

MASTER

Organizing collaborations for sustainability-oriented innovation the case of Enpuls in the energy transition of the Netherlands

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Eindhoven, November 2018

Organizing collaborations for sustainability-oriented innovation:

The case of Enpuls in the Energy Transition of the Netherlands

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Preface

Dear reader,

When you are reading this, I am writing now one of the last pages of my master thesis. Let me take you on a journey through my academic career.

My academic journey started in September 2015, with the pre-master program of Innovation Management. There, I have met new friends: “Weg met de Geit”, Daan, Bart, Marco en Joep. Together we have made it through the pre-master and master courses, thank you guys.

Of course, special thanks has to be given to great teachers. This includes Emiel van Berkum for the support during the pre-master program for obtaining an extra chance for the statistics exam from the exam committee, and Sarah Gelper, for her flexible registration capabilities during exam periods.

I have spent 7 wonderful months during the master in Munich, Germany, studying at the TUM. In that period, I have met Rutger, thank you for your support and assistance during our final weeks, buddy. Back in the Netherlands starting with the master thesis, I have experienced a fruitful and intense collaboration with Isabelle Reymen. She connected me to the founders of Taylor, Michiel and Rein, that resulted in a wonderful experience of building a start-up. I am sorry for choosing a different direction, but I have the trust you guys are going to make it. Thanks to the team of Taylor for their trust and opportunity for offering me the chance to help building the company next to my thesis.

In the search for a connection between my bachelor in electrical engineering and master in innovation management, I came across Enpuls, located in my home town, ‘s-Hertogenbosch. Thanks to Bram Gerrist and Frank van Rossum, all colleagues of Enpuls and the participants in the interviews for making this thesis possible. Bram, your personal approach and coaching abilities are highly appreciated.

Thanks to my brother for providing advice on taking the thesis serious and my parents for their brilliant advice: “if you can explain it to us, you can explain it to anyone”.

It’s been a honor to graduate under the supervision of prof.dr.ir.arch. Isabelle Reymen and dr.ir. Boukje Huijben. A phrase that is heard a lot in the development of electronics, is that flexibility increases costs. If that could be applied to people - Isabelle Reymen is priceless. On this final note, I will be sending out the thesis for the final approval and defense.

So when you are reading this, you are probably searching for inspiration and references for your own thesis. Remember that your academic journey is a great one and before you know, you will be also writing this final page. And last, I could recommend choosing the winter period to write a thesis, as I experienced the hottest summer in 2018 since 1976 - July and August are just not the most motivational months of the year.

Yours sincerely,

Floris Valentijn ter Heide, 23 November, 2018

Management summary

Abstract

This management summary contains the main topics of the master thesis report, performed at Enpuls B.V., located in 's-Hertogenbosch. This master thesis investigates interorganizational collaborations in the context of the energy transition of the Netherlands. The theoretical body of knowledge of *interorganizational collaborations*, *open innovation management* and *sustainability-oriented innovations* are synthesized in this study. Combining this synthesis with 10 in-dept interviews and secondary data, four cases are investigated. The opinions and experiences retrieved from the interviews are analyzed among a framework with three key dimensions. In the empirical analysis, barriers and enablers during interorganizational collaborations are identified and categorized into challenges using a cross-case analysis method. The emerged challenges are further analyzed in relation with the project phase which creates new insights in what challenges require more attention in a certain project phase. A design solution is proposed and tested how these challenges during collaborations can be dealt with. Finally, this study concludes with theoretical contributions to the combination of *interorganizational collaborations*, *innovation management* and *sustainability-oriented innovation*.

Introduction

The global energy market is changing rapidly under the pressure of new regulations to suppress further effects of climate change. In the European Union (EU), the targets for these new regulations are clearly defined. The ambitions for 2030 are at least a 40% reduction in domestic greenhouse gas emissions, a 27% share of renewable energy consumption and a 27% improvement in energy efficiency. These goals reflect a high level of ambition and require fundamental changes to the current production and consumption of our energy. To reach the EU 2030 objectives, the required share of renewable electricity production is estimated up to 50% (EU, 2015). In the Netherlands, the goal is to consume 14% of energy from renewable sources by 2020 (Ministerie van Economische Zaken, 2016). Currently, the percentage of energy from renewable sources remains however only at 6,6% in 2017 (CBS, 2018).

The entire supply chain of the energy market is faced with major challenges in the upcoming years. To engage these challenges, renewable energy sources receive an increasing amount of attention in terms of research and development by many countries (Shen, Chou, & Lin, 2011). The fundamental structural changes in the energy sector are called energy transitions (Hauff, Bode, Neumann, & Haslauer, 2014). The energy transition of the Netherlands is the shift from the use of fossil fuels to the use of 100% renewable energy sources by 2050 (Sociaal-Economische Raad, 2013). The big question is in short, how are we going to achieve all these goals, suppressing the further effects of climate change? All these new developments require fundamental changes in strategies, businesses and especially, new innovations.

Enpuls is founded in 2016 by the Enexis Groep N.V. with the goal to explore concepts and develop scalable solutions to accelerate the energy transition of the Netherlands. One of the core beliefs of Enpuls is that one cannot change the world on its own. Therefore, many collaborations and projects with external actors exist to create the largest impact on the energy transition of the Netherlands. Currently, there is however no structured approach or process to manage the interorganizational collaborations of Enpuls. This study answers therefore the following main research question:

“How can Enpuls, (re-)organize their internal process, to create more insight and structure in their interorganizational collaborations in the sustainable context of the energy transition?”

Methodology

This research is performed as a multiple case study within the organization of Enpuls. The project portfolio of Enpuls consists of three types of projects, (1) internal originated projects, (2) customer/supplier relationships and (3) interorganizational collaboration projects. Four interorganizational collaboration projects are selected for further investigation. Retrieved from the literature review, three dimensions (*cognitive, relational* and *structural*) are used as the main categories to collect the data with corresponding attributes.

Every respondent is asked about their successes and failure indicators within the specific case that resulted in barriers and enablers. From the *open innovation management* literature, a role division model is presented to the respondents and how it would affect their collaborations. In combination with the secondary data, the primary interview data is triangulated to increase construct validity and reliability. After the initial coding of the primary data, the coding book is peer reviewed to increase the reliability of the coding.

Empirical analysis

A cross-case analysis is performed during the empirical analysis, that resulted in barriers and enablers during interorganizational collaborations. The most occurring barriers and enablers are identified and numbered during the analysis. The barriers and enablers are categorized into 9 challenges that emerge during interorganizational collaborations for sustainability-oriented innovations, which are shown in the table below.

Challenge	Description
Responsibility	Stakeholders lack taking responsibility
Distance	Physical distance between stakeholders
Motivation	Lack of motivation to collaborate
Definition mismatch	Definition mismatch and interpretation deviations
Goal alignment	Shared interest alignment
Political inertia	Slowed down processes due to provinces/municipalities
Knowledge levels	Insufficient knowledge on topic or experience in interorganizational collaborations
Intention-to-action	Barrier between the talking in meetings and executing the activities
Operational management	Project management activities, including planning

After the identification of the challenges, the investigated cases are categorized in their project phase. The earlier identified challenges are then analyzed over time. This analysis indicates that the challenges during interorganizational collaborations for sustainability-oriented innovations change over time, which is shown in the table below.

Challenges	Begin phase	Intermediate phase	End phase
	Case 1	Case 2	Case 4
			Case 3
Responsibility			X
Distance			X
Motivation			X
Definition mismatch	X	X	X
Goal alignment	X		
Political inertia		X	
Knowledge levels	X	X	X
Intention-to-action	X	X	X
Operational management	X	X	X

Design

The proposed design solution follows the method of Aken, Berends, & Bij (2007). First, design specifications and parameters are drafted to indicate the direction of the design solution. Second, a trade-off is made between an internal and external design direction, which considering the design restrictions, resulted in an internal direction. Two design alternatives are then assessed qualitatively which resulted in the development of the collaboration canvas with a corresponding implementation process. The collaboration canvas is initially reviewed with 24 employees of Enpuls, providing feedback on the design. After this review, a new design iteration was made and the final design solution was proposed. The collaboration canvas addresses all 9 identified challenges that emerged during the empirical analysis. The purpose of the canvas is to create awareness and insight for employees involved in interorganizational collaborations.

Conclusion and contribution

The identified challenges during the empirical analysis illustrate that in the sustainability-oriented innovation environment of Enpuls, the need exists for organizational improvements. Interorganizational collaborations in the context of the energy transition are key and necessary because sustainability oriented innovations address many stakeholders. The challenges identified in the four investigated cases show that there are extensive differences among the origination of the challenges and no specific solution existed to date to deal with all of them. This study delivered therefore a tool with a corresponding process that can be implemented in the organization of Enpuls.

The contributions of this master thesis can be found in a first attempt of researching interorganizational collaborations in a sustainability-oriented innovation context. Additions are made to the interorganizational collaboration literature, where a central leader role is proposed but in contrast to the context of this study, equivalence among stakeholders is preferred. The managerial role model in open innovation is extended by proposing that stakeholders can change in their role.

Table of Contents

Preface	III
Management summary	IV
1. Introduction	1
1.1 The quest for sustainability.....	1
1.2 Focal company.....	3
1.3 Problem statement	6
1.4 General research design.....	7
1.5 Research questions and sub-assignments	8
2. Theoretical background.....	10
2.1 Literature search methodology	10
2.2 Interorganizational collaboration.....	12
2.3 Open innovation management	15
2.4 Sustainability-oriented innovation.....	18
2.5 Gap identification	19
2.6 Theoretical synthesis	21
3. Research methodology	22
3.1 Case selection	23
3.2 Data collection.....	24
3.3 Data processing and analysis	27
3.4 Design and testing	30
4. Empirical analysis and results	31
4.1 Case descriptions	31
4.2 Cross-case analysis	33
4.2.1 Structural dimension	33
4.2.2 Relational dimension.....	36
4.2.3 Cognitive dimension	37
4.2.4 Other dimensions and attributes.....	39
4.2.5 Barriers of all cases	40
4.2.6 Enablers of all cases	41
4.3 Challenges analysis.....	42
4.3.1 Challenge analysis over time.....	44
4.4 Results discussion.....	46
5. Design	50
5.1 Design specifications and parameters.....	50

5.2	Design directions and alternatives	51
5.3	Design artifact – collaboration canvas.....	52
5.4	Design testing – user evaluation.....	53
5.5	Design artifact – collaboration process	54
6.	Conclusion	55
6.1	Answer to the research question.....	55
6.2	Theoretical contribution	56
6.3	Limitations and further research.....	57
6.4	Practical implications	58
	References	59
	Appendix A – Confidential appendices	64
	Appendix B – Minutes of explorative interviews	65
	Appendix C – Initial set of articles.....	67
	Appendix D – Interview protocol.....	69
	Appendix E – Coding scheme	71
	Appendix F – Concept design artifact.....	73

List of Figures

Figure 1 - Supply chain of energy in the Netherlands.....	3
Figure 2 - Organizational chart Enexis Holding N.V. (31 December 2017)	3
Figure 3 - Organizational chart Enpuls	4
Figure 4 - Conceptual project design (Aken et al., 2007)	6
Figure 5 – Regulative and reflective cycle (Aken et al., 2007).....	7
Figure 6 - Visual representation of the theme relations	11
Figure 7 - Management of inter-organizational projects (Matinheikki et al., 2016).....	14
Figure 8 - Three archetypes of open innovation processes (Gassmann & Enkel, 2004)	15
Figure 9 - Published articles on open innovation over time (Sciencedirect, 2018)	16
Figure 10 - Research gap identification	20
Figure 11 – Theoretical framework of literature synthesis	21
Figure 12 - Basic types of Designs for case studies (COSMOS Corporation)	22
Figure 13 - Data processing and analysis process (Gorden, 1998)	29
Figure 14 - Key activities in designing synthesis-evaluation iterations (Aken et al., 2007)....	30
Figure 15 - Timeline representation of cases	44
Figure 16 - Collaboration canvas filled out example	52
Figure 17 - Design artifact - collaboration process	54
Figure 18 - Visual representation of theme relation.....	56

List of Tables

Table 1 - Overview of themes at Enpuls	5
Table 2 - Explorative interviewee list	5
Table 3 - Keyword definition per theme	10
Table 4 - Database search and settings - Web of Science (Clarivate Analytics)	11
Table 5 - Highly cited papers in the coordination and management perspective	13
Table 6 - Key findings and recommendations for further research.....	19
Table 7 - Types of projects at Enpuls.....	23
Table 8 - Project selection for investigation with status and interviews	24
Table 9 - Overview interviewees and duration	25
Table 10 - Overview of secondary data	25
Table 11 - Interview topics.....	26
Table 12 - Coding categories with description and attributes	28
Table 13 - Excerpt from coding book	28
Table 14 – Example of method of difference (Mill, 1843)	29
Table 15 - Data overview of the structural dimension	33
Table 16 - Data overview of the relational dimension	36
Table 17 - Data overview of the cognitive dimension	37
Table 18 - Reactions to role division model	39
Table 19 - Managerial roles and response sentiment	39
Table 20 - Barriers of all cases.....	40
Table 21 - Enablers of all cases.....	41
Table 22 - Identified challenges in cases	42
Table 23 - Phase categorization and motivation	44
Table 24 - Challenges analyzed per project phase	45
Table 25 – Results discussion against the backdrop of theoretical framework	47
Table 26 - Case comparison in relation to origination	49
Table 27 - Overview of the design specifications	50
Table 28 - Design parameters.....	50

1. Introduction

This master thesis report presents the results of the graduation research, performed at Enpuls B.V., located in 's-Hertogenbosch. In this master thesis, the results are presented from the literature review, the research methodology, the empirical analysis, the design artifacts and ends with conclusions and recommendations. This introductory chapter explains the context of the research and what the reader can expect from this report. The focal company with the problem statement and the design of the research with corresponding research questions is discussed in this chapter.

1.1 The quest for sustainability

The global energy market is changing rapidly under the pressure of new regulations to suppress further effects of climate change. In the European Union (EU), the targets for these new regulations are clearly defined. The ambitions for 2030 are at least a 40% reduction in domestic greenhouse gas emissions, a 27% share of renewable energy consumption and a 27% improvement in energy efficiency. These goals reflect a high level of ambition and require fundamental changes to the current production and consumption of our energy. To reach the EU 2030 objectives, the required share of renewable electricity production is estimated up to 50% (EU, 2015). In the Netherlands, the goal is to consume 14% of energy from renewable sources by 2020 (Ministerie van Economische Zaken, 2016). Currently, the percentage of energy from renewable sources remains however only at 6,6% in 2017 (CBS, 2018).

The existing energy markets and electricity grids are too rigid to meet these future demands and fluctuations of renewable energy. The infrastructure of electricity dates from an era which is dominated by large-scale, centralized power plants fueled by fossil fuels. Fortunately, nowadays energy markets are already changing due to the economic viability of renewable energy sources. This results in negative wholesale electricity prices during peak hours which implies that energy consumption could actually be rewarded during these times. In fact, the load on the system is starting to follow generation of renewable sources. This is the complete opposite of the original system design, where large-scale production provides the current energy demand (USEF Foundation, 2015). Hence, the production, consumption and consumer behavior in the energy market is changing rapidly.

The entire supply chain of the energy market is faced with major challenges in the upcoming years. To engage these challenges, renewable energy sources receive an increasing amount of attention in terms of research and development by many countries (Shen et al., 2011). The fundamental structural changes in the energy sector are called energy transitions (Hauff et al., 2014). The energy transition of the Netherlands is the shift from the use of fossil fuels to the use of 100% renewable energy sources by 2050 (Sociaal-Economische Raad, 2013). The big question is in short, how are we going to achieve all these goals, suppressing the further effects of climate change? All these new developments require fundamental changes in strategies, businesses and especially, new innovations.

Over the last few decades, it has become clear that just simply launching new products and innovations into the market might be insufficient to gain and maintain competitive advantage. Increasing rates of innovation, complex global supply chains and environmental problems are just a few factors that force companies to (co-)operate in a multi-stakeholder context (Holmes & Smart, 2009; Stafford, Polonsky, & Hartman, 2000). Fortunately, innovation and sustainability are nowadays recognized as two empowering instead of counteracting subjects. Operating from a sustainability perspective lowers costs, because of reducing inputs and generates additional revenues from better products, and it even enables companies to discover new business models (Nidumolu, Prahalad, & Rangaswami, 2009). The concept of *open innovation* suggests that an internal, centralized approach to R&D has become obsolete (Chesbrough, 2003). The inbound and outbound flow of ideas becomes also more accepted in developing sustainability-oriented innovations.

Another way to develop new businesses, is to start from sustainability ideals and translating them into product features that contribute to customer value (Keskin, Diehl, & Molenaar, 2013). In the work of Keskin et al. (2013), conventional wisdom suggests that new firms have the ability to innovate at a faster rate than incumbent companies. They are therefore the potential candidates in offering new solutions to the challenges of sustainability. This master thesis investigates the interorganizational collaborations of Enpuls, a young company founded in 2016 that focusses on the challenges in sustainability-oriented innovations.

Only a few studies address the management and implementation of sustainability-oriented innovation processes in new companies. The scope of this master thesis is to study the managerial aspects of interorganizational collaborations, when innovating in a sustainability context.

This master thesis consists of six chapters, representing the full context of the research. In chapter 1, the context of the research is explained together with the introduction of the focal organization. Next, the research design is presented with corresponding research questions and what is needed to answer them. Following the introductory chapter, an extensive literature review is conducted on the themes of interest in chapter 2, the literature gap is identified and the theoretical framework of the analysis is presented. In chapter 3, the methodology is discussed, explaining how the research is executed and which steps are taken to validate and verify the research. After chapter 3, the empirical data is analyzed in chapter 4. In this chapter, emerging barriers and enablers are categorized, analyzed and the results are discussed in relation to the theoretical background. Combining the theoretical background and empirical analysis, the design solution is presented in chapter 5. Design specifications, parameters, directions and alternatives are extensively discussed. In the sixth and final chapter, the conclusion of this master thesis is presented by answering the research questions, the contributions to academic literature, the limitations and the recommendations for further research.

