taak van een netbeheerder om een dergelijke toekomstgerichte visie mee te nemen in de ontwikkeling van een strategie voor het net op zee. Het introduceert wel het risico van stranded investments als OWF's niet als verwacht ontwikkelen. Dit risico wordt gering geacht indien de overheid bij de uitgifte van kavels en het daarop te realiseren windvermogen rekening houdt met het transportvermogen van de door TenneT te plaatsen aansluitingen op zee (ACM.nl, 2016; DNV GL, 2014).

Datum van implementatie: 2017

34. Uitvoeringswet windenergie op zee

Dit wetsvoorstel heeft tot doel de opwekking van windenergie op zee te bevorderen, ook ter uitvoering van het Energieakkoord voor Duurzame Groei. Daartoe beoogt het een integraal wettelijk stelsel te bieden voor de aanwijzing van geschikte locaties voor windparken op zee en de uitgifte van vergunningen voor de bouw en exploitatie van deze windparken(Eerste Kamer der Staten-Generaal, n.d.; Overheid.nl, 2015b).

Datum van implementatie: 1-7-2015

36. Spoedwet wind op zee

Met de aangenomen wet krijgen ontwikkelaars van de windparken daarnaast meer duidelijkheid over de aansprakelijkheid van schade door eventuele vertraging en storingen aan het net op zee. Naar verwachting zullen hierdoor meer ontwikkelaars zich in schrijven op de tenders die voor de windparken worden uitgeschreven. Hoe groter de concurrentie, hoe goedkoper een windpark kan worden aangelegd.

De wet geeft netbeheerders meer zekerheid dat zij investeringen voor de aanleg van windparken op land kunnen terugverdienen. Hierdoor kunnen de nieuwe windparken naar verwachting een half jaar tot een jaar sneller worden ontwikkeld. Ook is een verbetering aangebracht in de provinciale coördinatieregeling. Deze regeling geeft provincies en gemeenten nu meer duidelijkheid dat zij samen kunnen besluiten over wie welk project oppakt bij de ontwikkeling van een windpark op land (Rijksoverheid, 2016; VNO-NCW, 2016).

Datum van implementatie: 1-4-2016

37. Gedragscode windenergie op land

Kern van de Gedragscode is dat de omgeving in een zo vroeg mogelijk stadium bij windprojecten wordt betrokken. Voor ieder project wordt in dialoog met belanghebbenden en het bevoegd gezag (bijvoorbeeld de gemeente) een participatieplan opgesteld, waarmee afspraken over participatie door burgers vast komen te liggen. Ook stelt de initiatiefnemer van een windproject een aanspreekpunt voor de omgeving aan. Bij het opstellen van het participatieplan is het uitgangspunt altijd maatwerk. Alle windprojecten zijn immers verschillen. Het maakt bijvoorbeeld uit of het om windmolens op de Tweede Maasvlakte gaat of nabij stedelijk gebied (SER, 2014b).

Datum van implementatie: 4-9-2014

39. Aanwijzing gebieden windenergie op zee

Ook wijst de Rijksoverheid gebieden aan voor de bouw van windparken op zee. Alleen binnen die gebieden is windenergie op zee mogelijk. Er is gekozen voor een beperkt aantal grote windparken. Dat is goedkoper. En zo blijft er zo ruimte over voor andere gebruikers op de Noordzee, zoals de scheepvaart.

Op 26 september 2014 is de Rijksstructuurvisie vastgesteld. Daarmee zijn de windenergiegebieden Hollandse Kust en Ten Noorden van de Waddeneilanden aangewezen. De Rijksstructuurvisie is een wijziging van het Nationaal Waterplan 2009–2015. De aangewezen gebieden liggen buiten de 12-mijlszone (Ministry of Economic Affairs, 2014b; Rijksoverheid, n.d.).

Datum van implementatie: 26-9-2014

43. Garantieregeling geothermie

Het doel van de garantieregeling aardwarmte is het afdekken van het geologisch risico dat het boren van putten voor de toepassing van aardwarmte, niet succesvol is. Het gaat om het risico dat de volgens plan aangeboorde aardlaag minder warm water productie en/of water van lagere temperatuur oplevert dan op basis van een gedegen geologisch vooronderzoek mocht worden verwacht (Rijksoverheid.nl, 2016; Staatscourant, 2009).

Datum van implementatie: 1-1-2010

47. Aanpassing SDE+ voor windenergie op zee

Net als bij de reguliere SDE+ mogen partijen zelf aangeven, onderbouwd met een windrapport, hoeveel vollasturen zij verwachten te produceren. De reden hiervoor is dat de vollasturen per type windturbine verschillen. Al deze vollasturen komen in aanmerking voor subsidie, zodat de subsidie techniekneutraal is en niet een specifieke turbine bevoordeelt. De subsidie wordt uiteraard alleen verstrekt over het daadwerkelijk aantal geproduceerde kilowatturen. Ik sta toe om gemiste subsidiabele productie in te halen, het zogenoemde banking. Als de productie in een jaar tegenvalt, kan dit later alsnog worden gerealiseerd en kan er subsidie voor worden ontvangen. Ook is het mogelijk om energieproductie die hoger is dan de jaarlijkse subsidiabele productie mee te nemen en deze te benutten in latere jaren als de productie tegenvalt. Gemiste productie kan worden ingehaald in één extra jaar na het einde van de subsidieperiode van 15 jaar. Dit is in lijn met de reguliere SDE+.

Naast de algemene voorwaarden van de SDE+ zijn er specifieke criteria voor de categorie windenergie op zee. Die criteria moeten ervoor zorgen dat de windparken werkelijk worden gerealiseerd. Zo moet het eigen vermogen van aanvragers minimaal gelijk zijn aan 10% van de investeringskosten. Hiermee voorkom ik dat te kleine partijen een bod indienen, om de situatie te vermijden dat een winnaar de uiteindelijke financiering niet rond krijgt. Tegelijkertijd is de grens niet te hoog, zodat concurrentie wordt gestimuleerd (Ministerie van Economische Zaken, 2015; Overheid.nl, 2017c).

Datum van implementatie: 1-12-2015

48. SDE: ondersteuning bij- en meestook

De SDE+ ondersteunt in 2017 de productie van energie uit biomassa. U kunt subsidie aanvragen voor vergisting en co-vergisting van mest, allesvergisting, thermische conversie, bij- en meestook van biomassa in kolencentrales, afvalwater- en rioolwaterzuivering (AWZI en RWZI) en vergassing.
Ook is het mogelijk om subsidie aan te vragen voor verlengde levensduur voor installaties die eerder zijn gesubsidieerd vanuit de (OV-) Regeling Milieukwaliteit van de Elektriciteitsproductie MEP of de Subsidieregeling opwekken duurzame elektriciteit in vergistingsinstallaties.

Bij- en meestook van biomassa in kolencentrales is in 2015 toegevoegd aan SDE+. Voor installaties die al eerder via de MEP-regeling biomassa hebben bij- of meegestookt, kunt u subsidie aanvragen in de categorie ‘Bestaande capaciteit voor bij- en meestook van biomassa in kolencentrales’. Bij deze installaties zijn de investeringen die nodig zijn om de biomassa bij of mee te kunnen stoken al gedaan.
Voor bestaande en nieuwe kolencentrales die nog niet eerder biomassa hebben bijgestookt, kan subsidie worden aangevraagd in de categorie ‘Nieuwe capaciteit voor meestook van biomassa in kolencentrales’ (Overheid.nl, 2015; RVO.nl, n.d.-d).

Datum van implementatie: 1-1-2015

49. AMvB Biomassa duurzaamheidscriteria (opgenomen in SDE)

In het energieakkoord is afgesproken dat bij- en meestook in kolencentrales gestimuleerd zal worden. Voorwaarde hierbij is dat er nationale duurzaamheidscriteria voor vaste biomassa worden opgesteld. Om de stimulering van bij- en meestook mogelijk te maken zullen verschillende punten in het Besluit SDE worden gewijzigd. In het energieakkoord is afgesproken dat er niet meer dan 25 PJ per jaar bij- en meestook gesubsidieerd mag worden. In het besluit wordt geregeld dat een cap op de energieproductie kan worden gesteld (Staatsblad van het Koninkrijk der Nederlanden, 2015; Tweede Kamer der Staten-Generaal, 2016).

Datum van implementatie: 18-3-2015

54. ISDE (Investeringssubsidie duurzame energie)

Met de Investeringssubsidie duurzame energie (ISDE) kunt u een tegemoetkoming krijgen voor de aanschaf van zonneboilers, warmtepompen, biomassaketels en pelletkachels. De regeling is voor zowel particulieren als zakelijke gebruikers (Overheid.nl, 2017h; RVO.nl, n.d.-o).

Datum van implementatie: 20-8-2014

55. Communicatiecampagne ISDE

Als ondersteuning van ISDE.

Datum van implementatie: 20-8-2014

56. Offensief lokale energie inclusief postcoderoos

Onderdelen van het offensief zijn (ECN, 2016; Postcoderoos, n.d.):

1. Een volledige vrijstelling van het EB-tarief van 9,5 ct/kWh voor lokaal duurzaam opgewekte stroom per 1 januari 2016
2. Een constructieve communicatie-aanpak per 1 januari 2016 naar wijken en instellingen die een impuls geeft aan coöperatieve projecten voor zon-PV én voor wind en warmte én uitstraling heeft naar projecten in de SDE en/of saldering. Ook de sector zelf gaat onder leiding van ODEDecentraal proberen nieuwe projecten te starten
3. De sector gaat de komende jaren werken aan een kostenverlaging van projecten van energiecoöperaties; ODE-Decentraal formuleert een kostenreductieaanpak die richting 2018 uitkomt op minimaal 30 % kostenreductie bij de opstart van een nieuwe lokale energiecoöperatie.
4. In het overleg lokale energie worden plannen uitgewerkt voor het onderwerp salderen, in samenhang met plannen rondom flexibilisering van de energiemarkt en flexdiensten.

Datum van implementatie: 1-1-2014

58. Subsidies sportaccomodaties subsidieregeling Energiebesparing en duurzame energie sportaccommodaties (EDS)

Deze regeling is gericht op investeringen in energiebesparing en toepassing van duurzame energie ten behoeve van sportaccommodaties. Hoewel het subsidiebudget afkomstig is van het ministerie van VWS, valt de subsidieregeling onder de Kaderwet EZ-subsidies (Overheid.nl, 2017h; RVO.nl, n.d.-ac).

Datum van implementatie: 1-1-2016

63. Meerjarenafspraak energie-efficiency ETS-bedrijven (MEE)

Het MEE-convenant is in 2009 ondertekend en gebaseerd op de structuur van MJA3. MEE is een vervolg op het Convenant Benchmarking. Bij MEE zijn de ministeries van Economische Zaken, Infrastructuur en Milieu en Financiën betrokken. Het MEE-convenant is bedoeld voor grote industriële bedrijven die verplicht meedoen aan het emissiehandelsysteem van de Europese Unie: Emissions Trading System (ETS). De MEE-deelnemers vallen geheel of gedeeltelijk onder het ETS.

The objective of this sector accord is to ensure that the ETS enterprises make a significant contribution to improving energy efficiency for their facilities in the period up to and including 2020 in accordance with the agreed procedures in this sector, by: a. adopting profitable measures aimed at improving the energy efficiency at their facilities and in the chain; b. investigating at strategic level what the energy-saving possibilities are in the long term (RVO.nl, n.d.-v; RVO, 2009).

Datum van implementatie: 2-10-2009

64. Meerjarenafspraken energie-efficiency (MJA-3)

Bij MJA3 zijn de ministeries van Binnenlandse Zaken en Koninkrijksrelaties, Economische Zaken, Infrastructuur en Milieu, Financiën en het IPO namens de provincies betrokken. De intensivering betekent onder meer dat bedrijven zich inspannen voor 30% energie-efficiëntieverbetering in de periode 2005-2020. Ook zijn routekaarten ingevoerd. Verder ligt meer focus op ketenefficiëntie en sector overstijgende samenwerking (RVO.nl, n.d.-v; RVO, 2008).

Datum van implementatie: 1-7-2008

66. 1e selectie erkende besparingsmaatregelen in WMB

Bedrijven en instellingen zijn verplicht om energiebesparende maatregelen te nemen. Het gaat om gebouwen met een jaarlijks elektriciteitsverbruik van meer dan 50.000 kWh of meer dan 25.000 m3 aardgasequivalenten (Aeq). De energiebesparing levert ten opzichte van de investering al snel geld op. In het Activiteitenbesluit, art. 2.15 is de verplichting beschreven dat in dergelijke gebouwen alle maatregelen zijn genomen met een maximale terugverdientijd van 5 jaar. Ook in de gebouwde omgeving zijn veel maatregelen haalbaar met een korte terugverdientijd. Een terugverdientijd is mede afhankelijk van de energieprijs. Om onnodige discussies te vermijden zijn ter verduidelijking erkende maatregelenaangewezen per bedrijfstak (Overheid.nl, 2017b; RVO.nl, n.d.-c).

Datum van implementatie: 1-1-2008

70. Intensivering handhaving Wet Milieubeheer

De partijen van het Energieakkoord gaan extra maatregelen nemen om de doelen van het Energieakkoord voor 2020 en 2023 te kunnen halen. Uit de Nationale Energieverkenning (NEV) 2015, die de stand van zaken van de Nederlandse energiehuishouding geeft, bleek dat voor twee van de vijf doelen (percentage duurzame energie en energiebesparing) extra maatregelen nodig zijn.

Hiervoor worden twintig extra toezichthouders ingezet voor de intensivering van de handhaving van de Wet milieubeheer (Wm) (Bodemrichtlijn, n.d.).

Datum van implementatie: 2015

71. Expertisecentrum energiebesparing

Het ExpertiseCentrum Energiebesparing (ECE) is een onafhankelijke, flexibele netwerk- en kennisorganisatie. Het ECE wordt ondersteund door een ECE team met leden, die parttime gedetacheerd zijn vanuit RVO.nl, maar werken in opdracht van de programmamanager ECE. Het gehele team groeit in 2016 naar bijna 4 fte. Het doel is bedrijven stimuleren om energie te besparen en efficiënter energie te gebruiken. Dit doet het ECE team door kennis toepasbaar te maken en samen met de netwerkpartners goede aanpakken te ontwikkelen (ECEonline.nl, n.d.).

Datum van implementatie: 1-8-2015

72. Raamwerk 1-op-1 afspraken met MEE-bedrijven

Een bedrijfsspecifieke afspraak is een vrijwillige afspraak tussen een bedrijf of een groep van bedrijven die deelnemen aan het MEE-convenant en de overheid (het ministerie van EZ). In het MEE-convenant is afgesproken dat deelnemende bedrijven rendabele energie efficiëntie maatregelen nemen. De bedrijfsspecifieke afspraken gaan dus over energie efficiëntie maatregelen die verder gaan dan wat is afgesproken in het MEE-convenant (Rijksoverheid.nl, 2015; RVO, 2015).

Datum van implementatie: 29-6-2015

75. Nieuwe F-gassen verordening (2014)

De belangrijkste wijzigingen voor de eindgebruiker zijn de frequentie van lekcontroles aan de installatie en de uitfasering van koudemiddelen met een hoog GWP (NVKL.nl, 2015).

Datum van implementatie: 1-1-2015

76. Stimulering van natuurlijke koudemiddelen en de optimalisatie van de EIA ten aanzien van koudemiddelen

Qua financiële stimuli bevordert de Energie Investeringsaftrek het van natuurlijke koudemiddelen te stimuleren in plaats van het gebruik van HFC's die een sterke broeikasgaswerking hebben (Ministerie van Infrastructuur en Milieu, 2011a, 2011b).

Datum van implementatie: 2011

77. Vastgestelde efficiency eisen apparatuur en verlichting in het kader van de Ecodesign richtlijn

De Europese richtlijnen waarin de vereisten voor ecodesign voor energie gerelateerde producten zijn vastgelegd, blijven de verlichtingsmarkt in 2016 beïnvloeden met het doel inefficiënte producten uit te bannen. Met ingang van 1 september 2016 mogen daarom in overeenstemming met de derde implementatiemaatregel 1194/2012 geen gerichte halogeenlampen op netspanning meer op de markt worden gebracht (European Commission, 2012).

Datum van implementatie: 21-10-2009

79. Ecodesign eisen voor kleine gas- en oliegestookte ketels (Verordening 813/2013)

Bij deze verordening worden eisen inzake ecologisch ontwerp vastgesteld voor het in de handel brengen en/of in werking stellen van ruimteverwarmingstoestellen en combinatieverwarmings-toestellen met een nominale warmteafgifte van ≤ 400 kW, inclusief verwarmingstoestellen die zijn geïntegreerd in pakketten van ruimteverwarmingstoestellen, temperatuurregelaars en zonne-energie-installaties en pakketten van combinatieverwarmings-toestellen, temperatuurregelaars en zonne-energie-installaties als omschreven in artikel 2 van Gedelegeerde Verordening (EU) nr. 811/2013 (Europese Commissie, 2013).

Datum van implementatie: 21-10-2009

80. Energie Prestatie Normen en Lenteakkoord (woningen EPC 0,4 vanaf 2015)

Het Bouwbesluit stelt eisen aan energiezuinigheid van nieuwe woningen en utiliteitsgebouwen. De maat voor energiezuinigheid heet Energie Prestatie Coëfficiënt (EPC). De bepaling van de EPC ligt vast in de norm NEN 7120 Energieprestatie van gebouwen (EPG). Deze norm geldt voor zowel nieuwbouw van woningen als utiliteitsbouw (NEN, 2014; Overheid.nl, 2016; RVO.nl, n.d.-k).

Datum van implementatie: 1-1-2008

81. EPC utiliteitsbouw 50% aanscherping in 2015 t.o.v 2007

See 80.

83. Aanscherping Rc waarden in bouwbesluit vanaf 2015

See 80.

85. Btw-verlaging isolatie

Isoleert u een woning? En is het doel hiervan dat de woning energiezuiniger wordt? Dan vallen de arbeidskosten voor het aanbrengen van het isolatiemateriaal aan vloeren, muren en daken bij woningen ouder dan 2 jaar onder het 6%-tarief (Belastingdienst, n.d.-a; NOA.nl, 2015).

Datum van implementatie: 1-1-2014

86. Energielabel: onderdeel woningwaarderingsstelsel

Bij de verkoop, verhuur en oplevering van woningen is een geldig energielabel verplicht. Het Energielabel laat de energieprestatie van de woning zien en maakt duidelijk welke energiebesparende maatregelen nog mogelijk zijn. Het nemen van maatregelen draagt bij aan een comfortabele en energiezuinige woning. De labelklassen voor woningen lopen van A t/m G, oftewel van weinig naar veel besparingsmogelijkheden (Overheid.nl, 2016; RVO.nl, n.d.-j).

Datum van implementatie: 1-1-2008

87. Verruiming hypotheekruimte voor het nemen van energiebesparende maatregelen (ltv en lti toets)

Hogere LTI en LTV normen bij een hypotheek voor het nemen van energiebesparende voorzieningen (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2014a).

Datum van implementatie: 1-1-2013

88. Minimumeisen energieprestatie bij ingrijpende renovatie

Bij het gedeeltelijk vernieuwen of veranderen of het vergroten van een bouwwerk is de energieprestatie-eis (artikel 5.2) niet van toepassing en geldt voor de thermische isolatie (5.3) en de luchtvolumestroom (artikel 5.4) het rechtens verkregen niveau. Indien het rechtens verkregen niveau voor de warmteweerstand lager is dan 1,3 $m^2 \bullet K/W$, dan moet bij het gedeeltelijk vernieuwen of veranderen of het vergroten van het bouwwerk een warmteweerstand van ten minste 1,3 $m^2 \bullet K/W$ worden aangehouden. Zie voor een toelichting op het rechtens verkregen niveau artikel 1.1. Bij het geheel vernieuwen zijn de nieuwbouwvoorschriften onverkort van toepassing (BRIS Bouwbesluit Online, n.d.; Overheid.nl, 2017f).

Datum van implementatie: 1-4-2012

89. Keuring airco: Beg en Reg

Vanaf 1 december 2013 is een wijziging Besluit Besluit energieprestatie gebouwen(BEG) en Regeling energieprestatie gebouwen(REG) van kracht voor keuringen van airconditioningssystemen met een totaal opgesteld koelvermogen op gebouwniveau (dit geldt dus ook voor woningen) van meer dan 12 kilowatt(kW). De eigenaar of huurder van een gebouw dient dit systeem om de 5 jaar te laten keuren door een deskundige volgens een voorgeschreven inspectiemethodiek.

Datum van implementatie: 1-12-2013

90. Bestaande woningen en utiliteitsgebouwen die worden verhuurd of verkocht moeten een energielabel hebben.

See 86.

92. VNG facilitator op lokaal en regionaal niveau door ondersteuningsstructuur inclusief regionale energieloketten

Centraal in de ondersteuningsstructuur staat de regionale ondersteuning. Regio’s kunnen aanvragen indienen bij de VNG voor de ondersteuning van regionale allianties van bedrijven, maatschappelijke organisaties en overheden om zo een bijdrage te leveren aan het behalen van de ambities uit het SER energieakkoord met betrekking tot de particuliere woningeigenaar. De regionale ondersteuning bestaat voor een substantieel deel uit de inzet van coördinatoren (deze worden in het SER Energieakkoord facilitatoren genoemd). Deze coördinatoren ondersteunen en helpen bij het uitbouwen van slimme en innovatieve partnerschappen en concrete projecten binnen de energieke samenleving op het gebied van energiebesparing en duurzame energieopwekking voor particuliere woningeigenaren. Aansluitend bij de ervaringen uit de praktijk leggen de coördinatoren waar mogelijk verbinding met de andere opgaven uit het Energieakkoord (VNG, 2014).

Datum van implementatie: 1-1-2014

94. Grootschalige uitrol van slimme meters

Samenvattend constateer ik dat de uitrol van slimme meters goed verloopt en dat er geen belemmeringen zijn om de grootschalige uitrol te starten. De slimme meter biedt de consument voordelen op het gebied van energiebesparing en gemak op het gebied van administratieve processen. Tevens draagt het bij aan efficiënter netbeheer en slimme netten (Ministry of Economic Affairs, 2014a).

Datum van implementatie: 1-1-2012

96. Introductie voorlopig label woningen

Begin 2015 hebben alle vijf miljoen huiseigenaren van de Rijksoverheid een voorlopig energielabel ontvangen. Dit label is gebaseerd op onder meer bouwjaar en is bedoeld als stimulans om na te denken over kansen voor een comfortabele en energiezuinige woning. Bij verkoop of nieuwe verhuur moet u het voorlopige label definitief gemaakt hebben (Energielabel.nl, n.d.; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2014b; RVO.nl, n.d.-j).

Datum van implementatie: 1-1-2015

97. Borging berekeningssystematiek energieprestatiecertificaat

Het energielabel zal gebaseerd zijn op een uitgebreide bepalingsmethode, die wordt vastgesteld door de NEN en volledig erkend wordt door de marktpartijen. Omdat er veel bekend is over de Nederlandse woningvoorraad kunnen de benodigde gegevens betrouwbaar worden ingeschat. De woningeigenaar is wel verplicht om de juiste gegevens aan te leveren voor de energetische kenmerken die de grootste invloed hebben op het energielabel.

Om een goede handhaving te borgen is in de richtlijn vereist dat er een sanctie wordt gezet op het niet voldoen aan de eis tot overhandigen van een energielabel op transactiemomenten. Ik heb de ILT opgedragen om als onafhankelijk toezichthouder te controleren of een woningeigenaar of verkoper aan zijn plicht heeft voldaan om een energielabel te overhandigen bij verkoop, nieuwe verhuur en oplevering. Door een koppeling van de databases van het Kadaster met de energielabeldatabase zijn alle overtredingen direct in beeld (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2014b).

Datum van implementatie:1-1-2015

98. Gebouw- en gebiedsgebonden specificaties in energieprestatiecertificaat

Het **derde lid** biedt de mogelijkheid om bij zogenoemde gebiedsgebonden maatregelen voor de rendementen bij verwarming, warm tapwater en koeling naar keuze gebruik te maken van een in NEN 7120 aangegeven vaste waarde (referentierendement) of gebruik te maken van een volgens NVN 7125 te berekenen waarde. Wanneer in het kader van gebiedsgebonden maatregelen wordt besloten gebruik te maken van NVN 7125, mag de waarde van de energieprestatiecoëfficiënt zonder dat gebruik gemaakt is van deze voornorm ten hoogste 1,33 maal de in tabel 5.1 aangegeven waarde zijn. Dit betekent dat bij het gebruik maken van NVN 7125 de berekening altijd tweemaal moet worden uitgevoerd, eenmaal zonder en eenmaal met toepassing van NVN 7125. Alleen op grond van de berekening zonder NVN 7125 wordt bepaald of de gebouwgebonden maatregelen zodanig zijn dat de NVN kan worden toegepast. Is de uitkomst van deze berekening ten hoogste 1,33 maal de in tabel 5.1 aangegeven waarde, dan kan vervolgens de energieprestatiecoëfficiënt worden bepaald aan de hand van de feitelijke, met behulp van de voornorm, te berekenen waarde. Toepassing van NVN 7125 biedt dus de mogelijkheid om uit te gaan van een gunstiger rendement van gebiedsgebonden maatregelen dan het in NEN 7120 opgenomen referentierendement. Opgemerkt wordt dat gebiedsgebonden maatregelen die nog niet in NVN 7125 zijn opgenomen op basis van gelijkwaardigheid (zie artikel 1.3) kunnen worden toegepast (Bouwbesluit Online, n.d.).

Datum van implementatie: 1-7-2012

99. Nationale aanpak vervanging oude apparatuur

Lang met spullen doen is bijna altijd goed voor het milieu. Maar dat geldt niet voor koelkasten. Die zijn de afgelopen jaren zó veel zuiniger geworden, dat vervangen loont uit milieuoogpunt. Berekeningen van Milieu Centraal laten zien dat de besparing door het lagere energiegebruik van een zuinige koelkast ruimschoots opweegt tegen de 'weggegooide' productie-energie van het oude apparaat en de energie die het kost om een nieuwe koelkast te maken (ECN, 2013; MilieuCentraal, n.d.).

Datum van implementatie: 2014

101. Nationaal energiebespaarfonds en verkenning aansluiting met Europese en regionale fondsen

Woningeigenaren mogen met deze lening energiebesparende maatregelen financieren, zoals betere isolatie of een nieuwe hr-ketel of zonneboiler. Zonnepanelen mogen ook uit de lening worden betaald, maar voor maximaal 75% van de lening. Het restant moet dan in andere maatregelen worden gestoken. De lening kan gebruikt worden voor 17 energiebesparende maatregelen (Rijksoverheid.nl, 2014b; RVO.nl, n.d.-t).

Datum van implementatie: 21-2-2014

105. Uitvoering Convenant Energiebesparing Huursector reguliere tempo

Op basis van de doelstellingen zoals geformuleerd in het Koepelconvenant: 1. Beogen Aedes en Woonbond met dit convenant in 2020 ten minste een gemiddelde Energie- Index van 1,25 (gemiddeld energielabel B) te bereiken voor de totale huurwoningenvoorraad van de corporaties. Dat komt overeen met een besparing op het gebouwgebonden energieverbruik van bestaande corporatiewoningen van 33% in de periode 2008 tot en met 2020. Deze ambitie betreft het gebouw- en installatiegebonden energiegebruik voor met name ruimteverwarming, warm tapwater en ventilatie. 2. Beoogt Vastgoed Belang de realisatie van een verbetering van de woningvoorraad van haar leden, leidend tot een woningvoorraad in 2020 waarvan 80% label C of beter (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2012).

Datum van implementatie: 28-6-2012

107. Subsidieregeling 400 miljoen voor verhuurders (STEP)

Bent u een verhuurder van een of meer huurwoningen in de gereguleerde huursector? Wilt u de energieprestatie van uw huurwoning(en) verbeteren? Vraag de Stimuleringsregeling energieprestatie huursector (STEP) aan tot en met 31 december 2018.

Het ministerie van Binnenlandse Zaken en Koninkrijksrelaties geeft hiermee een extra impuls aan investeringen in energiebesparing in bestaande woningen binnen de gereguleerde huursector. De stimuleringsregeling komt voort uit het Energieakkoord (Overheid.nl, 2017i; RVO.nl, n.d.-aa).

Datum van implementatie: 1-7-2014

110. Stroomversnelling deal fase 1 en 2 (eerste 11.000 woningen)

Fase 1 prototyping: 1.000 woningen september 2013 t/m december 2014; fase 2 industrialisatie: 10.000 woningen januari 2015 t/m december 2016. Deal: Stroomversnelling huur voor realisatie 110.000 Nul op de Meter renovaties werd voortgezet. Totaal zijn er eind 2015 ruim 250 woningen in de corporatiesector gerenoveerd naar Nul op de Meter. Er zijn duizenden woningen in ontwikkeling (PLatform 31 & Energiesprong, 2015; Rijksoverheid.nl, 2013).

Datum van implementatie: 1-9-2013

115. 1e lichting branches verankeren van erkende maatregellijsten in de Wet Milieubeheer

Met dit geheel aan wet en regelgeving en afspraken met branches en lokale overheden liggen er veel kansen voor energiebesparing. Kansen die het bedrijfsleven zelf ook ziet. Dat biedt een uitstekend startpunt voor een betere naleving van artikel 2.15 die vooral ontstaat doordat sprake is van gezonde bedrijfsvoering en het realiseren van rendabele besparingen (Omgevingsweb, 2014; Staatsblad, 2015b).

Datum van implementatie: 1-12-2015

117. Intensivering handhaving Wet Milieubeheer: prestatieafspraken met gemeenten

Het ministerie van I&M maakt vanaf begin 2015 prestatieafspraken met gemeenten over handhaving van de energiebesparingsverplichting in de Wet milieubeheer. Gemeenten borgen in 2015 een goede naleving van het activiteitenbesluit (Sociaal-Economische Raad, 2016).

Datum van implementatie: 2015

119. Uitvoering EPK-systeem (pilots energie prestatie keuring)

Bedrijven en instellingen die niet deelnemen aan de meerjarenafspraken energie-efficiency dienen te worden ondersteund met een zogenoemde Energie Prestatie Keuring (EPK). Hierbij krijgen private dienstverleners een toetsende rol in de vorm van een periodieke keuring van de energieprestatie van een bedrijf. Met de periodieke keuring toont het bedrijf aan zich te houden aan de energiemaatregel-verplichting van de Wet Milieubeheer. EPK beoogt bedrijven te stimuleren om proactief aan de slag gaan met energiebesparing en tegelijkertijd de handhavinglasten van provincies en gemeenten te verminderen (RVO.nl, n.d.-i; SER, 2014a).

Datum van implementatie: 12-2014

127. Proof-of-principle (onderdeel afspraken Kas als Energiebron - KaE), intensivering KAE

In aanvulling op het eerste lid zet het ministerie van EZ zich binnen de geldende wettelijke kaders en met inachtneming van de Europese mededingingsregels in om voor de periode 2014 tot en met 2017 financiële middelen beschikbaar te stellen. Ten behoeve van Proof of Principle onderzoeksprojecten naar innovatiedoorbraken en grensverleggende concepten op voor de praktijk relevante schaal, 1 miljoen euro per jaar in 2014 en 2015 en 0,5 miljoen euro per jaar in 2016 en 2017 (Staatscourant, 2014b).

Datum van implementatie: 1-1-2014

128. Garantstellingsfaciliteit aardwarmte, intensivering KAE

Via de regeling kan een garantstelling van de overheid worden aangevraagd voor het risico op misboring bij aardwarmte. RNES Aardwarmte is voor initiatiefnemers die gevorderde plannen hebben om een aardwarmteproject uit te voeren. Misboringen worden 'verzekerd' met deze garantieregeling. U betaalt vooraf een premie en in ruil daarvoor keert de regeling uit als een boring een teleurstellend resultaat heeft. Op deze pagina houden wij u op de hoogte van nieuwe openstellingen van de regeling.' (Kas als Energiebron, 2017; RVO.nl, n.d.-y)

Datum van implementatie: 2009

129. versnellingsplan aardwarmte, intensivering KAE

Doel van het versnellingsplan van LTO Glaskracht Nederland en het ministerie van EZ, is het versnellen van de ontwikkeling en toepassing van aardwarmte in de glastuinbouw, zodat het aardwarmte potentieel optimaal benut kan worden. Streefdoel daarbij is 0,3 Mton CO_2-reductie door toepassing van aardwarmte in de glastuinbouw in 2020. Dit komt overeen met ca. 5 PJ en bijna 5% van het energiegebruik van de tuinbouwsector. De laatste jaren zijn gemiddeld 2 projecten per jaar gerealiseerd. Doel van het versnellingsplan is een realisatie van 4 tot 5 projecten in de glastuinbouw per jaar. Zonder versnellingsplan bestaat het risico om terug te vallen naar 1 project per jaar (Kas als Energiebron, 2014b).

Datum van implementatie: 5-2014

131. versnellingsplan HNT (Het Nieuwe Telen), intensivering KAE

De versnelde praktijkintroductie van HNT en de ontwikkeling van innovatie doorbraken sluiten nauw op elkaar aan. Ervaringen bij de uitrol worden benut bij de ontwikkeling van nieuwe doorbraken. En vice versa. Bovendien is de uitrol een essentiële stap om over enkele jaren die doorbraken te kunnen toepassen. De doorbraken kunnen alleen landen in een basis van Het Nieuwe Telen. Bij de toepassing van HNT in de praktijk wegen de teelt effecten minstens zo zwaar als de energiebesparing. Vanwege de diversiteit aan teelten is samenwerking met teeltcoöperaties en teeltgroepen de aangewezen weg voor de ontwikkeling van concepten, demonstratie hiervan en voor (co)financiering van onderzoek (Kas als Energiebron, 2014a).

Datum van implementatie: 5-2014

132. MEI-regeling, intensivering KAE

De overheid en het bedrijfsleven hebben hiervoor het programma Kas als Energiebron opgezet. Daaronder vallen verschillende subsidies, waaronder de subsidie Marktintroductie Energie-innovaties (MEI) voor investeringen in innovatieve energiesystemen (Overheid.nl, 2017h; RVO.nl, n.d.-p).

Datum van implementatie: 22-8-2016

133. IMM (Investeringen in Milieuvriendelijke Maatregelen voorheen IRE), intensivering KAE

Deze subsidie ondersteunt landbouwondernemers die willen investeren in milieuvriendelijke maatregelen (RVO.nl, n.d.-n). Subsidiecategorieën:

1. Mestbewerking
2. Precisielandbouw
3. Mestopslag
4. energie-efficiëntie
5. hernieuwbare energie
6. waterkwantiteit
7. glastuinbouw

Datum van implementatie: 2010

136. Sectoraal CO2-kostenvereveningsysteem

Het CO2-sectorsysteem is een collectief systeem gericht op het behalen van een sectorale CO2-doelstelling. Jaarlijks wordt de werkelijke CO2-emissie vergeleken met de sectorale doelstelling. Hieruit volgt een verrekening over de sector die naar de bedrijven wordt vertaald met een verrekenprijs per m3 aardgas. Deze verrekenprijs is voor alle bedrijven gelijk (Overheid.nl, 2016; RVO.nl, n.d.-l).

Datum van implementatie: 1-1-2015

137. Individueel CO2-kostenvereveningsysteem. (EBG)

Het EBG betreft een door de sector ontwikkeld systeem dat zich richt op het gasverbruik op bedrijfsniveau. Jaarlijks wordt het werkelijke gasverbruik op bedrijfsniveau vergeleken met het toegestaan gasverbruik. Hieruit volgt een verrekening per bedrijf. De deelnemers aan het CO-sectorsysteem en het EBG zijn gelijk (Overheid.nl, 2017l; RVO.nl, n.d.-l).

Datum van implementatie: 26-10-2011

138. Erkende maatregelenlijst Wmb

In het Activiteitenbesluit, art. 2.15 is de verplichting beschreven dat in dergelijke gebouwen alle maatregelen zijn genomen met een maximale terugverdientijd van 5 jaar. Ook in de gebouwde omgeving zijn veel maatregelen haalbaar met een korte terugverdientijd. Een terugverdientijd is mede afhankelijk van de energieprijs. Om onnodige discussies te vermijden zijn ter verduidelijking erkende maatregelenaangewezen per bedrijfstak (RVO.nl, n.d.-c).

Datum van implementatie: 1-12-2015

140. CO_2 normering personenauto's 95 g/km per 2021

In december 2008 zijn op Europees niveau afspraken gemaakt met de autofabrikanten over de gemiddelde CO2-uitstoot van nieuwverkopen: het Europees bronbeleid. In 2015 mag voor elke afzonderlijke fabrikant de gemiddelde CO2-uitstoot van verkochte nieuwe personenauto's ten hoogste 130 gram per kilometer bedragen. Deze grenswaarde wordt teruggebracht naar 95 gram per kilometer in 2021 (Compendium voor de Leefomgeving, 2017; European Parliament & Council of the European Union, 2014b; Ministry of Economic Affairs, 2016).

Datum van implementatie: 11-3-2014

141. CO_2 normering bestelauto's 147 g/km per 2020

Met ingang van 2020 wordt in deze verordening een doelstelling bepaald van een gemiddelde emissie van 147 g CO2/km voor in de Unie ingeschreven nieuwe lichte bedrijfsvoertuigen, voor zover de haalbaarheid daarvan is bevestigd, als bepaald in artikel 13, lid 1 (European Parliament & Council of the European Union, 2011).

Datum van implementatie: 11-5-2011

142. Fiscale stimulering ultrazuinige auto's 2016-2020 (conform Belastingplan 2015 en Wet uitwerking Autobrief II)

Nulemissievoertuigen blijven tot en met 2020 op hetzelfde niveau gestimuleerd, de voor nieuwe auto’s geldende bijtelling voor deze auto’s blijft voor deze periode 4%. Deze stimulering is techniekneutraal en geldt dus voor alle nulemissievoertuigen met een elektrische aandrijflijn, ongeacht of de motor wordt aangedreven door een batterij of een waterstofbrandstofcel. Wel begrenst het kabinet vanaf 2019 het verlaagde bijtellingspercentage voor nulemissievoertuigen aangedreven door een batterij tot het deel van de catalogusprijs tot en met € 50.000. Voor nulemissievoertuigen met een waterstofbrandstofcel is deze begrenzing niet van toepassing. De nulemissievoertuigen behouden tevens een volledige vrijstelling in de MRB en BPM tot en met 2020.

Zoals uitgebreid is toegelicht in Autobrief II kiest het kabinet ervoor om de PHEV’s meer en meer als reguliere auto’s te behandelen en de fiscale stimulering in de komende periode met beheerste stappen af te bouwen (Ministry of Economic Affairs, 2016; Overheid.nl, 2017n).

Datum van implementatie: 1-1-2017

143. Teruggaveregeling LNG 2014-201

LNG wordt gelijk belast als LPG: € 0,315 per kg. Wel geldt er een teruggaveregeling voor de periode 2014–2018 die de verhoging per 2014 van € 0,135 compenseert, waardoor de accijns voor LNG uitkomt op € 0,18 per kg (GroenGas Nederland, 2016).

Datum van implementatie: 2014

144. Programma beter benutten (fase 1 en 2), onderdeel logistiek

Het programma Beter Benutten, de regionale overheden en het bedrijfsleven slaan met het gezamenlijke programma Beter Benutten de handen ineen voor een betere bereikbaarheid in de drukste regio’s van Nederland. Tot 2018 trekken de betrokken partijen daar in totaal € 600 mln voor uit. Binnen dit programma krijgt ook de logistieke sector veel aandacht. Betrokken overheden en bedrijfsleven hebben de intentie om gezamenlijk projecten uit te voeren ter waarde van € 39 miljoen.

Logistieke vraagstukken: Hoe kansen te verzilveren voor lagere transportkosten, betere milieuprestaties en minder ritten in de spits? Hoe te komen tot meer samenwerking en informatie-uitwisseling in de keten zodat er mogelijkheden kunnen worden benut voor verdere logistieke efficiency? Wat is er voor nodig om de binnenvaart of het spoor een aantrekkelijke alternatief te laten zijn voor weggebruik? Welke slimme arrangementen zijn mogelijk voor meer efficiënte stadsdistributie, inclusief de bijbehorende retourstromen? (Platform Beter Benutten, n.d.)

Datum van implementatie: nb

145. Voorlichtingscampagne ‘Kies de beste band’

Doel van de campagne is om het kwaliteitsbesef van banden bij de automobilist te verhogen. Er wordt niet alleen verwezen naar het bandenlabel, maar ook naar bandentesten die de overige prestatiecriteria beoordelen. Daarbij wordt de automobilist geadviseerd de bandenspecialist te raadplegen om de beste band voor zijn auto te kiezen.

De campagne moet het kwaliteitsbesef van banden bij de automobilist verhogen. Daarom wordt niet alleen verwezen naar het bandenlabel, maar ook naar reguliere bandentesten die de overige prestatiecriteria beoordelen. Daarbij wordt de automobilist geadviseerd de bandenspecialist te raadplegen om de beste band voor zijn auto te kiezen. Tot slot wordt ook benadrukt dat regelmatige controle van de bandenspanning essentieel is, net zoals controle op beschadigingen (VACO, 2015).

Datum van implementatie: 17-4-2015

146. Green Deal Elektrisch Vervoer 2016-2020

Deze Green Deal Elektrisch Vervoer 2016-2020 heeft als doel om alle acties op EV-terrein die de regering en het Formule E-Team gezamenlijk oppakken, voor de komende vijf jaar te bundelen en op hoofdlijnen te beschrijven. Het Formule E-Team heeft daarin een belangrijke adviserende en aanjagende rol. Zo draagt deze Green Deal bij aan verdergaande elektrificatie van het (weg)verkeer en autonome groene groei. De Green Deal heeft een looptijd van vijf jaar. Partijen gaan ervan uit dat na 2020 geen specifieke overheidsinterventies en andere activiteiten meer nodig zijn om de uitrol van EV (voertuigen en infrastructuur) aan te jagen en dat er na 2020 een stevige basis zal zijn voor verdere groene groei (Green Deals, 2016).

Datum van implementatie: 14-4-2016

147. Green Deal Zero Emission Stadslogistiek

Partijen van de Green Deal Zero Emission Stadslogistiek willen dat in 2025 de stadskernen emissievrij worden beleverd. Daarmee lopen partijen vooruit op de Europese wetgeving die stelt dat in 2050 alleen emissievrije voertuigen de stad in mogen. Doel is de emissie van CO2, NOx en fijnstof als gevolg van stadslogistiek te reduceren tot nul. Daarnaast willen partijen het geluid te beperken. Middels Living Labs (regionale pilots) kijkt men waar 'Zero Emission' levering mogelijk is én wat er nodig is om dat mogelijk te maken. Er worden diverse routes bewandeld. Verbeteren van de voertuigtechnologie, de benutting en belading van vrachtauto's en het starten van innovatieve logistieke trajecten, zijn een aantal voorbeelden. In 2020 zullen partijen de eerste resultaten en bevindingen van de Living Labs presenteren. De resultaten toetsen zij op technische, economische, juridische, veiligheids- en handhavingsaspecten. De resultaten vormen de basis voor een advies over de haalbaarheid en brede toepassing van Zero Emission Stadslogistiek (Green Deals, 2014; Greendeals, 2014).

Datum van implementatie: 21-11-2014

148. Green Deal Openbaar toegankelijke elektrische laadinfrastructuur

Om de laadinfrastructuur verder te verbeteren, zetten partijen in op drie thema's: innovatie, beperking van de kosten en aanpassing van de wetgeving. Eind 2014 is het Nationaal Kennisplatform Laadinfrastructuur (NKL) opgericht. Het NKL wil innovatie op het terrein van laadinfrastructuur stimuleren en zo de kosten voor de aanleg en beheer van de laadpalen omlaag brengen. Ideeën – bijvoorbeeld om technologieën en processen te verbeteren – kunnen ingediend worden bij het NKL. Tot slot worden binnen de experimenteerruimte van de Energiewet 1998 pilots geïnitieerd. Wanneer nodig spant de Rijksoverheid zich in voor aanpassing van wet- en regelgeving (Rijksoverheid, 2015; RVO.nl, n.d.-m).

Datum van implementatie: 9-6-2015

149. Green Deal Autodelen

Doel van deze Green Deal is bedrijven, overheden en burgers te stimuleren en te faciliteren om hun mobiliteitsbehoefte in te vullen op een manier die maximaal gebruik maakt van de mogelijkheden die autodeelconcepten bieden. Partijen willen komen tot een netwerk van 100.000 deelauto's in 2018 (Green Deals, 2015).

Datum van implementatie: 3-6-2016

150. Meerjarige gedragscampagne 'ik ben hopper'

Met de Hoppercampagne laten we zien dat slim reizen heel gewoon en gemakkelijk is. De Hoppercampagne moet bijdragen aan minder belasting van het milieu, minder files en meer reisgemak.

Op deze website ontdek je hoe je zo slim mogelijk vanuit jouw huis of werkplek kunt reizen. Wie zijn locatie invult op de website krijgt direct een overzicht met alle Hoppermogelijkheden in zijn of haar omgeving: alle deelauto's, flexwerkplekken, (OV-)fietsverhuur en –stallingen, OV-haltes en stations, P&R-locaties en oplaadpunten. Het bijzondere van de website is dat voor het eerst alle reismogelijkheden op één plek te vinden zijn. Wij bundelen de beschikbare online informatie over al deze verschillende locaties op één kaart (Ik ben Hopper, n.d., 2015).

Datum van implementatie: 7-1-2015

151. Lean & Green Personal Mobility

Lean and Green Personal Mobility is een stimuleringsprogramma voor duurzame mobiliteit, dat zich specifiek richt op CO2 -reductie met betrekking tot personen mobiliteit, dus op ca. 60-70% van uw totale CO2 -footprint. Personenmobiliteit betreft het woon-werkverkeer, operationeel verkeer, of zakelijk verkeer. Het programma stimuleert en ondersteunt werkgevers én werknemers om hun CO2 -uitstoot ten gevolge van mobiliteit met minimaal 20% te verlagen in een periode maximaal 5 jaar. Wij helpen u op weg naar het bereiken van dit doel, en inspireren u met actuele informatie, kennis en expertise. Is de doelstelling behaald, dan geeft de officiële uitreiking van uw Lean and Green Personal Mobility Award u de mogelijkheid om u in de markt te onderscheiden (Connekt, 2008; Lean & Green NL, n.d.-b).

Datum van implementatie: 2008

152. Regionale afspraken gericht op verhoging aandeel schone tweewielers

Stimuleren modal shift van auto naar schone tweewielers (SER, 2013; VNG, n.d.):

1. Een schaalsprong is nodig om het gebruik van schone tweewielers op de korte en middellange afstand te laten groeien in Nederland. Daartoe bevordert VNG in samenwerking met KpVV, ANWB, Fietsersbond en NS (in overleg met ProRail en regionale OV-bedrijven) dat voor eind 2014 op lokaal/regionaal niveau afspraken worden gemaakt over de inzet van een selectie van maatregelen met het oog op het vergroten van het aandeel schone tweewielers in de modal split van 26 procent van de verplaatsingen in 2011 naar 35 procent in 2030.
2. NS (trekker), Fietsersbond, ANWB en VNG stellen in overleg met regionale OV bedrijven en Pro-Rail voor medio 2014 een plan van aanpak op voor verbetering van stationsfietsstallingen.

Datum van implementatie: 30-9-2013

153. Lean & Green Logistics

Lean & Green Logistics is een stimuleringsprogramma wat organisaties binnen de logistieke wereld stimuleert om te groeien naar een hoger duurzaamheidsniveau, door maatregelen te nemen die niet alleen kostenbesparingen opleveren, maar gelijktijdig milieubelasting reduceren. Met Lean & Green Logistics laten organisaties zien dat zij zich actief inspannen om hun logistieke proces duurzamer te maken. En dat is iets om trots op te zijn. Want duurzaamheid leidt niet alleen tot winst voor het milieu, maar ook voor de economie. Haal je de verspilling eruit, dan levert dat automatisch geld op (Lean & Green NL, n.d.-a).

Datum van implementatie: 2008

154. Programma Truck van de Toekomst

RVO.nl, Rijkswaterstaat en TNO hebben in opdracht van het ministerie van Infrastructuur en Milieu het programma ‘Truck van de Toekomst’ uitgevoerd. Het programma omvat het TNO-demonstratieprogramma [TNO 2013], de RVOsubsidieregeling en het kennisloket. De doelstelling van het programma is het doen toenemen van het gebruik van brandstofbesparende maatregelen in de praktijk. In het programma zijn marktrijpe brandstofbesparende maatregelen gedemonstreerd en zijn projecten gesubsidieerd bij een brede selectie transportbedrijven. De subsidieprojecten waren gericht op het opdoen van ervaring in de praktijk met alternatieven voor diesel bij vrachtauto’s en liepen van oktober 2010 tot eind 2012, met een verlenging tot eind 2014. De effectiviteit, praktische toepasbaarheid en de business case zijn geëvalueerd. Door het verspreiden van deze kennis en adviezen die daaruit volgen, kunnen transportbedrijven de kansen verzilveren om CO2, brandstof en daarmee geld te besparen (Rijkswaterstaat, n.d.; RVO.nl, n.d.-b, n.d.-ad; TNO, 2016).

Datum van implementatie: 2010

155. Inzet Lange en Zware Vrachtauto's (LZVs)

Onder druk van markt-, veiligheids- en milieueisen zoeken Nederlandse bedrijven en overheden continu naar nieuwe mogelijkheden om het wegvervoer zo efficiënt, duurzaam en veilig mogelijk te verrichten. Deze eisen zijn (Ministerie van Verkeer en Waterstaat, 2010):

1. Markteisen: lagere transportkosten, betere logistieke service en een verbeterde concurrentiepositie;
2. Verkeersveiligheidseisen: in ieder geval geen verslechtering en waar mogelijk een verbetering van de verkeersveiligheid;
3. Duurzaamheidseisen: minder emissies, minder geluidsoverlast en minder congestie/een betere bereikbaarheid.

Eén van de meest praktische verbeteroplossingen voor bedrijven en overheden is om de laadcapaciteit van de vrachtauto te vergroten door met Langere en (eventueel) Zwaardere Vrachtautocombinaties (LZV's) te gaan werken.

Datum van implementatie:12-2001

156. Lean & Green Synchromodal

Lean & Green Synchromodal betekent groener, flexibeler en efficiënter vervoer. Want het transport van volle en lege containers naar het achterland kan (voor een deel van de route) prima met een binnenvaartschip of trein worden uitgevoerd. Dit stoot minder CO2 uit dan het wegvervoer: geen last van files en met minder mankracht meer transporteren. Daarom verkennen steeds meer verladers de mogelijkheden van Lean & Green Synchromodal.

Met de bundeling van containerstromen via de binnenvaart en het spoor behalen verladers hun duurzaamheidsdoelstellingen en optimaliseren tegelijkertijd hun eigen logistieke proces. Zo geven ze praktische invulling aan het begrip 'synchromodaliteit'.

De rol van Lean and Green Synchromodal ligt vooral in het samenbrengen van de partijen. Het programma ondersteunt verladers bij het kiezen voor andere modaliteiten. Echter, weinig verladers zijn zó groot dat ze zelf een heel binnenvaartschip of trein kunnen vullen. Samenwerking met andere verladers en bundeling van lading is daarom belangrijk (Lean and Green, n.d.).

Datum van implementatie: nb

157. Nederlands standpunt CO2-normering personenvoertuigen na 2020

De EU heeft een rol als koploper om ambitieuze klimaatdoelen te halen. Nederland vindt dat de EU deze rol als koploper moet houden en voorts moet inzetten op een transitie naar nulemissie van personenvoertuigen. Uit onderzoek blijkt dat een norm voor 2025 met maximaal het WLTP-equivalent van 70 gram CO_2per kilometer (NEDC) doelmatig is. Voor 2030, zo komt uit het onderzoek naar voren, dient een norm van maximaal het WLTP-equivalent van 35 gram CO_2 per kilometer (NEDC) dit doel het beste. De partijen komen op grond van het onderzoek tot de conclusie dat er in Europees verband naar deze normen gestreefd moet worden en maken zich hier hard voor (Ministry of Economic Affairs, 2016).

Datum van implementatie: 4-2016

158. Green Deal Zero Emissie Busvervoer

Schoon openbaar busvervoer in Nederland in 2025. Deze Green Deal vormt het platform waar alle ketenpartijen samenwerken om belemmeringen op organisatorisch, bestuurlijk en technisch gebied aan te pakken. Voor uitwisseling en aanscherping van kennis en inzichten bestaan landelijke werkgroepen. Onderwerpen zijn bijvoorbeeld techniekontwikkeling, concessieverlening, business cases en de ontwikkeling van een total cost of ownership (TCO) model dat zowel voor private als publieke partijen werkt (Green Deals, 2012; Zero Emissie Busvervoer, 2011).

Datum van implementatie: 9-10-2012

159. Programma beter benutten (fase 1 en 2), onderdeel personenvervoer

De doelstelling van het vervolgprogramma Beter Benutten is in de spits een reistijdvermindering van 10 procent van deur tot deur. De nadruk in het vervolgprogramma wordt vooral gelegd op maatregelen die reizigers in staat stellen op een slimme manier snel op de plaats van bestemming te komen. Hiervoor slaan veel regio's de handen in elkaar. Een belangrijke rol is weggelegd voor Intelligente Transport Systemen (ITS)

Door de samenwerking tussen regionale overheden, bedrijfsleven en het rijk zijn per 1 november van dit jaar ruim 90% van alle maatregelen uitgevoerd en opgeleverd. Sinds 2011 hebben deze maatregelen geleid tot 47.000 spitsmijdingen per dag. Dit heeft bijgedragen aan 19% minder vertraging in de spits op specifieke Beter Benutten trajecten. Het grote aantal spitsmijdingen vermindert ook de uitstoot van schadelijke stoffen aanzienlijk (Ecorys, n.d.; Ministry of Infrastructure and Environment, 2015).

Datum van implementatie: 6-2011

165. ILUC richtlijn biobrandstoffen

De ILUC-richtlijn heeft als doel de uitstoot van broeikasgassen, veroorzaakt door indirect veranderend landgebruik door de productie van biobrandstoffen, terug te dringen.

De ILUC-richtlijn geeft de lidstaten de vrijheid zelf een limiet te bepalen voor de bijmenging van conventionele biobrandstoffen, met een maximum van 7% (European Parliament & Council of the European Union, 2014a, 2015; Ministry of Infrastructure and Environment, 2016; Overheid.nl, 2016b).

Datum van implementatie: 2017

166. Richtlijn Brandstofkwaliteit (FQD)

De FQD is gericht op transportbrandstoffen en heeft daarmee alleen betrekking op de transportsector en de keten van brandstoffen. De richtlijn verplicht brandstofleveranciers om op 31 december 2020 de gemiddelde broeikasgasintensiteit van de door hen op de markt gebrachte brandstoffen met 6% gereduceerd te hebben ten opzichte van de fossiele referentie in 2010 (83.8 gCO2/MJ). De doelstelling geldt voor de emissies over de hele keten (van oliewinning tot de voertuigtank) en kan zowel gehaald worden door de inzet van hernieuwbare energie in transport, zoals biobrandstoffen, als door emissiereducties in de keten bij bijv. de winning van olie (CE Delft, 2014; RVO, n.d.).