1.2 Focal company

In the Netherlands, several companies take care of the production and distribution of energy in the form of electricity and gas. In Figure 1, the supply chain of energy in the Netherlands is schematically shown. On the left-hand side, Centralized Generators (CGs) are responsible for the production of energy. Then, Transmission System Operators (TSOs) take care of the (national) transportation of the produced energy. Next, Distributed System Operators (DSOs) connect millions of houses and companies to local grids. Finally, the feed-in of local sustainable generation and energy and metering services complete the activities of the DSO. One of these DSOs is the Enexis Holding N.V. (hereafter, Enexis), providing 2,8 million customers electricity and 2,3 million customers gas, the second largest DSO of the Netherlands. Enexis operates in five of the twelve Dutch provinces (Enexis Holding N.V., 2017).

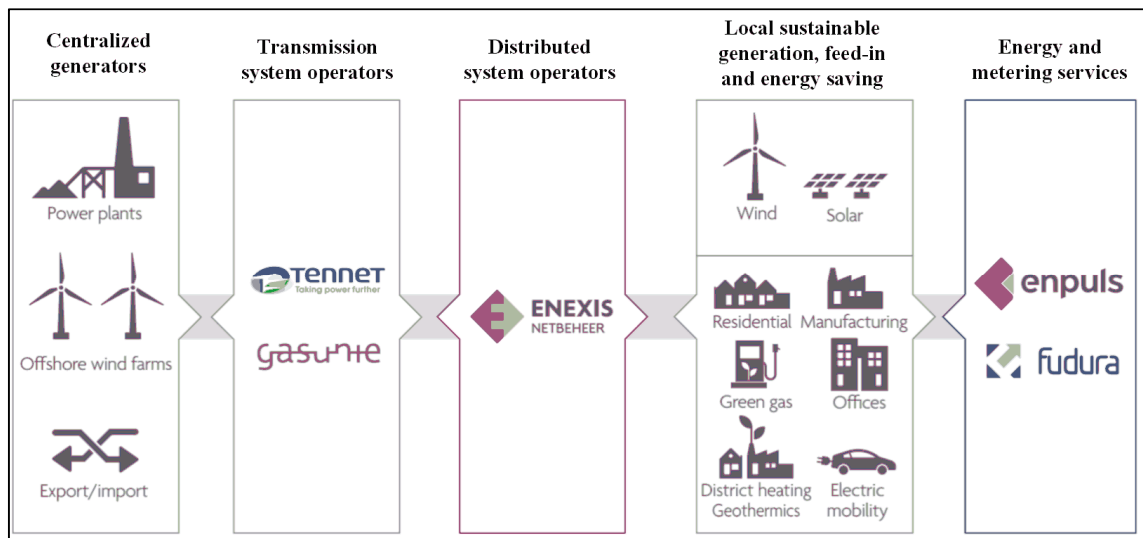


Figure 1 - Supply chain of energy in the Netherlands

The Enexis Holding N.V. consists of several subsidiaries that have their own focus area which is illustrated in Figure 2. Enexis B.V. is responsible for the construction, maintenance, development and management of the electricity and gas grids in their service areas. Enpuls B.V. (hereafter, Enpuls) is the focal company of this master thesis and will be explained in more detail below. Endinet Groep B.V. is a former small DSO of the city of Eindhoven and is fully acquired and integrated in the Enexis companies. Fudura B.V. focuses on non-regulated commercial activities, as optimizing energy supply for businesses for example. Enexis Personeel B.V. and Enexis Vastgoed B.V. support the various companies in human resources management and property respectively (Enexis Holding N.V., 2017).

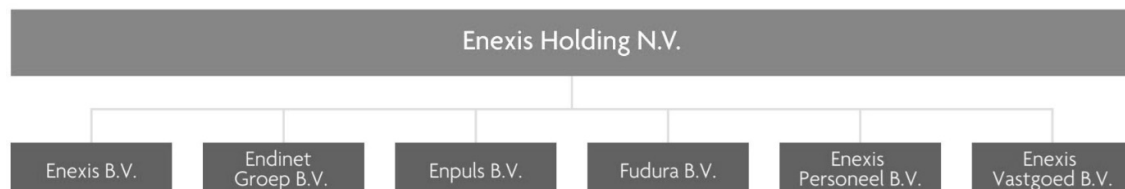


Figure 2 - Organizational chart Enexis Holding N.V. (31 December 2017)

The focal company of this thesis is Enpuls, located in the city of ‘s-Hertogenbosch in the Netherlands. Enpuls is founded by Enexis in September 2016 with the goal to explore and develop scalable concepts to accelerate the energy transition of the Netherlands. With approximately 24 FTE, Enpuls operates as an independent company, completely funded by Enexis to challenge the ongoing quest for sustainability by discovering and working on the challenges of tomorrow.

Enpuls is recognized by several unique features which distinguishes Enpuls from traditional innovation intermediaries or accelerators. All projects are for example operated from a non-profit perspective and there are no revenue goals, the positive impact on society and the effects on sustainability have the highest priority. Enpuls explores and validates new concepts, but has the goal to transfer concepts to the market when they are ready to scale-up. The Enexis Holding N.V. is the only shareholder and source of resources for Enpuls. The Enexis Holding N.V. however, is owned by municipalities and provinces of the operating area in the Netherlands, creating a very unique and interesting public/private relationship to perform research on.

Enpuls is characterized by a flat organizational structure, stimulating a high autonomy and self-organization of employees. There are different roles within the organization, but activities can be exchanged and performed by others. Collaboration and communication are therefore key at Enpuls, an overview of the organizational role division is shown in Figure 3.

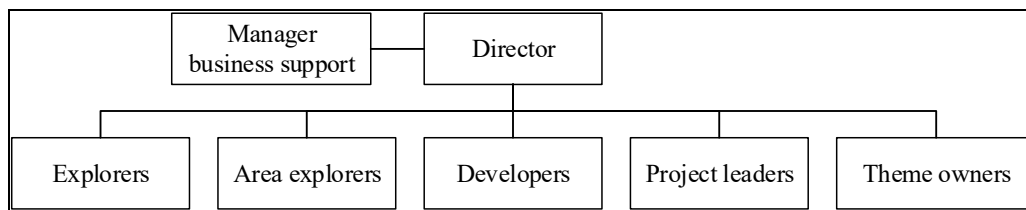


Figure 3 - Organizational chart Enpuls

There are different roles in the organization with their own responsibilities. The following roles are explained in short: Explorers, Area explorers, Developers, Project leaders and Theme-owners. The Explorers are responsible for discovering and signaling new trends and developments in the context of the energy transition. If a new trend or concept is accepted by a Theme owner, a Developer will further try to design and validate the business case for the concept. An Area explorer is mostly in discussion with municipalities and provinces to signal their challenges and developments dealing with the new energy regulations. Project leaders and Theme owners fulfill the managerial aspects, such as resource management and planning for example. The Director forms with the Theme owners the core team on developing and defining the strategy of Enpuls¹.

¹ Sources: explorative interviews and company website <https://www.enpuls.nl/> (2018)

One of the core beliefs of Enpuls is that one cannot change the world on its own. Therefore, many collaborations and projects with external stakeholders exist to create the largest impact on the energy transition of the Netherlands. To categorize all projects and collaborations, Enpuls works with five themes. The themes are: New Developments (ND), Sustainable Mobility (SM), Flexibility (FL), Energy Savings (ES) and Sustainable Area Development (SAD). These themes address many stakeholders due to a very broad market perspective, effective collaborations are therefore key to successfully accelerate the energy transition of the Netherlands. Each theme has their own focus and specialities which are briefly discussed in Table 1.

Table 1 - Overview of themes at Enpuls

Theme	Focus area
New Developments	Signaling and discovering new trends and developments related to the energy transition of the Netherlands
Sustainable Mobility	Developing concepts related to (e)-mobility, smart charging and car sharing for example
Flexibility	Developing concepts related to the regulation of supply and demand in the electricity network
Energy Savings	Developing concepts that contribute to awareness of energy usage and energy savings
Sustainable Area Development	Developing concepts that contribute to the sustainable developments of new residential or industrial areas

To define the problem statement, explorative interviews are conducted to gain more insight in the organization. In Table 2, the interviewed employees are shown with their corresponding function. During these explorative interviews, the interviewees were asked about the activities of Enpuls and the projects and activities they are responsible for. The interviews lasted between 20 to 30 minutes and the minutes are shown in Appendix B. In addition to the three interviewees, discussions with the two company supervisors are held on a regular basis.

Table 2 - Explorative interviewee list

Name	Function	Date
Lisa Bisschop	Project leader	20-06-2018
Alexander Savelkoul	Theme owner FL	21-06-2018
Willem Alting Siberg	Theme owner SM	20-06-2018
Frank van Rossum	Explorer	Weekly
Bram Gerrist	Theme owner ND	Weekly

1.3 Problem statement

In this paragraph, the essence for the research at Enpuls is discussed. Based on the preliminary interviews and discussions with employees of Enpuls, the following problem context is defined.

The energy transition of the Netherlands involves many different actors from different industries and governmental organizations. Because there are so many actors with different interests within the energy transition, the energy transition is perceived as a very dynamic and complex field to operate in. There are many examples of companies, research institutes and entrepreneurs that try to innovate and develop solutions in the context of the energy transition. One of the observations of Enpuls is that they often only address a small, or incremental innovation, thus a partial solution of the required system innovation to make the energy transition a success. To accelerate the energy transition, an effective collaboration with involved stakeholders is key. Therefore, Enpuls works together in several consortia with a large number of stakeholders, for example corporates, municipalities, provinces and research institutes like universities. Through connecting stakeholders with shared interests and goals, Enpuls (co)-creates and validates new innovative concepts that will benefit the acceleration of the energy transition. Enpuls is regarding this phenomenon of open innovation practices searching for empirical evidence and design solutions to structure these interorganizational collaborations. The goal is to collaborate in a more structured way and to connect stakeholders to accelerate the energy transition of the Netherlands, which leads to the following problem statement:

“Enpuls has many interorganizational collaborations and participates in consortia with different stakeholders to accelerate the energy transition of the Netherlands. However, there is currently no process or framework that Enpuls applies to organize and manage these interorganizational collaborations. Therefore, the shared vision, interests and goals of some collaborations are unclear.”

The conceptual project design (Aken et al., 2007) of this master thesis is illustrated in Figure 4. The theoretical fields that are required are shown in the left-hand side of the model. The subject of analysis is shown on the right-hand side of the model, the external collaboration process. Finally, the deliverables are shown in the bottom of the model which will function as a reference for the deliverables of this master thesis.

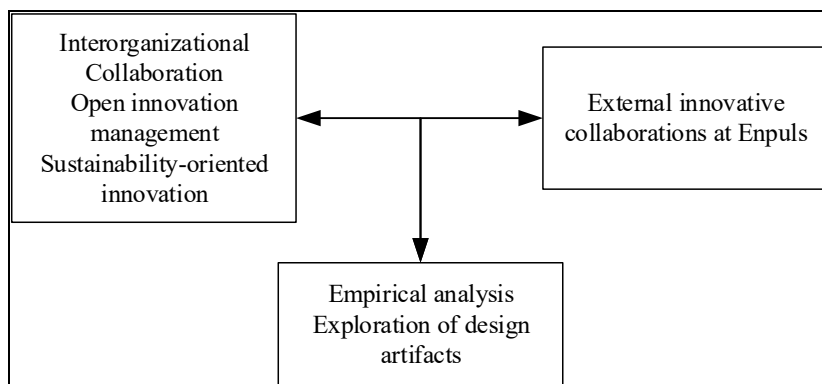


Figure 4 - Conceptual project design (Aken et al., 2007)

1.4 General research design

In this paragraph, the general research design is discussed based on the research context and problem statement of chapter 1. Four research questions function as the foundation for this research.

The two goals of this master thesis are, (1) to contribute to the academic literature and (2) to solve the business problem of the studied organization. To ensure both goals can be achieved in a systematic way, this research design is based on the business problem solving (BPS) project of van Aken, Berends, & Bij, (2007). The BPS project method can be described as the blueprint for this master thesis. The general design is based on a combination of the reflective and regulative cycle which are both shown in Figure 5 and the application of both cycles is explained further below.

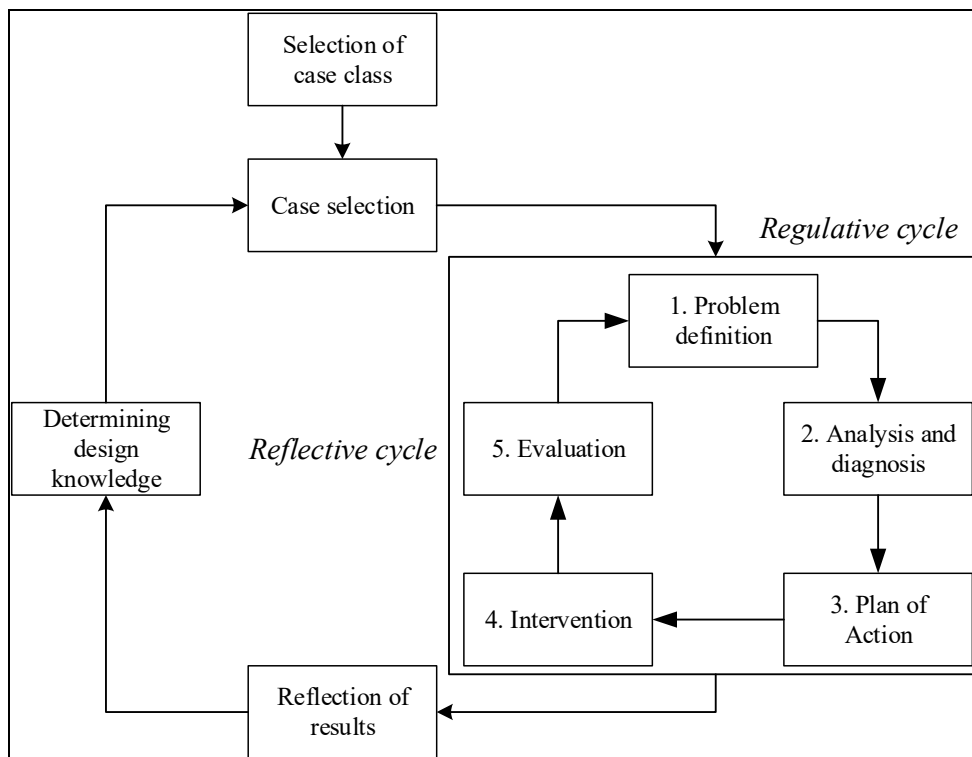


Figure 5 – Regulative and reflective cycle (Aken et al., 2007)

The reflective cycle is illustrated by its reflection on the results and the design knowledge that can be retrieved from those results. The first step of the regulative cycle is already described in this first chapter. The second step involves the empirical analysis of the qualitative data. After the analysis, a proposal is made in the form of a design artifact in the third step.

The regulative cycle is characterized by the absence of a strict sequence of phases. There is flexibility in the execution of the various process steps, an example of this flexibility is that a problem definition can be further defined after the exploration of possible solution directions. Several explorative interviews are therefore conducted with theme owners and project managers of Enpuls to define the problem definition and research questions in the next paragraphs. Due to the time and scope limitations, the focus of this master thesis will include the execution of the first three steps of the regulative cycle which is illustrated in Figure 5.

1.5 Research questions and sub-assignments

This paragraph contains the research questions to indicate the scope of the master thesis. Based on the problem statement of paragraph 1.3 and on an explorative review of literature and interviews at Enpuls, the following central research question is composed with additional sub-questions. There is a short explanation below each question to create a deeper understanding of the research problem. In chapter 3, a detailed methodology is explained how the sub-questions are executed.

RQ: How can Enpuls, (re-)organize their internal process, to create more insight and structure in their interorganizational collaborations in the sustainable context of the energy transition?

The main research question has a broad definition with two goals. The first one is to gain insight in the status quo of the inter-organizational collaboration processes at Enpuls and the second goal is what would be the desired solution, to create more insight and structure in their sustainability-oriented collaborations. This with the overarching goal to create more impact in the sustainability context of accelerating the energy transition of the Netherlands.

SQ-1: What is the status quo in academic literature on the topics of inter-organizational collaboration processes and open innovation management in a sustainability context?

Following the preliminary theoretical insights in this chapter, this research question tries to answer what the status quo is in academic literature in the fields of interorganizational collaboration management, the managerial aspects of open innovation and sustainability-oriented innovation. The result of this literature synthesis is used as the main theoretical input for the analysis of the empirical data in this master thesis. The goal is to gain a deep understanding of the available literature and identify the research gap. The results of this sub-question are presented in chapter 2.

SQ-2: How does Enpuls organize and manage their current interorganizational collaborations?

This sub-question is related to the Analysis & Diagnosis phase of the regulative cycle from paragraph 1.4. The goal is to gain an insight in the status quo of the interorganizational collaboration process at Enpuls and to select the appropriate cases for the empirical analysis. This sub-question also includes data collection, data processing and data analysis. The data collection comprises interviews with the involved employees to gain a deep understanding of the individual cases. During the processing of the collected data, several qualitative research methods are applied to increase the construct validity and reliability. In the data analysis, barriers and enablers are used to identify failure and success indicators. The results of the data processing and analysis are described in chapter 4.

SQ-3: What would be a desired design solution where the theoretical and practical findings are synthesized?

This sub-question is related to the Plan of Action phase of the regulative cycle from paragraph 1.4. A design artifact is proposed in a suitable way that it can be implemented by Enpuls in the future in organizing their interorganizational collaboration processes. The goal is to synthesize the theoretical findings from the literature with the empirical analysis to create the design artifact. The methodology that is used to develop the artifact is described in chapter 3, the design specifications and implemented design at Enpuls is described in chapter 5.

2. Theoretical background

The aim of this chapter is to discuss the theoretical background of the core concepts with supporting literature. First, the methodology is explained how the appropriate literature is retrieved and analyzed. Second, each core concept is discussed independently to gain a deeper understanding of the status quo in literature. Third, the literature gap is identified based on recommendations for further research from the studied literature. Finally, a theoretical synthesis is made of the studied concepts.

2.1 Literature search methodology

Two search strategies are combined to conduct a systematic review of available literature. The first search strategy focuses on keyword search with the use of online databases. The second strategy makes use of the reference list in the found articles to identify new papers to include, this method is referred to as the “backward snowballing” method to extent the body of knowledge further (Aken et al., 2007; Wohlin, 2014). To ensure a critical and unbiased assessment of literature which is also replicable and follows a transparent process, the method of Kitchenham & Charters (2007) is used. Finally, the insights of Green, Johnson, & Adams (2006) are used to synthesize all theoretical knowledge into a table followed with the identification of the gap in the academic literature.

As previously discussed in chapter 1, the context of this research is the (re-)organization of inter-organizational collaborations at Enpuls, which focus on sustainability-oriented innovations. In this context, the research themes inter-organizational collaboration, open innovation management and sustainability-oriented innovations are the starting point of the literature review. The keywords used in the initial search are derived from explorative search, the explorative interviews, discussions with Enpuls, prof.dr.ir.arch. I.M.M.J. Reymen and dr.ir. J.C.C.M. Huijben. An overview of all keywords used during the search is shown in Table 3.

Table 3 - Keyword definition per theme

Research theme	Keywords
Interorganizational collaboration	Interorganizational Collaboration OR Interorganizational Relationships OR Collaboration Framework OR Collaboration Frameworks OR Collaboration Process OR Collaboration Processes OR B2B OR Partnerships OR Partnership management OR Cooperation
Open innovation management	Open innovation management OR Open innovation practices OR Open innovation design OR Co-creation OR Co-innovation OR Value Co-creation OR Cooperation Innovation OR B2B Innovation
Sustainability-oriented innovation	Sustainability-oriented innovation OR Sustainability OR Sustainable OR CSR OR Corporate Social Responsibility OR Eco OR Green OR Environment OR Energy transition

The keyword search was executed within the online database shown in Table 4 with their corresponding search settings.

Table 4 - Database search and settings - Web of Science (Clarivate Analytics)

Search settings	
Database:	Web of Science core collection, search executed in Topic
Years:	1945-2018, time of search: July 2018

The initial search resulted in 2.726 articles for interorganizational collaboration, 13.023 articles for open innovation, and 397 articles for sustainability-oriented innovation. To restrict the amount of articles for further investigation and to remain with a high-quality set of articles, the search results were refined by ESI² top papers and the categories environmental sciences, green sustainable science technology, management and business literature. This resulted in 28 articles for interorganizational collaboration, 50 articles for open innovation and 12 articles for sustainability-oriented innovation respectively. All search results of literature were evaluated by title and abstract if there was an appropriate fit with the scope of the research questions.

During this evaluation, it was found that some extra limits were needed while conducting the review. Therefore, in the literature is searched for interrelations between the three research themes as illustrated in Figure 6. Thus, to set a boundary for the literature review, the focus is on research that explains or describes interorganizational collaborations in an open innovation context related to sustainability. This resulted in an initial body of knowledge of 5 articles (3 literature reviews) for interorganizational collaboration, 15 articles (3 literature reviews) for open innovation, and 4 articles (2 literature reviews) for sustainability-oriented innovation. After the in-depth reading of the articles, the “backward snowballing” method was used to extend the list of scientific articles further. New keywords found during this method were added to Table 3. A few articles were found on a later moment in time using Google Scholar and keyword search. The initial set of articles used during the literature review is shown in Appendix C with their corresponding journal and impact factor.



Figure 6 - Visual representation of the theme relations

² Highly Cited Papers received enough citations as of March/April 2018 to place them in the top 1% of their academic fields based on a highly cited threshold for the field and publication year.

2.2 Interorganizational collaboration

In the extensive literature on interorganizational collaboration, the definitions of collaboration, cooperation and relationships are often used interchangeably. Most scholars agree that there is a difference in the depth, interaction, integration, commitment and complexity, with cooperation on the lower side of the scale and collaboration at the higher side (Thomson & Perry, 2006). Interorganizational collaborations are also often indicated as interorganizational relationships (IORs) (Ring & Van De Ven, 1994). In this review of literature, the focus is on interorganizational collaborations, in relation to the field of open innovation management and sustainability-oriented innovations.

In an environment of rapid technological change and development, the locus of innovation is nowadays found in the networks of interorganizational relationships. This is in contrast to the traditional internal oriented research and development (R&D) process. The most common rationales for this increase in interorganizational collaborations are risk sharing, obtaining access to new markets and technologies, speeding products to market and pooling complementary skills. This new trend requires new organizational practices to access such a network community (Powell, Koput, & Smith-Doerr, 1996).

It can be concluded that the essence of interorganizational collaboration is clear in academic literature. Managerial guidelines on how to implement such practices are however scarce. In the academic field of management of interorganizational collaborations, three main perspectives were identified; (1) the knowledge management perspective (Hardy, Phillips, & Lawrence, 2003; Vaccaro, Parente, & Veloso, 2010); (2) the organization theory perspective (Gray, 1985; Sinha & Van de Ven, 2005); and (3) the coordination and management perspective (Matinheikki, Artto, Peltokorpi, & Rajala, 2016; Okhuysen & Bechky, 2009; Thomson & Perry, 2006).

The knowledge management perspective in the study of Hardy, Phillips, & Lawrence (2003), identified three types of effects in the interorganizational collaboration literature, which are; (1) strategic effects, (2) knowledge creation effects and (3) political effects. They argue that collaboration has been researched in a variety of different perspectives and organizational forms, but that it developed into separate bodies of work lacking a comprehensive approach. Their work concludes with an interesting insight for managers: if they collaborate to gain strategic advantage, they may limit new knowledge, but if they collaborate to maximize knowledge creation, they will not necessarily maximize strategic effects (Hardy et al., 2003).

When looking at the knowledge management perspective from Hardy et al. (2003), the three identified effects are not produced by all collaborations. They argue therefore that the involvement and embeddedness of collaborations are associated with those effects. This also illustrates the uniqueness and complexity of interorganizational collaborations, which is confirmed in the organization theory perspective by Sinha & Van de Ven, (2005). As work systems are characterized by unique demands, trade-offs and expectations, it becomes difficult to model a theoretical solution is their conclusion.

In the organization theory perspective on interorganizational collaboration, Gray (1985) proposed a process model of collaboration of three phases; (1) problem-setting, (2) direction setting and (3) structuring. Each phase consists of several facilitative conditions to achieve and sustain collaborative relationships. The reason for this research is in line with several other papers on interorganizational collaboration of the late 20th century. Collaboration is a viable and necessary approach to solve many “indivisible” problems faced by our society, i.e. problems which are bigger than any single organization can solve alone (Gray, 1985). The mitigation of climate change is an example of a major challenge that addresses governments and corporates worldwide (Shen et al., 2011).

In the coordination and management perspective, the results that were found in earlier academic work are in line with the findings of Thomson & Perry (2006). They argue that five process dimensions exist in that what was formerly known as the black box in interorganizational collaborations. In their review, governance, administration, organizational autonomy, mutuality, and norms are identified as the five key dimensions in public administration collaborations. Focusing too much on antecedents and wrestling with the process itself in the public management literature, we are lacking a more systematic approach that will benefit public managers coping with the intrinsic challenges of collaborations (Thomson & Perry, 2006).

The main research question of this study tries to answer how Enpuls can (re)organize their interorganizational collaboration process. From this internal orientation, the coordination and management perspective has the best connection to the scope of the research questions and is explored in-depth. The perspectives from other stakeholders are not taken into account during this master thesis. Two highly-cited papers from a comparable context are identified in Table 5 and are synthesized in the following section.

Table 5 - Highly cited papers in the coordination and management perspective

Title	Author(s)	Journal	Citations	IF
Coordination in Organizations: An Integrative Perspective	(Okhuysen & Bechky, 2009)	The Academy of Management Annals	533	9.281
Managing inter-organizational networks for value creation in the front-end of projects	(Matinheikki et al., 2016)	International Journal of Project Management	34	4.328

To successfully accomplish emergent coordination in organizations, people need the awareness and understanding how their work fit with the work of others in the organization. Okhuysen et al. (2009) reviewed the available literature on how collective work is accomplished within organizations. They propose three integrating conditions to coordinate activities: (1) accountability, (2) predictability and (3) common understanding. Five mechanisms are also proposed to achieve those conditions: (1) plans and rules, (2) objects and representations, (3) roles, (4) routines and (5) proximity. The integrating conditions and mechanisms are used as input for the synthesis at the end of this chapter.

In the study of Matinheikki et al. (2016), concepts from the interorganizational network and project management literature are applied to analyze the empirical case of a health care campus project. First, they report four key management activities: (1) assigning a network leader role to one or a few central organizations in the network, (2) establishing a joint coordination body among the network organizations, (3) arranging frequent formal and informal meetings among the network organizations, and (4) engaging internal and external actors in decision-making related to the network. Second, they also report five value-creating network attributes: (1) centrality of leading actor(s), (2) network density, (3) tie strength, (4) trust, and (5) shared vision. The management activities influence the network attributes that eventually results in the creation of value as illustrated in Figure 7.

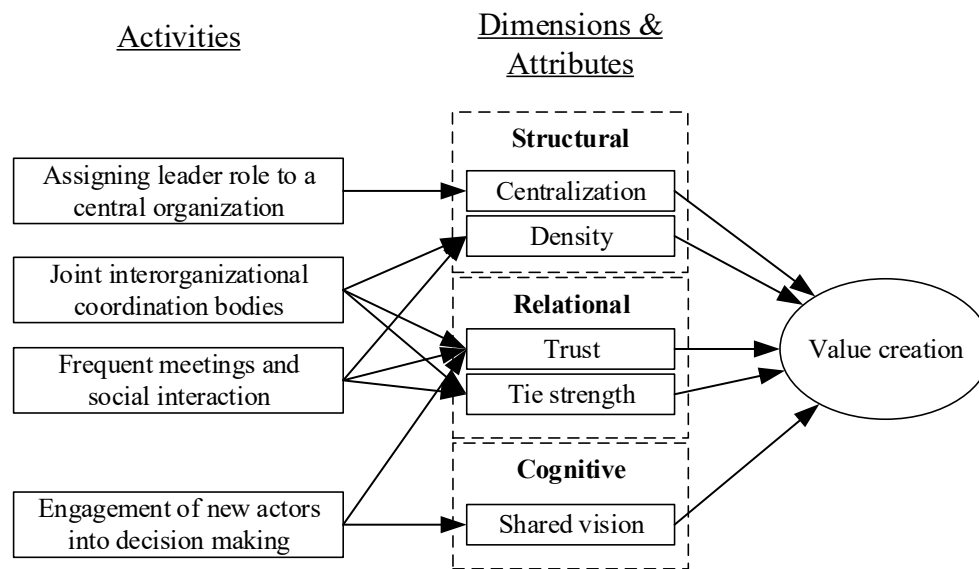


Figure 7 - Management of inter-organizational projects (Matinheikki et al., 2016)

Interorganizational collaborations continue to receive the attention of scholars and managers. The reason and necessity of cooperating beyond organizational boundaries is also emerging and recognized by (public) organizations that cannot solve nowadays challenges alone (Gray, 1985). Several attempts have been made by scholars, identifying activities, mechanisms, attributes and dimensions to describe the dynamic and complex process of interorganizational collaborations (Matinheikki et al., 2016; Thomson & Perry, 2006), but not in the context of sustainability-oriented innovations. One of the questions to answer is therefore what are the commonalities and differences of interorganizational collaborations in this specific context? At the end of this chapter, a synthesis is made of all insights to create a framework that functions as a theoretical lens in further analyzing the empirical data. In the next paragraph, a related form of interorganizational collaboration is discussed: open innovation management.

2.3 Open innovation management

The second subject of the literature review is the academic field of open innovation management. Related to the concepts of interorganizational collaboration, the publications of Chesbrough in 2003 on the concept of open innovation have received a lot of interest in academic literature and from innovation managers. In fact, open innovation is a form of interorganizational collaboration. Therefore, the dominant view of internal R&D discoveries shifted to an open paradigm characterized by external influences in the innovation process.

The importance of collaboration for innovation has been recognized by industrial leaders around the globe. They find collaborative partners to design an innovative value chain, combining their competences with other industrial leaders (Tapscott & Williams, 2006). The organizations that use these form of collaborations are described as “simultaneously innovative, efficient, agile and scalable” (Adler et al., 2010).

However, in several studies open innovation is still considered as a company-centric concept (Fichter, 2009; West & Lakhani, 2008). In the work of Giannopoulou, Yström, & Ollila (2011), it is claimed that open innovation has been researched with a variety of perspectives such as strategy, leadership and organizational structure, but research on open innovation in practice and managerial challenges is still scarce. This is further confirmed by the later study of Ollila & Yström (2017), as they conclude that the management of complementary partners and their role in open innovation is still underrepresented in the literature. In the concept of open innovation, three core processes can be identified that are illustrated in Figure 8 (Gassmann & Enkel, 2004).

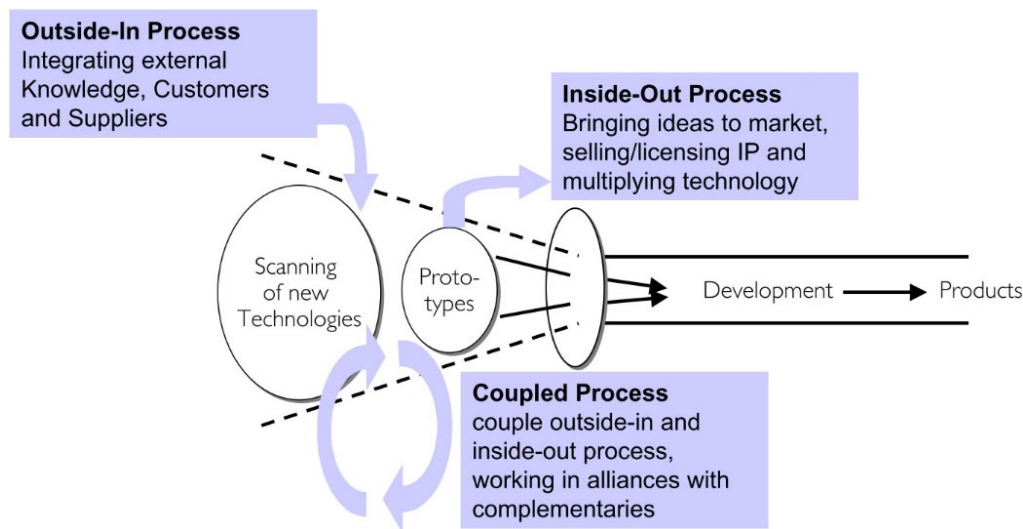


Figure 8 - Three archetypes of open innovation processes (Gassmann & Enkel, 2004)

The *outside-in process* is characterized by strengthening the company’s own knowledge base through the integration of suppliers, customers, and external knowledge sourcing. The *inside-out process* is characterized by earning profits from commercializing ideas to the market, selling IP and by transferring ideas to the outside environment. The *coupled process* is characterized by co-creation practices, with (mainly) complementary partners. Companies that establish the coupled process, successfully combine the outside-in and the inside-out process to jointly develop and commercialize innovations (Enkel, Gassmann, & Chesbrough, 2009).

Open innovation has extensively been researched in the last decade and continues to receive an increasing amount of attention from scholars since the initial publications of Chesbrough in 2003. A search on “Open Innovation” in Title, Abstract and Keywords in Research Articles of the ScienceDirect database in June 2018 resulted in the graph of Figure 9, illustrating a growing interest. Despite the extensive research on open innovation, there is a lack of clarity of the concept and available literature is fragmented (Dahlander & Gann, 2010).

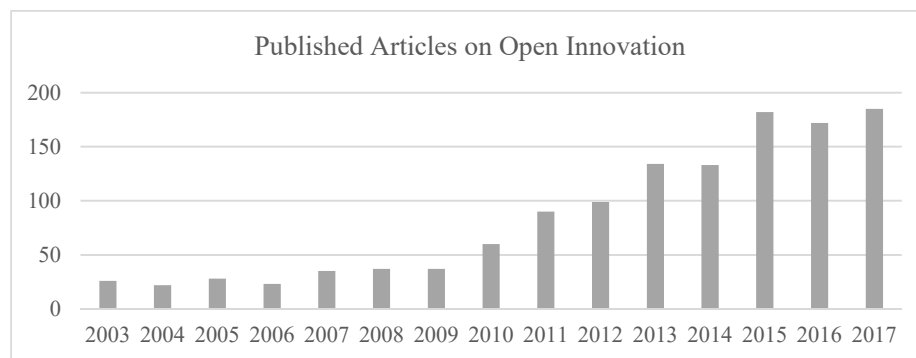


Figure 9 - Published articles on open innovation over time (Sciencedirect, 2018)

Open innovation is typically a subject being researched in large organizations (S. Lee, Park, Yoon, & Park, 2010), as it is there more easily studied than in comparison to Small and Medium Enterprises (SMEs), as they have less ability to access external resources and fewer technological assets that they can exchange (Narula, 2004). Other publications even suggest that open innovation research in SMEs is neglected (van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009).

Extensive literature and research exists in the field of co-creation. This definition is used to describe open innovation regarding a business to consumer setting and collaborations with end-users (Antikainen, Mäkipää, & Ahonen, 2010; Prahalad & Ramaswamy, 2002, 2004). To make a contribution to an underexposed field of open innovation literature, the focus of the master thesis and further exploration is in the direction of the management of open innovation.

In the work of Ollila & Yström (2017), a first attempt is made to create an initial conceptualization of managerial roles in open innovation with two case-studies. They suggest from their findings three managerial roles that are crucial in open innovation collaborations: *a facilitator*, *a tactician* and *a sensegiver*. These three emerging managerial roles appear to be crucial in achieving innovation in an open, collaborative context. The insights from their work are added to the theoretical framework at the end of this chapter.