Datum van implementatie: 23-4-2009

168. Besluit hernieuwbare energie vervoer 2015 (implementatie RED)

Leveranciers van brandstoffen aan de Nederlandse vervoersmarkt hebben een jaarverplichting voor hernieuwbare energie en in het jaar 2020 een CO2-reductieverplichting. Hierover moeten ze rapporteren bij de Nederlandse Emissie Autoriteit, NEa. Voor het nakomen van de verplichtingen dienen de leveranciers verhandelbare hernieuwbare brandstofeenheden,(HBE’s) te verwerven. Deze vormen het bewijs dat een hoeveelheid hernieuwbare energie vervoer op de markt is gebracht.

Leveranciers kunnen de benodigde HBE’s verkrijgen door ze te kopen van partijen die een hoeveelheid hernieuwbare energie op de markt gebracht hebben (de inboekers) of door zelf een hoeveelheid hernieuwbare energie vervoer op de markt te brengen (Overheid.nl, 2017g; Platform Duurzame Biobrandstoffen, 2016).

Datum van implementatie: 1-1-2015

169. Verordening (EG) Nr. 661/2009 met eisen voor rolweerstand banden, schakelindicatoren en bandenspanningscontrolesystemen

Het verplichte en consequente gebruik van banden met lage rolweerstand en van geavanceerde technologieën voor het vervaardigen van banden is van cruciaal belang om het aandeel van het wegverkeer in de uitstoot van broeikasgassen in de transportsector te verkleinen, terwijl het tegelijkertijd bevorderlijk is voor de innovatie, de werkgelegenheid en het concurrentievermogen van de automobielindustrie van de Gemeenschap (European Parliament & Council of the European Union, 2009).

Datum van implementatie: 13-7-2009

170. Belastingregime personenauto's conform Wet Uitwerking Autobrief II

De voornemens in het wetsvoorstel moeten leiden tot robuuste belastingopbrengsten en een kostenefficiënte inzet van overheidsmiddelen met een zo groot mogelijke milieuwinst voor het ingezette overheidsgeld voor de periode 2017 tot en met 2020. De voornemens in dit wetsvoorstel zien op wijzigingen in de belasting van personenauto's en motorrijwielen (BPM), de motorrijtuigenbelasting (MRB) en de bijtelling in de loon- en inkomstenbelasting (bijtelling LB/IB) (Ministry of Economic Affairs, 2016; Overheid.nl, 2017n).

Datum van implementatie: 1-1-2017

171. Brandstofaccijnzen en energiebelasting per mei 2016

Voor energie belasting zie nummer 1.

Brandstofaccijnzen 2016 (Belastingdienst, n.d.-b; Ministry of Economic Affairs, 2017; Staatscourant, 2015):

Benzine: 0.77 p/L

Kerosine: 0.48 p/L

Diesel: 0.48 p/L

LPG/LNG 0.34 p/kg

Datum van implementatie: 1-1-1992

172. Low Car Diet

Het Low Car Diet is de ideale speeddate met verschillende vormen van duurzaam vervoer, opgezet door Urgenda. Vanaf de start maken topbestuurders en medewerkers één maand lang gebruik van fietsen, (high-speed) e-bikes, werk- en vergaderlocaties, openbaar vervoer (OV) en elektrische-/deel-auto’s (EV). Organisaties en medewerkers gaan met elkaar de strijd aan om zoveel mogelijk duurzame kilometers te maken en ontdekken dat de dagelijkse reis goedkoper, schoner en gezonder kan (Low Car Diet, n.d.).

Datum van implementatie: 2012

173. Project Band op Spanning

In Nederland rijdt 60 procent van alle auto’s met een te lage bandenspanning. Dit kost 2 tot 5 procent extra brandstof, versnelde bandenslijtage en de lucht wordt vervuild met CO_2, fijnstof, en NO_x. Auto’s met onderspanning zorgen voor een verdubbeling van verkeerslawaai en krijgen vaker ongelukken. Bijna 7 procent rijdt zelfs ongemerkt met een lekke band: levensgevaarlijk.

Per jaar kost dit per auto snel 75 tot wel 150 euro. Zonde van het geld, de vervuiling en de ongelukken! Banden lopen altijd langzaam leeg. Daar is niets aan te doen. Om te zorgen dat een auto met de juiste spanning rijdt, helpen wij met twee goede oplossingen (Band op Spanning, n.d.).

Datum van implementatie: nb

174. Verhoging snelheidslimiet hoofdwegennet

Bij het snelhedenbeleid is het uitgangspunt dat we de snelheid alleen verhogen als dat binnen de normen voor milieu, natuur en verkeersveiligheid kan. Voor de verhoging van de snelheid onderzoeken we daarom altijd wat het effect is van de verhoging op de luchtkwaliteit en geluidproductie. Ook kijken we of de snelheidsverhoging past binnen de kaders die gelden voor verkeersveiligheid. Om te zorgen dat we ook na de verhoging van de snelheid blijven voldoen aan de normen voor luchtkwaliteit en geluid, houden we vinger aan de pols. We monitoren de luchtkwaliteit, geluidproductie en verkeersveiligheid (Rijkswaterstaat, 2016).

Datum van implementatie: 1-9-2012

175. Meerjaren Afspraken Energie-efficiëntie 2008-2020 Rail

De NS Groep streeft naar een jaarlijkse efficiëntieverbetering van minimaal 2 procent. Voor de facilitaire energie is dit jaarlijks 2 procent, voor tractie-energie 5 procent. ProRail streeft jaarlijks naar een verbetering van 2 procent en neemt daarvoor een groot aantal maatregelen bij stations, wissels, seinen en kantoren (Rijksoverheid, 2011).

Datum van implementatie: 2011

176. EEDI/SEEMP zeeschepen

In 2011 wordt in de Internationale Maritieme Organisatie een eerste stap gezet gericht op de reductie van CO2-uitstoot door de zeescheepvaart, met de aanname van een aantal technische maatregelen. Zo heeft de IMO de Energy Efficiency Design Index (EEDI) en het Ship Energy Efficiency Management Plan (SEEMP) in regelgeving opgenomen (Panteia, 2014).

The EEDI for new ships is the most important technical measure and aims at promoting the use of more energy efficient (less polluting) equipment and engines. The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments (IMO, n.d.-a).

The Ship Energy Efficiency Management Plan (SEEMP) is an operational measure that establishes a mechanism to improve the energy efficiency of a ship in a cost-effective manner. The SEEMP also provides an approach for shipping companies to manage ship and fleet efficiency performance over time using, for example, the Energy Efficiency Operational Indicator (EEOI) as a monitoring tool (IMO, n.d.-b).

Datum van implementatie: 1-1-2013

177. Subsidieprogramma innovaties duurzame binnenvaart

Het doel van deze subsidieregeling is om een bijdrage te leveren aan het reduceren van de uitstoot (emissie) van CO2, NOx, PM en/of methaanslib bij de voortstuwing van binnenschepen. Projecten zijn subsidiabel indien ze gericht zijn op het gebruik van alternatieve brandstoffen, alternatief motorgebruik, voor- of nabehandelingstechnieken of motormanagement, inrichting en gebruik van het schip ten behoeve van de reductie van CO_2-, NO_x- en PM-emissies en/of methaanslip bij de voortstuwing van binnenschepen (Berger Maritiem, 2016; Overheid.nl, 2014b, 2016e).

Datum van implementatie: 8-10-2016

178. Luchtvaart in ETS

Sinds 2012 valt de CO_2-uitstoot van alle binnenlandse en internationale vluchten die vertrekken van of landen op een Europese luchthaven onder het Europese emissiehandelssysteem (EU ETS). Het gaat hierbij om luchthavens in de 28 lidstaten van de Europese Unie en in IJsland, Liechtenstein en Noorwegen. Voor de periode 2013-2016 is de geografische reikwijdte echter beperkt tot binnen-Europese vluchten. Zo komt er ruimte voor het ontwikkelen van een wereldwijd systeem (European Parliament & Council of the European Union, 2014a; Ministry of Infrastructure and Environment, 2014; Nederlandse Emissieautoriteit, n.d.-a, n.d.-b)

Datum van implementatie: 1-1-2012

182. Besluit gebruik meststoffen: emissiearme aanwending (ook ikv de PAS)

Deze wijziging van het Bgm strekt tot de implementatie van de volgende maatregelen uit het vijfde actieprogramma Nitraatrichtlijn: vrijstelling vernietiging graszode in verband met infrastructurele werken; vrijstelling herstel beperkte schade aan grasland; aanwending runderdrijfmest ter bestrijding van winderosie; toegestane hoeveelheid fosfaat op overige grond (Overheid.nl, 2017e; Staatsblad, 2014).

Datum van implementatie: 9-1-1998

183. Provinciale verordeningen: ammoniakemissie huisvestingssystemen BBT++ in NB en Limburg; alle stallen tussen 2010 en 2028/2030

De initiatiefnemer, onderscheidenlijk drijver van de betrokken inrichting, draagt er zorg voor, dat bij het realiseren van een nieuwe stal voldaan is aan de vereisten als opgenomen in Bijlage 1 bij deze regeling. Onverminderd artikel 2 draagt de initiatiefnemer, onderscheidenlijk de drijver van de inrichting er zorg voor, dat uiterlijk per 1 januari 2028 het bedrijf als geheel gemiddeld voldoet aan de vereisten als opgenomen in Bijlage 1 bij deze regeling (Provinciaal blad van Noord-Brabant, 2010).

Datum van implementatie: 13-7-2010

184. Wet Ammoniak en Veehouderij beleidslijn IPPC-omgevingstoetsing (2007), Wet geurhinder en veehouderij (2006), natura 2000, Wet luchtkwaliteit 2007: BBT+ /BBT++

De Beleidslijn geeft een generieke invulling aan artikel 3, lid 3 van de Wet ammoniak en veehouderij (Wav). Dat artikel bepaalt dat het bevoegd gezag voor een veehouderij die onder de werkingssfeer van de voormalige IPPC-richtlijn (nu: RIE-richtlijn) valt, moet beoordelen of voorschriften in de omgevingsvergunning milieu nodig zijn die verder gaan dan het toepassen van de beste beschikbare technieken (BBT). Het stellen van verdergaande voorschriften kan nodig zijn om: technische kenmerken en de geografische ligging van de installatie of de plaatselijke milieuomstandigheden.

Centraal in de Beleidslijn staat dat bij een emissie boven de 5.000 kg ammoniak, strengere emissie-eisen dan BBT gelden (BBT+ of BBT++). Het gaat dan alleen om IPPC-veehouderijen met een totale emissie van boven de 5.000 kg, die: uitbreiden in dieren en dus al een emissie hadden van meer dan 5.000 kg (vóór de uitbreiding) of die eerst onder de 5.000 kg zaten maar door de uitbreiding boven de 5.000 kg ammoniak komen. Pas vanaf de 5.000 kg moet u dan voor de uitbreiding strengere emissie-eisen stellen (BBT+). Boven de 10.000 kg ammoniak kunt u nóg strengere emissiewaarden dan BBT+ eisen (BBT++), vergelijkbaar met een gecombineerde luchtwasser. De Beleidslijn is niet in strijd met de IPPC-richtlijn. Zo heeft de rechter bepaald in ABRvS, 200800463/1, 18 maart 2009 (Venray) (Kenniscentrum InfoMil, n.d.; Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer, 2007).

De Wet geurhinder en veehouderij (2006) is het toetsingskader voor de omgevingsvergunning milieu voor het aspect geurhinder van dierenverblijven van veehouderijen. Met minimumafstanden en maximale waarden voor geurbelasting krijgen geurgevoelige objecten bescherming tegen overmatige geurhinder (Overheid.nl, 2013, 2016c; Velthof et al., 2016).

Datum van implementatie: 2007

186. Besluit emissiearme huisvestingsystemen landbouwhuisdieren –aanscherping en uitbreiding vm Besluit ammoniakemissie huisvesing veehouderij (ook ikv de PAS)

In dit nieuwe besluit worden de maximale emissiewaarden voor ammoniak en fijnstof (PM10) per staltype weergegeven. De belangrijkste veranderingen ten opzichte van het eerdere Besluit huisvesting zijn (Overheid.nl, 2017d; Velthof et al., 2016):

1. De meeste maximale emissiewaarden voor ammoniak zijn aangescherpt (diercategorieën melk- en kalfkoeien ouder dan 2 jaar, vleesvarkens, legkippen, vleeskuikens en (groot)ouderdieren van vleeskuikens); Er gelden ook maximale emissiewaarden voor fijnstof voor de diercategorie kippen (leghennen en vleeskuikens) en de diercategorieën vleeskalkoenen en vleeseenden;
2. Er zijn nu maximale emissiewaarden opgenomen voor de diercategorieën vleeskalveren, opfokhennen (niet-batterijhuisvesting), (groot)ouderdieren van vleeskuikens in opfok en vleeskalkoenen).

Datum van implementatie: 1-8-2015

187. Convenant voer- en management maatregelen melkvee (ikv PAS)

Vrijwillige voer- en managementmaatregelen (à 3 kton) door middel van een convenant met de sectororganisaties. De KringloopWijzer voor de melkveesector is hierbij een hulpmiddel. Gebruik hiervan is verplicht vanaf januari 2015 voor melkveebedrijven met een fosfaatoverschot en vanaf 16 voor de hele melkveesector. Dit is geen wettelijke verplichting, maar een van de hoofdpunten uit het convenant dat LTO samen met zuivelondernemingen (NZO), veevoerindustrie (Nevedi) en accountancy (VLB) heeft afgesloten6. De KringloopWijzer is een managementinstrument en geeft inzicht in de N- en P-kringloop en de emissie (LTO Nederland, 2013; Velthof et al., 2016).

Datum van implementatie: 1-7-2013

188. Dierrechten varkens/pluimvee

In de Regeling ontheffing productierechten Meststoffenwet krijgen varkens- en pluimveebedrijven ontheffing voor 50% van de voor de uitbreiding benodigde dierrechten. Zij moeten dan hun volledige fosfaatoverschot laten verwerken. Zij mogen geen gebruikmaken van de mogelijkheid om vervangende verwerkingsovereenkomsten te sluiten (RVO.nl, n.d.-x; Staatscourant, 2014; Velthof et al., 2016).

Datum van implementatie: 1-1-2015

190. P- en N-gebruiksnormen 5e AP

Het Nederlandse mestbeleid is primair gericht op het realiseren van de doelstellingen die voortvloeien uit de Nitraatrichtlijn, namelijk niet meer dan 50 milligram nitraat per liter in het grondwater of in zoet oppervlaktewater met het oog op de bereiding van drinkwater. Een andere doelstelling van de Nitraatrichtlijn is vermindering van de eutrofiëring van het zoete en zoute oppervlaktewater. In de uitwerking van het mestbeleid wordt gestreefd om bij te dragen aan het realiseren van de doelstellingen van andere Europese richtlijnen en verdragen, met name die van de Kaderrichtlijn Water (KRW). Nederland geeft door middel van meerjarige actieprogramma's op hoofdlijnen invulling aan de implementatie van de Nitraatrichtlijn. Het vijfde actieprogramma omvat de hoofdlijnen van het Nederlandse mestbeleid van 2014 tot en met 2017. Er zijn op dit moment geen maatregelen in de KRW voorzien die ten opzichte van het 5e actieprogramma Nitraatrichtlijn een effect hebben op de emissie van ammoniak (Overheid.nl, 2016; Rijksoverheid.nl, 2014a; Staatsblad, 2015a; Velthof et al., 2016).

Datum van implementatie: 27-2-2015

191. Derogatie (en mestproductieplafond)

De derogatie voor dierlijke mest in Nederland is geharmoniseerd met die in andere EU-lidstaten (zoals de eis dat oppervlak van bedrijven met derogatie uit 80% grasland moet bestaan). De aanname in deze studie is daarom dat de voorwaarden voor derogatie niet zullen veranderen na 2017. Er zijn tendensen naar meer differentiatie van gebruiksnormen, onder andere door gebruik van de Kringloopwijzer (bv. opbrengstafhankelijkheid van gebruiksnormen voor stikstof en fosfaat), waardoor mogelijk de totale stikstof- en fosfaatruimte in Nederland weinig zal veranderen, maar er tussen de bedrijven wel veranderingen optreden.

U mag op landbouwgrond 170 kilogram stikstof uit dierlijke mest per hectare per jaar gebruiken. Dit mag u verhogen naar 230 of 250 kilogram als u voldoet aan de voorwaarden voor derogatie (European Commission, 2005; RVO.nl, n.d.-f; Velthof et al., 2016).

Datum van implementatie: 8-12-2005

192. Verplichte mestverwerking

Op basis van dit stelsel zijn ondernemers, die op hun bedrijf meer fosfaat produceren dan zij binnen de gebruiksnormen kunnen aanwenden, verplicht een deel van het fosfaatoverschot te verwerken. Mestverwerking houdt volgens de Meststoffenwet in de afzet van mest(producten) buiten de Nederlandse landbouwsector ('export') alsook het dusdanig behandelen van de mest dat het geen mest(product) meer is (bijvoorbeeld het verbranden van pluimveemest). Voor een beperkt deel betreft het 'export' naar andere sectoren binnen Nederland, maar merendeels is dat buiten Nederland. De (vaste) pluimveemest wordt grotendeels verwerkt; deels via export van mest (al dan niet na behandeling, zoals korrelen) en deels via verbranding. Verwerking van dunne (varkens)mest behelst in Nederland op dit moment naast export van (gehygieniseerde) mest ook export van de dikke fractie na het scheiden van de mest in een dikke en dunne fractie (Velthof et al., 2016).

Datum van implementatie: 1-1-2014

193. Besluit Uitvoeringsbesluit verantwoorde groei melkveehouderij

In 2015 is een einde gekomen aan de melkquotering. Om een ongebreidelde groei van de melkveehouderij te voorkomen, heeft het kabinet de Wet verantwoorde groei melkveehouderij voorgesteld. Op 16 december 2014 is deze melkveewet door de Eerste Kamer aangenomen. Groei van de melkveehouderij is mogelijk onder de voorwaarde dat de toename van de fosfaatproductie boven de melkveefosfaatreferentie van 2013 op 'eigen grond' geplaatst wordt, geheel verwerkt wordt of een combinatie van beide (Staatsblad, 2015; Velthof et al., 2016).

Datum van implementatie: 1-1-2016

194. AMVB grondgebonden groei melkveehouderij

Per 1 januari 2016 is de Algemene Maatregel van Bestuur Verantwoorde groei melkveehouderij (AMvB grondgebondenheid) in werking getreden. De AMvB grondgebondenheid heeft als doel te voorkomen dat de melkveehouderij grondloos kan groeien. Daarom beperkt de AMvB grondgebondenheid de mogelijkheid voor melkveehouderijbedrijven om alleen op basis van mestverwerking te groeien.

In de AMvB grondgebondenheid wordt een grens gesteld aan de omvang van het melkveefosfaatoverschot dat maximaal verwerkt mag worden. Als u meer melkvee wil gaan houden dan de berekende maximale omvang van het melkveefosfaatoverschot dan zult u in dat kalenderjaar meer grond in gebruik moeten nemen (RVO.nl, n.d.).

Datum van implementatie: 1-1-2016

A.2 Thirteen policy emasures that could not be identified

1. Internationaliseringsagenda
2. Wet algemene bepalingen omgevingsrecht (Wabo) / besluit omgevingsrecht en – regeling
3. Richtlijn emissie-eisen middelgrote stookinstallaties
4. ‘Green Deals’
5. Aanpassing taakstellende kostendaling windenergie op zee
6. Optimalisatie van vollasturen-problematiek
7. Innovatie binnen SDE+
8. Versteviging/Aanscherping convenanten (MJA3 & MEE)
9. Richtlijn auto airco's (EG2006b)
10. Integrale aanpak ontzorging particulieren, incl. energieprestatie-garantie
11. Extra effect huurconvenant door lokale afspraken in kader Woningwet
12. Voortzetting afspraken Kas als Energiebron
13. Financiering Kas als Energiebron, intensivering KAE

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B

Starting factors of all policy measures

This Appendix includes the characterisation of all policy measures for their sub-type, direction, process, specifications, target group, sector, and policy goal. Also all starting factors are included.

Table 1: Sub-types, directions, process, specification, target group, sector, policy goal and starting points of all selected policy measures

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
1	Energie-belasting	Tax	Increase	Electricity price		Consumer, Commercial, and ETS - parties	Multi-sector		Energy efficiency
				Natural gas price		Consumer, Commercial, and ETS - parties	Multi-sector		Energy efficiency
2	Shift in Energie-belasting	Tax	Increase	Natural gas price		Consumer, Commercial, and ETS - parties	Multi-sector		GHG emission
		Tax	Decrease	Electricity price		Consumer, Commercial, and ETS - parties	Multi-sector		GHG emission
3	Vamil / MIA	Tax	Decrease	Energy efficiency	Innovative energy efficiency measures	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Tax decrease for energy efficiency with innovative energy efficiency measures for commercial and ETS-parties in transport and industry sectors	Energy efficiency
4	EIA (energy investment deduction)	Tax	Decrease	Energy efficiency	Energy efficiency measures	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Tax decrease for energy efficiency with energy efficiency measures for commercial and ETS-parties in transport and industry sectors	Energy efficiency
				Decentral renewable energy production	Decentral measures	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Tax decrease for decentral renewable energy production with decentral measures for commercial and ETS-parties in	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								transport and industry sectors	
5	Change in Uitvoerings-regeling EIA	Tax	Decrease	Energy efficiency	Energy efficiency measures	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Tax decrease for energy efficiency with energy efficiency measures for commercial and ETS-parties in transport and industry sectors	Energy efficiency
				Decentral renewable energy production	Decentral measures	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Tax decrease for decentral renewable energy production with decentral measures for commercial and ETS-parties in transport and industry sectors	Renewable energy production
6	Increase in EIA percentage	Tax	Decrease	Energy efficiency	Energy efficiency measures	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Tax decrease for energy efficiency with energy efficiency measures for commercial and ETS-parties in transport and industry sectors	Energy efficiency
				Decentral renewable energy production	Decentral measures	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Tax decrease for decentral renewable energy production with decentral measures for commercial and ETS-parties in transport and industry sectors	Renewable energy production
7	TSE	Costs (investment)	Decrease	Energy efficiency	Innovative solutions	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Investment cost decrease for energy efficiency with innovative solutions for commercial and ETS-parties in transport and industry sectors	Energy efficiency
				Decentral renewable	Innovative solutions	Commercial and ETS-parties in	Multi-sector	Investment cost decrease for decentral renewable energy production with	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
				energy production		transport and industry sectors		innovative solutions for commercial and ETS-parties in transport and industry sectors	
8	DEI	Costs (R&D)	Decrease	Energy efficiency	Innovative solutions	Commercial and ETS-parties in transport and industry sectors	Multi-sector	R&D cost decrease of energy efficiency with innovative solutions for commercial and ETS-parties in transport and industry sectors	Energy efficiency
				Decentral renewable energy production	Innovative solutions	Commercial and ETS-parties in transport and industry sectors	Multi-sector	R&D cost decrease of decentral renewable energy production with innovative solutions for commercial and ETS-parties in transport and industry sectors	Renewable energy production
9	MIT	Costs (R&D)	Decrease	Energy efficiency	Process efficiency with innovative solutions	Commercial and ETS-parties in transport and industry sectors	Multi-sector	R&D cost decrease of energy efficiency with process efficiency with innovative solutions for commercial and ETS-parties in transport and industry sectors	Energy efficiency
11	Regeling groenprojecten	Financing options	Increase	Energy efficiency	Sustainable projects	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Financing options increase for energy efficiency of sustainable projects for commercial and ETS-parties in transport and industry sectors	Energy efficiency
				Decentral renewable energy production	Sustainable projects	Commercial and ETS-parties in transport and industry sectors	Multi-sector	Financing options increase for decentral renewable energy production of sustainable projects for commercial and ETS-parties in	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								transport and industry sectors	
12	Wet milieubeheer (Wm) / activiteitenbesluit en -regeling	Obligatory implementation	-	Energy efficiency	Buildings	Commercial and ETS-parties	Multi-sector	Obligatory implementation of energy efficiency measures for buildings for commercial and ETS-parties	Energy efficiency
14	ETS	Permit	Decrease	CO_2 emission	Point sources	ETS parties in energy and industry sectors	Multi-sector	Decrease in permits for CO_2 emissions of point sources by ETS parties in energy and industry sectors	GHG emission
		Price	Increase	CO_2 emission price		ETS parties in energy and industry sectors	Multi-sector		GHG emission
17	Expertisecentrum Warmte	Information exchange	Increase	Sustainable heat production	Regional networks	Commercial	Energy	Information exchange increase for sustainable heat production and heat transport in regional networks in the commercial energy sector	Renewable energy production
20	Energiebelasting opslag duurzame energie	Tax	Increase	Electricity price		Consumer, Commercial, and ETS - parties	Multi-sector		Energy efficiency
21	Afschaffen Kolenbelasting	Tax	Decrease	Fossil fuel electricity production	Coal fired power plants	ETS-parties	Energy	Tax decrease for fossil fuel electricity production with coal fired power plants for ETS-parties in the energy sector	GHG emission
22	Congestie-management	Administrative process	Decrease	Electricity transport reliability	Renewable electricity production	Commercial and ETS-parties	Energy	Administrative process decrease for electricity transport reliability of central renewable electricity for commercial	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								and ETS-parties in the energy sector	
25	Regeling Indirecte Emissiekosten ETS	Price	Decrease	Electricity price		Commercial	Multi-sector		GHG emission
29	MEP-regeling	Return on investment	Increase	Central renewable electricity production	Renewable electricity	Commercial and ETS parties	Energy	Return on investment increase for central renewable electricity production for commercial and ETS-parties in the energy sector	Renewable energy production
30	SDE-regeling	Return on investment	Increase	Central renewable electricity production	Renewable electricity	Commercial and ETS-parties	Energy	Return on investment increase for central renewable electricity production for commercial and ETS-parties in the energy sector	Renewable energy production
31	SDE+ regeling	Return on investment	Increase	Central renewable electricity production	Renewable electricity	Commercial and ETS-parties	Energy	Return on investment increase for central renewable electricity production for commercial and ETS-parties in the energy sector	Renewable energy production
32	Rijksstructuurvisie windenergie op land	Administrative process	Decrease	Central renewable electricity production	Wind energy on land	Commercial and ETS-parties	Energy	Administrative process decrease of central renewable electricity production with wind energy on land for ETS-parties in the energy sector	Renewable energy production
33	Investeringsuitrol net op zee vanaf 2017 e.v.	Design specifications	-	Electricity transport	Wind energy at sea	Commercial and ETS-parties	Energy	Design specifications for electricity transport of wind energy at sea for commercial and ETS-	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								parties in the energy sector	
34	Uitvoeringswet windenergie op zee	Administrative process	Decrease	Central renewable electricity production	Wind energy at sea	Commercial and ETS-parties	Energy	Administrative process decrease for central renewable electricity production with wind energy at sea for commercial and ETS-parties in the energy sector	Renewable energy production
36	Spoedwet wind op zee	Administrative process	Increase	Electricity transport	Wind energy at sea and on land	Commercial and ETS-parties	Energy	Administrative process decrease in electricity transport for wind energy at sea and wind energy on land for commercial and ETS-parties in the energy sector	Renewable energy production
37	Gedragscode windenergie op land	Stakeholder involvement	Increase	Central renewable electricity production	Wind energy on land	Commercial and ETS-parties	Energy	Stakeholder involvement increase for central renewable electricity production with wind energy on land for commercial and ETS-parties in the energy sector	Renewable energy production
39	Aanwijzing gebieden windenergie op zee	Administrative process	Decrease	Central renewable electricity production	Wind energy at sea	Commercial and ETS-parties	Energy	Administrative process decrease for central renewable electricity production with wind energy at sea for commercial and ETS-parties in the energy sector	Renewable energy production
43	Garantieregeling geothermie	Insurance	Increase	Sustainable heat production	Geothermal energy	Commercial	Energy	Insurance increase for sustainable heat production with	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								geothermal energy in the commercial energy sector	
47	Aanpassing SDE+ voor windenergie op zee	Return on investment	Increase	Central renewable electricity production	Wind energy at sea	Commercial and ETS-parties	Energy	Return on investment increase for central renewable electricity production with wind energy at sea for commercial and ETS-parties in the energy sector	Renewable energy production
48	SDE: ondersteuning bij- en meestook	Return on investment	Increase	Central renewable electricity production	Biomass	Commercial and ETS-parties	Energy	Return on investment increase for central renewable electricity production with biomass for commercial and ETS-parties in the energy sector	Renewable energy production
49	AMvB Biomassa duurzaamheidscriteria	Design specifications	-	Central renewable electricity production	Biomass	Commercial and ETS-parties	Energy	Design specifications for central renewable electricity production with biomass for commercial and ETS-parties in the energy sector	Renewable energy production
54	ISDE	Costs (investment)	Decrease	Sustainable heat production	Sustainable heat	Consumer and Commercial	Energy	Investment cost decrease for sustainable heat production in the consumer and commercial energy sector	Renewable energy production
55	Communicatiecampagne ISDE	Information supply	Increase	Sustainable heat production	Sustainable heat	Consumer and Commercial	Energy	Information supply increase on sustainable heat production with in the consumer and commercial energy sector	Renewable energy production
56	Offensief lokale energie inclusief postcoderoos	Return on investment	Increase	Decentral renewable	Decentral measures	Consumer	Energy	Return on investment increase for decentral renewable electricity	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
				electricity production				production with decentral measures in the consumer energy sector	
		Information exchange	Increase	Decentral renewable electricity production	Decentral measures	Consumer	Energy	Information exchange increase for decentral renewable electricity production with decentral measures in the consumer energy sector	Renewable energy production
58	Subsidieregeling Energiebesparing en Duurzame energie Sportaccommodaties (EDS)	Costs (investment)	Decrease	Energy efficiency	Energy efficiency in sport centres	Commercial	Energy	Investment cost decrease for energy efficiency with energy efficiency in sport centres in the consumer energy sector	Energy efficiency
				Decentral renewable energy production	Decentral measures in sport centres	Commercial	Energy	Investment cost decrease for decentral renewable energy production with decentral measures in sport centres in the consumer energy sector	Renewable energy production
63	Meerjarenafspraak energie-efficiency ETS-bedrijven (MEE)	Cooperative	-	Energy efficiency	Process efficiency	ETS parties	Industry	Cooperative on energy efficiency due to process efficiency for ETS parties in industry	Energy efficiency
					Chain efficiency	ETS parties	Industry	Cooperative on energy efficiency due to chain efficiency for ETS parties in industry	Energy efficiency
64	Meerjarenafspraken energie-efficiency (MJA-3)	Cooperative	-	Energy efficiency	Process efficiency, chain efficiency	Commercial	Industry	Cooperative on energy efficiency due to process efficiency and chain efficiency for commercial industry	Energy efficiency
66	1e selectie erkende besparings-maatregelen in WMB	Obligatory implementation	-	Energy efficiency	Buildings	Commercial and ETS-parties	Industry	Obligatory implementation of energy efficiency for buildings	Energy efficiency