Another example of recent work in open innovation management is from Guertler & Lindemann (2016). They propose an integrated methodology for selecting relevant partners for an open innovation project. By combining different approaches such as Lead-User identification and stakeholder analysis, their method offers a structural approach to partner selection in open innovation. Another publication in the field of partner selection in open innovation comes from Meulman, Reymen, Podoyntsyna, & Romme (2018). Concluding from their work, the search for partners in open innovation is often performed local which typically leads to collaboration with already known partners.

In the context of open innovation for sustainability-oriented innovation, the most important competences to execute innovation sustainably are integrating customers, suppliers and research institutions efficiently and effectively (Carrillo-Hermosilla, Del Río, & Könnölä, 2010; De Medeiros, Ribeiro, & Cortimiglia, 2014; K.-H. Lee & Kim, 2011). There are several positive arguments in favor of using open innovation as a concept for sustainable innovation (M. Arnold & Barth, 2012; M. G. Arnold, 2011; De Medeiros et al., 2014; Hossain, 2013), but it is also recognized that there is insufficient knowledge available about the contribution of open innovation to sustainable innovation (Mustaquim & Nyström, 2014).

Open innovation for sustainability-oriented innovation is considered to be an outside-in process as illustrated in Figure 8, where the internal development of sustainability oriented innovations is complemented by external knowledge (Rauter, Perl-Vorbach, & Baumgartner, 2017). In contrast to traditional stakeholder management and integration, where needs and requirements related to the company background are taken, the open innovation for sustainable innovation approach focuses more on the entire process. This includes the phases of initiation, development, implementation and diffusion (Achterkamp & Vos, 2006).

2.4 Sustainability-oriented innovation

The third and last subject of the literature review is sustainability-oriented innovation and the relation to the field of open innovation management and interorganizational collaboration.

The quest for sustainability has in general only been addressed by governments to get more renewable energy in place. There are however multiple goals to achieve that can be sorted into the energy goal, the environmental goal and the economic goal (Shen et al., 2011). In their work, the three E's are addressed as major policy goals. Several studies indicate that specific policy goals lead to specific forms of renewable energy and technologies. In their analysis, different policy goals are examined and how they lead to corresponding energy sources (Shen et al., 2011).

Sustainability-oriented innovation is receiving more and more attention of scholars, which is clearly identified in two recent literature reviews. A conceptual framework is drafted by Adams, Jeanrenaud, Bessant, Denyer, & Overy (2016). By synthesizing several dimensions and contexts, five activities are identified varying over three levels of sustainability-oriented innovation. The degrees of sustainability-oriented innovation are *Operational Optimization*, *Organizational Transformation* and *Systems Building*. The *Systems Building* degree involves the most integrated level of activities for sustainability-oriented innovation and has the most similarities with the strategy and activities of Enpuls. Their model provides a strong basis that pragmatically oriented sustainability innovation has a positive effect on organizational behavior.

In the work of Rauter, Perl-Vorbach, & Baumgartner (2017), another literature review is conducted on the topic of sustainable innovation in relation to open innovation. One of the reasons that the attraction of sustainable innovation is rising, is the fact that environmental constraints may put limits on company growth (De Medeiros et al., 2014). Not only scholars are becoming more aware of the importance of sustainability aspects in open innovation, but firms are also becoming aware of this trend.

The highly cited work of Porter (1991), concluded that environmental protection can benefit competitiveness if it is approached properly. This conclusion is better known as the Porter Hypothesis (PH), which received over time a large amount of attention by scholars and nowadays the findings are still not aligned (Ambec, Cohen, & Elgie, 2011). Reflecting on their own work, Porter concluded that increasing environmental regulations (taxes or cap-and-trade emissions allowances) can “trigger innovation [broadly defined] that may partially or more than fully offset the costs of complying with them” in some instances (Porter & Linde, 1995). The PH makes policymakers think on how to design and implement regulations that will lead to sustainable innovation among firms and finally to a win-win situation for the whole society (Ambec et al., 2011). The need for sustainable innovation is widely accepted, but questions on how it can be integrated into the innovation process, still remain unanswered (Rauter et al., 2017).

2.5 Gap identification

In this paragraph, an overview is presented of the reviewed literature followed by the identification of the research gap and the need for further research. The most recent primary studies in the domain of the research are ascending shown on the year of publication in Table 6.

Table 6 - Key findings and recommendations for further research

Author, Year	Key findings and recommendations for further research
(Okhuysen & Bechky, 2009)	“Boundaryless” organizations (...) have shifted the nature and location of the task boundary. In these organizations, some tasks are outsourced either to individual contractors or to firms. But, in the absence of centralized planning or hierarchical structures , how do interdependent parties create accountability ?
(Matinheikki et al., 2016)	“Another interesting avenue for future research would be clarifying the contextual biases , which our study might present. How the front-end of projects differ in other project-based industries such as complex system deliveries to health care and construction discussed here?”
(Rauter et al., 2017)	“The issue of how to tackle innovation problems that arise when sustainability and external knowledge from various sources are integrated has not been carefully considered thus far.”
(Ollila & Yström, 2017)	“Thus, we argue that the findings are a crucial first step in the further exploration of open innovation management in networks, intermediaries, and firms. Further, we suggest that the findings can offer managerial advice on issues such as best practices and the extension of management theory”
(Rauter, Globocnik, Perl-Vorbach, & Baumgartner, 2018)	“Second, opportunities exist to conduct a more detailed investigation of open innovation practices and its suitability for sustainability innovation (...) Third, it would be interesting to additionally analyze how company factors influence the internal acceptance and implementation of open innovation for sustainability innovation. ”

This chapter started with an overview of three academic themes related to the context of this master thesis. By discovering diverse analytical frameworks, perspectives and insights, the status quo of academic literature is identified. A synthesis is made of the key papers to function as a theoretical lens where the empirical data is analyzed against in this paragraph. The key insights from interorganizational collaborations, open innovation management and sustainability-oriented innovation are first briefly discussed and summarized below in relation to each other.

The *interorganizational collaboration* literature recommends on clarifying the contextual biases which might be present (Matinheikki et al., 2016). Other recommendations are an investigation of how projects differ in other project-based industries and what would be the effect of different national and institutional contexts. The insights of Okhuysen & Bechky (2009), conclude with a comparable recommendation for further research how accountability is reached when tasks are outsourced by the organization.

What can be concluded from the studied literature and Table 6, is that the well present academic body of knowledge in *open innovation management* and *sustainability-oriented innovation* still lacks managerial insights and implications. Not to forget the absent detailed investigation of both research themes in a holistic approach (Rauter et al., 2018). Other researchers recommend the investigation of open innovation management in networks, intermediaries and firms (Ollila & Yström, 2017) and how it can be implemented to benefit sustainability-oriented innovation.

A clearly growing interest in open innovation and the combination with sustainability-oriented innovation confirms the need for extensive research in these topics. Therefore, the research gap this master thesis is founded on is managing open innovation collaborations in a sustainability oriented context. The research gap is illustrated in Figure 10, where the intersection of the three investigated themes is the focus of this research. This unique combination has not been investigated before to the best of the researcher's knowledge after the literature study. In combination with the business-oriented research questions, both theoretical and practical contributions of this thesis are assured.

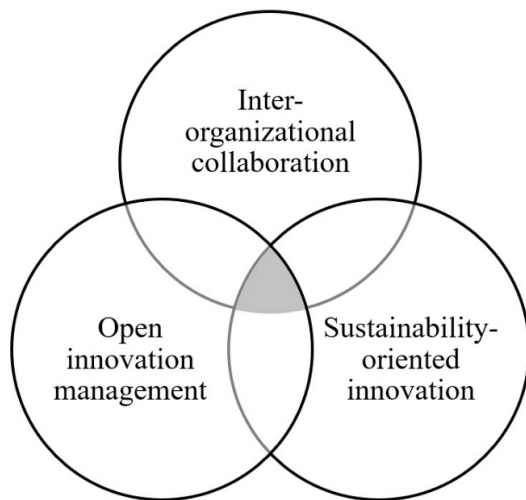


Figure 10 - Research gap identification

2.6 Theoretical synthesis

A theoretical framework is developed to synthesize the studied literature. This framework is used as an input for the empirical analysis. A synthesis is made combining the dimensions and attributes in (inter)organizational collaboration management together with the insights from open innovation management and sustainability oriented innovation.

The dimensions and attributes from paragraph 2.2 are combined into a theoretical framework in Figure 11. In this framework, the three dimensions (*Structural, Relational and Cognitive*) are shown which function as overarching criteria. The attributes of both papers are clustered and indicated by the dashed arrows. The questions used during the interviews are based upon this framework.

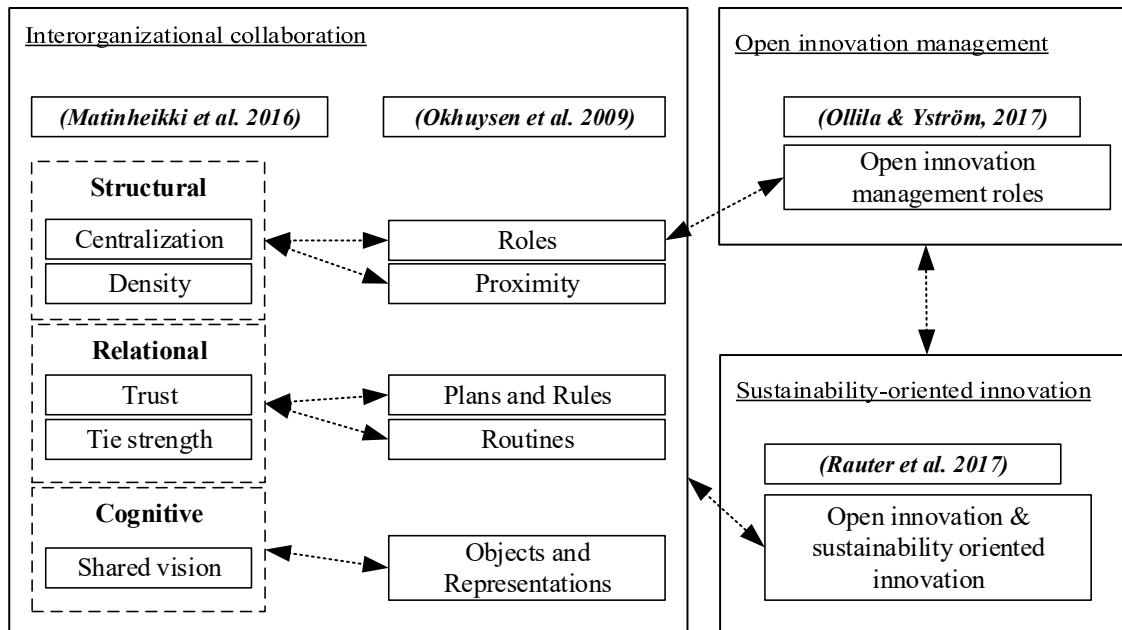


Figure 11 – Theoretical framework of literature synthesis

The aim of the synthesis is to investigate for commonalities and differences between the studied literature and the empirical data. Following from the synthesis in Figure 11, the structural dimension is related to two attributes, centralization and density. In the work of Okhuysen et al. (2009), a role division is perceived positively in collaborations. This is in the open innovation management literature related to the managerial roles of Ollila & Yström (2017).

In the relational dimension, trust and tie strength are the two related attributes. These attributes include activities like frequent meetings (routines) and interactions with stakeholders. Combined with the insights of Okhuysen et al. (2009), plans, rules and routines are the two mechanisms that are related to this dimension. In the cognitive dimension, shared vision includes the engagement of new actors into decision making as activity for example. In the related work of Okhuysen et al. (2009), objects and representations are related to this dimension. The perspectives of Rauter et al. (2017) are used to investigate how open innovation affects sustainability-oriented innovation and what the effect is on interorganizational collaborations.

3. Research methodology

In this chapter, the approach to answer the research questions is described. There are several research methods available to obtain the required empirical data and insights to answer the research questions. The selected methods are explained in the following paragraphs.

Case study research is the method of preference compared to other research methods (experiments, surveys, statistical modeling), when (1) the main research questions are “how” or “why” questions; (2) a researcher has little or no control over behavioral events; and (3) the focus of study is a contemporary phenomenon (Yin, 2014). Therefore, due to the explorative and descriptive nature of the research questions, a case study research methodology is chosen, as this research also focusses on contemporary events. A case-study research allows to discover why and how practical occurrences can be explained through theory or not. Because of the focus on a single business problem at Enpuls, a case study research is applicable to the nature of this study.

There exist however some limitations in case study research. Some examples are lack of rigor due to an unsystematic approach, insufficient generalizability, an unmanageable level of effort and limited comparative advantage. These limitations are counteracted as much as possible by following the systematic approach of Yin (2014).

According to Yin (2014), four types case-study research designs exist which are illustrated in Figure 12. Regarding the research context, the chosen case-study design type is the multiple case-study with one single unit of analysis. This research focusses on the project level of the focal organization (Enpuls) with a business problem in a sustainable context. The unit of analysis are the different projects involving interorganizational collaborations. The collection of the data included primary sources such as interviews and secondary sources like minutes, reports, presentations and e-mails.

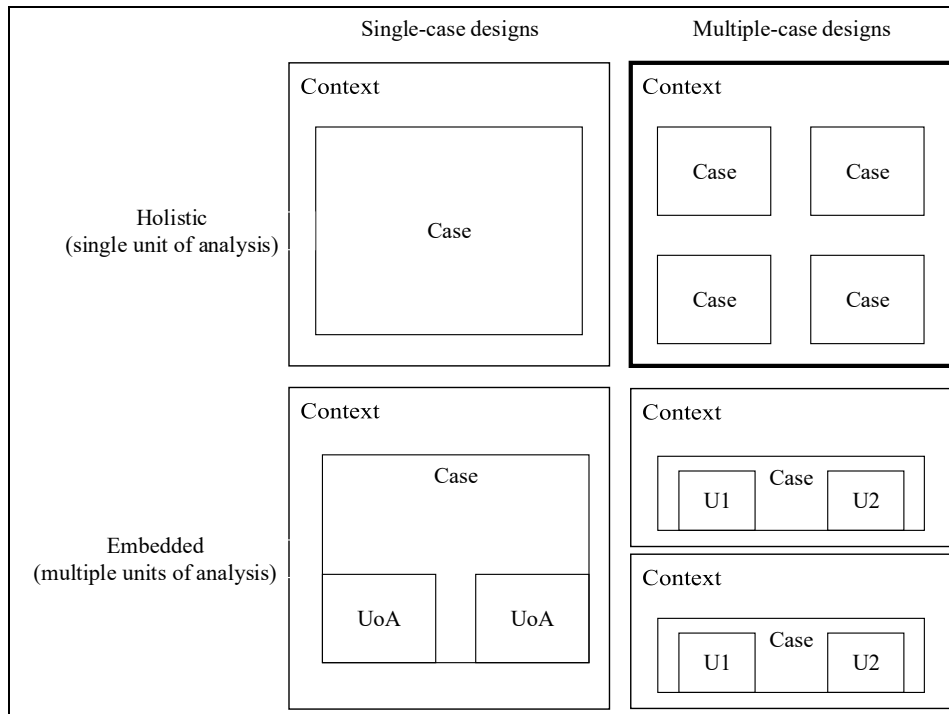


Figure 12 - Basic types of Designs for case studies (COSMOS Corporation)

3.1 Case selection

In this paragraph, the selection of the projects for the empirical analysis is described. Enpuls is involved in many different projects, scattered over different themes with their respective characteristics. The unit of analysis is one single collaboration project involving external stakeholders, this will be referred to as a case from this point. The project portfolio of Enpuls is categorized to search for applicable cases, next, the selection requirements are presented.

In the project portfolio of Enpuls, three types of projects are identified. All projects have in common that they are executed in a sustainability-oriented context. Retrieved from the explorative interviews with project leaders and theme owners from paragraph 1.2, the project types with motivations are shown in Table 7.

Table 7 - Types of projects at Enpuls

Type of project	Description
Internal originated project	Some projects are originated and developed internally. There is no question of interorganizational collaborations or open innovation concepts.
Customer/Supplier relationship	Some projects are mature or are managed by an external organization. There are no (more) signs of ongoing interorganizational collaboration or open innovation concepts.
Interorganizational collaboration project	Some projects are originated within external collaborations or are based upon them. There are indicators of ongoing interorganizational collaborations or open innovation concepts.

From the projects that are categorized as an *interorganizational collaboration project*, maximum variation sampling is applied to find important shared patterns across the heterogeneous cases (Patton, 2015). This corresponds to the explorative character of this master thesis. The following requirements are taken into account when selecting from the remaining cases:

1. The case must involve external stakeholders, who collaborate on a regular basis.
2. The main goal of the project must involve creating new concepts or solutions, or in other word, needs to have signs of (open) innovation.
3. The case status is active or finished.
4. Information and employees involved in the case are available for investigation.

The requirement regarding availability involves the overall availability of data and employees involved in the particular case. Secondly, the willingness from employees to participate in the data collection part is key to investigate a case thoroughly. The status (active or finished) of a case can produce extra perspectives during the analysis on what could not be foreseen upfront.

To ensure an unbiased selection of cases that match the requirements mentioned above, the *interorganizational collaboration projects* which are indicated in Table 7 are matched with the selection requirements together with project leaders and theme owners of Enpuls. This resulted in the following selection of cases with their corresponding theme, shown in Table 8.

Table 8 - Project selection for investigation with status and interviews

Case ID	Project name	Status	Conducted interviews	Theme
Case 1	Exentr	Active	3	ND
Case 2	Slim Energienet Roermond (SER)	Active	3	SAD
Case 3	Jouw Energie Moment 2.0 (JEM-GO)	Finished	1	FL
Case 4	Bedrijfskracht	Active	3	ES

From the selected cases, involved employees of Enpuls are interviewed to retrieve qualitative data on the experiences and opinions of each case. The interviews follow a semi-structured approach to focus on the characteristics of interest in interorganizational collaborations. A more detailed explanation on the interview methodology is given in paragraph 3.2.

3.2 Data collection

In this paragraph, the methodology is described how the data is collected for the empirical analysis. This includes the approach of how the interviews are conducted and how secondary data related to the cases is gathered.

The data collection in this study consists of semi-structured interviews which are conducted by the researcher in an one-to-one setting. Next to the interviews, secondary data like presentations or reports which are related to a particular case were reviewed. The data collection, processing and analysis in this study consists of five stages: (1) conducting and transcribing the interviews related to each case; (2) defining the coding categories based on findings from the theoretical background; (3) (open-)coding the transcribed interviews and secondary data; (4) testing and measuring the reliability of the coding; and (5) analyzing the patterns and relationships between the cases and against the literature findings (Gorden, 1998). The used methodology of the five stages is presented in this paragraph until paragraph 3.3.

In total, 10 employees were interviewed in the time period August 2018 – October 2018. This resulted in 65 full pages of verbatim transcript. In Table 8, the number of interviews related to one single case and the status is shown. The status indicator shows if the case is active or finished in the organization. When the interviews were conducted, all cases were active and being worked on except for case 3, which was finished. In case 3 only one interview was conducted due to the absence of other possible interviewees. The interview of case 3 was however conducted with the theme-owner, which made it possible to obtain a holistic perspective. Final reports and presentations of case 3 were provided to complement the primary data.

Table 9 - Overview interviewees and duration

Case	Person	Function	Date	Duration	Identifier
1	1	Explorer	20/08/2018	00:48:02	R1.1
1	2	Theme Owner ND	27/08/2018	00:36:37	R2.1
1	3	Area Explorer	29/08/2018	00:34:19	R3.1
2	4	Project Leader	29/08/2018	00:46:52	R4.2
3	5	Theme Owner FL	31/08/2018	00:42:31	R5.3
2	6	Area Explorer	26/09/2018	00:44:40	R6.2
2	7	Developer	01/10/2018	00:42:09	R7.2
4	8	Project Leader	12/10/2018	00:37:28	R8.4
4	9	Developer	12/10/2018	00:50:40	R9.4
4	10	Communication advisor	12/10/2018	00:50:40	R10.4
			Total	06:23:18 h	

To guarantee a high-quality research design, secondary data like reports and presentations were collected when available for each case to include multiple sources of evidence. This form of triangulation increases construct validity and reliability (Yin, 2014). An overview of the secondary data with corresponding identifiers is shown in Table 10. Two presentations with the case identifier 0 are used as general documents and not related to a specific case.

Table 10 - Overview of secondary data

Document description	Identifier
Presentation of annual plan Enpuls 2018	D1.0
Presentation of new strategy 2019	D1.0
Presentation value proposition related to Case 1 - Exentr	D1.1
Letter of Intent (LOI), agreement of development Case 2 - SER	D1.2
Final report Case 3 – JEM2	D1.3
Final report Case 3 – JEM-GO	D2.3
Presentation of project evaluation Case 3 – JEM-GO	D3.3
Website of Case 4	D1.4

In this section, the collection and processing of the primary data is described. The interviews follow a semi-structured approach using a list of specific topics and questions but leaving sufficient room for extra information (Aken et al., 2007). The interview topics are with their description shown in Table 11. A comprehensive interview protocol including all questions and definitions is shown in Appendix D.

Table 11 - Interview topics

Topic	Description	References
Introduction	Acknowledgements and introduction to the research topic	n.a.
Personal background	Professional background of the employee	n.a.
Case details	General and historical context of the case	n.a.
Dimensions	Reflection and opinions on the structural, relational and cognitive dimension with corresponding attributes and mechanisms	(Matinheikki et al., 2016; Okhuysen & Bechky, 2009)
Open innovation management	Feedback on open innovation management roles with respect to case	(Ollila & Yström, 2017)
Success and failure indicators	Success and failure indicators of the case that resulted in barriers and enablers	n.a.
Closing	Final remarks and room for additional feedback in the context of the research	n.a.

3.3 Data processing and analysis

The first stage of the data collection includes a verbatim transcription of all interviews. The interviews are audio recorded and manually transcribed by the researcher. In the second stage, all transcriptions are read to identify applicable categories for the coding. The three identified dimensions from the theoretical background are used as key categories in the coding protocol. When this stage is finished, the interviews are further coded following an open coding protocol (Corbin & Strauss, 1990).

In the third stage, the interviews are coded using a template approach from the perspective of the three key dimensions as discussed in paragraph 2.5. Including the other emerged themes and attributes, the resulting coding categories with their description are shown in Table 12. In total, 6 coding categories were used to group all data. The category personal information includes codes related to the personal background of the employee, regarding education or former employers. The category case details, includes all general details of the case under investigation. This is objective information without opinions or experiences. The next three dimensions are case-specific coding categories with opinions and experiences of the employee about the case. The last category, includes all other codes which are not case-specific. Some examples are the feedback on the open innovation model and success and failure indicators in collaborations.

To improve the quality of qualitative research, several methods are available at the disposal of the researcher. In this master thesis, *multiple coding* and *triangulation* are chosen as the methods of preference (Barbour, 2001). These methods are complemented with practitioner research and described at the end of this paragraph.

In the fourth stage, the reliability of the coding is investigated. To increase the level of integrity and competence of the researcher, the codebook is reviewed by another independent researcher³ following the method of Berends & Johnston, (2005). After an initial discussion, coding categories and coding constructs were reviewed and improved until consensus was reached between the two researchers. Subsequently, one interview was manually checked for agreement in the application of the codes. After this revision, the coding book was finalized with the retrieved feedback and used during further analyzing of the empirical data. The qualitative approach to the review of the codes helped to identify reasons for disagreement or consensus.

A quantitative method to compare the coding was not applicable due to compatibility issues between the used coding software⁴. The final coding book is with the corresponding instructions shown in Appendix E. In the fifth and final stage of the data collection and analysis, the data is evaluated on patterns and relationships between the cases.

Next to the primary and secondary data, the researcher conducted the research within Enpuls. This included for example attending strategy and general meetings to gain more insight in the day to day operations of the company. This form of practitioner research provided insightful information that contributed to the overall understanding of the research questions.

³ T.G.J. (Tom) Selten, MSc graduation student at TU/e

⁴ NVivo 12 Pro by QSR International for Windows. The other researcher used the Macintosh version.

Table 12 - Coding categories with description and attributes

Coding categories	Description and Attributes
Personal information (PERS)	Information regarding the personal background of the interviewee. attributes: function, theme, starting date, education, former employers
Case details (CASE)	Information regarding the general details of the case under investigation. attributes: project name, start date, involved stakeholders
Structural dimension (STRU)	Specific characteristics regarding the structural dimension of the case. attributes: organizational aspects, centralization, resources, role divisions, density, performance management, decision making, meetings
Relational dimension (RELA)	Specific characteristics regarding the relational dimension of the case. attributes: trust, tie strength, communication, knowledge transfer
Cognitive dimension (COGN)	Specific characteristics regarding the cognitive dimension of the case. attributes: shared vision or goal, goal alignment
Other (OTHE)	General data of interest that doesn't fit in the specific case context of the categories mentioned above. attributes: key success or fail indicators, reflection on the literature, ideal collaboration, desired situation, general need

In Table 13, an excerpt from the coding book is shown regarding the structural dimension. Every unique coding node has a short description and empirical indicators to code relevant information.

Table 13 - Excerpt from coding book

Coding node	Description	Empirical indicators
Stru_location	Meeting place or opinions about location	Geographical locations
Stru_meeting_frequency	Frequency of which meetings are held	Weekly, monthly

In the fifth and final stage, is described which methods are used during the empirical analysis and how they are approached. When performing qualitative research, there are several methods to choose from to analyze the processed data. Cross-case analysis is for example a research method that facilitates the comparison of similarities and differences between the units of analysis in case studies (Khan & Vanwynsberghe, 2008). It also enhances generalizability and it deepens understanding and explanation (Miles & Huberman, 1994). In cross-case analysis, a distinction can be made between variable-oriented approaches and case-oriented approaches. Both methods are briefly explained.

The variables retrieved during the empirical analysis can be used as an input to create tables to create an overview of similarities and differences between cases. Two examples of variable oriented approaches are Mill’s methods, the method of difference and the method of agreement (Mill, 1843). In the example in Table 14 of the method of difference where similar cases are selected, characteristic D seems to be the key variable that is responsible for the case to be recognized as a success.

Theoretically, key success factors in collaborations can be indicated with such an analysis. However, innovation processes are characterized by complex and unique situations. Variable-oriented approaches in cross-case analysis are therefore a challenge to conduct, because a fair comparison is difficult to achieve, due to the plethora of (case-unique) factors. In other words, successful or unsuccessful outcomes can have a complex web of causes, which are difficult if not impossible to indicate as deterministic (Khan & Vanwynsberghe, 2008). A consequence of this is also that a Boolean indicator whether a case is a success or a failure is absent. When a case is for example identified as a failure, the learnings can still be perceived as a success.

Table 14 – Example of method of difference (Mill, 1843)

Case	Characteristic A	Characteristic B	Characteristic C	Characteristic D
Case 1 (failure)	x	x	x	
Case 2 (success)	x	x	x	x

In case-oriented approaches, similarities across multiple instances of a phenomenon may contribute to conditional generalizations. The researcher can therefore show that the outcomes of the case analysis have enough similarities to be treated as instances of the same thing. Instead of the variables across cases, more emphasis is given to the case itself (Miles & Huberman, 1994). Miles & Huberman also suggest that stacking, building truth tables and narrative models are a mixture of case- and variable oriented approaches. Both techniques and especially the tables and narrative models are used in the empirical analysis.

To summarize this paragraph, the processing and analysis of the data is visually presented in Figure 13. First, the data is collected and coding categories are defined. The coding of the primary and secondary data is subsequently followed by the validation of the quality of the coding. Then, the data is ready for the analysis and identification of the barriers and enablers. The barriers and enablers are categorized using Factoring (Miles & Huberman, 1994) during the analysis. The challenges are finally analyzed per project phase of the respective case, to discover if challenges change over time.

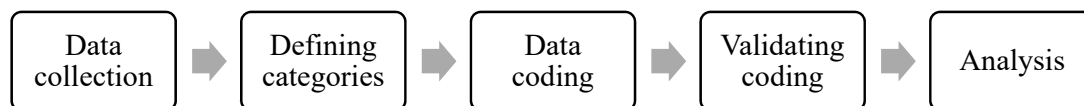


Figure 13 - Data processing and analysis process (Gorden, 1998)

3.4 Design and testing

In this paragraph, the methodology is described how the design of the solution is approached and how the design is tested. After the analysis and diagnosis step of the reflective cycle from paragraph 1.4, the plan of action follows which involves the design of the solution (Aken et al., 2007). Second, the process of synthesis-evaluation iterations is illustrated in Figure 14 and briefly explained below.

The design process is characterized by an iteration step that provides feedback to the synthesis, where it is compared again with the design specifications. This process is followed to develop an evaluated and accepted design solution. A method of developing creative solutions to business problems is the idealized design approach (Ackoff, 1981). In the idealized design methodology, one designs an ideal solution to the business problem. The difference between an idealized design approach and a normal design approach, is that in the first one the problems of changing the present to the ideal are not taken into account. Therefore, idealized design is usually not a redesign. As there is currently no existing process in the organization of the focal company, the idealized design method is applicable and therefore chosen as preferred approach.

The design specifications (*design requirements*) are drafted together with the theme owner ND from Enpuls based on the results of the empirical analysis. From the design specifications, design parameters and design alternatives are proposed.

During the weekly company presentation, the concept of the design solution is presented to receive feedback. Every attendant was asked to apply the design solution to their own working experience and provide feedback. After this round of evaluation, a new synthesis was made what resulted in the final justified design solution in chapter 5.

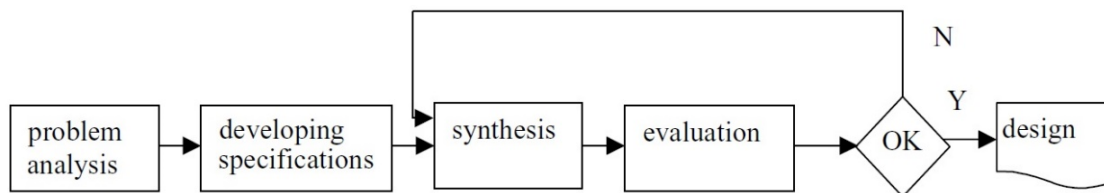


Figure 14 - Key activities in designing synthesis-evaluation iterations (Aken et al., 2007)

4. Empirical analysis and results

In this chapter, the empirical analysis of the collected data is presented. First, the analyzed cases are described to get a better understanding of the data. Second, the investigated cases are cross-analyzed against the dimensions, attributes and mechanisms as discussed in chapter 2 to search for similarities and differences. Third, the identified barriers and enablers are first categorized into challenges and second how they change over time.

4.1 Case descriptions

In this paragraph, a short summary is presented of the selected cases before the cross-case analysis. During the empirical analysis, quotes and insights from the primary and secondary data are used to illustrate the findings. A quote from the primary data is indicated with quotation marks and is formatted in italic. A quote is followed by (R-X,Y), where X is the respondent number and Y is the case identifier. A reference to the secondary data is indicated by (D-X,Y), where X is the document number and Y is the case identifier. In Appendix A, the list of respondents can be found.

Case 1 - Exentr

Exentr is an interorganizational collaboration with five partners in total. The goal of Exentr is to develop challenges in the context of the energy transition, where start-ups, scale-ups and other innovative companies can work on a challenge, combining their individual solutions to create new concepts to solve bigger challenges. The partners are located in the same geographical area of Enpuls, the province Noord-Brabant in the Netherlands. The partners include a commercial energy supplier, an economic knowledge developing organization, a public venture capitalist and a technical university. The idea of this collaboration is originated in 2014, after two years of exploratory discussions it became a project in the organization of Enpuls in 2016. After a few changes in responsibilities and functions at Enpuls, in the beginning of 2018 more focus was assigned to Exentr and the organization of the collaboration received more attention. The collaboration has the intention to form a non-profit foundation and focuses geographically on the area of Eindhoven (D1.1).

Case 2 – Slim Energieneet Roermond (SER)

SER is an interorganizational collaboration with in total ten partners, of which four are key. These key partners are located in the province Limburg. The key partners are a commercial paper manufacturer, the province board of Limburg, the municipality Roermond and Enpuls. The idea for this collaboration originated around 2012, with the vision of creating a sustainable energy system in the future for the municipality Roermond. The idea of this sustainable energy system, is that for example electricity, heat and biogas can be connected and exchanged on one system. The most concrete example which is currently explored, is transferring the residual heat created during the manufacturing process of the paper manufacturer to households. The use of residual heat from manufacturing processes can significantly reduce the emission of greenhouse gasses, which benefit the energy transition. Regarding resources, every consortium partner delivers between 0,2-0,3 FTE to the collaboration project. The other six consortia partners include for example a university of applied sciences, a housing corporation and a construction company. The remaining partners are informed during the process but do not actively

participate in the organization or development. The four key partners meet each other every two weeks in person on a separate location (D1.2).

Case 3 – Jouw Energie Moment 2.0 (JEM-GO)

Jouw Energie Moment-Geaggregeerde Opslag (JEM-GO) is an interorganizational collaboration with six partners. This case is a follow-up on a previous project with a comparable context. The goal of this collaboration is to explore the possibilities in changing consumer behavior by dynamic pricing of electricity. The partners are scattered in the north-west and south west of the Netherlands across three different provinces, but the location of the experiment was in the area of Breda and Etten-Leur. Participants in this collaboration were Enpuls, Enexis, an energy supplier, a technology consultant, a software developer and a research institute. During the experiments with dynamic pricing, two different groups were used to test the technical variations, where the first group of consumers used a collective electricity storage system and the second group an individual electricity storage system. Enexis, Enpuls and the energy supplier accounted for the largest amount of resources. During the collaboration, meetings were held on a weekly basis with the operational task group and quarterly with the strategic task group (D1.3; D2.3.3; D3.3).

Case 4 – Bedrijfkracht

Bedrijfkracht is an interorganizational collaboration with three partners and an additional corporate organization facilitate in the process of energy saving measures for the employees of the corporate organization. Besides Enpuls, a Transmission System Operator (TSO) of gas and an University of Applied Sciences are the main collaborating partners which are both located in the city of Groningen. The idea for this collaboration is originated in early 2017, where among all three partners the need existed to realize additional measures in CO2 reduction. Based on a similar concept of Enpuls where energy saving measures are realized in local communities, Bedrijfkracht was founded to realize energy saving measures among employees via the employer, as this is perceived as a trustful partner. By the means of suitcases equipped with tools and information, awareness is created among employees that can result in sustainable measures in their home-situation. Some examples of these measures are isolation, solar panels, heat-pumps or LED lighting. The meetings were divided between an operational and strategic group, where the first one had a monthly frequency and the last one a quarterly frequency (D1.4).

4.2 Cross-case analysis

In this paragraph, the empirical data is discussed in relation to the earlier identified dimensions with their corresponding attributes from paragraph 3.3. Every dimension is supported with the data presented in the table at the beginning of each paragraph. During the cross-case analysis, a comparison is made on the factual and objective data retrieved from the empirical data. First, the data related to the structural dimension is categorized and shown in Table 15. In Table 16 and Table 17 in the next paragraphs, the data is presented for the other dimensions. Emerging barriers and enablers are identified during the narrative cross-case analysis which are analyzed by the end of this paragraph.

4.2.1 Structural dimension

Table 15 - Data overview of the structural dimension

Attribute	Case 1 – Exentr	Case 2 – SER	Case 3 – JEM-GO	Case 4 - Bedrijfskracht
Resource division	Equal, 0,5 FTE	Equal, 0,2 FTE	Equal & 3rd party subsidies	Equal
Role division	Not explicitly appointed, but originated over time	Not explicitly appointed, but Enpuls coordinates	Not explicitly appointed, based on equivalence, two project leaders	Not explicitly appointed, UoA operational role
Performance management	Minimal	Minimal, deadlines	Minimal	Moderate
Legal form/contractual agreements	Non-profit organization (in formation)	Letter of Intent	Cooperation agreement	Existing cooperation agreement
Collaboration tools	Tool in the cloud	E-mail, phone	Storage in the cloud	E-mail, phone
Density	High (38km)	Medium (90km)	Medium (61km)	Low (230km)

When examining the **resource divisions** among the investigated cases in Table 15, most partners contribute with an equal amount of resources. Differences are found in monetary resources, which are not always contributed by each partner. In for example case 1, the resources that are committed to the collaboration are fairly equal. The commercial energy supplier and Enpuls both deliver 0,5 FTE and monetary resources to this collaboration. The economic knowledge developer, the public venture capitalist and the technical university deliver 0,5 FTE each but no monetary resources. Further, all involved parties agreed on a weekly meeting of two hours on a separate location on a predetermined time and date. In reality however, it seems to be an obstacle that there is a deviation in the perception of what every stakeholder defines as an FTE.