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								for commercial and ETS-parties in industry	
70	Intensivering handhaving Wet Milieubeheer	Enforcement	Increase	Energy efficiency	Buildings	Commercial and ETS-parties	Industry	Enforcement increase on energy efficiency for buildings for commercial and ETS-parties in industry	Energy efficiency
71	Expertisecentrum energiebesparing	Information exchange	Increase	Energy efficiency	Process efficiency	ETS-parties	Industry	Information exchange increase for energy efficiency due to process efficiency for ETS-parties in industry	Energy efficiency
					Chain efficiency	ETS-parties	Industry	Information exchange increase for energy efficiency due to chain efficiency for ETS-parties in industry	Energy efficiency
72	Raamwerk 1-op-1 afspraken met MEE-bedrijven	Cooperative	-	Energy efficiency	Process efficiency	ETS-parties	Industry	Cooperative on energy efficiency due to process efficiency for ETS parties in industry	Energy efficiency
					Chain efficiency	ETS-parties	Industry	Cooperative on energy efficiency due to process efficiency and chain efficiency for ETS parties in industry	Energy efficiency
75	Nieuwe F-gassen verordening (2014)	Design specifications	-	GHG emission reduction	Alternative fuel use for climate systems	Commercial and ETS-parties	Industry	Design specifications of GHG emission reduction with alternative fuel use for climate systems for commercial and ETS-parties in industry	GHG emission
		User-friendliness	Increase	GHG emission reduction	Alternative fuel use for climate systems	Commercial and ETS-parties	Industry	User-friendliness increase for GHG emission reduction with alternative fuel use for climate systems for commercial	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								and ETS-parties in industry	
76	Stimulering van natuurlijke koudemiddelen en de optimalisatie van de EIA ten aanzien van koudemiddelen	Tax	Decrease	GHG emission reduction	Alternative fuel use for climate systems	Commercial and ETS-parties	Industry	Tax decrease for GHG emission reduction with alternative fuel use for climate systems for commercial and ETS-parties in industry	GHG emission
77	Vastgestelde efficiency eisen apparatuur en verlichting in het kader van de Ecodesign richtlijn	Design specifications	-	Energy efficiency	Lighting in buildings	Consumer and Commercial	Built environ-ment	Design specifications for the energy efficiency due to lighting in buildings in the consumer and commercial built environment	Energy efficiency
79	Ecodesign eisen voor kleine gas- en oliegestookte ketels	Design specifications	-	GHG emission	Heating appliances for buildings	Consumer and Commercial	Built environ-ment	Design specifications for the GHG emission due to heating appliances for buildings in the consumer and commercial built environment	GHG emission
80	Energie Prestatie Normen en Lenteakkoord (woningen EPC 0,4 vanaf 2015)	Design specifications	-	Energy efficiency	Buildings	Consumer and Commercial	Built environ-ment	Design specifications for the energy efficiency of buildings in the consumer and commercial built environment	Energy efficiency
81	(EPC utiliteitsbouw 50% aanscherping in 2015 t.o.v 2007)	Design specifications	-	Energy efficiency	Buildings	Consumer and Commercial	Built environ-ment	Design specifications for the energy efficiency of buildings in the consumer and commercial built environment	Energy efficiency
83	Aanscherping Rc waarden in bouwbesluit vanaf 2015	Design specifications	-	Energy efficiency	Buildings	Consumer and Commercial	Built environ-ment	Design specifications for the energy efficiency of buildings in the consumer and commercial built environment	Energy efficiency

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
85	Btw-verlaging isolatie	Tax	Decrease	Energy efficiency	Isolation replacement in houses	Consumer	Built environ-ment	Tax decrease for energy efficiency due to isolation replacement in houses in the consumer built environment	Energy efficiency
86	Energielabel: onderdeel woningwaarderingsstelsel	Information supply	Increase	Energy efficiency	Houses	Consumer	Built environ-ment	Information supply increase on energy efficiency of houses in the consumer built environment	Energy efficiency
87	Verruiming hypotheekruimte voor het nemen van energiebesparende maatregelen (ltv en lti toets);	Financing options	Increase	Energy efficiency	Houses	Consumer	Built environ-ment	Financing options increase for energy efficiency of houses in the consumer built environment	Energy efficiency
88	Minimumeisen energieprestatie bij ingrijpende renovatie	Design specifications	-	Energy efficiency	Buildings	Consumer and Commercial	Built environ-ment	Design specifications for energy efficiency of buildings in the consumer and commercial built environment	Energy efficiency
89	Keuring airco: Beg en Reg (1 december 2013 in werking)	User-friendliness	Decrease	Energy efficiency	Air-conditioning in buildings	Consumer and Commercial	Built environ-ment	User-friendliness decrease for energy efficiency of air-conditioning in buildings in the consumer and commercial built environment	Energy efficiency
90	Bestaande woningen en utiliteitsgebouwen die worden verhuurd of verkocht moeten een energielabel hebben.	Information supply	Increase	Energy efficiency	Houses	Consumer	Built environ-ment	Information supply increase on energy efficiency of houses in the consumer built environment	Energy efficiency
92	VNG facilitator op lokaal en regionaal niveau door ondersteuningsstructuur inclusief regionale energieloketten	Support in implementation process	Increase	Energy efficiency	Houses	Consumer	Built environ-ment	Support in implementation process increase for energy efficiency for houses in	Energy efficiency

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								the consumer built environment	
				Decentral renewable energy production	Houses	Consumer	Built environ-ment	Support in implementation process increase for decentral renewable energy production for houses in the consumer built environment	Energy efficiency
94	Grootschalige uitrol van slimme meters	Information supply	Increase	Energy efficiency	Houses	Consumer	Built environ-ment	Information supply increase on energy efficiency of houses in the consumer built environment	Energy efficiency
		Administrative process	Decrease	Electricity transport	Smart grid for houses	Consumer	Built environ-ment	Administrative process decrease of electricity transport with a smart grid to houses in the consumer built environment	Energy efficiency
96	Introductie voorlopig label woningen	Information supply	Increase	Energy efficiency	Houses	Consumer	Built environ-ment	Information supply increase on energy efficiency of houses in the consumer built environment	Energy efficiency
97	Borging berekenings-systematiek energieprestatie-certificaat	Enforcement	Increase	Energy efficiency	Buildings	Consumer and Commercial	Built environ-ment	Enforcement increase on energy efficiency of buildings in the consumer and commercial built environment	Energy efficiency
98	Gebouw- en gebiedsgebonden specificaties in energieprestatiecertificaat	Enforcement	Increase	Energy efficiency	Buildings	Consumer and Commercial	Built environ-ment	Enforcement increase on energy efficiency of buildings in the consumer and commercial built environment	Energy efficiency

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
99	Nationale aanpak vervanging oude apparatuur	Information supply	Increase	Energy efficiency	New household appliances	Consumers	Built environ-ment	Information supply increase on energy efficiency of new household appliances in the consumer built environment	Energy efficiency
101	Nationaal energiebespaarfonds en verkenning aansluiting met Europese en regionale fondsen	Financing options	Increase	Energy efficiency	Houses	Consumers	Built environ-ment	Financing options increase for energy efficiency of houses in the consumer built environment	Energy efficiency
105	Uitvoering Convenant Energiebesparing Huursector reguliere tempo	Cooperative	-	Energy efficiency	Rental house	Commercial	Built environ-ment	Cooperative for energy efficiency of rental houses in the commercial built environment	Energy efficiency
107	Subsidieregeling 400 miljoen voor verhuurders (STEP)	Costs (investment)	Decrease	Energy efficiency	Rental house	Commercial	Built environ-ment	Investment cost decrease for energy efficiency in rental houses in the commercial built environment	Energy efficiency
110	Stroomversnelling deal fase 1 en 2 (eerste 11.000 woningen)	Cooperative	-	Energy efficiency	Rental house	Commercial	Built environ-ment	Cooperative for energy efficiency of rental houses in the commercial built environment	Energy efficiency
115	1e lichting branches verankeren van erkende maatregellijsten in de WMB	Obligatory implementation	-	Energy efficiency	Buildings	Commercial	Built environ-ment	Obligatory implementation of energy efficiency in buildings in the commercial built environment	Energy efficiency
117	Intensivering handhaving WMB: prestatieafspraken met gemeenten	Enforcement	Increase	Energy efficiency	Buildings	Commercial	Built environm.	Enforcement increase on energy efficiency for buildings in the commercial built environment	Energy efficiency
119	Uitvoering EPK-systeem (pilots energie prestatie keuring)	Enforcement	Increase	Energy efficiency	Buildings not included in MEE (no.63),	Commercial	Built environm.	Enforcement increase on energy efficiency of buildings not included in	Energy efficiency

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								MEE (no.63) in the commercial built environment	
127	Proof-of-principle (onderdeel afspraken Kas als Energiebron - KaE), intensivering KAE	Costs (R&D)	Decrease	Energy efficiency	Innovative research	Commercial	Green-house industry	R&D cost decrease for energy efficiency with innovative research in the commercial greenhouse industry	Energy efficiency
				Decentral renewable energy production	Innovative research	Commercial	Green-house industry	R&D cost decrease for decentral renewable energy production with innovative research in the commercial greenhouse industry	Renewable energy production
128	Garantstellingsfaciliteit aardwarmte, intensivering KAE	Insurance	Increase	Sustainable heat production	Geothermal energy	Commercial	Green-house industry	Insurance increase for sustainable heat production using geothermal energy in the commercial greenhouse industry	Renewable energy production
129	Versnellingsplan aardwarmte, intensivering KAE	Support in implementation process	Increase	Sustainable heat production	Geothermal energy	Commercial	Green-house industry	Support in implementation process increase for sustainable heat production using geothermal energy in the commercial greenhouse industry	Renewable energy production
131	Versnellinsgplan HNT (Het Nieuwe Telen), intensivering KAE	Support in implementation process	Increase	Sustainable heat production	Research on geothermic applications	Commercial	Green-house industry	Support in implementation process increase for sustainable heat production with research on geothermic applications in the commercial greenhouse industry	Renewable energy production

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
132	MEI-regeling, intensivering KAE	Costs (investment)	Decrease	Energy efficiency	Innovative systems	Commercial	Green-house industry	Investment cost decrease for energy efficiency with innovative systems in the commercial greenhouse industry	Energy efficiency
				Decentral renewable energy production	Innovative systems	Commercial	Green-house industry	Investment cost decrease for decentral renewable energy production with innovative systems in the commercial greenhouse industry	Renewable energy production
133	IMM (Investeringen in Milieuvriendelijke Maatregelen voorheen IRE), intensivering KAE	Costs (investment)	Decrease	Energy efficiency	Greenhouses	Commercial	Green-house industry	Investment cost decrease for energy efficiency for greenhouses in the commercial greenhouse industry	Energy efficiency
136	Sectoraal CO_2-kostenverevening-systeem	Costs (emission)	Increase	CO_2 emissions	Greenhouses	Commercial	Green-house industry	Cost increase die to CO_2 emissions of greenhouses in the commercial greenhouse industry	GHG emission
137	Individueel CO_2-kostenverevening-systeem. (EBG)	Costs (emission)	Increase	CO_2 emissions	Natural gas use in greenhouses	Commercial	Green-house industry	Cost increase due to CO_2 emissions of natural gas use in greenhouses in the commercial greenhouse industry	GHG emission
138	Erkende maatregelenlijst Wmb	Obligatory implementation	-	Energy efficiency	Buildings	Commercial	Agri-culture	Obligatory implementation of energy efficiency for buildings in commercial agriculture	Energy efficiency
140	CO_2-normering personenauto's 95 g/km per 2021	Design specifications	-	CO_2 emissions	Per driven kilometre, for new cars	Consumers	Tran-sport	Design specifications for CO_2 emissions per driven kilometres of new cars in consumer transport	GHG emission
141	CO_2-normering bestelauto's 147 g/km per 2020	Design specifications	-	CO_2 emissions	Per driven kilometre, for new vans	Commercial	Tran-sport	Design specifications for CO_2 emissions per driven kilometres of new vans in commercial transport	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
142	Fiscale stimulering ultrazuinige auto's 2016-2020 (conform Belastingplan 2015 en Wet uitwerking Autobrief II)	Costs (investment)	Decrease	CO_2 emission reduction	EV's and PHEV's	Consumers	Tran-sport	Investment cost decrease for CO_2 emission reduction due to EV's and PHEV's in consumer transport	GHG emission
				Energy efficiency	EV's and PHEV's	Consumers	Tran-sport	Investment cost decrease for energy efficiency due to EV's and PHEV's in consumer transport	GHG emission
		Tax	Decrease	CO_2 emission reduction	EV's and PHEV's	Consumers	Tran-sport	Tax decrease for CO_2 emission reduction due to EV's and PHEV's in consumer transport	GHG emission
				Energy efficiency	EV's and PHEV's	Consumers	Tran-sport	Tax decrease for energy efficiency due to EV's and PHEV's in consumer transport	GHG emission
143	Teruggaveregeling LNG 2014-2018	Tax	Decrease	LNG price	Fossil fuel use	Consumer and Commercial	Tran-sport	Tax decrease of LNG price for LNG demand for fossil fuel use in consumer and commercial transport	GHG emission
144	Programma beter benutten (fase 1 en 2), onderdeel logistiek	Costs (R&D)	Decrease	Transport efficiency	Alternatives to road transport	Commercial	Tran-sport	R&D cost decrease of transport efficiency with alternatives for road transport in commercial transport	GHG emission
		Cooperative	-	Transport efficiency	Alternatives to road transport	Commercial	Tran-sport	Cooperative on transport efficiency with alternatives for road transport in commercial transport	GHG emission
145	Voorlichtingscampagne 'Kies de beste band'	Information supply	Increase	Fuel efficiency	Tire choice	Consumer and Commercial	Tran-sport	Information supply increase on fuel efficiency due to tire choice in consumer and commercial transport	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
146	Green Deal Elektrisch Vervoer 2016-2020	Cooperative	-	CO_2 emission reduction	Charging infrastructure for EV's	Consumer and Commercial	Tran-sport	Cooperative for CO_2 emission reduction due to charging infrastructure for EV's in consumer and commercial transport	GHG emission
				Energy efficiency	Charging infrastructure for EV's	Consumer and Commercial	Tran-sport	Cooperative for energy efficiency due to charging infrastructure for EV's in consumer and commercial transport	GHG emission
147	Green Deal Zero Emission Stadslogistiek	Cooperative	-	GHG emission reduction	City logistics	Commercial	Tran-sport	Cooperative for GHG emission reduction by city logistics in commercial transport	GHG emission
148	Green Deal Openbaar toegankelijke elektrische laadinfrastructuur	Cooperative	-	CO_2 emission reduction	Charging infrastructure for EV's	Consumer and Commercial	Tran-sport	Cooperative for CO_2 emission reduction due to charging infrastructure for EV's in consumer and commercial transport	GHG emission
				Energy efficiency	Charging infrastructure for EV's	Consumer and Commercial	Tran-sport	Cooperative for energy efficiency due to charging infrastructure for EV's in consumer and commercial transport	GHG emission
149	Green Deal Autodelen	Cooperative	-	Transport efficiency	Car sharing	Consumer	Tran-sport	Cooperative for transport efficiency due to car sharing in consumer transport	GHG emission
150	Meerjarige gedragscampagne 'ik ben hopper'	Information supply	Increase	Transport efficiency	Alternatives for cars	Consumer	Tran-sport	Information supply increase on transport efficiency due to alternatives for cars in consumer transport	GHG emission
151	Lean & Green Personal Mobility	Support in implementation process	Increase	CO_2 emission reduction	Alternatives to cars	Consumer	Tran-sport	Support in implementation process increase for CO_2 emission reduction due to	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								alternatives for cars in consumer transport	
152	Regionale afspraken gericht op verhoging aandeel schone tweewielers	Cooperative	-	CO_2 emission reduction	Clean two-wheelers, charging infrastructure	Consumer	Tran-sport	Cooperative for CO_2 emission reduction by implementing clean two-wheelers and charging infrastructure in consumer transport	GHG emission
153	Lean & Green Logistics	Support in implementation process	Increase	Transport efficiency	Logistics	Commercial	Tran-sport	Support in implementation process increase for transport efficiency in logistics in commercial transport	GHG emission
154	Programma Truck van de Toekomst	Projects	-	Fuel efficiency	Trucks	Commercial	Tran-sport	Projects for fuel efficiency for trucks in commercial transport	GHG emission
		Costs (R&D)	Decrease	Fuel efficiency	Trucks	Commercial	Tran-sport	R&D cost decrease of fuel efficiency for trucks in commercial transport	GHG emission
155	Inzet Lange en Zware Vrachtauto's (LZVs)	Cooperative	-	Transport efficiency	LZV use	Commercial	Tran-sport	Cooperative for transport efficiency due to LZV use in commercial transport	GHG emission
156	Lean & Green Synchromodal	Support in implementation process	Increase	Transport efficiency	Alternatives to road transport	Commercial	Tran-sport	Support in implementation process increase for transport efficiency due to alternatives for road transport in commercial transport	GHG emission
157	Nederlands standpunt CO2-normering personenvoertuigen na 2020	Design specifications	-	CO_2 emissions	Per driven kilometre of new cars	Consumers	Tran-sport	Design specifications for CO_2 emissions per driven kilometres of new cars in consumer transport	GHG emission
158	Green Deal Zero Emissie Busvervoer	Cooperative	-	CO_2 emission reduction	Public busses	Consumers	Tran-sport	Cooperative on CO_2 emission reduction by	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								public busses in consumer transport	
159	Programma beter benutten (fase 1 en 2), onderdeel personenvervoer	Costs (R&D)	Decrease	Transport efficiency	Alternatives to cars	Consumer	Tran-sport	R&D cost decrease for transport efficiency due to alternatives for cars in consumer transport	GHG emission
		Cooperative	-	Transport efficiency	Alternatives to cars	Consumer	Tran-sport	Cooperative for transport efficiency due to alternatives for cars in consumer transport	GHG emission
165	ILUC richtlijn biobrandstoffen	Design specifications	-	CO_2 emission reduction	Biofuel use	Consumer and Commercial	Tran-sport	Design specifications of CO_2 emission reduction due to biofuel use in consumer and commercial transport	GHG emission
166	Richtlijn Brandstofkwaliteit (FQD)	Design specifications	-	CO_2 emission reduction	Fossil fuel properties	Consumer and Commercial	Tran-sport	Design specifications for CO_2 emission reduction due to fossil fuel properties in consumer and commercial transport	GHG emission
168	Besluit hernieuwbare energie vervoer 2015 (implementatie RED)	Permits	Decrease	CO_2 emission	Fossil fuel properties	Consumer and Commercial	Tran-sport	Decrease in permits for CO_2 emission for fossil fuel properties in consumer and commercial transport	GHG emission
169	Verordening (EG) Nr. 661/2009 met eisen voor rolweerstand banden, schakelindicatoren en bandenspanningscontrolesystemen	Design specifications	-	Fuel efficiency	Tire pressure	Consumer and Commercial	Tran-sport	Design specifications for fuel efficiency due to tire pressure in consumer and commercial transport	GHG emission
170	Belastingregime personenauto's conform Wet Uitwerking Autobrief II	Tax	Decrease	CO_2 emission reduction	EV's and PHEV's	Consumers	Tran-sport	Tax decrease for CO_2 emission reduction due to EV's and PHEV's for consumer transport	GHG emission
				Energy efficiency	EV's and PHEV's	Consumers	Tran-sport	Tax decrease for energy efficiency due to EV's and	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
								PHEV's for consumer transport	
171	Brandstofaccijnzen per mei 2016	Tax	Increase	GHG emission	Fossil fuel use	Consumer and Commercial	Tran-sport	Tax increase based on GHG emissions of fossil fuel use for consumer and commercial transport	GHG emission
172	Low Car Diet	Projects	-	Transport efficiency	Alternatives to cars	Consumer	Tran-sport	Projects on transport efficiency with alternatives for cars in consumer transport	GHG emission
173	project Band op Spanning	Information supply	Increase	Fuel efficiency	Tire pressure	Consumer and Commercial	Tran-sport	Information supply increase on fuel efficiency due to tire pressure in consumer and commercial transport	GHG emission
174	Verhoging snelheidslimiet hoofdwegennet	Maximum	Increase	Fuel efficiency	Speed on highways	Consumer and Commercial	Tran-sport	Increase in maximum speed on highways for fuel efficiency of consumer and commercial transport	GHG emission
175	Meerjaren Afspraken Energie-efficiëntie 2008-2020 Rail	Cooperative	-	Energy efficiency	Electricity in the rail sector	Consumer and Commercial	Tran-sport	Cooperatives on energy efficiency of electricity in the rail sector in consumer and commercial transport	Energy efficiency
176	EEDI/SEEMP zeeschepen	Obligatory implementation	-	Energy efficiency	Sea vessels	Commercial	Tran-sport	Obligatory implementation of energy efficiency for sea vessels in commercial transport	GHG emission
177	Subsidieprogramma innovaties duurzame binnenvaart	Costs (investment)	Decrease	GHG emission reduction	Alternative fuel use for inland shipping	Commercial	Tran-sport	Investment cost decrease due to GHG emission reduction with alternative fuel use for inland shipping in commercial transport	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
178	Luchtvaart in ETS	Permits	Decrease	CO_2 emission	Air transport	ETS parties	Tran-sport	Decrease in permits for CO_2 emissions of air transport by ETS parties in transport	GHG emission
		Price	Increase	CO_2 emission price		ETS parties	Tran-sport		GHG emission
182	Besluit gebruik meststoffen: emissiearme aanwending (ook ikv de PAS)	Obligatory implementation	-	GHG emission reduction	Fertilizer use	Commercial	Agri-culture	Obligatory implementation of GHG emission reduction for fertilizer use in commercial agriculture	GHG emission
183	Provinciale verordeningen: ammoniakemissie huisvestings-systemen BBT++ in NB en Limburg; alle stallen tussen 2010 en 2028/2030	Obligatory implementation	-	GHG emission reduction	Stables	Commercial	Agri-culture	Obligatory implementation of GHG emission reduction of stables in commercial agriculture	GHG emission
184	Wet Ammoniak en Veehouderij beleidslijn IPPC-omgevingstoetsing (2007), Wet geurhinder en veehouderij (2006), natura 2000 , Wet luchtkwaliteit 2007: BBT+ /BBT++	Obligatory implementation	-	GHG emission reduction	Stables	Commercial	Agri-culture	Obligatory implementation of GHG emission reduction of stables in commercial agriculture	GHG emission
186	Besluit emissiearme huisvestingsystemen landbouwhuisdieren – aanscherping en uitbreiding vm Besluit ammoniakemissie huisvesing veehouderij (ook ikv de PAS)	Design specifications	-	GHG emission	Stables	Commercial	Agri-culture	Design specifications of GHG emissions for stables for in commercial agriculture	GHG emission
187	Convenant voer- en management maatregelen melkvee (ikv PAS)	Cooperative	-	GHG emission	Ammonia use for dairy cattle ranches	Commercial	Agri-culture	Cooperative for GHG emissions of ammonia use for dairy cattle ranches in commercial agriculture	GHG emission

No	Measure	Sub-type	Direction	Process	Specification	Target group	Sector	Starting point factor	Policy goal
188	Dierrechten varkens/pluimvee	Permits	Increase	GHG emission reduction	Phosphate processing for Pig and poultry farm	Commercial	Agri-culture	Increase in permits received with GHG emission reduction by phosphate processing for pig and poultry farms in commercial agriculture	GHG emission
190	P- en N-gebruiksnormen 5e AP	Design specifications	-	GHG emission	Fertilizer use	Commercial	Agri-culture	Design specifications for GHG emissions of fertilizer use in commercial agriculture	GHG emission
191	Derogatie (en mestproductie-plafond)	Maximum	Decrease	GHG emission	Fertilizer use	Commercial	Agri-culture	Decrease in maximum of GHG emissions of fertilizer use in commercial agriculture	GHG emission
192	Verplichte mestverwerking	Obligatory implementation	-	GHG emission reduction	Phosphate processing for fertilizer use	Commercial	Agri-culture	Obligatory GHG emission reduction by phosphate processing for fertilizer use in commercial agriculture	GHG emission
193	Besluit Uitvoeringsbesluit verantwoorde groei melkveehouderij	Obligatory implementation	-	GHG emission reduction	Phosphate processing for dairy cattle ranches	Commercial	Agri-culture	Obligatory GHG emission by phosphate processing of dairy cattle ranches in commercial agriculture	GHG emission
194	AMVB grondgebonden groei melkveehouderij	Maximum	Decrease	GHG emission reduction	Phosphate processing for dairy cattle ranches	Commercial	Agri-culture	Decrease in maximum of GHG emission by phosphate processing of dairy cattle ranches in commercial agriculture	GHG emission

C

Policy chains of all policy measures

This Appendix includes the staring factors, behavioural factors, implementation factors, process factors, target group goal factors, sector goal factors, and policy goal factors for all policy measures.