“Every partner agreed on participating with 0,5 FTE, but then it does not unfold the way we have agreed on it together. (...) One can interpret that [0,5 FTE] is equal to one person that spends 2,5 days a week there. Other parties say, that is spread across myself and another colleague. So the interpretations differ, what is actually 0,5 FTE?” (R1.1)

A deviation in the perception of resources could have an effect on the expectations of the other involved partners. When one of the partners participates with differing persons in the meetings, this could have a secondary negative effect on knowledge transfer and thus the desired outcomes. This phenomenon is also recognized in case 4, where the people who attended the meetings changed over and over.

“I’ve seen there around five different people, that were assigned to it for a few hours” (R8.4)

This identification of misunderstanding is collectively recognized among the cases and is therefore the first barrier:

Identified barrier 1 – misunderstanding in resource management

In addition to the resource division and especially monetary resources, it is notable that in case 3 a large part of the monetary resources were 3rd party subsidies. When these subsidies were depleted by the stakeholders during the case, the motivation to participate further in the collaboration diminished significantly. In the other cases, the monetary resources were contributed by the partners themselves.

Regarding the **role divisions**, in none of the investigated cases an explicit role division was present. The cases have in common that stakeholders participate on the basis of equivalence. However, in case 1 and 2, a division of the activities originated over time. When respondents were asked if a role division would contribute to a more successful outcome, almost all agreed. A consensus exists that in the beginning and exploration of a collaboration, an explicit role division would obstruct the relational terms. But when time continued however, an explicit role division with adequate responsibilities was perceived as welcome and helpful. When the amount and type of work is known, roles could be divided fitting the competence of the partners for example.

Identified enabler 1 – explicit responsibilities for each partner

When it comes to **performance management**, KPI’s or other measures are rarely actively used to keep track on performance in cases. The most concrete examples come from case 2 and 4. In case 2, a planning with deadlines is used to keep track of the progress. In case 4, a scorecard with for example the reduced amount of CO2 emissions in kg was used as a performance indicator. The overall insight is that indicators tracking performance are rarely used, but nonetheless are desired in a successful organized collaboration. One of the respondents was even triggered by this question that they could have implemented such indicators, but lacked implementing them. Case 1 is recognized by the strongest absence in terms of measurable milestones or a planning. In the long-term, there are no plans present for what will be executed in the future.

“There are no programs or complete roadmaps (...) the target is to do it before the end of this year.” (R1.1)

Identified barrier 2 – No clear performance or progress indicators

All cases have their own **legal form or contractual agreements**. Case 1 is the only collaboration with a new created legal entity in the form of a non-profit organization. Case 2 is based on a Letter of Intent (LOI) (D1.2) signed by the key partners and case 3 has a similar form of agreement. Case 4 is based on an existing umbrella agreement with one of the partners of the parent company. Similar to a role division in a collaboration, most respondents agree that starting a collaboration with legal contracts and negotiations is not a desired situation. But when the activities become more demanding in terms of resources and commitment, some form of legal agreements have to be implemented.

The only case that makes explicit use of **collaboration tools** is case 1. In the beginning of case 1, a schedule was present, but it lacked on the content and some partners could often not attend the meetings. This was resolved by scheduling on a fixed day every week and by using a tool in the cloud to keep track of actions and decisions.

“What has originated, is that a sort of administration has been set up in the cloud. (...) We use it as an agenda and to keep track on actions and decisions.” (R1.1)

In the other cases is trusted on more classical forms of collaboration tools and methods in the form of e-mail and phone calls. One respondent of case 2 indicates that the tool Trello is partly used, but is completely new to the other stakeholders that have no experience with it.

Identified barrier 3 – absence of collaboration tools

Most stakeholders are located in the same geographical area, indicated in Table 15 as **density**. A relative distinction is made on a one-way trip to compare the cases. In case 1 for example, the relative distance between the stakeholders is low (38km) compared to the distance between the stakeholders of case 4 (230km). By the respondents of case 4, distance was mentioned as one of the main obstacles during the collaboration. As a compromise, meetings were scheduled on half-way distances. Case 2 and case 3 score medium on density and respondents did not mention any problems regarding the locations of stakeholders.

Identified barrier 4 – distance between stakeholders

Concluding on the structural dimension, there is no systematic approach to the organization of interorganizational collaborations at Enpuls, which answers research sub-question 2. Every respondent uses their own experiences and knowledge to organize and structure activities with stakeholders. There exists however the need and awareness for a more structured approach among the respondents and several suggestions are made during the interviews.

4.2.2 Relational dimension

Table 16 - Data overview of the relational dimension

Attribute	Case 1 – Exentr	Case 2 – SER	Case 3 – JEM-GO	Case 4 - Bedrijfskracht
Meeting frequency	Weekly	Steering committee: quarterly Workgroup: Biweekly	Steering committee: quarterly Workgroup: weekly	Steering committee: quarterly Workgroup: monthly
Knowledge levels	High on stakeholders' expertise, low on goal of collaboration			
Social interactions, informal meetings	Not present	Not present	Not present	Not present
Decision making	Collectively	Steering committee and workgroup	Steering committee and workgroup	Steering committee and workgroup

The first attribute of the relational dimension is the **frequency of meetings**. When examining Table 16, all cases have a comparable schedule of meetings with their collaborating partners. A weekly or a biweekly meeting is perceived as the most pleasant frequency to work with. When this frequency lowers, respondents argue that other priorities then come first and the collaboration then deserves less attention.

During the meetings of case 1, the agenda, bottlenecks and other points of interest are discussed. This was not always the case, because beforehand the meetings were used as a working together meeting and this reduced the efficiency. After this has been structured, all partners perform their operational work outside the meeting. Eventually, the goal of all stakeholders is to work physically together one day a week on a new location.

Identified enabler 2 – frequent (personal) meetings

When it comes to the **knowledge levels** of stakeholders participating in collaborations, many opinions and experiences emerge. In case 1 for example, the inexperience at participating partners led to difficulties in translating the strategic message to operational tasks. This requires other skills and knowledge, which was underrepresented among the partners in the collaboration. The intention was present, but how that should look like in practice was unknown. The knowledge level of each of the stakeholders is perceived as high on their own disciplines. Only the specific knowledge and experience required for the realization of the collaboration with other companies is perceived as low.

Identified barrier 5 - lack of experience in interorganizational innovation processes

In case 2, it is stated that Enpuls has the most experience and in-depth knowledge among the other stakeholders regarding the subject of heat networks. The other stakeholders, in particular the province and the municipality, are process-oriented and lack the knowledge and development experience. This is also recognized in case 4, where a clear lack of organizational skills existed among the participating stakeholders. It is often recognized that stakeholders think they talk about the same and agree with each other, but when it comes to the execution large differences can appear.

“What I’ve noticed was that every partner was looking with a different lens at it and didn’t know where they were talking about.” (R2.1)

Identified barrier 6 - definition mismatch in knowledge perspectives

During the **social interactions** with stakeholders, only a few respondents recognize the importance of getting to know each other to establish trust. To know what kind of person someone is and his or her background, contributes to a better division in responsibilities and activities during a collaboration. An informal meeting is only mentioned by one of the respondents (R3.1).

Identified enabler 3 – social informal interactions with stakeholders

In case 2, 3 and 4, **decision making** is separated on two levels. There is a division between a steering committee and an operational workgroup. The operational workgroup often meets on the weekly or biweekly frequency and the steering committee sometimes quarterly. In case 1, decision making is done collectively among all participating partners.

4.2.3 Cognitive dimension

Table 17 - Data overview of the cognitive dimension

Attribute	Case 1 – Exentr	Case 2 – SER	Case 3 – JEM-GO	Case 4 - Bedrijfkracht
Shared goal	Creating the connection between innovations and market demands on a system level.	Reaching the climate change targets and CO2 reduction.	Exploring how financial incentives affect electricity consumption behavior.	CO2 reduction by creating awareness and offering solutions via the employer.
Consistent with parent company core business	Low	Moderate	Moderate	Low
Shared interests outside collaboration	Low	Moderate	Low	Low

The first attribute of the cognitive dimension starts also with the most occurring and important one, the **shared goal**. The goal of each case is described in Table 17.

In the beginning of case 1, big ideas and large business plans were present, but no consensus was reached on what should be the actual goal of the collaboration. The shared vision or goal of the collaboration was not clearly defined in the beginning and again interpretation differed among the stakeholders. In recent meetings, there was agreed on a more pragmatic approach. Every stakeholder committed for one year on developing two challenges, to validate the concept of the collaboration and to get an idea of the amount of work that comes with it.

“Exentr is brought together on the premise of, we should do something fun. (...) So first the consortium was brought together and then it was determined what we were going to do. (...) But when it became clear what we were going to do, the interest of partners increases or decreases” (R1.1)

In case 2, the shared goal is supported by the participating partners, focusing on measures to reduce CO2 emissions by the means of using residual heat from the paper manufacturer. Where Enpuls, the province and the municipality represent social interests, the paper manufacturer is a commercial organization focusing on revenue and profits. In this case however, the paper

manufacturer feels the social responsibility in contributing to a sustainable society and therefore provides the residual heat at no cost.

A goal doesn't have to be the same from the start of a collaboration, which is identified in case 3. During the process, the goals changed on what should be delivered before the project ended. This illustrates that a shared goal can be dynamic and change over time.

Identified barrier 7 – different goals between stakeholders

In case 4 the goal of the collaboration receives no extensive support by all partners. The respondents mention varying reasons where the differing in **parental company core business** is the most interesting one. With this statement, it is meant that the parent company goals are not in line with the goal of the collaboration. The goal of Enpuls is for example reducing CO2 emissions by implementing measures, where it is for the university of applied sciences studying behavioral change and for the TSO focusing on the distribution of natural gas. The tools that were used to create awareness that should result in energy saving measures became a target on its own.

Identified barrier 8 – goal of collaboration not core business of parental company

Related to the parental company core business, **shared interests outside collaboration** receives attention from a few respondents. In case 2, a successful implementation of the heat network benefits the paper manufacturer and the municipality the most by reaching their sustainability goals. Both stakeholders share however also outside this collaboration more sustainability goals, that illustrates their common interests. In case 1 however, the stakeholders vary more on shared interests, as for the energy supplier the commercial interests are more important and for the technical university in contrast the research opportunities. This barrier is illustrated with the following quote:

“Everyone has separate interests, but they are also participating from that point of view in the collaboration” (R1.1)

4.2.4 Other dimensions and attributes

During the coding of the interviews, many interesting insights emerged. All respondents were also asked about opinions and experiences beyond their specific case. In addition to this, the respondents were also asked about their opinions on a role division model proposed in literature in managing open innovation projects.

Feedback on role division model

The role division model as suggested by Ollila & Yström (2017), which is described in chapter 2, was shown to the respondent and every role was explained. After the introduction of the model, it was asked if it would benefit in their opinion the outcome of the collaboration, if it was implemented in their case. In Table 18, the sentiment of the role division model is summarized from very negative to very positive per respondent.

Table 18 - Reactions to role division model

Relative reaction	Respondents
Very positive	R2.1; R3.1
Positive	R4.2; R5.3; R7.2
Neutral	R1.1; R6.2
Negative	n.a.
Very negative	n.a.

The role division model as suggested by Ollila & Yström (2017) receives predominantly positive feedback and is recognized as helpful in organizing interorganizational collaborations. Some of the roles are already recognized in a case and that they originated over time. A few respondents point out that in their respective case, one of the roles is currently missing. The need of some explicit measures in the collaboration is recognized by almost all respondents. Only respondent 1 mentions that it could obstruct the innovative character of a collaboration and respondent 6's opinion is that due to practical limitations it has a small chance of success. Another important remark is that some of these role divisions appear hierarchical, what could diminish the sense of equivalence among the collaborating partners. Role divisions are also not perceived as a static model, but can be changing and thus dynamic over time.

In Table 19, the response sentiment per managerial role is shown. It is recognized that the role of Enpuls differs among the investigated cases and no strict structural approach is common.

Table 19 - Managerial roles and response sentiment

Managerial role	Response sentiment
<i>Facilitator</i>	Most recognized role, often indicated as project leader in collaborations.
<i>Tactician</i>	Recognized as most valuable, signaling problems or difficulties in time before escalation. Could have contributed to more positive outcomes in collaborations.
<i>Sensegiver</i>	Recognized as primary task for Enpuls in combination with the <i>tactician</i> role.

4.2.5 Barriers of all cases

During the cross-case analysis, the barriers that occurred most frequent were identified and numbered from 1 to 8. In this paragraph, all 17 barriers are shown that emerged during the empirical analysis.

All barriers are shown in Table 20 with the corresponding respondents. A few of the barriers are perceived by more respondents in more cases. B4 for example is related to the density attribute from the structural dimension. It is perceived as a great disadvantage in case 4 that the partners are located at the other side of the country. Barrier B9 indicates that the local governmental decision making units have a different organizational pace. The development of sustainability-oriented innovations often addresses changes in local regulations or policies, but due to the unfamiliarity with these innovations, vast amounts of time are required by provinces and municipalities to take decisions. In line with this barrier is also the perceived rigidity of the policies and regulations in the energy sector (B12). Most activities are all fixed by law and changes require support on all political levels, which is illustrated with the following quote:

“If I look at the energy sector where everything is quite rigid and fixed, there is relatively little room for innovation, so that’s also a problem” (R1.1)

Table 20 - Barriers of all cases

ID	Barriers	Respondents
B1	Misunderstanding in resource management	R1.1; R8.4
B2	No clear performance or progress indicators	R7.2; R1.1
B3	Absence of collaboration tools	R8.4; R7.2; R9.4
B4	Distance between stakeholders	R8.4; R9.4
B5	Lack of experience in interorganizational innovation processes	R7.2; R2.1
B6	Definition mismatch in knowledge perspectives	R2.1
B7	Different goals between stakeholders	R1.1
B8	Goal of collaboration not in line with parental company vision	R8.4
B9	(Political) Inertia	R4.2
B10	Lack of business model	R7.2
B11	Gap between steering group and workgroup	R9.4
B12	Rigid market/organizational regulations	R1.1
B13	Nonequivalence in decision making	R6.2
B14	Lack of explicit measures/responsibilities	R5.3
B15	Process leading over content	R3.1
B16	Interrupted schedule	R5.3
B17	Changing interests over time	R5.3

4.2.6 Enablers of all cases

Equal to the barrier summary, the most occurring enablers were identified and numbered during the empirical analysis from 1 to 3. In this paragraph, all 14 enablers are shown that emerged during the empirical analysis in Table 21. Most of the enablers emerged during the interviews when asked about the ideal situations and general needs.

An overall consensus exists among the interviewed employees that creating a shared goal, aligning the shared vision in the beginning of a collaboration is perceived as the most important enabler. What after that is pointed out as two important enablers, are frequent meetings and making responsibilities explicit with for example a role division. What has been indicated as an enabler by respondents in case 1 and 2, is the presence of experienced partners in innovation processes. Furthermore on an equally occurring amount, fulfilment of all desired competences, alignment with the parental company strategy and vision, long-term commitment, sufficient monetary resources and resource alignment among partners are other enablers.

During the interviews, there was room for personal input and perspectives on interorganizational collaborations in general. The need for a more structural approach to interorganizational collaborations inside Enpuls is also recognized by respondents (R7.2; R6.2; R9.4). Another insight is that the environment to innovate in needs to be present. With such an environment is meant the availability of resources in both monetary and human capital forms, complemented with no constraints or management involvement (R1.1; R8.4; R10.4). To let the interviewees step out from their own case and have a holistic perspective on the research topic, they were asked how in their opinions an ideal interorganizational collaboration would look like. These enablers are added to Table 21.

Table 21 - Enablers of all cases

ID	Enablers	Respondents
E1	Explicit responsibilities / role division	R2.1; R4.2; R5.3
E2	Frequent (personal) meetings	R7.2; R8.4; R6.2
E3	Social/Informal interactions with stakeholders	R3.1
E4	Goal alignment / shared vision	R8.4; R1.1; R3.1; R4.2
E5	Create conditions where innovation can take place in with time and money and experiment	R1.1; R8.4; R10.4
E6	Commercial interest combined with social importance, heterogenous partners, triple helix	R1.1; R7.2, R3.1
E7	Experienced partners in processes and innovation	R1.1; R6.2
E8	Aligned with parental company strategy/vision	R6.2
E9	Long-term commitment	R2.1
E10	Sufficient and aligned monetary resources	R3.1; R4.2
E11	Fulfilment of all desired competences/partners	R7.2
E12	Involvement of large corporate organizations	R8.4
E13	External facilitator in setting-up collaboration	R3.1
E14	Only involve necessary partners	R5.3

4.3 Challenges analysis

Based on the cross-case analysis of paragraph 4.1, a large number of barriers and enablers emerged among the evaluated dimensions. The feedback on the open innovation management model, general needs and ideal situations complete the holistic perspective on interorganizational collaborations. Some of the barriers are directly inversed or related to some enablers. When having a closer look at these retrieved insights, several interrelationships emerge. These interrelationships can be grouped and the following challenges were identified as a result in Table 22. Below the title of the challenge, the related barriers and enablers are indicated with (B# or E#). The other challenges are derived from the 2nd order coding and rereading of the interview transcripts. The 9 challenges that emerged during organizing interorganizational collaborations at Enpuls are briefly discussed below.

Table 22 - Identified challenges in cases

Challenge	Description	1	2	3	4
Responsibility (E1)	Stakeholders lack taking responsibility	X		X	
Distance (B4)	Physical distance between stakeholders	X			X
Motivation (B16; B17)	Lack of motivation to collaborate			X	
Definition mismatch (B1; B6)	Definition mismatch and interpretation deviations	X			
Goal alignment (B7; B8; E4)	Shared interest alignment	X	X	X	X
Political inertia (B9)	Slowed down processes due to provinces/municipalities		X		
Knowledge levels (B5)	Insufficient knowledge on topic or experience in interorganizational collaborations	X	X		
Intention-to-action (R8.4; R3.1; B9)	Barrier between the talking in meetings and executing the activities	X			X
Operational management (B2; B3; E2)	Project management activities, including planning	X			X

When it comes to the challenge of **responsibility**, it is noted in some cases that not every partner in a collaboration was executing the task related to their competences or even executing it at all, where it is closely related to the motivational challenge and the intention-to-action barrier. An example of the responsibility challenge is illustrated with the quote below:

“If I don’t do it, it won’t happen at all (...) and if the other partners would do it, they would look at each other asking themselves how” (R1.1)

The **distance** between stakeholders appeared as a barrier in case 4 and as an enabler in case 1. It is noted that distance as a barrier has more effect on the outcome than as an enabler during the empirical analysis.

The **motivational** challenge is mostly related to case 3, where near the end of the collaboration the subsidies were depleted and stakeholders almost stopped executing their activities. A concrete planning, complemented with a tight budget forecast could help dealing with this challenge.

A communication related challenge is the **definition mismatch** challenge. As every partner in a collaboration operates with their own knowledge field and expertise, misunderstandings in agreements can occur causing delays and relational damage.

When collaborating stakeholders are not explicit about the **shared vision or goals**, deviations in perceptions among the stakeholders emerge. When time continues and the shared vision or goals are not in line with each other, partners can lose interest and in the worst case leave a consortium, wasting time and resources.

Political inertia is mostly recognized by case 2, as it has a large impact on the area planning of the municipality and the province. The decision making process of a governmental organization has a much longer lead time compared to the collaborations of Enpuls with private organizations.

The challenge that addresses the **knowledge levels** of stakeholders includes also the experience with innovation processes. The knowledge of every stakeholder is perceived high on their core business, but does not always include experience with innovation processes or interorganizational collaborations.

One of the more abstract challenges is the **intention-to-action** challenge, which is in other words, respondents recognize that there exists often a great intention to undertake a lot of things, but when it comes to the execution new hurdles come up. These hurdles are for example misunderstandings in what the joint activities should be, lacking resources or no available capacity for the execution of the collectively set goals.

A fairly trivial activity that emerged as the last challenge, is **operational management**. In case 1, the organization during the early stage of the collaboration went not very smoothly. No clear goals were set on what the stakeholders were planning to achieve. Some stakeholders proposed executing activities as searching for a new logo while the shared vision or goal was not even set. Parallel to case 4, the lack of operational management emerged as the largest barrier. Project managers that would be responsible for the execution of the activities were absent.

Concluding on the emerged challenges, another main concern of respondents in innovating in the context of the energy transition, is that the energy markets are quite rigid and inflexible. The desired innovations on a system level, require changes in regulations and an approach from an integral perspective. As a large amount of the concepts and innovations address municipalities and provinces, the inertia during decision making has a major role in the development and execution.

Following this categorization of barriers and enablers into challenges, an extra analysis is made with regard to time in the next paragraph to investigate the effects per project phase.

4.3.1 Challenge analysis over time

Concluding from the categorization of barriers and enablers, it appears that challenges vary over time. To investigate this phenomenon, an extra analysis is made with the challenges and the project phase. A division is made between the cases in their progress, the begin phase, the intermediate phase and the end phase.

The investigated cases are categorized relatively in three different phases: (1) begin phase, (2) intermediate phase and (3) end phase. The phases with their motivation are briefly discussed in Table 23. In case 1, there are still exploratory discussions held among the partners on how the collaboration should be organized and what the legal form should look like. Therefore, case 1 is categorized in the begin phase. Case 2 and 4 are both ongoing for a longer period of time and resources are committed to the collaboration by all partners. This is categorized as the intermediate phase. The last investigated case, case 4, is finalized at the end of the first quarter of 2018. Therefore, it is assigned to the end phase in the comparison.

Table 23 - Phase categorization and motivation

Phase of project	Motivation
Begin phase	Exploratory discussions, no legal contracts or other agreements in forms of commitment
Intermediate phase	Reoccurring meetings, committed resources, legal forms of agreements, executing activities
End phase	Reoccurring meetings stopped, no more commitment, activities stopped

In Figure 15, the investigated cases are visually represented among a timeline with the three different phases. The goal of this distinction on phase, is to discover if and how the earlier identified challenges and obstacles differ over time.

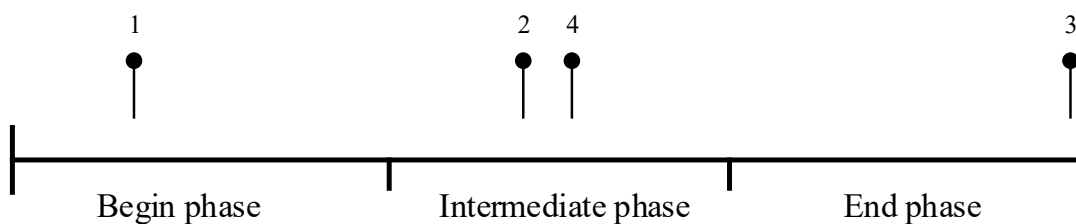


Figure 15 - Timeline representation of cases

Some of the challenges are prevalent more in a case compared to others. To gather insight in how the phase of a case influences the experienced challenges, the identified challenges are matched with the project phase in Table 24.

Table 24 - Challenges analyzed per project phase

Challenges	Begin phase	Intermediate phase		End phase
	Case 1	Case 2	Case 4	Case 3
Responsibility				X
Distance			X	
Motivation				X
Definition mismatch	X	X	X	
Goal alignment	X			
Political inertia		X		
Knowledge levels	X	X	X	
Intention-to-action	X	X	X	
Operational management	X	X	X	

What can be derived from Table 24, is that the challenges change over time during the project depending on the phase. According to the phase of a collaboration, starting with the *begin phase*, ambitious plans exist coming from all stakeholders. The biggest challenge is then aligning these plans, goals and visions into one that is shared and supported by all stakeholders, which is categorized as the challenge goal alignment.

In the *intermediate phase*, distance and political inertia emerge as new challenges and goal alignment diminishes in this phase. Several challenges from the *begin phase* still occur during the *intermediate phase* and require attention.

But even when goal alignment has been set in the begin phase, due to changing markets and stakeholder interests, the shared goal can change over time from one of the stakeholders. This was the problem in case 3, where one of the stakeholders changed their company strategy from consumer oriented to a business oriented model. The strategy change resulted, that the existing collaboration became significantly less important to this stakeholder. This had a major impact to the outcome of the collaboration, as the motivation diminished among the partners. The remaining partners and especially Enexis and Enpuls, tried to regroup the collaboration by adjusting and determining new goals. This resulted in meeting only a minimum amount of the original objectives. With the help of an external consultant, the gathered data of the experiments were processed and reported. Due to the lack of motivation, resources and subsidies, the contribution of each partner was minimal, what resulted in poor results.

It must be stated that despite it is indicated that challenges differ over time, there is not enough empirical evidence to prove that there is also a causal relationship between the phases and challenges. The contribution of this qualitative analysis is more in the awareness of challenges during interorganizational collaborations in the sustainability context. Due to the unique nature and characteristics of each case, there is no statement made about causality. In the next paragraph, the results are discussed against the backdrop of the theoretical background.

4.4 Results discussion

In chapter 4, several techniques were used to analyze the empirical data, resulting in barriers, enablers and the latent challenges. By summarizing the analysis, the following results are discussed against the theoretical background in this paragraph. The discussion of the results is divided in three parts: (1) interorganizational collaboration management, (2) open innovation management and (3) sustainability oriented innovation.

Interorganizational collaboration perspective

Every case has its own characteristics and specialty in the field it is operated in. Although every case differs considerably from one another, similarities emerged among the identified barriers and enablers. In for example case 1, the focus is on the development of concepts in the context of the energy transition by connecting start-ups, scale-ups and other innovative companies. The partners involved in the origination of case 1 differ particularly on market, business model and social importance. This is recognized as a heterogeneous group of partners in the collaboration. This is in line with the other cases, where again collaborations exist between universities, research institutes, consultancies, energy suppliers and grid operators. This multidisciplinary approach has several advantages when it comes to developing concepts and solutions for the energy transition, as this requires the input from all stakeholder perspectives. This is confirmed by one of the enablers that emerged in the ideal situation, where respondents agreed on a heterogeneous combination of stakeholders (R1.1; R7.2, R3.1). This could be for example the *triple helix*, where an university, a business and a government are represented in a collaboration.

These findings confirm that “in a field of rapid technological development, the locus of innovation is found within the networks of interorganizational relationships” (Powell et al., 1996). Also stated in their work, is that in the context of taking part in a community requires different kinds of organizations and organizational practices.

This multidisciplinary approach also has a drawback in terms of knowledge transfer and definition mismatches. Because every stakeholder uses their own knowledge and expertise, even the smallest deviations in definitions and understandings can induce large misunderstandings over time. An example that clearly illustrates this drawback, is the following quote from case 2.

“Sometimes we needed a full morning, just to get clear and to write down which steps were required to divide the project. (...) And if I say to you, can you do that? And we don’t mean the same, that was sometimes the biggest part of a meeting.” (R6.2)

This challenge in aligning definitions and process steps is one of the most important actions to undertake in organizing interorganizational collaborations. In line with the response of R6.2, this phenomenon is also recognized by the respondents of case 1.

Another important challenge to deal with is the intention-to-action barrier. Most respondents agree on the fact that a lot of stakeholders love to talk about collaborating and developing plans for it, but when it comes to the execution of them, a barrier exists for example in monetary or human resources, company policy or definition mismatch (R8.4; R3.1; R5.3). The only case where this is not explicitly recognized as a barrier, is in case 2 where already legal agreements

and long-term commitments are made. This indicated that during the whole process of an ongoing collaboration, commitment must be secured. Several options could be organizing the collaboration in a separate entity (Case 1), signing a Letter of Intent (Case 2), or other contractual agreements (Case 3, 4).

When comparing the empirical findings from this research to the body of knowledge from the theoretical background, the following insights emerge. The synthesis of the theoretical models of Matinheikki et al. (2016) and Okhuysen & Bechky (2009) from paragraph 2.5 was used during the research to reflect on the cases under investigation. The dimensions and attributes that were proposed provided a solid framework for investigating the interorganizational collaborations at Enpuls. The structural dimension received during the processing and analysis the most attention, in the forms of codes and opinions. The relational and cognitive dimension are more abstract in their definition, but the importance is no less than the structural. When looking again at the model of Figure 11, the attributes and activities are discussed against the backdrop of the empirical analysis in Table 25.

Table 25 – Results discussion against the backdrop of theoretical framework

Dimensions	Attributes	Activities	Empirical result
Structural	Centralization	Assigning leader role to a central organization	For discussion
	Density	Joint interorganizational coordination bodies	Validated
Relational	Trust		Validated
	Tie strength	Frequent meetings and interactions	Validated
Cognitive	Shared vision	Engagement of new actors in decision making	For discussion

The activity ‘assigning leader role to a central organization’ receives mild support by the empirical findings, as the equivalence among partners is perceived as valuable instead of a hierarchical structure. It depends on the context of the collaboration if a central leader role would benefit the outcome. The attribute ‘density’ receives empirical support from case 1 and 4, where in the first one it worked out very positive and in the last one it was indicated as a major obstacle. Trust and tie strength are both influenced by activities such as the frequent meetings and joint coordination bodies. Both are validated, as these attributes in the relational dimension received notably support by the empirical data. The last activity however, ‘engagement of new actors in decision making’, adds more stakeholders to the decision making process that could lead to (political) inertia which was designated as a major obstacle. As the respondents indicated that a ‘less-is-more’ attitude to collaborating partners is appreciated, this activity remains a point of discussion.

Reflecting on the work of Thomson & Perry (2006), they proposed five collaboration process dimensions that public managers can use in their daily experiences with collaboration partners. The five dimensions are (1) governance, (2) administration, (3) organizational autonomy, (4) mutuality, and (5) norms of trust and reciprocity. The process dimensions have commonalities with the used dimensions in this master thesis and new insights are explained.

The governance and administration dimensions have parallels with the relational dimension, as they argue that the key to getting things done in a collaborative setting, is to find the right balance between administrative capacity (coordination and hierarchy) and social capacity to build relationships. During the empirical analysis, it is found that interorganizational collaborations focusing on sustainability-oriented innovations are based upon equivalence among stakeholders. In case 3 however, the need existed for more administrative capacity near the end of the project. This illustrates that interorganizational collaborations focusing on sustainability-oriented innovations are started upon relational attributes but require more structural mechanisms over time, which is also illustrated in paragraph 4.3.

Open innovation management perspective

The theoretical background on open innovation management indicated that research on practice, managerial challenges and complementary partners is still underrepresented (Giannopoulou et al., 2011; Ollila & Yström, 2017). Therefore, one of the main goals of this study is to present the challenges that emerged during the empirical analysis.

All respondents were asked about their opinions on the open innovation management role model as suggested by Ollila & Yström (2017) to validate if these suggestions are in line with this case-study. The overall consensus is that making responsibilities and activities explicit for every partner in a collaboration can significantly contribute to the desired outcomes, which is also empirically validated with the responses of the interviewees. A contribution to their work, is that in the context of this study, the proposed role model can vary over time and should therefore have a more dynamic character. This enables a flexible change or replacement of roles when necessary due to unforeseen circumstances.

The unique characteristics in the cases under research are in line with the organizational form of the adhocracy configuration, the classic management literature does therefore not apply here (Ollila & Yström, 2017).

Sustainability oriented innovation perspective

In the theoretical background, the insight is discussed that using open innovation as a concept for sustainability oriented innovation would have several positive arguments (M. Arnold & Barth, 2012; M. G. Arnold, 2011; De Medeiros et al., 2014; Hossain, 2013). This master thesis investigates this intersection of themes. In every investigated case, there are signs of open innovation practices in a sustainability-oriented context as classified in paragraph 3.1. This confirms the added value about the contribution of open innovation to sustainability-oriented innovation (OISI), which was not possible before due to a lack of available knowledge (Mustaquim & Nyström, 2014).

In the review of Rauter et al. (2017), OISI is considered as an outside-in process in the existing literature, where the internal development of sustainability-innovations is supported by the gathering of external knowledge. When comparing the investigated cases however, not all cases are originated in an outside-in process but also with an inside-out process or coupled process. In Table 26, the place of origination of the cases is shown with the corresponding process from Gassmann & Enkel (2004). Case 2 and 3 are classified as an outside-in process, because of the fact that the focal organization has no explicit role in the origination but has joined the collaboration in a later stage. Case 1 is actually a coupled process, as the idea comes from an internal employee but was given shape by external stakeholders.

Table 26 - Case comparison in relation to origination

Case	Origin	Type of process
1. Exentr	Among network of people	Coupled
2. SER	After external feasibility study	Outside-in
3. JEM-GO	Follow-up project	Outside-in
4. Bedrijfkracht	Derived from internal brainstorm session	Inside-out

In case 4, the idea for this SI is originated internally in the focal organization, where after the ideation phase complementing partners were integrated in the collaboration. This indicates that it is possible and not mentioned in literature before that OISI can also take place as an inside-out process in contrast to contemporary literature. The evidence is clear that OISI is actually a combination of the outside-in and inside-out process and therefore a coupled process according to the model of Gassmann & Enkel (2004).

In conclusion, the common denominator of all cases is sustainability-oriented innovation, this research indicates a strong relationship between open innovation in favor of sustainability-oriented innovation. Therefore, this study is in complete agreement to the following statement: “Applying open innovation in the context of sustainability seems to be reasonable, given the complexity of sustainability-innovation tasks and the need to exploit external knowledge sources, in order to develop, adopt and diffuse innovations.” (Rauter et al., 2017)

5. Design

In this chapter, the design artifacts are presented proceeding from the methodology of paragraph 3.4. First, the design requirements are taken into account and synthesized with the identified challenges from chapter 4. With this synthesis, a first concept of one of the design artifacts was made. Second, the concept was evaluated and received feedback from 24 employees of the focal company. After the concept testing, a new synthesis was made and the final design is presented in paragraph 5.3, followed by a new process in paragraph 5.5.

5.1 Design specifications and parameters

First, the design specifications are shown in Table 27 which indicate the desired requirements on four different levels (Aken et al., 2007). *Functional requirements* describe the required performance of the design solution. *User requirements* describe the demands from the employees that will work with the new design solution. *Boundary conditions* and *Design restrictions* make sure that the design solution fits within the organization and implementation is realistic.

Table 27 - Overview of the design specifications

Functional requirements	
1	The design solution should solve the business problem, which is the key requirement
2	The design solution should improve the process of organizing interorganizational collaborations
3	The benefits of the design solution should exceed the costs
User requirements	
4	The people which are currently working in the organization should have the competences needed to work with the design solution
5	The design solution should be user-friendly and thus not slowing the process down
Boundary conditions	
6	The design solution should fit in the current organizational structure and culture
7	The design solution should comply with the legal requirements of the organization
Design restrictions	
8	The design solution should be finished by 1 st of December 2018
9	The design solution should require no additional development costs

The design specifications are subsequently used to determine the design parameters. The design parameters indicate the design direction of the desired design solution. In discussion with the company supervisors, several design parameters are drafted with their corresponding range and value in Table 28. The combination of the design specifications and parameters leaves sufficient creativity for the researcher to design a satisfactory solution based on the empirical analysis and local business experience (Aken et al., 2007).

Table 28 - Design parameters

Parameter	Range	Value
Level of structure	Low – High	High
Level of control	Low – High	High
Number of addressed challenges	1 – 9	9
Level of flexibility	Low – High	High
Number of collaborations	0 – ~	~

5.2 Design directions and alternatives

In this paragraph, two design directions and two alternatives are presented and compared to each other. First, both design alternatives are briefly discussed. Second, both design alternatives are rated on several criteria and one design alternative is chosen to be further developed.