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
3	Tax decrease for energy efficiency with innovative energy efficiency measures for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation of energy efficiency with innovative energy efficiency measures for commercial and ETS-parties in transport and industry sectors	Energy efficiency for commercial use	Energy efficiency in commercial sectors	All sectors	Energy efficiency
				Energy efficiency of ETS-parties in transport and industry sectors	Energy efficiency of ETS-parties in transport and industry sectors	Transport and industry sectors	Energy efficiency
4,5,6	Tax decrease for energy efficiency with energy efficiency measures for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation of energy efficiency with energy efficiency measures for commercial and ETS-parties in transport and industry sectors	See 3a			
				See 3b			
	Tax decrease for decentral renewable energy production with decentral measures for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation of decentral renewable energy production with decentral measures for commercial and ETS-parties in transport and industry sectors	Decentral renewable energy production for commercial use	Renewable energy production in commercial sectors	All sectors	Renewable energy production
				Decentral renewable energy production for ETS-parties in transport and industry sectors	Renewable energy production of ETS-parties in transport and industry sectors	Transport, Industry	See 4c
7	Investment cost decrease for energy efficiency with innovative solutions for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation of energy efficiency with innovative solutions for commercial and ETS-parties in transport and industry sectors	See 3a			
				See 3b			
	Investment cost decrease for decentral renewable energy production with innovative solutions for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation of decentral renewable energy production with innovative solutions for commercial and ETS-parties in transport and industry sectors	4c			
				4d			
8	R&D cost decrease of energy efficiency with innovative solutions for commercial and ETS-parties in transport and industry sectors	See 7a					

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
	R&D cost decrease of decentral renewable energy production with innovative solutions for commercial and ETS-parties in transport and industry sectors	See 7b					
9	R&D cost decrease of energy efficiency with process efficiency with innovative solutions for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation energy efficiency with process efficiency with innovative solutions from collaborative projects for commercial and ETS-parties in transport and industry sectors	See 3a			
				See 3b			
11	Financing options increase for energy efficiency of sustainable projects for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation of energy efficiency of sustainable projects for commercial and ETS-parties in transport and industry sectors	See 3a			
				See 3b			
	Financing options increase for decentral renewable energy production of sustainable projects for commercial and ETS-parties in transport and industry sectors	Perceived behavioural control	Implementation of decentral renewable energy production of sustainable projects for commercial and ETS-parties in transport and industry sectors	See 4c			
				See 4d			
12	Obligatory implementation of energy efficiency measures for buildings for commercial and ETS-parties	-	Implementation energy efficiency measures for buildings for commercial and ETS-parties	See 3a			
				See 3b			
14	Decrease in permits for CO_2 emissions of point sources by ETS parties in energy and industry sectors	-	-	CO_2 emission of ETS parties in energy and industry sectors	GHG emission of ETS parties in energy and industry sectors	GHG emission of in energy and industry	GHG emission
17	Information exchange increase for sustainable heat production and heat transport in regional networks in the commercial energy sector	Subjective norms	Implementation of sustainable heat production in regional networks in the commercial energy sector	Sustainable heat production in the commercial energy sector	Renewable energy production in the commercial energy sector	Renewable energy production in the energy sector	Renewable energy production
21	Tax decrease for fossil fuel electricity production with coal fired power plants for ETS-parties in the energy sector	Perceived behavioural control	Implementation of fossil fuel electricity production with coal fired power plants for ETS-parties in the energy sector	Fossil fuel electricity production of ETS-parties in the energy sector	GHG emission of ETS-parties in the energy sector	GHG emission in the energy sector	GHG emission

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
22	Administrative process decrease for electricity transport reliability of central renewable electricity for commercial and ETS-parties in the energy sector	Perceived behavioural control	Implementation of electricity transport reliability of central renewable electricity for commercial and ETS-parties in the energy sector	Electricity transport reliability in the commercial energy sector	See 17		
				Electricity transport reliability of ETS-parties in the energy sector	Renewable energy production of ETS-parties in the energy sector	See 17a	
29, 30, 31	Return on investment increase for central renewable electricity production for commercial and ETS-parties in the energy sector	Perceived behavioural control	Implementation of central renewable electricity production for commercial and ETS parties in the energy sector	Central renewable electricity production in the commercial energy sector	See 17		
				Central renewable electricity production of ETS-parties in the energy sector	See 22b		
32	Administrative process decrease of central renewable electricity production with wind energy on land for ETS-parties in the energy sector	Perceived behavioural control	Implementation of central renewable electricity production with wind energy on land for commercial and ETS-parties in the energy sector	See 29a			
				See 29b			
33	Design specifications for electricity transport of wind energy at sea for commercial and ETS-parties in the energy sector	-	-	See 22a			
				See 22b			
34, 39	Administrative process decrease for central renewable electricity production with wind energy at sea for commercial and ETS-parties in the energy sector	Perceived behavioural control	Implementation of central renewable electricity production with wind energy at sea for commercial and ETS-parties in the energy sector	See 29a			
				See 29b			
36	Administrative process decrease in electricity transport for wind energy at sea and wind energy on land for commercial and ETS-parties in the energy sector	Perceived behavioural control	Implementation of electricity transport for wind energy at sea and wind energy on of central renewable electricity for commercial and ETS-parties in the energy sector	See 22a			
				See 22b			

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
37	Stakeholder involvement increase for central renewable electricity production with wind energy on land for commercial and ETS-parties in the energy sector	Subjective norms	See 32				
43	Insurance increase for sustainable heat production with geothermal energy in the commercial energy sector	Perceived behavioural control	Implementation of sustainable heat production with geothermal energy in the commercial energy sector	See 17			
47	Return on investment increase for central renewable electricity production with wind energy at sea for commercial and ETS-parties in the energy sector	See 34					
48	Return on investment increase for central renewable electricity production with biomass for commercial and ETS-parties in the energy sector	Perceived behavioural control	Implementation of central renewable electricity production with biomass for commercial and ETS-parties in the energy sector	See 29a			
				See 29b			
49	Design specifications for central renewable electricity production with biomass for commercial and ETS-parties in the energy sector	-	-	See 29a			
				See 29b			
54	Investment cost decrease for sustainable heat production in the consumer and commercial energy sector	Perceived behavioural control	Implementation of sustainable heat production in in the consumer and commercial energy sector	See 17			
				Sustainable heat production in the consumer energy sector	Renewable energy production in the consumer energy sector	See 17	
55	Information supply increase on sustainable heat production with in the consumer and commercial energy sector	Attitude	See 54				

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
56	Return on investment increase for decentral renewable electricity production with decentral measures in the consumer energy sector	Perceived behavioural control	Implementation of decentral renewable electricity production with decentral measures in the consumer energy sector	Decentral renewable electricity production in the consumer energy sector	See 54b		
	Information exchange increase for decentral renewable electricity production with decentral measures in the consumer energy sector	Subjective norms	See 56a				
58	Investment cost decrease for energy efficiency with energy efficiency in sport centres in the consumer energy sector	Perceived behavioural control	Implementation of energy efficiency with energy efficiency in sport centres in the consumer energy sector	Energy efficiency in the commercial energy sector	Energy efficiency in the commercial energy sector	Energy efficiency in the energy sector	Energy efficiency
	Investment cost decrease for decentral renewable energy production with decentral measures in sport centres in the consumer energy sector	Perceived behavioural control	Implementation of decentral renewable energy production with decentral measures in sport centres in the consumer energy sector	Decentral renewable energy production in the commercial energy sector	See 17		
63, 72	Cooperative on energy efficiency due to process efficiency for ETS parties in industry	Subjective norms	Implementation of energy efficiency due to process efficiency for ETS parties in industry	Energy efficiency of ETS parties in industry	Energy efficiency in ETS parties in industry	Energy efficiency in industry	Energy efficiency
	Cooperative on energy efficiency due to chain efficiency for ETS parties in industry	Subjective norms	Implementation of energy efficiency due to chain efficiency for ETS parties in industry	See 63a			
64	Cooperative on energy efficiency due to process efficiency and chain efficiency for commercial industry	Subjective norms	Implementation of energy efficiency due to process efficiency and chain efficiency for commercial industry	Energy efficiency for commercial industry	See 63a		
66	Obligatory implementation of energy efficiency for buildings for commercial and ETS-parties in industry	-	Implementation of energy efficiency for buildings for commercial and ETS-parties in industry	See 64			
				See 63a			
70	Enforcement increase on energy efficiency for buildings for commercial and ETS-parties in industry	Perceived behavioural control	See 66				

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
71	Information exchange increase for energy efficiency due to process efficiency for ETS-parties in industry	See 63a					
	Information exchange increase for energy efficiency due to chain efficiency for ETS-parties in industry	See 63b					
75	Design specifications of GHG emission reduction with alternative fuel use for climate systems for commercial and ETS-parties in industry	-	-	GHG emission reduction in the commercial industry	GHG emission in the commercial industry	GHG emission of industry	GHG emission
				GHG emission reduction of ETS-parties in industry	GHG emission of ETS-parties in industry	See 75a	
	User-friendliness increase for GHG emission reduction with alternative fuel use for climate systems for commercial and ETS-parties in industry	Perceived behavioural control	Implementation of GHG emission reduction with alternative fuel use for climate systems for commercial and ETS-parties in industry	See 75a			
				See 75b			
76	Tax decrease for GHG emission reduction with alternative fuel use for climate systems for commercial and ETS-parties in industry	See 75c					
77	Design specifications for the energy efficiency due to lighting in buildings in the consumer and commercial built environment	-	-	Energy efficiency in the consumer built environment	Energy efficiency in the consumer built environment	Energy efficiency in the built environment	Energy efficiency
				Energy efficiency in the commercial built environment	Energy efficiency in the commercial built environment	See 77a	
79	Design specifications for the GHG emission due to heating appliances for buildings in the consumer and commercial built environment	-	-	GHG emission in the consumer built environment	GHG emission in the consumer built environment	GHG emission in the built environment	GHG emission

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
				GHG emission in the commercial built environment	GHG emission in the commercial built environment	See 79a	
80, 81, 83, 88	Design specifications for the energy efficiency of buildings in the consumer and commercial built environment	-	-	See 77a			
				See 77b			
85	Tax decrease for energy efficiency due to isolation replacement in houses in the consumer built environment	Perceived behavioural control	Implementation of energy efficiency due to isolation replacement in houses in the consumer built environment	See 77a			
86, 90, 94, 96	Information supply increase on energy efficiency of houses in the consumer built environment	Attitude	Implementation of energy efficiency of houses in the consumer built environment	See 77a			
87	Financing options increase for energy efficiency of houses in the consumer built environment	Perceived behavioural control	See 86				
89	User-friendliness decrease for energy efficiency of air-conditioning in buildings in the consumer and commercial built environment	Perceived behavioural control	Implementation of energy efficiency of air-conditioning in buildings in the consumer and commercial built environment	Energy efficiency in the consumer built environment	See 77a		
				Energy efficiency in the commercial built environment	See 77b		
92	Support in implementation process increase for energy efficiency for houses in the consumer built environment	See 87					
	Support in implementation process increase for decentral renewable energy production for houses in the consumer built environment	Perceived behavioural control	Implementation of decentral renewable energy production for houses in the consumer built environment	Decentral renewable energy production in the consumer built environment	Renewable energy production in the consumer built environment	Renewable energy production in the built environment	Renewable energy production percentage

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
94	Administrative process decrease of electricity transport with a smart grid to houses in the consumer built environment	Perceived behavioural control	Implementation of electricity transport with a smart grid to houses in the consumer built environment	Electricity transport in the consumer built environment	See 92b		
97, 98	Enforcement increase on energy efficiency of buildings in the consumer and commercial built environment	Perceived behavioural control	See 86				
			Implementation of energy efficiency of buildings in the commercial built environment	See 77b			
99	Information supply increase on energy efficiency of new household appliances in the consumer built environment	Attitude	Implementation of energy efficiency of new household appliances in the consumer built environment	See 77a			
101	Financing options increase for energy efficiency and renewable energy production of houses in the consumer built environment	See 87					
		See 92b					
105, 110	Cooperative for energy efficiency of rental houses in the commercial built environment	Subjective norms	Implementation of energy efficiency of rental houses in the commercial built environment	See 77b			
107	Investment cost decrease for energy efficiency in rental houses in the commercial built environment	Perceived behavioural control	See 105				
115	Obligatory implementation of energy efficiency in buildings in the commercial built environment	-	See 97b				
117	Enforcement increase on energy efficiency for buildings in the commercial built environment	See 97b					
119	Enforcement increase on energy efficiency of buildings not included in MEE (no.63) in the commercial built environment	Perceived behavioural control	Implementation of energy efficiency of buildings not included in MEE (no.63) in the commercial built environment	See 77b			
127	R&D cost decrease for energy efficiency with innovative research in the commercial greenhouse industry	Perceived behavioural control	Implementation of energy efficiency with innovative research in the commercial greenhouse industry	Energy efficiency and decentral energy production in the	Energy efficiency of the commercial	Energy efficiency in the	Energy efficiency

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
				commercial greenhouse industry	greenhouse industry	greenhouse industry	
	R&D cost decrease for decentral renewable energy production with innovative research in the commercial greenhouse industry	Perceived behavioural control	Implementation of decentral renewable energy production with innovative research in the commercial greenhouse industry	Decentral renewable energy production in the commercial greenhouse industry	Renewable energy production in the commercial greenhouse industry	Renewable energy production in the greenhouse industry	Renewable energy production percentage
128	Insurance increase for sustainable heat production using geothermal energy in the commercial greenhouse industry	Perceived behavioural control	Implementation of sustainable heat production using geothermal energy in the commercial greenhouse industry	Sustainable heat production in the commercial greenhouse industry	See 127b		
129	Support in implementation process increase for sustainable heat production using geothermal energy in the commercial greenhouse industry	See 128					
131	Support in implementation process increase for sustainable heat production with research on geothermic applications in the commercial greenhouse industry	Perceived behavioural control	Implementation of sustainable heat production with research on geothermic applications in the commercial greenhouse industry	See 128			
132	Investment cost decrease for energy efficiency with innovative systems in the commercial greenhouse industry	Perceived behavioural control	Implementation of energy efficiency with innovative systems in the commercial greenhouse industry	See 127a			
	Investment cost decrease for decentral renewable energy production with innovative systems in the commercial greenhouse industry	Perceived behavioural control	Implementation of decentral renewable energy production with innovative systems in the commercial greenhouse industry	See 127b			
133	Investment cost decrease for energy efficiency for greenhouses in the commercial greenhouse industry	Perceived behavioural control	Implementation of energy efficiency for greenhouses in the commercial greenhouse industry	See 127a			

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
136	Cost increase due to CO_2 emissions of greenhouses in the commercial greenhouse industry	Perceived behavioural control	Implementation of CO_2 emission of greenhouses in the commercial greenhouse industry	CO_2 emissions of greenhouses in the commercial greenhouse industry	GHG emissions in the commercial greenhouse industry	GHG emissions of greenhouse industry	GHG emissions
137	Cost increase due to CO2 emissions of natural gas use in greenhouses in the commercial greenhouse industry	Perceived behavioural control	Implementation of CO_2 emissions of natural gas use in the commercial greenhouse industry	See 136			
138	Obligatory implementation of energy efficiency for buildings in commercial agriculture	-	Implementation of energy efficiency for buildings in commercial agriculture	Energy efficiency for the commercial agriculture	Energy efficiency in the commercial agriculture	Energy efficiency of agriculture	Energy efficiency
140, 157	Design specifications for CO_2 emissions per driven kilometres of new cars in consumer transport	-	-	CO_2 emission of cars in consumer transport	GHG emissions in consumer transport	GHG emission of transport	GHG emission
141	Design specifications for CO_2 emissions per driven kilometres of new vans in commercial transport	-	-	CO_2 emission of vans in commercial transport	GHG emission of commercial transport	See 140	
142	Investment cost decrease for CO2 emission reduction due to EV's and PHEV's in consumer transport	Perceived behavioural control	Implementation of CO2 emission reduction due to EV's and PHEV's in consumer transport	CO2 emission reduction in consumer transport	See 140		
	Investment cost decrease for energy efficiency due to EV's and PHEV's in consumer transport	Perceived behavioural control	Implementation of energy efficiency due to EV's and PHEV's in consumer transport	Energy efficiency in consumer transport	Energy efficiency of consumer transport	Energy efficiency of transport	Energy efficiency
142, 170	Tax decrease for CO2 emission reduction due to EV's and PHEV's in consumer transport	See 142a					
	Tax decrease for energy efficiency due to EV's and PHEV's in consumer transport	See 142b					
143	Tax decrease of LNG price for LNG demand for fossil fuel use in consumer and commercial transport	Perceived behavioural control	Implementation of LNG demand for fossil fuel use in consumer and commercial transport	LNG demand in consumer transport	See 140		
				LNG demand in commercial transport	See 141		

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
144	R&D cost decrease of transport efficiency with alternatives for road transport in commercial transport	Perceived behavioural control	Implementation of transport efficiency with alternatives for road transport in commercial transport	Transport efficiency in commercial transport	See 141		
	Cooperative on transport efficiency with alternatives for road transport in commercial transport	Subjective norms	See 144a				
145	Information supply increase on fuel efficiency due to tire choice in consumer and commercial transport	Attitude	Implementation of fuel efficiency due to tire choice in consumer and commercial transport	Fuel efficiency in consumer transport	See 140		
				Fuel efficiency in commercial transport	See 141		
146, 148	Cooperative for CO2 emission reduction due to charging infrastructure for EV's in consumer and commercial transport	Subjective norms	Implementation of CO2 emission reduction due to charging infrastructure for EV's in consumer and commercial transport	See 142a			
				CO2 emissions reduction in commercial transport	See 141		
	Cooperative for energy efficiency due to charging infrastructure for EV's in consumer and commercial transport	Subjective norms	Implementation of energy efficiency due to charging infrastructure for EV's in consumer and commercial transport	See 142b			
				Energy efficiency in commercial transport	Energy efficiency of commercial transport	See 142b	
147	Cooperative for GHG emission reduction by city logistics in commercial transport	Subjective norms	Implementation of GHG emission reduction by city logistics in commercial transport	GHG emission reduction in commercial transport	See 141		
149	Cooperative for transport efficiency due to car sharing in consumer transport	Subjective norms	Implementation of transport efficiency due to car sharing in consumer transport	Transport efficiency in consumer transport	See 140		
150	Information supply increase on transport efficiency due to alternatives for cars in consumer transport	Attitude	Implementation of transport efficiency due to alternatives for cars in consumer transport	See 140			
151	Support in implementation process increase for CO_2 emission reduction due to alternatives for cars in consumer transport	Perceived behavioural control	Implementation of CO_2 emission reduction due to alternatives for cars in consumer transport	See 142			

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
152	Cooperative for CO_2 emission reduction by implementing clean two-wheelers and charging infrastructure in consumer transport	Subjective norms	Implementation of CO_2 emission reduction by implementing clean two-wheelers and charging infrastructure in consumer transport	See 142			
153	Support in implementation process increase for transport efficiency in logistics in commercial transport	Perceived behavioural control	Implementation of transport efficiency in logistics in commercial transport	See 144a			
154	Projects for fuel efficiency for trucks in commercial transport	Attitude	Implementation of fuel efficiency for trucks in commercial transport	See 145b			
	R&D cost decrease of fuel efficiency for trucks in commercial transport	Perceived behavioural control	See 154a				
155	Cooperative for transport efficiency due to LZV use in commercial transport	Subjective norms	Implementation of transport efficiency with LZV use in commercial transport	See 144a			
156	Support in implementation process increase for transport efficiency due to alternatives for road transport in commercial transport	See 144a					
158	Cooperative on CO_2 emission reduction by public busses in consumer transport	Subjective norms	Implementation of CO_2 emission reduction by public busses in consumer transport	See 142			
159	R&D cost decrease for transport efficiency due to alternatives for cars in consumer transport	Perceived behavioural control	See 150				
	Cooperative for transport efficiency due to alternatives for cars in consumer transport	Subjective norms	See 150				
165	Design specifications of CO2 emission reduction due to biofuel use in consumer and commercial transport	-	-	See 142			
				See 146b			
166	Design specifications for CO2 emission reduction due to fossil fuel properties in consumer and commercial transport	-	-	See 142			
				See 146b			

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
168	Decrease in permits for CO_2 emission for fossil fuel properties in consumer and commercial transport	-	-	CO_2 emission in consumer transport	See 140		
168				CO_2 emission in commercial transport	See 141		
169	Design specifications for fuel efficiency due to tire pressure in consumer and commercial transport	-	-	See 145a			
169				See 145b			
171	Tax increase based on GHG emissions of fossil fuel use for consumer and commercial transport	Perceived behavioural control	Implementation of GHG emissions of fossil fuel use for consumer and commercial transport		See 140		
171					See 141		
172	Projects on transport efficiency with alternatives for cars in consumer transport	See 150					
173	Information supply increase on fuel efficiency due to tire pressure in consumer and commercial transport	Attitude	Implementation of fuel efficiency due to tire pressure in consumer and commercial transport	See 145a			
173				See 145b			
174	Increase in maximum speed on highways for fuel efficiency of consumer and commercial transport	-	-	See 145a			
174				See 145b			
175	Cooperatives on energy efficiency of electricity in the rail sector in consumer and commercial transport	Subjective norms	Implementation of energy efficiency of electricity in the rail sector in commercial transport	Energy efficiency in commercial transport	See 146		
176	Obligatory implementation of energy efficiency for sea vessels in commercial transport	-	Implementation of fuel efficiency for sea vessels in commercial transport	See 145b			
177	Investment cost decrease due to GHG emission reduction with alternative fuel use for inland shipping in commercial transport	Perceived behavioural control	Implementation of GHG emission reduction with alternative fuel use for inland shipping in commercial transport	GHG emission reduction in commercial transport	See 141		
178	Decrease in permits for CO_2 emissions of air transport by ETS parties in transport	-	-	CO_2 emission by ETS parties in transport	GHG emission by ETS parties in transport	See 141	

No.	Starting points	Behavioural factor	Implementation factor	Process factor	Target group goal factor	Sector goal factor	Policy goal factor
182	Obligatory implementation of GHG emission reduction for fertilizer use in commercial agriculture	-	Implementation of GHG emission reduction for fertilizer use in commercial agriculture	GHG emission reduction in commercial agriculture	GHG emission in the commercial agriculture	GHG emissions of agriculture	GHG emissions
183, 184	Obligatory implementation of GHG emission reduction of stables in commercial agriculture	-	Implementation of GHG emission reduction of stables in commercial agriculture	See 182			
186	Design specifications of GHG emissions for stables for in commercial agriculture	-	-	GHG emission in commercial agriculture	See 182		
187	Cooperative for GHG emissions of ammonia use for dairy cattle ranches in commercial agriculture	Subjective norms	Implementation of GHG emissions of ammonia use for dairy cattle ranches in commercial agriculture	See 186			
188	Permits received with GHG emission reduction by phosphate processing for pig and poultry farms in commercial agriculture	-	-	See 182			
190	Design specifications for GHG emissions of fertilizer use in commercial agriculture	-	-	See 186			
191	Decrease in maximum of GHG emissions of fertilizer use in commercial agriculture	-	-	See 182			
192	Obligatory implementation of GHG emission reduction by phosphate processing for fertilizer use in commercial agriculture	-	Implementation of GHG emission reduction by phosphate processing for fertilizer use in commercial agriculture	See 182			
193	Obligatory implementation of GHG emission by phosphate processing of dairy cattle ranches in commercial agriculture	-	Implementation of GHG emission by phosphate processing of dairy cattle ranches in commercial agriculture	See 182			
194	Decrease in maximum of GHG emission by phosphate processing of dairy cattle ranches in commercial agriculture	-	-	See 182			

D

System overview

This appendix includes the system overview that is constructed in steps 1 through 5 of the 7-step methodology.

Interference of policy measures in the Dutch energy system

Appendix D - System overview

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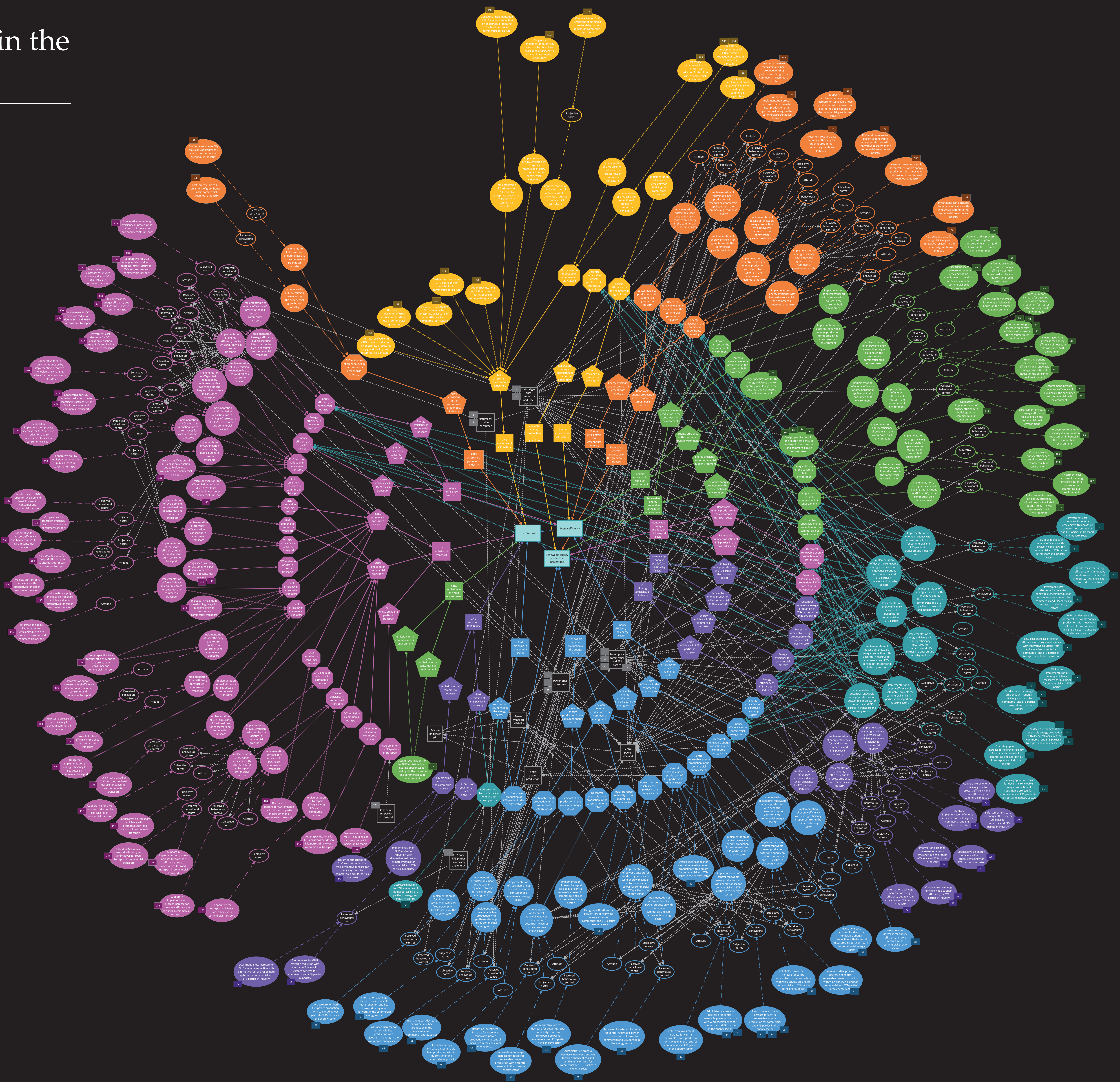

Legend

- Multisector
- Energy sector
- Industry sector
- Transport sector
- Built environment sector
- Greenhouse industry sector
- Agriculture industry sector

- Policy measure
- Starting factor
- Behavioural factor
- Cross-sectoral factor
- Implementation factor
- Process factor
- Target group goal factor
- Sector goal factor
- Policy goal factor

- Treshold relation
- Dependent relation
- Delay relation
- Non-linear relation
- Linear relation

E

Validation case two – Sustainable heat

This appendix includes the second validation for the 7-step methodology. The subject of sustainable heat is analysed for the public discussion surrounding this topic.

E.1 Introduction

Heat demand in the Netherlands is a significant part of the energy demand, a complete renewable energy system cannot be accomplished without heat demand reductions and sustainable heat production (Ministry of Economic Affairs, 2015). This validation analysis will focus on the production of sustainable heat only.

To be able to develop a sustainable heat production system in the Netherlands, heat should be seen as equal to gas and electricity in the energy system of the Netherlands (Ministry of Economic Affairs, 2015). Currently heat is seen as a product of either gas or electricity rather than a necessary good on its own.

The use of waste heat is seen as a viable source of sustainable (CO_2-low) heat, this is also recognized by both industry and regional governments (Ministry of Economic Affairs, 2015). However, waste heat is not seen as a renewable (CO_2-free) heat source, excluding it from (financial) benefits, hampering the implementation of waste heat networks (Ministry of Economic Affairs, 2016b).

The growth of sustainable heat production will also aid the decrease in dependency on gas of the Dutch energy system (Ministry of Economic Affairs, 2015). However, the dependency on natural gas for the peak demand of heat, as fuel for shipping, and as heat source for the industry is expected to last. The sustainable alternatives are not yet developed enough to cover these function of gas. The phasing out of gas is therefore regarded dependent on the development of sustainable alternatives (Ministry of Economic Affairs, 2016b).

E.2 Public discussion

The five main topics that are visible in the public discussions are; methods of sustainable heat production, sources for sustainable heat production, affordability of sustainable heat, heat markets and infrastructures, as well as possible alternatives for incentivising sustainable heat production in the Netherlands. These five topics will be discussed shortly below.

Sustainable heat production The following sustainable heat production methods are seen as most promising: '*warmte- en koudeopslag (wko), geothermie, zonthermie, biomassa en warmtepompen*' (Ministry of Economic Affairs, 2015). Also sustainable methods for producing cooling options will grow (Ministry of Economic Affairs, 2015). Natural gas production is expected to decrease the coming years, as the national gas sources will start to deplete. However, the role of natural gas in the heat supply can be taken over by biogas and green gas. Also the role of electricity for the heat supply is likely to grow. As the electricity production is expected to become more intermittent, also the importance of energy storage will grow (Ministry of Economic Affairs, 2015).

Technology uncertainty plays a large role in the energy transition. It is important to remain 'technology-free' by keeping all options open for the different technologies for sustainable heat. A technological lock-in should be avoided (Ministry of Economic Affairs, 2016b).

Users of collective sustainable heat production also pay less energy taxes (Ministry of Economic Affairs, 2015). Also the height and stability of the electricity and gas prices are a large factor in the industry sector, as a large part of the production cost exists of the electricity and gas costs. The same holds for the greenhouse and agriculture sector.

The long term visions for sustainable heat production are included in financial incentives (such as the EIA). There are also options for information on sustainable heat production through the '*experticecentrum warmte*' (Ministry of Economic Affairs, 2015).

Sustainable heat sources An important sustainable heat source is waste heat, the use of waste heat contributes both to process efficiency as well as sustainable heat production. The use of waste heat can also lead to an integrated cluster of companies, connected by their surplus or demand for heat. This can have a positive effect on the investment climate of the cluster (Ministry of Economic Affairs, 2015).

However, there is a bottleneck in the use of waste heat. For the companies that have a surplus of heat is heat production a secondary goal, for them heat is a by-product that they have, but not necessarily need or want. For the heat demanding companies is heat a primary energy source, they cannot continue without a heat source. This difference between the supply and demand of heat can lead to a low security of supply (heat is not the main produced good), which is crucial for the heat demanding companies (where heat is a primary energy source). This effect can be mitigated by developing heat markets and clusters with multiple suppliers of heat (Ministry of Economic Affairs, 2015).

A second drawback is the low return on investments for waste heat projects, this is mainly due to the large upfront investment costs that are required to develop the infrastructure to transport heat. Besides large investment costs are the profits of heat sales limited by the gas price. The price of (sustainable) heat cannot exceed the costs of heat production form natural gas. This dynamic can be used to create an incentive for heat buyers to choose sustainable heat. Heat producers, however, have to pay less energy taxes if they use (or sell) their waste heat (Ministry of Economic Affairs, 2015).

Affordability Sustainable heat production is eligible for SDE+ subsidies. As sustainable heat is a relative affordable option of sustainable energy. Due to the way the SDE+ subsidy is designed, many sustainable heat projects have been subsidized (Ministry of Economic Affairs, 2015).

Due to the connection of sustainable heat prices with the natural gas price (in waste heat networks) and the electricity price (in electric heating mechanisms such as solar boilers), is also the energy tax of influence on the cost efficiency of sustainable heat production (Ministry of Economic Affairs, 2015). Also Combined Heat and Electricity (CHP) installations receive financial incentives, in exemptions of energy tax for electricity use of the installation (Ministry of Economic Affairs, 2015).

Markets and infrastructures As already mentioned is the security of supply for waste heat buyers crucial. Therefore not only the production of heat is relevant, also the transportation and market mechanisms play a vital role in the adoption of sustainable heat. The market mechanism and infrastructure are also important for heat be regarded as an equal energy carrier to electricity and natural gas.

Currently is the network of heat supply and demand a closed market. There are long term contracts between seller and buyer, and infrastructure for the transportation of heat is mostly only present between these two parties. Here there is a separate entity that owns the infrastructure and is in charge of the physical supple of heat (Ministry of Economic Affairs, 2015).

Due to the growth in heat networks and the electrification of the energy demand will gas networks become more and more obsolete. As large parts of the gas infrastructure will have to be renewed in the coming years, it is essential to consider the future needs of gas, heat, and electricity before renewing the gas network. Especially in cities, where district heating is growing, the gas network will be superfluous (Ministry of Economic Affairs, 2015).

Policy alternatives Market parties have mentioned that the national government should create continuity and clarity in their legislation. A leading role and courage are seen as necessary elements of the national government in the energy transition (Ministry of Economic Affairs, 2016b).

Regulations should remain flexible to allow for changes in the energy sector towards a sustainable sector. In this context, are *'kaderwetgeving'* and *'doelwetgeving'* better suited than restrictions and obligations.

The sense of urgency of the general public should be enhanced, as the direct environment of their daily lives and environment will have to change to become more sustainable. Knowing that for example cooking on electricity is better for the climate than cooking on natural gas is not enough incentive to change. The same goes for energy saving measures for their homes (Ministry of Economic Affairs, 2016b). An incentive for property owners, infrastructure owners, and other market parties is to create a timeline for the phasing out of the natural gas networks (Ministry of Economic Affairs, 2016b).

E.3 Validation of the energy system

Within this analysis of the energy system is sustainable heat not always specified as such. Multiple policy measures mention 'renewable energy', which consists of both renewable electricity and sustainable heat. To analyse the validation of the system overview for sustainable heat, should sustainable heat as well as renewable energy measures be included. Measures specified explicitly for renewable electricity will be excluded from this sustainable heat analysis.

Policy goals The main influence of sustainable heat production on the policy goals is the increase in renewable energy production. This can be seen in Figure 1 by all coloured arrows that lead from the sector goals towards the policy goal of renewable energy production.

The influence on the policy goal of GHG emission reduction is based on the decreasing use of natural gas for heating purposes as the renewable energy (heat) production increases if heat demand is maintained constant. This influence on the GHG emission reduction goal is indicated in Figure 1 by the cross-sectoral relation between renewable energy production and GHG emission policy goals.

Behaviour factors The political discussion pointed out that there is a need to include the general public to induce a social change to adopt sustainable heat sources. The behavioural factors that indicates the influence on the mind-set of society as whole is depicted by the subjective norms, the mind-set of individuals is depicted with the attitude factors. However, there are only one subjective norms factor and one attitude factor directly influenced by policy measures in the system overview for sustainable heat production, see Figure XX. Based on cross-sectoral relations are more subjective norms and attitude factors included.

The policy measure that directly influences the subjective norms factor focusses on information exchange between commercial parties in the energy sector (no. 17, 'Expertiseventrum warmte'). The attitude factor is directly influenced by a policy measure that is focussed on the supply of information on sustainable heating options from government to both consumer and commercial parties in the energy sector (no. 55, 'Communicatie campagne ISDE'). The view on societal change is represented in the system overview by the behavioural factors of subjective norms and attitude.

Cross-sectoral factors The main cross-sectoral aspect that is identified in the political discussion is the shift from natural gas demand to electricity demand. This shift in choices of energy carriers is illustrated in Figure 1 by the influence of both the natural gas price and the electricity price on the behavioural factors. As electricity is expected to become more renewably produced will electricity also become a more renewable source for heat than natural gas. The shift towards an increase in electricity demand is also stimulated by the financial measures that make electricity cheaper compared to natural gas for heating purposes (no. 1, 2, and 20). The presence of the cross-sectoral factors is essential to depict the technology implementations that occur in multiple sectors.

E.4 Validation of interference

The political discussion mentioned multiple policy measures that should be visible in the system overview and account for (some of) the interference. The mentioned policy measures that are included in the data set of the NEO 2016 model by ECN are: (1) Energy Investment Deduction (no. 4, 5, and 6, 'Energie Investeringsaftrek'), (2) the energy tax (no. 1, 2, and 20), gas pricing measures (no. 1 and 2, 'Energie belasting'), (3) Subsidies for renewable energy production (no. 29, 30 and 31, 'SDE+'), and (4) expertise centre for heat (no. 17, 'Expertisecentrum warmte').

The political discussion identifies interference between the policy measures for SDE+ and the electricity and natural gas prices, as well as between the electricity price and natural gas prices themselves. The behavioural factor of the SDE+ policy chain (no. 29, 30, and 31) is influenced by both the natural gas price and the electricity price. The identified interference in the political discussion is also identified in the system overview. The interference between electricity price and natural gas price is visible throughout the system overview. There are multiple behavioural factors that are influenced by both the natural gas price and the electricity price. Indicating a constant tension between these two prices that influences the chosen action of individuals throughout the energy system.

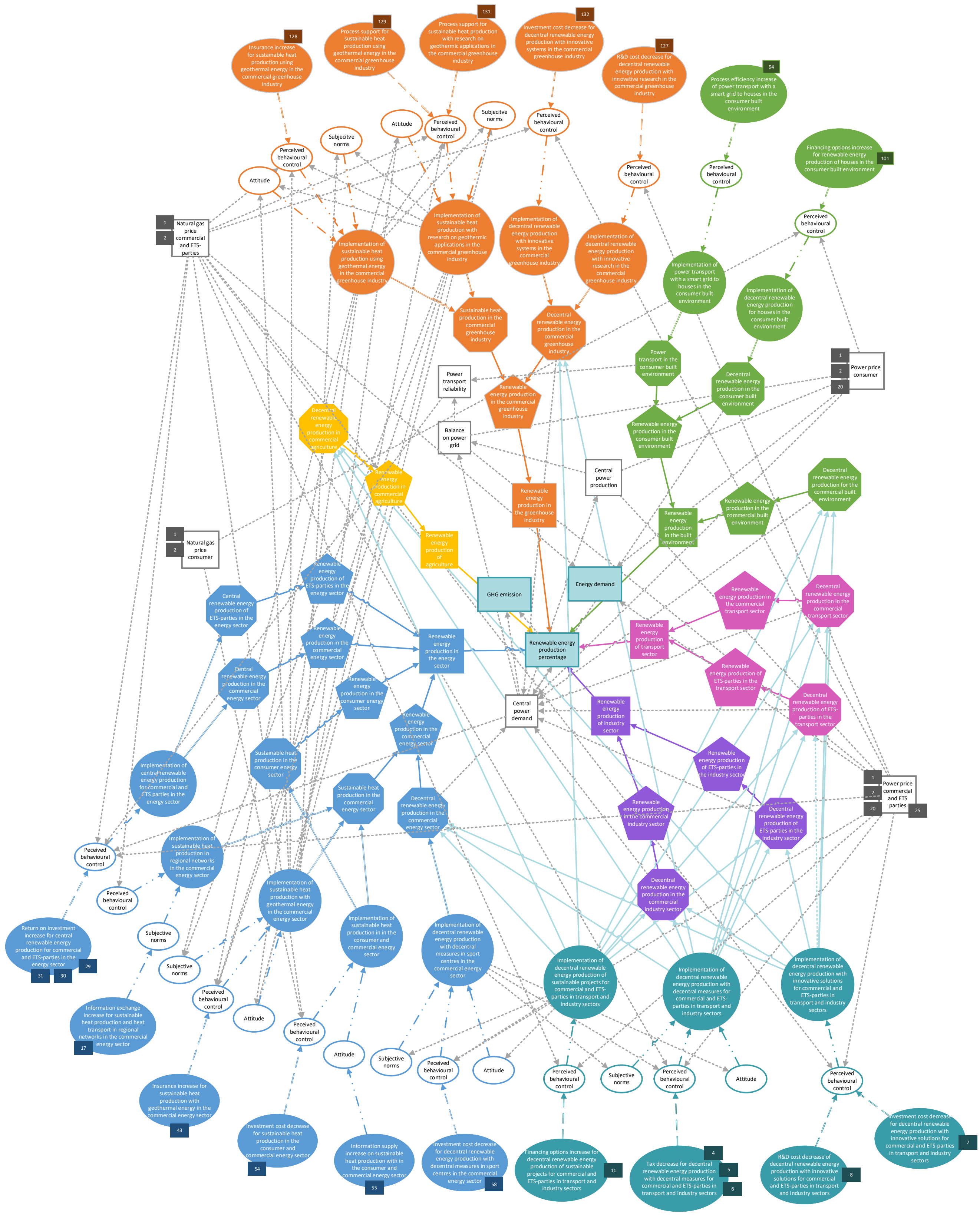

Figure 1: System overview for sustainable heat production

F

Paper

This Appendix includes the scientific paper on the CoSEM research on the interference of policy measures in the Dutch energy system.

Interference of policy measures in the Dutch energy system

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Abstract

The energy system is a complex socio-technical system, characterised by a multitude of stakeholders, different goals, long-term investments, and large scale sub systems with long lifetimes. The government of the Netherlands aims to support the transition of the energy system of the Netherlands towards a sustainable system by implementing policy measures. Recently, companies have voiced their concerns on the fluctuating effects of policy measures in the Netherlands and have asked for a more long term vision of policy measures. This long term vision can be (partly) provided by analysing the interference in the energy system. This research identifies five types of interference and analyses the effects of the identified interference on the energy system. This categorization of interference allows for a discussion on the unavoidable nature of interference. Moreover, it shows which types of interference can prove to be beneficial at certain times.

Keywords: Interference, policy measures, system analysis, sociotechnical systems, energy sector

1. Introduction

The energy system of the Netherlands is a complex socio-technical system (Bollinger et al., 2014), characterised by a multitude of stakeholders, different goals, long-time investments, and large scale (sub) systems. There is a strong physical embeddedness of energy production technologies that rely on the current system, which makes changing the system more difficult. Moreover, as the energy sector of the Netherlands is an integrated system, where the sub-systems also influence each other, the final effect of the policy measures is not always straightforward or clear.

Recently, companies have voiced their concerns on the fluctuating effects of policy measures in the Netherlands and have asked for a more long term vision for the policy measures (Accountant, 2016). This long term vision should focus on a period of twenty years, to accommodate the implementation and phasing out of energy production capacity. The long term vision both needs to account for the interconnectedness of the energy system, as well as for the effects of a multitude of policy measures in the energy system that are all active at the same time.

The interconnectedness of the energy system, together with the large amounts of policy measures that influence this system can lead to interference between the policy measures. Interference between policy measures can be interpreted in different ways, and to make it even more complex, there are multiple terms used to describe the same phenomenon (e.g. overlap or integration of policy measures). Interference in this research is defined as the combined influence of more than one policy measure on a single system component of the energy system.

For example, the implementation of electric vehicles (EV's) reduces the greenhouse gas (GHG) emissions of transport, while at the same time increasing the electricity demand. If this increase in electricity demand cannot be met with renewable sources, the GHG emissions of electricity production increase. What is a positive change for one sub-system can therefore have (negative) effects on another sub-system.

Interference between policy measures has been researched to some extent. Many researchers see the need for policy integration (Briassoulis, 2004;

Ghersi, 2014; Greening & Bernow, 2004). Briassoulis (2004, p.2) states that "*policies are often found to be little coordinated, to overlap or even to be in conflict. The policy system is unduly complicated, producing inefficient or even ineffective solutions, giving rise to new problems and waste of resources.*". Pasimeni et al. (2014) analysed 114 papers that were published between 2000 and 2011 on the interaction between climate change, land-use, and energy, mention the need for further research into policy interference.

Most research into policy integration focusses on the integration of environmental and energy policies, whereas none of the researches explicitly mentions the possibility for interference of energy policies itself (Briassoulis, 2004; Ghersi, 2014; Greening & Bernow, 2004; Simões, 2013). Moreover, there is no method suggested to identify the critical policies.

Research by Simões (2013) on the integration of higher level policy instruments for energy and environmental legislation does state a methodology for identifying 'overlapping' policy measures. The difference of the definition of overlap in the work by Simões and the definition of interference used in this article is mainly in the number of policy measures that can interfere. Simões (2013) limits the number of policy measures that can interfere (or overlap) to only two policy measures. Whereas this research works on the premises that also more than two policy measures can interfere at the same time for the same part of the energy system.

The methodology of Simões identifies interference by finding those policy measures that have the same goal, and influence the same stakeholders. However, there might be other characteristics of policy measures and/or the energy system that also lead to interference. As Simões (2013, p.55) states: "*Because this framework focuses on the policy instruments and actors or stakeholders, it also does not address the other components of the policy process (objects, goals and the structures and procedures). Including these components would be relevant to understand the motives behind each overlap and co-effect but that is not the purpose of the framework.*".

This paper aims to analyse the effects of interference that is present in the Dutch energy system. To be able to identify and analyse this interference, the methodology of Simões (2013) will be extended to include the structures and processes of the energy system in the Netherlands.

The following section will elaborate on the extension of the methodology to identify interference. The third section will discuss the identified interference. In the fourth section is the extended methodology applied to the energy system of the Netherlands. The fifth section contains the discussion, conclusion, and the recommendations for further research.

2. Methodology to identify interference between policy measures.

As is mentioned in the introduction will the methodology of Simões (2013) be extended to include the structures and processes of the energy system in the Netherlands. Two additional theories are used to determine the main structures and processes in the methodology. The two theories are systems thinking applied to socio-technical systems, and the Theory of Planned Behaviour.

2.1 Systems thinking and socio-technical systems

Systems theory is explained as (Sterman, 2001, p. 9-10): "*the ability to see the world as a complex system, in which we understand that 'you can't do just one thing' and that 'everything is connected to everything else.'*" At the same time is a complex socio-technical system described as (Bollinger et al., 2014, p.2): "*highly interconnected networks of interacting social and technical components that cannot easily be addressed independently from one*". Both theories indicate the interconnectedness of a system, and the influence this can have on the dynamics in the system.

The sub-systems are determined by the main processes of the energy system. The main processes are the production, transport, and use of energy carriers. Energy carriers are those forms of energy that are used throughout the Netherlands and can be divided into three main categories; electricity, heat, and (fossil) fuels. The main processes of the energy system are depicted in Figure 2.

The dynamics within these processes are based on the supply and demand of these processes, as well as on the physical system that is required for these processes.

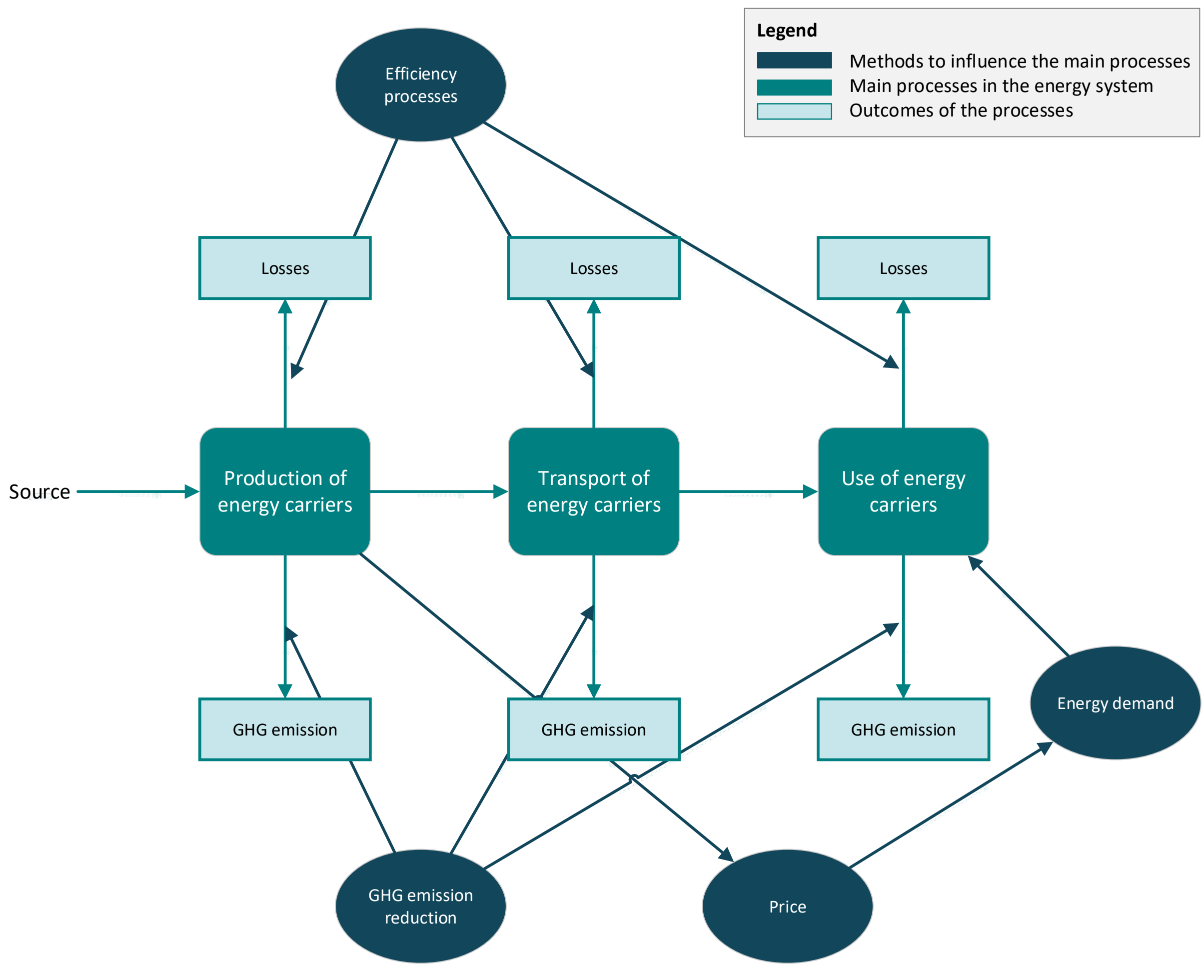

Figure 2: Processes in the energy system of the Netherlands

2.2 Theory of planned behaviour

Policy measures essentially influence the behaviour of a person. For example whether or not a person will implement a technology, or change their consumption patterns. A widely used theory to connect cause and effect for the adoption of technologies is the Theory of Planned Behaviour (Jensen, 2017). The Theory of Planned Behaviour (TPB) is applicable in multiple different contexts (such as information technology, psychology, and social policy) and is seen as *"the most dominant model of attitude-behaviour relations"* (Armitage & Christian, 2003).

The Theory of Planned Behaviour is developed by Azjen (1991) and includes three attributes that influence the intention of a person to change their The subjective norm consist of the likelihood that peer groups approve or disapprove of a certain behavioural choice (Ajzen, 1991). The perceived behaviour. The three attributes are *attitude*, *social norms*, and *perceived behavioural control*. All three influence ones *intention* to perform a certain behaviour (or behaviour change). The perceived behavioural control together with the intention to change the behaviour plays a large role in the actual (change in) behaviour. The TPB is summarized in Figure 3.

The attribute 'attitude' (or 'attitude towards behaviour') is the positive or negative value a person associates with the intended behaviour, and is explained by Azjen (1991, p.191) as: *"[…] we learn to favor behaviors we believe have largely desirable consequences and we form unfavourable attitudes toward behaviors we associate with mostly undesirable consequences."*.

behavioural control indicates to what extent the individual sees themselves capable of the behaviour, and thinks adopting the behaviour is feasible (Jensen, 2017).

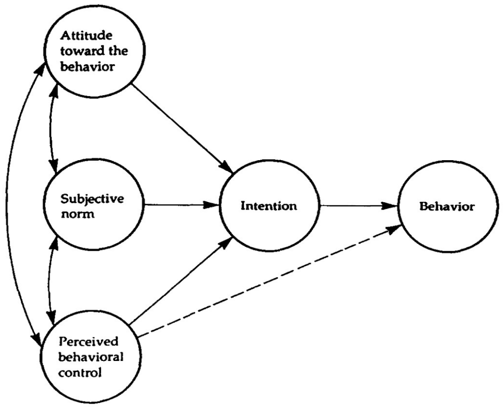

Figure 3: Theory of Planned Behaviour from (Ajzen, 1991)

The TPB is focussed on the behaviour of individuals, mostly consumers. However, a small but growing body of knowledge researches the application of the theory of planned behaviour for organizations (Southey, 2011). In order to use the TPB in this research are the three attributes for the organizations based on organizational theories.

The attitude of an organization towards an action or behaviour is based on the attitudes of managers within the organization (Damanpour & Schneider, 2006, p.231): *"Our results confirm Hage and Dewar's (1973) finding on the explanatory power of organizational leaders' attitudes, and add by showing that the impact of managers' attitude toward innovation on the adoption of innovation is considerably stronger than both environmental and managers' demographic characteristics, and is nearly as strong as that of organizational factors".*

The subjective norms of an organization are likely to be based on the opinions of their stakeholders. As Rivera-Camino (2012, p.404) explains: *"stakeholders appear as critical drivers of corporate ecological responses (Berry and Rondinelli, 1998) and pressures from industry stakeholders can prompt managers to adopt environmental strategies (King and Lenox, 2000).".* This dependency on the opinions and views of their stakeholders as a whole has also been mentioned by Rowley (1997, p.906-907): "*Stakeholder research has concentrated primarily on classifying individual stakeholder relationships and influences. However, this analysis cannot be extended to explain how a firm reacts to its stakeholders, because each firm faces a different set of stakeholders, which aggregate into unique patterns of influences. Thus, firms do not respond to each stakeholder individually, but instead must answer the simultaneous demands of multiple stakeholders."*

The perceived behavioural control for managers in organizations is twofold, one relating to internal control and one relating to external control (Rivera-Camino, 2012). The internal control factor includes the awareness of managers of the issues of the organizations and the environment (Rivera-Camino, 2012, p.404): *"The internal control factor pertains to earlier research on the relationship between the manager's awareness of the firm's problems and the firm's performance (Thomas, Clark, and Gioia, 1993). Studies show that awareness is a significant factor in fostering environmental concern (Ashford, 1993), and this factor motivates managers to improve their organizations' environmental performance (Starik and Rands, 1995) and to adopt pollution-prevention activities (Schmidheiny, 1992)."*

The external control is categorized differently by different researchers (e.g. (Rivera-Camino, 2012; Salzmann, Ionescu-Somers, & Steger, 2005)). This explanation differentiates between financial, social, and environmental factors of perceived control (Salzmann et al., 2005). The financial business case of organizations is based on investments, returns on investments, risk (avoidance). The social and environmental factors of perceived control for organizations are based on corporate social responsibility and corporate social performance (Salzmann et al., 2005).

2.3 Extended methodology to identify interference between policy measures

The initial methodology by Simões (2013) determines two characteristics of the policy measures that can be used to identify if policy measures interfere. These two characteristics are the goal and target group. For the extended methodology is the target group also specified per sector.

The two additional theories (for systems thinking, and the Theory of Planned Behaviour) allow for the identification of five more characteristics that include the main structures and processes of energy systems.

The theory on systems thinking led to the identification of the main processes in the energy system (Bollinger et al., 2014; Sterman, 2000). The TPB needs a characterization of policy measures that allows to identify which behavioural attribute is influenced by a specific policy measure (Ajzen, 1991). The characteristics for type, and sub-type can provide the information to make this distinction.

In total provide the three theories eight characteristics that can be used to identify and analyse interference between policy measures in the energy system. The eight characteristics will be shortly defined below.

Policy goal Each policy measures should be characterised for the policy goal they aim to achieve. The three policy goals for the Dutch energy system are (European Commission, 2017):

1. Reduction in greenhouse gas emissions of 40% (compared to 1990) before 2030,
2. Increase of renewable energy production to a minimum share of 27% of the energy mix before 2030,
3. Increase in energy efficiency with a result of 27% energy savings before 2030.

Sector Within the energy system of the Netherlands is not just energy production applicable, the different applications or uses of energy, as well as the different users of energy also influence the energy production and transport. The seven sectors included in this methodology are (1) Multi sector, (2) Energy, (3) Industry, (4) Transport, (5) Built environment, (6) Greenhouse industry, and (7) Agriculture industry (ECN, 2016).

Target group The target group is based on the nature of actors (stakeholders) that are influenced within the different sectors. Policy measures make a distinction between commercial parties and consumers (individual people). This distinction is based on whether or not the wanted action of the target group is governed by the aim for profit, or the aim of a fulfilling life. There is also a target group especially for those commercial parties that fall under the EU-ETS (Emission Trading Scheme) policy. The three target groups are: (1) Consumers, (2) Commercial parties, and (3) ETS-parties.

Process The policy measures all influence one of the main identified processes directly. The main processes are depicted in Figure 2. These process form the categories for the possible process characterisations. The categories are (1) Production of energy carriers, (2) Transport of energy carriers, (3) Demand of energy carriers, (4) Prices of energy carriers), (5) GHG emission reduction, and (6) Efficiency in the use of energy carriers.

Specification The specifications of policy measures indicate the technology and location of the process characteristic of a policy measure. For example, a policy measure can be characterised for the process of energy production, its technology specification can be 'wind energy' and a location specification can be 'on land', or for the demand of energy the location specification can be 'in buildings'.

Each policy measure can have either a technology specification, a location specification or both. Where possible it is more insightful to include both the technology and location specification.

Type A policy measure can either regulate the actions of a stakeholder in doing something, give financial incentives to the stakeholder, or provide information to the stakeholder.

Most policy measures are designed and implemented by policy makers alone. However, there are also policy measures that are the result of an agreement or collective aim of policy makers and (commercial) stakeholders. These two dimensions of policy measures lead to two determinants for a type of policy measure: the influence it exerts, and the unilateral or multilateral origin of the policy measure. This leads to six different types of policy measures: (1) Unilateral regulatory, (2) Multilateral regulatory, (3) Unilateral financial, (4) Multilateral financial, (5) Unilateral information, and (6) Multilateral information.

Sub-type The identified types for policy measures indicate the kind of influence that is exerted, and the role of the stakeholders in developing the policy measure. The sub-type indicates how this influence is implemented in the system. An example of a unilateral financial sub-type is a tax.

Direction The policy measures influence their target groups in a certain direction. The variable that is influenced by policy measures can either decrease or increase. The variable that is influenced in this methodology is indicated by the sub-types (e.g. the tax on something is increased or decreased). The policy measures are characterised for the direction of their sub-types.

3. Identification of interference

The characterisation of policy measures and the analysis of these characterisations, allows for the identification of five types of interference. These five types are induced from the application of the extended methodology on the Dutch energy system. The results of this application will be discussed in section four. The five types of interference will be discussed below.

3.1 Interference due to cross-sectoral factors

The first type of interference is the interference caused by the different processes across the sectors (sub-systems) in the energy system. These processes also interact with each other, creating feedback loops within the energy system. The variables that represent the main processes of the energy system are 'cross-sector factors' as the direct effects of these factors can span multiple sectors.

An example of a feedback loop is if a policy measure influences the behavioural aspect for decentral renewable energy production in such a way that more decentral renewable energy production capacity is installed, there is an increasing (positive) effect on the implemented decentral renewable energy production capacity. This leads to an increase in decentral renewable electricity (and heat) production. The increase in decentral electricity production decreases the central electricity demand, as stakeholders are providing in their electricity demand themselves, and thus need less electricity from the regional or national grids. A decrease in central power demand leads to a worsening of the business case for central electricity production. This worse business case can lead to a decrease in central (both fossil fuel and renewable) electricity production.

Due to the economic mechanisms of the electricity sector in the Netherlands, are the short and long term effects of the electricity production on the electricity price. On the short term, if the electricity production increases, increases also the electricity price. On the long term, if the central electricity production increases, the business case for building new central electricity production is better. More capacity of the cheaper production methods lead to a decrease in electricity price. If the central electricity production decreases, the electricity price decreases on the short term, however on the long term the business case is worse when newer (and often cheaper) production capacity is built, leading to a possible scarcity in electricity production capacity, and increasing electricity prices.

The (central) electricity price then influences the financial incentives for stakeholders to generate their own decentral electricity, where a lower central electricity price leads to a smaller incentive to produce your own electricity. This decrease in incentives can cause a decrease in new decentral electricity production capacity, which was initially increased by the influence of a policy measure.

Interference due to cross-sectoral factors is expected to have the largest effect. One group of interfering policy measures can include dozens of policy measures, as one single feedback loop can include all policy measures that contribute to renewable electricity production or increase energy efficiency.

This type of interference includes the most dynamics, and has different effects for different time scales. For the negative feedback loops should be monitored when the decreasing effect of the feedback loop becomes larger than the increasing effect of the policy measures (in the given example above, when the influence of the electricity price becomes larger than the incentives provided by policy measures for decentral renewable energy production). This turning point should be seen as the moment to phase out the policy measures.

3.2 Interference due to behavioural aspects

The second type of interference is caused by the behavioural aspects of the policy chains. It is possible that two policy measures provide incentives for the same technologies, but for different sectors. However, the implementation of a technology in one sector, also influences the behavioural aspects for the implementation of the same technology in another sector. The implementation and use of technologies provides success stories, and adopting this technology will become more and more common in the energy system. It is also possible for learning curves to proceed, leading to possible cost reductions for the implementation of this technology.

The effect of interference due to behaviour aspects is expected to have a relatively large impact on the energy system, albeit on a smaller scale. The influence of multiple policy measures on the behavioural factors in different sectors decreases the uncertainty of the effect of the policy measures, as a larger part of the target group is expected to implement the incentivised technologies. The decrease of uncertainty in the system also accounts for the expected reasonably strong effect. The uncertainty of the influence of policy measures is one of the main barriers within the energy system. If the policy measures do not 'convince' stakeholders to change their behaviour, there is no effect on the energy system as a whole.

However, once the majority of stakeholders has overcome their thresholds for the implementation this technology, the last part of the stakeholders is expected to be more difficult to influence. This expectation is based on the Technology Adoption Life Cycle (Moore, 1991; Rogers, 1983). This cycle indicates that once a small part of the stakeholders adopts a new technology, the large majority will follow and also adopt the technology. However, there will remain a small part of the stakeholders that will never adopt the new technology. This means that once the required small part of the stakeholders is convinced, the effects of the interference decreases, as the rest will follow on their own as well.

It is expected that incentives for the same technology in multiple sectors at the same time benefits most of positive interference at the start of the development or implementation of a new technology in the region.

3.3 Interference due to dependency of technologies

The third type of interference is based on the possible dependency of the implementation of two or more technologies. An example is the implementation of electric vehicles (EV) for consumer transport, and the implementation of the (charging) infrastructure for the EV's. The implementation of EV's is dependent on the implementation of the infrastructure for EV's, and vice versa. If there are EV's but you cannot charge them throughout the Netherlands, they will be used less. The total number of EV's can still increase, but the kilometres travelled with EV's is likely to decrease, as people will only use them close to where they can charge them. Alternatively, if there is an infrastructure but no EV's, the amount of kilometres travelled with an EV will also not increase. The effect of EV's and its infrastructures alone therefore do not (significantly) influence the emission reduction in the transport sector, but together they can have this influence.

Interference due to dependency also decreases the uncertainty in the system. This is due to the need of both policy measures for each to reach their aim. Without the one of the two technologies, neither will persevere.

Interference due to dependencies is expected to be effective throughout the implementation phases of the technology. This is in contrast with the influence of interference due to behavioural aspects, which is expected to be mostly effective for the start of the implementation of innovative technologies.

The continuing benefit of interference due to dependencies of technologies is especially true for dependencies based on design specifications for a technology and the implementation of the same technology. For example, two policy measures both aim to reduce the GHG emissions of the transport sector. One of these two policy measures poses design specifications of the GHG emission that a consumer car is allowed to emit per travelled kilometre. The second policy measure stimulates the sharing of cars for consumers. If the design specifications of the technology were to be removed after a period of time, there is a reasonable chance the cars will be designed differently, and will be more polluting. As the more sustainable method is mostly more expensive, otherwise no policy measure would be required to stimulate the sustainable variant of the technology to start with. The amount of reduction in GHG emissions due to the sharing of cars also depends on the design specifications of these cars. Interference due to dependency should therefore be stimulated throughout the development of these technologies in the energy system.

3.4 Interference due to two or more policy measures

It is likely that multiple policy measures will contribute to the same policy goal, as the policy goals include an overall aim, and the policy measures include specified actions for a specified target group to reach this aim. The effect of each policy measures follows a path through the energy system that is shaped by the different sub-systems of the energy system before the policy goal is reached. The paths of the effects of different policy measures cross paths on their way towards the policy goals. Each time the effects of two or more policy measures cross paths (or integrate into one new path) interference takes place.

This can also occur at the start of this path, for the different technologies or behaviour changes that are incentivised by the policy measures. If there is more than one policy measure that influences the implementation of a technology for a single target group in the same sector, their effects interfere. This interference occurs when two or more policy measures have the same characteristics for the target group, sector, process, specification, and policy goals.

The interference due to two or more policy measures that influence the implementation of the same behaviour has a reasonably strong effect on the system. The effect is similar to that of the second type of interference. As more policy measures for the same behaviour provide more incentives, and a larger chance of an intention to change the behaviour is created.

3.5 Interference due to path integration

The last type of interference is also caused by the paths of the effects of policy measures through the energy system. However, this type of interference takes place further down these paths, closer to the policy goals. This type of interference occurs for policy measures with the same policy aims and sector. This is similar to the interference as identified by Simões (2013).

Interference due to path integration has the smallest effect. This integration occurs closer to the policy goals and therefore does not decrease uncertainties (as this is present for the behavioural aspects between the policy measures and the implementation of a technology), and neither does it create feedback loops within the system. The only interference that is caused is an addition of effects of policy measures after they have reached the system for the different policy goals.

4. Interference in the Dutch energy system

A case study of policy measures in the Dutch energy system led to the identification of 119 policy measures. These policy measures are selected based on research done by ECN, commissioned and supported by three governmental organizations (ECN, 2016). The policy measures are categorized for the eight mentioned characteristics, and analysed for their interference.

All of these 119 policy measures are subject to the fifth type of interference, due to the integration of the effects of the policy measures for the three identified goals. The number of policy measures that influence each policy goal for the other four types of interference are summarized in Table 1.

Table 2: The number of interfering policy measures per policy goal for the first four types of interference

Numberof policy measures for the four types of interference per sector	**Cross-sectoral factors**		**Behavioural aspects**		**Dependency**		**Two or more policy measures**		**Total**	
	[#]	[%}	[#]	[%]	[#]	[%]	[#]	[%}	[#]	[%]
Increase in renewable energy production	20	31.7	14	37.8	5	29.4	11	25.0	50	31.1
Increase in energy efficiency	42	66.7	13	35.1	4	23.5	24	54.5	83	51.6
Reduction in GHG emissions	1	1.6	10	27.0	8	47.1	9	20.5	28	17.4
Total	*63*	*39.1*	*37*	*23.0*	*17*	*10.6*	*44*	*27.3*	*161*	*100*

Each of the five types of interference has different consequences for the system as a whole. Four of the five types of interference have a relatively small, localized impact.

The type of interference with the most system wide impact is the interference caused by the sub-systems and their processes in the energy system. As these processes are present in most sectors, this type of interference has a system wide impact. The four other types of interference also include many policy measures, but in small groups, whereas the processes create interference among many policy measures within one group.

Table 1 indicates that the policy measures that contribute to an increase in energy efficiency are subject to over half of the interference in the system (excluding the fifth type of interference). However, a large part of these policy measures are influenced by interference due to cross-sectoral factors. Therefore is the effect of this interference is difficult to determine. The feedback loop that is created by the cross-sectoral factors can have both positive and negative effects simultaneously.

The reduction of GHG emissions policy goal is least influenced by cross-sectoral factors. The other four types of interference all have a positive effect. Therefore is the effect of interference for this policy goal easier to determine. All but one interfering policy measures will be subject to positive effects of interference. How big these positive effects are depends on the timing of the interference for the different technologies, and cannot be determined solely based on the types of interference.

5. Discussion and conclusion

The limitations of the research results are presented and some conclusions can be drawn.

5.1 Discussion

Interference is not something you can prevent from happening. Therefore is it important to be aware of the interference that is present within the energy system. This interference influences the effects of individual policy measures on the system as a whole.

Most of the times interference contributes to the effectiveness of policy measures, by reducing the uncertainty of the behavioural aspects in the system. The only occasion where interference can be negative (assuming all implemented policies aim for the same goal(s)) are due to the cross-sectoral factors. Here the effects of a policy measure can have a positive influence, where the feedback loop present in the effect of the interference causes a negative influence on the same system element. However, the presented methodology cannot determine the size of the effect, this is one of the main limitations of the research. It remains important for all policy types of interference to provide a long term policy vision. Even if after a while the technology is adopted by the majority of the stakeholders, or the negative feedback loop overpowers the positive influence of a policy measure. If the stakeholders do not have long term assurance that they can count on the policy measure (e.g. a subsidy) they will not implement the subsidized technologies at all.

The phasing out of policy measures is just as important as their effects in the energy system and should be thought through carefully. It is most effective to implement a policy measure long enough so the technology can be adopted by the stakeholders, and short enough to try and prevent a negative feedback loop from developing, or to prevent costs that are out of proportion with the gains of a policy measure.

One possible way of giving the long term assurance, while also being able to phase out a policy measures is by providing the time frame of the policy measure from the start. An example is the feed-in tariff in Germany, even though this policy measure is amended four times after its implementation, it guarantees a fixed price for renewable energy producers for twenty years once a stakeholder receives the financial benefit (FuturePolicy.org, n.d.). This way stakeholders are therefore guaranteed a long term return on investment, but the policy measure can be amended and stopped, as along as the stakeholders that once started to receive the financial compensation, they will receive it for the predetermined twenty years.

6.2 Conclusion

The identification and analysis of interference based on the characteristics of policy measures and the energy system allows for the identification of five types of interference: (1) due to cross-sectoral factors, (2) due to behavioural aspects, (3) due to dependency of technologies, (4) due to two or more policy measures for one technology/behaviour, and (5) due to policy chain integration.

For each of the five types is it possible to analyse the effects. The first type of interference has the largest effect and creates feedback loops within the energy system. These feedback loops can both be positive and negative, and can have a different character based on the used time scale of the analysis.

The second and fourth types of interference decrease the uncertainty of the effects of policy measures in the energy system. The uncertainties are created by the behavioural aspects of the stakeholders and the individual rivers of each stakeholder. A policy measure provides incentives to create a change in behaviour, however these incentives are not always enough. Due to the interference of types 2 and 4 are the incentives for a specific behaviour change enlarged, decreasing the uncertainty of whether or not the incentives are enough.

The third type of interference also decreases the uncertainty in the system, but this is the uncertainty that the chosen behaviour or technology to incentivise will have the intended effects. Some technologies are dependent on other technologies as well. Two examples are discussed, one for EV's and their infrastructure, and one for the design specifications of alternative fuels and the use of these fuels. For both examples are both incentives required for each individual policy measure to have their intended effect.

The fifth and last type of interference has little to no effects in the energy system, as there are no feedback loops created, or uncertainties decreased.

The different types of interference can be beneficial under different circumstances. As explained, the feedback loops created by the first type of interference change from positive to negative, and vice versa, on the long term. These effects need to be monitored throughout the life time of the policy measures involved.

The second and fourth types of interference aid in the adoption of new or innovative technologies. These types of policy measures can therefore be stimulated for these new technologies, and then phased out. The phasing out of policy measures as been discussed in the previous section needs to be implemented thoughtfully.

The fourth type of interference is beneficial throughout the lifetime of the incentivised technologies. As long as these technologies need support, both (aspects of the) technologies need to be supported for the policy measures to reach their aim.

The fifth type of policy measures is neither negative nor positive, due to the small effect of this type of interference. It remains useful to be aware of this type of interference as it contributes to reaching the policy goals, but does not pose any possible benefits in certain times and not in others.

6.3 Recommendations for further research

Two main recommendations for further research will be discussed here.

First, the applied method of characterizing policy measures and the energy system, and then analysing the gathered 'data' is a time consuming method. The development of a tool that can support in the data processing can the future analysis of interference.

Second, the negative feedback loops, and behavioural aspects can require policy measures to be phased out. This phasing out should be thought through before implementing the policy measures. It is therefore useful to know how to determine the required running time of specific policy measures. How to determine this running time should be further researched. Understanding the necessary running times of policy measures can aid in the development of a coherent, long term, policy strategy.

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G

Definitions of factors

This appendix includes the definition of the 70 identified factors. The first 61 factors originate from the initial literature research by Kozuch and Sienkiewicz-Małyjurek (2016), the factors 62 through to 66 originate from the additional literature research performed in chapter 11 and the last four factors, 67 through to 70, originate from the open coding of the interviews of chapter 12.

Table XX: Definitions of the 70 factors identified for interorganizational collaboration between public parties

Factor	Definition and/or examples
1. Governmental policy (central, regional and local)	Influence of policy mechanisms, workings of political system
2. Legal regulations	Laws and regulations, official legislation
3. Development of social problems and needs	Social problems, common goods, etc.
4. National/regional culture	Culture within the geographical area
5. Social conditions in the region	Conditions such as unity and division within society
6. Economic conditions in the region	Employment, recession, inflation, budget deficit, etc.
7. Regulations in particular organizations	Rules and regulations of individual organisations
8. Organizational, professional and social culture in individual organizations	The culture, habits and values within the individual organizations
9. Leadership with organizational and communication skills	The skills of the leaders (management) of the individual organizations.
10. Team building	Team building exercises, explicit time and activities for team building
11. Resources of individual organizations	Finance, time, physical space, materials, equipment, working tools, appropriately skilled personnel, etc.
12. Type and structure of collaborative tasks	Content of tasks within collaboration
13. Structure of working groups	Heterogeneity, size, etc.
14. Common ground of collaboration	Vocabulary, values of interests, understanding of working practices and group norms
15. Collaborative technologies	Communication technologies, information systems, etc.
16. Adaptability to changing work requirements	Adaptability to a different content of work
17. Flexibility and openness to changing circumstances of collaboration	Adaptability to a different organisation of work e.g. new partners, different structure, different leadership/management styles
18. Organization of work in individual organizations	The work methods, the way execution styles, etc.
19. Organizational structure of individual institutions	The different vertical and horizontal layers and columns within the individual organizations and their official hierarchy.
20. Experience in inter-organizational collaboration	Participation in previous collaborations, not necessarily with the same organizations or people.
21. Professional competence of the employees from individual organizations	The professional skills of the employees of the individual organizations, such as content knowledge and analytical skills.
22. Conflicts between personnel from individual organizations	Previous or existing problems on a more personal level between two or more people from the individual organizations, not necessarily related to the collaborative team
23. Informal relations between personnel from individual organizations	Pre-existing or growing informal connections, unrelated to work
24. Personality of the chiefs of individual organizations	Personal characters, not the professional competence or skillset, of the leaders of the individual organizations
25. Respect between personnel from individual organizations	The presence or development of respect between people from the individual organizations, not necessarily related to the collaborative team
26. Commitment (willingness to cooperate) of particular organizations to collaboration	The drive of the drive of the organizations to remain involved in the collaboration and to make the most of it.
27. Trust within the interorganizational team	The presence or development of trust between the team members.

28. Understanding between personnel from individual organizations	The use of the same lingo (jargon, frames, storytelling, etc.) between people from the individual organizations, not necessarily related to the collaborative team
29. Professional and informal communication between personnel from individual organizations	The communication between people from the individual organizations, not necessarily related to the collaborative team, both regarding work and personal lives
30. Communication in inter-organizational working teams	The communication that takes place within the boundaries of the interorganizational team
31. Coordination of inter-organizational working teams	Clarity of tasks and responsibilities of collaboration as a whole for outsiders
32. Coordination of working in individual organizations	Clarity of tasks and responsibilities of individuals in their organisations
33. Incentives to inter-organizational collaboration	The use of additional sources to enhance the commitment and sense of urgency of people to the collaborative process or goals
34. Organization of collaborative work	Time pressured (subject to deadlines), competitive, rapidly changing, stable, etc.
35. Level of shared inter-organizational knowledge	The amount of knowledge and information that is shared between the members of the interorganizational team
36. Learning processes between organizations	The learning off the other organizations due to the collaboration, e.g. by experiencing different work styles, cultures, receiving new information.
37. Joint trainings	Time that the team together as a whole put into their professional development
38. Error management in individual organizations	How the different organizations handle crisis situations or mistakes made by their employees
39. Knowledge management in individual organizations	The different systems and chains through which knowledge and information flow in the individual organizations
40. Close links between organizations	The perceived closeness of other organizations, not in actual geographical space
41. Conflicts between organizations	On a different level than individual people, e.g. a feud between two ministries on a specific topic where their interests never align
42. Expectations of collaborating organizations	The expected result of the collaboration both on a personal and on an organizational level
43. Constraints in inter-organizational collaboration	Possible constant issues in the collaboration that are always present
44. Shared mission, vision and goals	The presence or development of a mission, vision, and goal that the collaborative team aims to fulfil
45. Interest in collaboration in fellow partners	The interest one organization in the collaboration has for the specific other organization in the collaboration (e.g. based on the resource one organization has that they want)
46. Self-interest of individual organizations from collaboration	On an organizational level, what the individual organizations aim to gain or achieve by collaborating
47. Specialization of collaborating organizations	The focus of the individual organizations, e.g. on a topic or process that they are known for, and have a high level of knowledge and information on
48. Interdependence of the particular organizations	The mutual dependency between organizations to achieve their own goals
49. Equitable contributions to collaboration of each willing organizations	The size and quality of contributions (e.g. time, knowledge, resources) of the organizations involved in the collaboration
50. Uncertainty conditions of collaborative work	The uncertainty of the continuation of the collaboration as is
51. Time of inter-organizational collaboration	E.g. time limits, and duration of collaboration
52. Iteration of inter-organizational collaboration	cycles of collaboration processes with a clear start and end

53. Roles of particular organizations in collaboration	The different functions and contributions of organizations based on their appointed or natural roles within the collaboration
54. Balance between dependence and autonomy	The dependence and autonomy of the individual organizations on each other within and outside of the collaboration
55. Inclusiveness to collaboration of needed organizations	The inclusion of all required organizations to the collaboration
56. Demands of collaborative tasks	The requirements of the collaborative actions asked of the individual organizations
57. Performance of inter-organizational collaboration	Both the performance of the process and outcome of the collaboration
58. Support within collaborating organizations	Inclusiveness of internal parties, and importance of collaboration within organisations
59. Management of inter-organizational collaboration	The managing of the team, e.g. management styles or transparency of decisions and guidance
60. Joint decision making by organizations	The efforts of the collaboration to come to a decision all participating organizations can find themselves in
61. Complexity of the issue	The nature of the topic of the collaboration and its system perspective complexity
62. Personal and political incentives of ministers to collaborate	The reasons for the minsters to collaborate with each other
63. Reputation of the organizations	The reputation of individual organizations as experienced by the other organizations in the collaboration
64. Power inequalities between the organizations	Differences in power, force, or say of the individual organizations.
65. Personality of the participants	The personality traits and personal characteristics of the individual participants in the collaboration
66. Geographical proximity of the collaborating organizations	The physical distance between the bases of the individual organizations
67. Commitment of participants to collaboration	The willingness to collaborate of individual people in the collaboration
68. System development in real world	The development of the topic (system) that is tried to be influenced or change by the collaboration
69. Tension between political concerns and concerns of the market parties	The difference in priorities of political parties and market parties within the system, and the issues this difference brings with it
70. Availability of multiple networks of different organizations	The different professional and social networks of the individual organizations that are shared in the collaboration

H

Literature research

This appendix includes the search queries, exclusion grounds, eligibility criteria, and results for the literature researches of chapter 11 and 14. The methodologies used for these three literature searches are similar to the method as explained in section 11.1.

H.1 Additional literature search for factors of interorganizational collaboration

This additional literature search is focussed on public parties as well. For the context articles will a longer time period be used for the literature search than for the search for review articles, the body of knowledge on collaboration has grown over the years, but also older articles can provide insight into the factors and relations over the years.

Also the sustainability challenge has been going on for more than 25 years, with the Kyoto protocol already agreed upon in 1992. Therefore is literature of the last twenty years (1997 till 2017) included in this research step. In this step are also sources that focus on one factor of inter organizational collaboration eligible. Literature with a context that does not focus on sustainability is not eligible. The review article did not include any specific context of the topics of public collaboration. However, as the body of knowledge on (interorganizational) collaboration is vast, alternative selection criteria are required to create a theoretical framework that is applicable to the transition of the Dutch energy system. A sustainable context has different drivers than (e.g.) medical or economical contexts, for example in the heterogeneity of the organizations that work together, which is larger for medical and corporate organizations than for public organizations. This is also indicated by the research into the interference between policy measures, where energy systems and the sustainable transition in these systems are built upon long term investments, a necessity for public participation and a changing morale. A medical context is mostly focussed on inter-professional collaboration and accessibility to the public rather than on participation, and economical contexts focus mostly on monetary drivers, whereas sustainable change is mostly based on values and norms.

The exclusion grounds are:

- Focus on private parties;
- Focus on non-sustainable context;
- Focus on digital communication only.

The search term that is used is similar to the preview search query, however without the reference to factors and its synonyms, for the period between 1997 and 2017:

collaborat* AND (inter-organi* OR interorgani*) AND public.

Figure 4 indicates the exclusion of articles in this literature research step. Three additional articles have been included in this research that were used in courses of the SEC masters programme at the Delft University of Technology. One article focusses on the roles of individuals in collaborations (Fisher et al., 1998), one article focusses on knowledge sharing between public parties (Dawes et al., 2009), and one article contains a literature review of the effects of 'proximity' (both in geographical distances as in organizational cultures) on interorganizational collaboration (Knoben & Oerlemans, 2006).

The three articles fulfil all eligibility criteria, and were screened and assessed in the same way as the other 468 articles.

The thirteen included articles for this thesis project of this literature search are analysed on the factors of interorganizational collaboration between public parties they mention, as well as any relations between these factors.

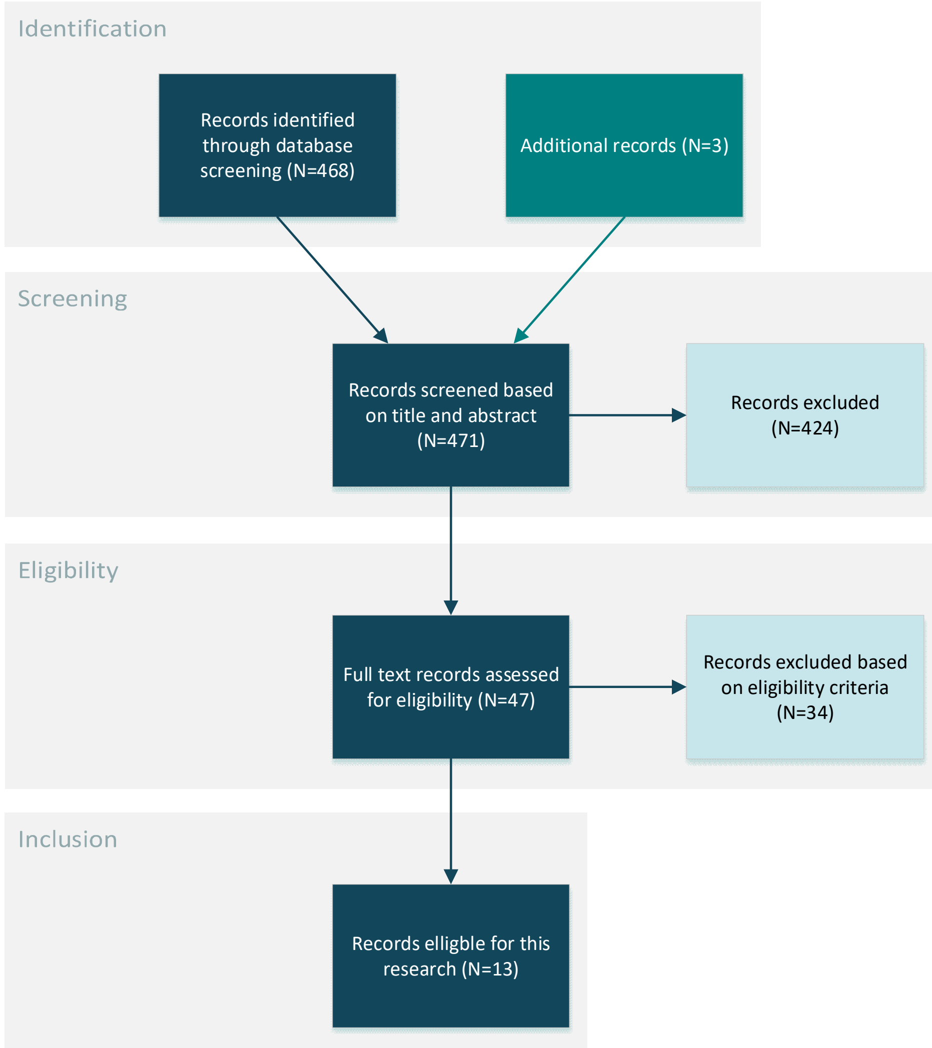

Figure 4: PRISMA flow diagram of first literature review into factors of interorganizational collaboration between public parties

H.2 Literature search for methods to influence the communication of interorganizational collaborations

This second literature search is focussed on possible methods to influence the communication within and outside the interorganizational collaboration team of public parties. The same time period will be used as for the context articles mentioned in section 11.2. This time period is twenty years (1997-2017). The eligibility of the results will be based on the following criteria;

- A focus on collaboration between public parties
- A focus on communication both within collaborating parties as well as within and between the individual organizations
- A context focussed on sustainability, or no specific context

These criteria are similar as for the context articles of chapter 11. However, in first instance no difference is made between inter- or intra-organizational collaborations, as long as they take place within or between public parties.

The search query that is used, consisted the term 'public', of variations of the terms for collaboration and communication, as well as a reference to the 'stimulation' of communication. The search query was:

> collaborat* AND communicat* AND public AND (stimulate OR inspire OR better OR enhance OR increase)

In order to limit the search results the time frame of 20 years was repeated. Also, as there is still no interest in inter-professional collaboration, or a medical context, were the subject areas of medicine and nursing excluded. This limited the search results from 1863 documents to 948 hits. As this is still too much to analyse within the scope of this project, was chosen to only include the subjects areas of social science, decision science, energy, environmental science, and multidisciplinary included. This left 484 hits. Then additional results relating to computer science, biochemistry, pharmacology, neuroscience, chemistry, dentistry, and health professions were excluded, as well as the area of 'business, management, and accounting' as this research only looks into public parties. This left 338 hits. These results were screened based on title and abstract.

The articles that were assessed for eligibility on their full text mostly considered communication from government organizations to the greater public. Only one article (also) mentioned communication within or between governmental organizations. The exclusion of articles can be seen in Figure 5 below.

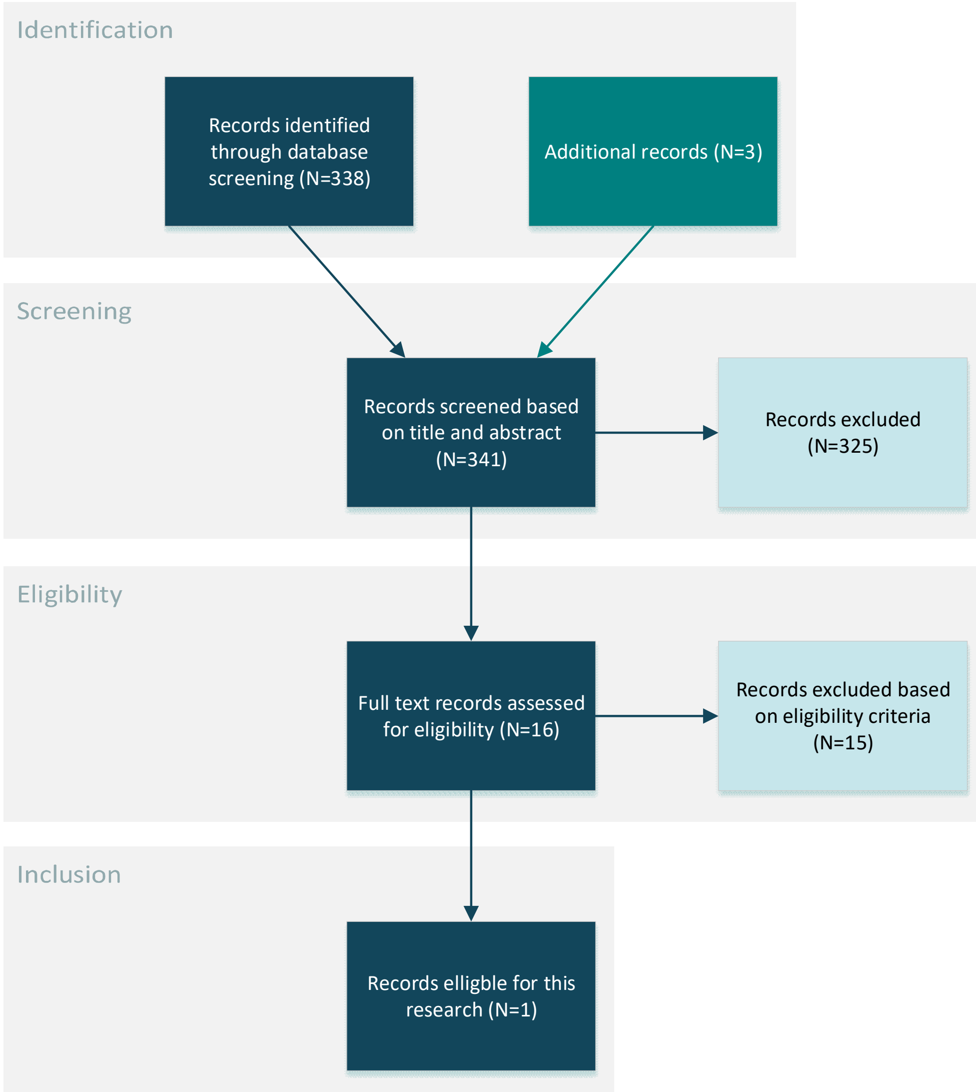

Figure 5: PRISMA flow diagram of the literature research into communication within the interorganizational team, as well as between other personnel form the individual organizations

H.3 Additional literature search for methods to influence the communication

The additional literature search focussed on the requirements of the design of online collaboration platforms. The search query was:

design* AND (online OR digital) AND collaborat* AND platform

The time frame for this research was chosen as five years, as online platforms and the use of internet as a whole is still developing rapidly, it is essential to include the most relevant information. The results were also limited to the social science subject area, as this literature search is interested in the social and collaborative conditions for online platforms and not the technological or system conditions. The last selection was the use of only articles. The previous three searches included all formats that the database offers, however it were only articles that turned out to be relevant. The most books and conference proceedings go less in-depth into the subject matter, or are not peer reviewed. This search led to 128 results that were screened based on title and abstract.

The eligibility criteria for the articles are a focus on communication (and not learning or information publication only), and a focus on communication between public parties. The exclusion of articles is depicted in Figure 6.

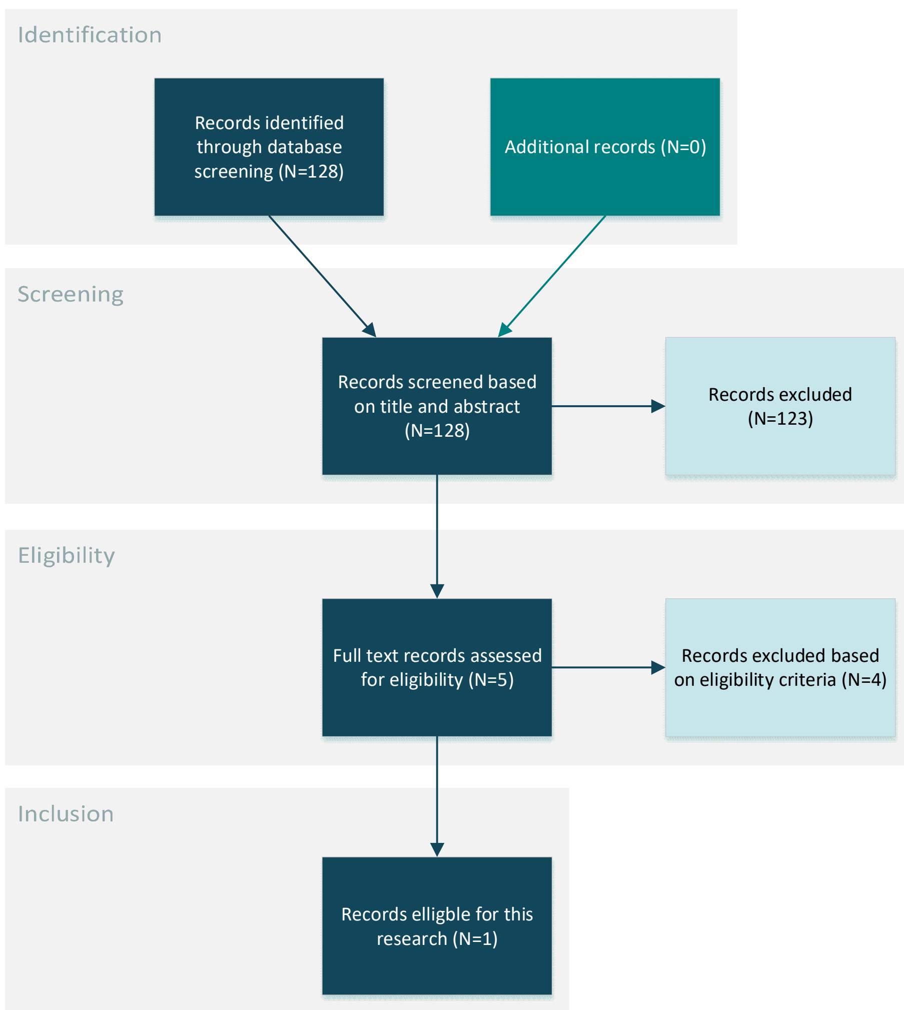

Figure 6: PRISMA flow diagram of the literature search into design principles of online collaboration platforms for public parties

I

Factors that influence interorganizational collaboration and their occurrence

This appendix includes the results of the literature review and interviews for the importance of the factors. For each factor is indicated how many articles mention the factor, how many times the factor is mentioned in the interviews, and how many participants have mentioned the factors in the interviews.

Table XX includes the number of articles that mention a factor, are the number of times each factor is mentioned in the interviews, as well as by how many participants the factor is mentioned. Here the additional factors that were identified in the literature are categorized as explained in section 11.3. The additional factors identified through open coding are added at the bottom of the table.

Table XX: Results of the coding process for all 70 factors

No.	Factor	Occurrence in literature	Total times mentioned in interviews	Number of participants
	External environment			
1.	Governmental policy	5	21	7
2.	Legal regulations	4	5	2
3.	Development of social problems and needs	3	2	2
4.	National/regional culture	0	5	3
5.	Social conditions in the region	0	1	1
6.	Economic conditions in the region	3	2	2
61.	Complexity of the issue	4	4	3
66.	Geographical proximity of the collaborating organizations	2	0	0
	Organization characteristics			
7.	Regulations in particular organizations	2	0	0
8.	Organizational, professional and social culture in individual organizations	9	7	6
9.	Leadership with organizational and communication skills	3	3	3
10.	Team building	0	0	0
11.	Resources of individual organizations	10	19	7
12.	Type and structure of collaborative tasks	1	0	0
13.	Structure of working groups	4	4	4
14.	Common ground of collaboration	5	7	5
15.	Collaborative technologies	5	0	0
16.	Adaptability to changing work requirements	0	0	0
17.	Flexibility and openness to changing circumstances of collaboration	2	0	0
18.	Organization of work in individual organizations	2	8	5
19.	Organizational structure of individual institutions	3	12	5
63.	Reputation of the organizations	1		
	People characteristics			
20.	Experience in inter-organizational collaboration	7	4	2
21.	Professional competence of the employees from individual organizations	4	13	7
22.	Conflicts between personnel from individual organizations	2	1	1
23.	Informal relations between personnel from individual organizations	7	4	3
24.	Personality of the chiefs of individual organizations	1	0	0
25.	Respect between personnel from individual organizations	1	5	4
26.	Commitment (willingness to cooperate) of particular organizations to collaboration	5	4	4
27.	Trust within the interorganizational team	8	10	7
28.	Understanding between personnel from individual organizations	6	7	2
62.	Personal and political incentives of ministers to collaborate	1	4	6
65.	Personality of the participants	2	7	3

Instruments of inter organisational collaboration				
29.	Professional and informal communication between personnel from individual organizations	4	9	7
30.	Communication in inter-organizational working teams	5	13	6
31.	Coordination of inter-organizational working teams	5	6	4
32.	Coordination of working in individual organizations	1	7	4
33.	Incentives to inter-organizational collaboration	3	1	1
34.	Organization of collaborative work	5	13	6
35.	Level of shared inter-organizational knowledge	8	13	6
36.	Learning processes between organizations	7	12	7
37.	Joint trainings	0	0	0
38.	Error management in individual organizations	0	0	0
39.	Knowledge management in individual organizations	4	0	0
Relational factors				
40.	Close links between organizations	6	2	1
41.	Conflicts between organizations	4	0	0
42.	Expectations of collaborating organizations	5	0	0
43.	Constraints in inter-organizational collaboration	1	0	0
44.	Shared mission, vision and goals	9	11	7
45.	Interest in collaboration in fellow partners	0	0	0
46.	Self-interest of individual organizations from collaboration	9	18	7
47.	Specialization of collaborating organizations	2	14	5
48.	Interdependence of the particular organizations	4	14	7
49.	Equitable contributions to collaboration of each willing organizations	4	0	0
50.	Uncertainty conditions of collaborative work	2	2	2
51.	Time of inter-organizational collaboration	4	1	1
52.	Iteration of inter-organizational collaboration	1	0	0
53.	Roles of particular organizations in collaboration	4	4	4
54.	Balance between dependence and autonomy	3	1	1
55.	Inclusiveness to collaboration of needed organizations	4	4	3
56.	Demands of collaborative tasks	3	0	0
57.	Performance of inter-organizational collaboration	3	9	5
58.	Support within collaborating organizations	5	8	3
59.	Management of inter-organizational collaboration	11	9	6
60.	Joint decision making by organizations	9	8	7
64.	Power inequalities between the organizations	1	0	0
Additional factors identified with open coding				
67.	Commitment of participants to collaboration	-	9	5
68.	System development in real world	-	9	6
69.	Tension between political concerns and concerns of the market parties	-	2	2
70.	Availability of multiple networks of different organizations	-	1	1

J

Interview guide

This appendix includes the interview guide of the semi-structured interviews. As the interviews were conducted in Dutch, the interview guide is also in Dutch. To prevent any subtleties to be lost in translation, the interview guide is not translated.

Algemene vragen

Naam:

Organisatie:

Functie binnen organisatie:

Hoe lang al werkzaam bij organisatie:

Functie binnen het interorganisatorische team:

Hoe lang al betrokken bij de samenwerking:

Open vragen

Wat is het doel van de samenwerking

Wat is de structuur van de samenwerking (frequentie meetings, frequentie digitaal contact, formele rol verdeling, etc.)

Wat maakt dat de samenwerking binnen het team goed werkt:

Wat zijn mogelijke barrières die de samenwerking vertragen of vermoeilijken?

Wat zijn de rollen van de anderen in het team?

Wat is hierop reflecterend jouw rol in het team?

Stellingen

Wat is de visie op de volgende 9 stellingen, met betrekking tot de samenwerking binnen het [onderwerp v/d samenwerking] team.

Context

1. Het politieke klimaat beïnvloed hoe de samenwerking verloopt, denk bijvoorbeeld aan;
    a. Spanningen in de tweede kamer
    b. Onzekerheid door kabinetsformatie
    c. De invloed van de vier jaarstermijn

2. Het karakter van Elektrisch Vervoer ten opzichte van andere dossiers beïnvloed de samenwerking, denk hierbij aan;
    a. Dynamisch
    b. Nog in een relatief vroeg stadium van ontwikkeling
    c. Grote invloed op twee systemen, infrastructuur en elektriciteit

Organisatie van samenwerking

3. De samenwerking wordt goed gemanaged, boorbeeld aan de hand van;
    a. Duidelijke structuur
    b. Onafhankelijk leiderschap
    c. Spelregels

4. De beslissing in het team worden samen gemaakt, bijvoorbeeld op basis van;
    a. Consensus,
    b. Onderhandeling,
    c. Of compromis.

Relationeel

5. De samenwerking heeft een duidelijk gezamenlijke missie, visie en doel
    a. Onduidelijkheid over de gezamenlijke doelen
    b. Invloed individuele doelen organisaties

6. Er is vertrouwen tussen de verschillende organisaties
    a. Vertrouwen tussen organisaties niet tussen personen

Individuele organisaties

7. De verschillende organisaties hebben genoeg middelen om de samenwerking goed te laten verlopen
    a. Geld, tijd, ruimte (fysiek), materialen, gereedschap, tools, en geschikt getraind personeel
    b. Gelijke verdeling van resources
    c. Financiële middelen.

8. De interesses van de individuele organisaties hebben voorrang boven de gezamenlijke interesses in de samenwerking.

Informatie- en kennisdeling

9. Door de samenwerking leren de organisaties van elkaar, bijvoorbeeld
    a. In werk processen of werk structuren
    b. Via de personen of de organisaties

K

Survey text

This appendix includes the definition of the 70 identified factors. The factors can originate from the initial literature research by Kozuch and Sienkiewicz-Małyjurek (2016), the additional literature research performed in chapter 11 and the open coding of the interviews of chapter 12.

.

K.1 Introduction to the survey

Welkom bij deze online survey.
De survey dient als een controle stap voor mijn onderzoek.
De survey zal zo'n vijf minuten duren. Er zullen 19 stellingen worden weergegeven, elke stelling behandelt een van de gevonden factoren die de samenwerking zou kunnen beïnvloeden. In deze selectie zijn helaas niet alle in de interviews genoemde factoren opgenomen, omdat dat er te veel zijn.

Bij elke stelling wordt gevraagd in hoeverre je het eens bent met de stelling, in andere woorden in hoeverre jij denkt dat de genoemde factor de samenwerking op het gebied van [onderwerp v.d. samenwerking] tussen de ministeries van [de vier organisaties] beïnvloed. Het antwoord op deze vraag kan worden gegeven op een schaal van helemaal oneens naar helemaal eens, hierin is de middelste optie (nummer 4) de neutrale optie van 'niet oneens, niet eens'.

Ook zal voor elke stelling worden gevraagd hoe vaak je denkt dat die factor naar voren komt binnen de samenwerking, hierbij zijn de keuzes dagelijks, wekelijks, maandelijks, jaarlijks, of nooit. Hierbij gaat het om hoe vaak jullie de gevolgen van de stelling ervaren.

Aan het einde is een mogelijkheid voor opmerkingen. De gehele survey is anoniem, mocht je een vraag of opmerking hebben waar je graag een één-op-één reactie op wilt kan je altijd je naam bij de opmerking achter laten, maar je kan natuurlijk ook mailen ([email]) of bellen ([telefoon]).

Ik hoop dat het duidelijk is. En alvast ontzettend bedankt voor het invullen van de survey.

Met vriendelijke groet,
Sofie van Zijl

K.2 Survey statements

Each statement was presented on a new online page, the indications of the factors was not included in the survey itself but is added in this appendix to make clear to which factors the statements are linked. For the first statement was one question asked.

The answer possibility for the first question looked like this:

1. Het delen van kennis en informatie is het hoofddoel van de samenwerking. *Factor 35*

For the next nineteen statements were two questions asked. The answer possibilities looked like this for each statement:


In hoeverre ben je het eens met deze stelling? *

	1	2	3	4	5	6	7	
Helemaal oneens	○	○	○	○	○	○	○	Helemaal eens

Hoe vaak ervaar je de gevolgen van deze stelling? *

- Dagelijks
- Wekelijks
- Maandelijks
- Jaarlijks
- Nooit

Before statement 15 a short message was displayed, this message introduced the last six more conceptual statements, in order to prepare the participant for the change in nature of the statements.

2. De vier betrokken organisaties (EZ, I&M, RVO en Rijkswaterstaat) hebben ieder hun specialisme op het gebied van elektrisch rijden. *Factor 47*

3. De vier organisaties (EZ, I&M, RVO en Rijkswaterstaat) zijn van elkaar afhankelijk om de ontwikkeling van elektrisch rijden goed te begeleiden. *Factor 48*

4. Als er meer kennis en informatie wordt gedeeld, dan draagt dat bij aan het goede verloop van de samenwerking. *Factor 35*

5. Als de samenwerking nu goed verloopt (bijvoorbeeld een goede sfeer of goede resultaten van de samenwerking), dan draagt dat bij aan het goede verloop van de samenwerking in de toekomst. *Factor 57*

6. Als de samenwerking een duidelijke organisatie heeft (bijvoorbeeld een vaste frequentie aan afspraken, of een lage frequentie aan wisselend personeel), dan draagt dat bij aan het goede verloop van de samenwerking. *Factor 34*

7. Als de communicatie in het team gemakkelijk en goed gaat, dan draagt dat bij aan het goede verloop van de samenwerking. *Factor 30*

8. Als de communicatie tussen medewerkers van de vier organisaties buiten het power team om gemakkelijk en goed gaat, dan draagt dat bij aan het goede verloop van de samenwerking binnen het power team. *Factor 29*

9. Als de bij de samenwerking betrokken medewerkers van EZ, I&M, RVO en Rijkswaterstaat een hoge professionaliteit hebben, dan draagt dat bij aan het goede verloop van de samenwerking. *Factor 21*

10. Als de medewerkers in de samenwerking betrokken zijn, dan draagt dat bij aan het goede verloop van de samenwerking. *Factor 67*

11. Als de samenwerking goed wordt gemanaged, dan draagt dat bij aan het goede verloop van de samenwerking. *Factor 59*

12. Als er geen duidelijke gemeenschappelijke visie is, dan staat dit het goede verloop van de samenwerking in de weg. *Factor 44*

13. Als de beslissingen in de samenwerking gezamenlijk worden genomen, dan draagt dit bij aan het goede verloop van de samenwerking. *Factor 60*

14. Als de samenwerking genoeg middelen ter beschikking heeft (bijvoorbeeld fondsen en personeel), dan draagt dat bij aan het goede verloop van de samenwerking. *Factor 11*

De laatste zes stellingen zijn conceptueler van aard en zijn iets theoretischer geformuleerd.

15. De ontwikkeling van [onderwerp v.d. samenwerking] als systeem in Nederland beïnvloed het goede verloop van de samenwerking. *Factor 68*

16. Door de samenwerking leren de medewerkers van elkaar, waardoor de organisaties ook leren. Het is daarentegen niet mogelijk voor een organisatie op zichzelf staand om te leren van de samenwerking. *Factor 36*

17. De verschillende politieke doelen van de organisaties (EZ, I&M, RVO en Rijkswaterstaat) staan het goede verloop van de samenwerking in de weg. *Factor 46*

18. De organisatie structuur van de ministeries beïnvloedt het goede verloop van de samenwerking. *Factor 19*

19. Spanningen in de tweede kamer zorgen ervoor dat de werkdruk te hoog wordt en er weinig tijd overblijft voor de samenwerking. *Factor 1*

20. De vier jaarstermijn van de kamer en ministers zorgt er voor dat er geen lange termijn visie voor [onderwerp v.d. samenwerking] kan worden geïmplementeerd *Factor 1*

K.3 Conclusion of the survey

The last page of the online survey included the following text.

Einde
Bedankt voor het invullen van de survey!

Hieronder is nog ruimte voor vragen en/of opmerkingen.
De gehele survey is anoniem, dus mocht je een persoonlijk antwoord op de vraag willen kan je ook altijd mailen ([email]) of bellen ([telefoon]).
Je naam toevoegen hieronder kan natuurlijk ook, ik zal als enige de opmerkingen en vragen te zien krijgen.

Nog vragen en/of opmerkingen?