Based on the design specifications and parameters, several design directions are possible. The key challenges identified during the empirical analysis can be addressed in several ways. Therefore in this master thesis, a distinction is made between an internal and an external design direction. The internal design direction includes the development and execution inside the organization. An example of the external design direction would be outsourcing the interorganizational collaboration process to a consultant or interim project manager. Both *design restrictions* are not in favor of the external design direction, therefore the internal direction is chosen.

When synthesizing the literature findings, the identified challenges in the empirical analysis and the design requirements, a few design alternatives are possible. The goal is to develop an artifact that can be implemented in the organization of Enpuls and that can be easily used by involved employees. The artifact has a few design alternatives and can be developed in the form of a online or offline solution.

Design alternative 1 – Collaboration canvas

The collaboration canvas is a tool that completely focusses on the challenges that emerged during the empirical analysis. This creates awareness among the involved employees to address the challenges in organizing interorganizational collaborations.

Design alternative 2 – Collaboration cloud

Parallel to design alternative 1, design alternative 2 is an online version of the challenges to address during interorganizational collaborations. A online method introduces more flexibility and more managerial insights. The development of an online tool introduces however extra costs and development time.

Taking into account the design restrictions from paragraph 5.1, design alternative 1 is preferred over design alternative 2 as design alternative 1 requires no development cost and can be developed within the time constraints of the master thesis. The detailed solution design of alternative 1 is shown in paragraph 5.3.

5.3 Design artifact – collaboration canvas

The collaboration canvas has been developed as a tool that can be used in starting new collaborations or during the evaluation of existing ones. All challenges that have been identified during the empirical analysis are represented on the canvas. It makes sure that participating partners have an explicit role with corresponding responsibilities. In addition to that, all organizational and relational aspects are also covered. On a managerial aspect, this also improves the overview of all ongoing collaborations inside the organizations, as they can be easily compared in the same format. A brief explanation of the canvas is given below followed by the actual design.

On top of the canvas, the most important challenge is shown, where a clear shared goal or vision needs to be filled out in Figure 16. Below the shared goal/vision, there is room in this example for 4 partners. The company name needs to be filled out in the first column, followed by the role or competence this partner will fulfill. In the next two columns, the assigned resources and the responsible person is filled out. With this method, it is directly clear what every partner contributes to the collaboration.

Shared goal: <i>Connecting start-ups and scale-ups that focus on energy saving measures</i>			
Stakeholders	Role / Competence	Resources (€/FTE)	Responsible person
1. <i>Enpuls</i>	<i>Tactician / evaluate business models</i>	<i>€100k / 0,5 FTE</i>	<i>John Doe</i>
2. <i>University</i>	<i>Facilitator / network of companies</i>	<i>€100k / 0,5 FTE</i>	<i>John Doe</i>
3. <i>Energy supplier</i>	<i>Sensegiver / evaluate energy savings</i>	<i>€100k / 0,5 FTE</i>	<i>John Doe</i>
4. <i>Software developer</i>	<i>Operational / back-end development</i>	<i>€100k / 0,5 FTE</i>	<i>John Doe</i>
Organizational		Relational	
Meeting frequency:..... <i>Weekly</i>		Decision making:..... <i>Collectively</i>	
Location:..... <i>University Room A01</i>		Planning:..... <i>See attachment</i>	
Tools:..... <i>Trello, Google Drive</i>		KPI's:..... <i>No. of start-ups, savings in kWh</i>	
Agreements:..... <i>LOI of 1 year</i>		Social interactions:..... <i>Monthly informal get-together</i>	
Theme owner: <i>John Doe Sr.</i>			
Developer: <i>John Doe Jr.</i>			

Figure 16 - Collaboration canvas filled out example

In the lower left section, organizational aspects need to be filled out like the meeting frequency, the location, the used tools and if applicable a legal agreement. In the lower right section, relational aspects such as decision making, KPI's and management practices need to be filled out.

5.4 Design testing – user evaluation

The concept design artifact is evaluated with 24 employees of the organization. This concept of the collaboration canvas is presented during a company presentation at Enpuls. All attendees were handed a canvas in pairs, with the instructions to fill out the canvas for their own project that involved collaborations with other partners. After this exercise, all attendees wrote their feedback below the canvas and were collected again by the researcher. This resulted in 12 filled out design artifacts with valuable feedback. With this feedback, an iteration was made by a new synthesis with the design requirements and the challenges from the empirical analysis. The first concept used during this evaluation is shown in Appendix F. A brief summary of the received feedback on the design concept is given below.

During the first evaluation, a few of the used terms were ambiguous and not self-explaining. This evaluation of the concept actually confirmed the challenge of definition mismatch, even in the same organization. Also the column where the resources could be filled out received criticism. Not every collaboration or project works with FTE, or has for example a duration longer or shorter than a year. Another remark was that this design made clear on what shared goal partners would collaborate, but not on what conditions the partners in the collaboration would quit working together. This could be for example when a value of the parental organization would be harmed.

In the column where responsibilities could be filled out, there was not enough space for what exactly a partner was responsible for. More attention was also needed to what every partner would contribute in the collaboration regarding competences, knowledge and networks. A final distinction should be added on what operational level and what management level tasks and activities should be executed. The overall sentiment during the evaluation was positive in the way that the attendees recognized the need for a more systematic approach to the interorganizational collaborations.

5.5 Design artifact – collaboration process

The process design describes how the collaboration canvas can be implemented in the organization of Enpuls to organize the interorganizational collaborations. The implementation of the design is an iterative process consisting of four phases. Every phase consists of several activities that need to be performed during the particular phase. The four meeting phases are briefly described below.

1. *Cognitive meeting*

The goal of the cognitive meeting is to reach consensus on what would be the shared goal and vision of the collaboration. The reaching of consensus is parallel to the identifying and selecting of appropriate stakeholders. The proposed work of Meulman et al. (2018) on selecting partners in open innovation could be of help during this process. Goal alignment is in this meeting the key challenge.

2. *Relational meeting*

During the relational meeting, several challenges can be addressed by activities that create social interactions. These are for example setting the meeting frequencies, identifying the required competences and knowledge for reaching the shared goal and identify parameters or indicators that can be used to monitor the progress of the collaboration. Preventing definition mismatch and verifying knowledge levels are the key challenges.

3. *Structural meeting*

During the structural meeting, more specific activities have to be defined. This includes the division of tasks and activities with the responsible persons. If it is already necessary, resources can be committed and a legal agreement can be made. The decision making process among the stakeholders is also defined during this phase. Responsibility and distance are the key challenges.

4. *Operational meeting*

During the operational meeting, there is evaluated on the earlier defined progress indicators and responsibilities. To keep up with changing environments and interests, the process can restart at the cognitive meeting to restate the shared goal or vision. Preventing the intention-to-action barrier, motivation and operational management are the key challenges.

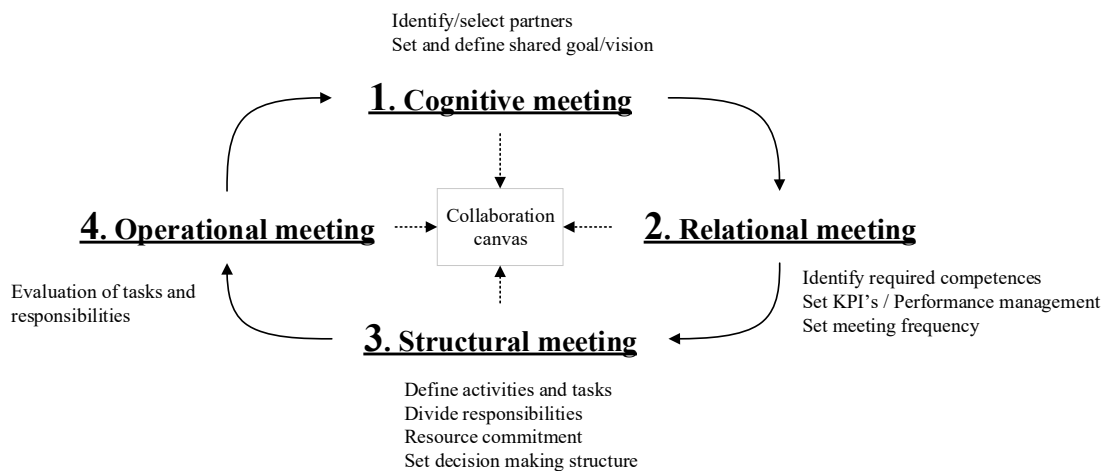


Figure 17 - Design artifact - collaboration process

6. Conclusion

This in-depth exploratory case study examined the interorganizational collaborations of Enpuls in the sustainability context of the energy transition of the Netherlands. With an in-depth investigation of four selected cases, barriers and enablers are identified during this process. The barriers and enablers are categorized into challenges, representing the key focus points in organizing interorganizational collaborations in a sustainability context.

Furthermore, a design is proposed to approach these challenges with a structured process and collaboration canvas. The design artifacts are both presented and reviewed during a company presentation at Enpuls. With the received feedback, a final iteration was made to the design. This chapter answers the research questions, discusses the theoretical and practical contributions and presents the limitations and recommendations for further research.

6.1 Answer to the research question

In this paragraph, the results of the thesis are discussed in relation to the research question. In chapter 1, the main research question was:

RQ: How can Enpuls, (re-)organize their internal process, to create more insight and structure in their interorganizational collaborations in the sustainable context of the energy transition?

To answer this question, several sub-questions were drafted and answered first to build a fundament of knowledge. From this fundament, the question can be answered as follows:

Enpuls can (re-)organize their inter-organizational collaboration process, by implementing the proposed design artifacts. The design artifacts create awareness and structure that support the best possible method to deal with the identified challenges during the empirical analysis. Together with an overview of the identified barriers and enablers, Enpuls has gained a comprehensive insight in the managerial practices of organizing inter-organizational collaborations for sustainability oriented innovations.

The identified challenges during the empirical analysis illustrate that in a dynamic environment of rapid change, the need exists for organizational improvements. Following from the design process, the *cognitive meeting* is key to create a shared goal and vision between the collaborating stakeholders. Then, in the *relational meeting*, agreements on the social interactions have to be made, including meeting frequencies, identifying stakeholders competences and performance indicators. During the *structural meeting*, the division of tasks and responsibilities is made between the stakeholders. The commitment of resources and setting up a decision making unit are included in this phase. The goal of the *operational meeting* is to deal with the challenge of the intention-to-action barrier. In this stage, it comes to the execution of the earlier identified tasks and responsibilities. Tracking and evaluating the performance indicators are key to reach the goals of the shared goals and vision. If due to changing markets or strategies the shared goal or vision is not valid anymore for all stakeholders, the process can start over again.

Interorganizational collaborations in the context of the energy transition are key and necessary because sustainability oriented innovations address many stakeholders. The challenges identified in the four investigated cases show that there are extensive differences among the origination of the challenges and no specific solution existed to date to deal with all of them. This study delivered therefore a tool with a corresponding process that can be implemented in the organization of Enpuls.

6.2 Theoretical contribution

This study stands on the shoulders of many previous scholars and extends the existing body of academic knowledge in several ways. This study made a first attempt to combine the perspectives from interorganizational collaboration management with open innovation management and sustainability-oriented innovation as illustrated in Figure 18. This unique combination of disciplines and the characteristics of Enpuls has resulted into the following theoretical contributions, which are discussed in this paragraph.



Figure 18 - Visual representation of theme relation

This study has identified an extensive list of barriers and enablers in organizing interorganizational collaborations in a sustainability-oriented innovation context. These barriers and enablers are grouped into 9 challenges that emerged during the empirical analysis. This study also indicated that some of the challenges are related more to a specific project phase. An example of this is the intention-to-action barrier, where stakeholders have the intention to achieve ambitious goals, but when it comes to the execution in the intermediate phase, responsibility or resources are lacking. Another example is the challenge regarding goal alignment between stakeholders in the begin phase.

With respect to the interorganizational collaboration literature, this study has validated and discussed several attributes, activities and mechanisms as discussed in paragraph 4.4. The unique characteristics of Enpuls indicated that stakeholders prefer collaborations on the basis of equivalence instead of assigning a central leader role. Involving only the necessary stakeholders to mitigate (political) inertia is also highly valued.

When it comes to the contribution to the open innovation management literature, this study has validated the need for managerial practices in the context of open innovation. The need for the suggested managerial role model of Ollila & Yström (2017), is empirically validated. In the

context of this research however, managerial roles are perceived as dynamic and the model should incorporate a more flexible character, enabling stakeholders to change their role if necessary. The contribution to the last theme of sustainability-oriented innovation can be found in the empirical evidence that in OISI, open innovation takes place with a coupled process instead of an outside-in process.

6.3 Limitations and further research

The following limitations apply to this thesis in terms of generalizability and methodology. First, the overall limitations of this study are discussed and second, some of the methodological limitations that need to be taken into account.

This explorative single-case study investigated four specific interorganizational collaborations in the context of the energy transition. The first limitation applies to the perspective of this study, where it has concentrated on a single perspective of the employees of Enpuls. In this study, it was chosen to investigate the in-depth perspectives of four different cases from one single organization. Because of the recent foundation of Enpuls in 2016, structures and processes are only present in a very small manner. Therefore, the focus of the thesis was to discover the challenges and obstacles in ongoing collaborations, so new collaborations in the future could profit from emerging managerial insights. This resulted in a very specific and valuable contribution for Enpuls, but limits the generalizability to other organizations in the same context.

One of the limitations in terms of generalization is that this research has focused on a single-case in the context of the energy transition. To validate existing or to develop new theory, more cases require an in-depth analysis in the context of the energy transition. Due to practical limitations in time and scope, it was chosen to focus on one single company.

Some of the methodological limitations are in this master thesis the execution by one single researcher. Another limitation is the translation deviation from the interviews that were conducted in the native language of the interviewees (Dutch) but quotes are used in English.

The following recommendations can be made for future research in these topics. First, a comparable case-study at another organization would be interesting to compare the identified barriers and enablers within the same context. Second, a research that would investigate the experienced challenges and perspectives from all collaborating partners would be interesting to execute. Third, a more quantitative approach to what extent several challenges contribute to the outcomes of a collaboration is recommended.

The next step in researching interorganizational innovation processes in a sustainability context would be more quantitative oriented. The challenges are now qualitatively identified, but how much they effect the process cannot be judged yet. A quantitative analysis including a large number of interorganizational collaborations in a comparable context would be interesting to discover the effects.

Finally, the effects of the context of sustainability-oriented innovations would be an interesting direction for further research. What are the differences and similarities with other organizational contexts and what are then the challenges in interorganizational collaborations?

6.4 Practical implications

The findings of this study also opens new perspectives for managerial practice. Some of the practical recommendations are already discussed in chapter 5 where the design is presented. In the section below, the practical implications are summarized.

- The collaboration canvas can be used as a tool to create overview and structure in the organization of interorganizational collaborations in an environment for sustainability-oriented innovations.
- The collaboration process can be implemented to structure interorganizational collaborations in an environment for sustainability-oriented innovations. This process addresses on four different meetings the identified challenges of this study.
- Both design artifacts can be used on the employee or managerial level to structure and organize new or ongoing interorganizational collaborations.
- Organizing companywide meetings or presentations, where employees share their successes and failures (experienced barriers and enablers) in organizing or ongoing collaborations they participate in to share their experiences.
- Training of employees and managers in the organization to work with both design artifacts is advised to improve the adoption and success.

The implementation of both design artifacts in new interorganizational collaborations is the most desired situation, as the challenges can be directly addressed from the begin phase. It is also possible to evaluate existing interorganizational collaborations using both design artifacts. This could also benefit the outcomes and efficient use of resources during the collaborations.

When both design artifacts are implemented in an organization, it is no guarantee that all interorganizational collaborations are successful. The outcomes are still highly dependent on challenges that are almost uncontrollable. Also unforeseen circumstances can still negatively influence the outcomes. In addition to the knowledge and competence part, if every partner fulfils their best fitting competence in the collaboration, it can happen that there is still a need for one or more competences. This could then be fulfilled by external partners on a customer/supplier relationship.

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Appendix A – Confidential appendices

Name	Case	Person	Function	Date	Duration
Frank van Rossum	1	1	Explorer	20/08/2018	00:48:02
Bram Gerrist	1	2	Theme Owner ND	27/08/2018	00:36:37
Leon Piepers	1	3	Area Explorer	29/08/2018	00:34:19
Jean-Paul Heuts	2	4	Project Leader	29/08/2018	00:46:52
Alexander Savelkoul	3	5	Theme Owner FL	31/08/2018	00:42:31
Tim van Melick	2	6	Area Explorer	26/09/2018	00:44:40
Danny Hanssen	2	7	Developer	01/10/2018	00:42:09
Johan Boekholt	4	8	Project Leader	12/10/2018	00:37:28
Simon Schoonen	4	9	Developer	12/10/2018	00:50:40
Erik van Stokkom	4	10	Communication advisor	12/10/2018	00:50:40

Document title	Document description	Identifier
20171120 Jaarplan Enpuls ver 1.1A	Presentation of annual plan Enpuls 2018	D1.0
20180702 Strategie Enpuls	Presentation of new strategy 2019	D1.0
Def Energy Lab Propositie Incl Pitch 06062018 vEG	Presentation value proposition related to Case 1 - Exentr	D1.1
20170713 - SER - LOI v0.94 (schoon)	Letter of Intent (LOI), agreement of development Case 2	D1.2
JEM2 openbaareindrapport DEF	Final report Case 3 – JEM2	D1.3
JEM-GO openbaareindrapport DEF	Final report Case 3 – JEM-GO	D2.3
Lessons learned JEM-GO	Presentation of project evaluation Case – JEM-GO	D3.3
https://bedrijfkracht.nl/	Website of Case 4	D1.4

Appendix B – Minutes of explorative interviews

Minutes in Dutch.

Alexander Savelkoul, Thema-Eigenaar flexibiliteit 21-06-2018

- Introductie Thema Flexibiliteit

De Flex challenge was een evenement georganiseerd door Enpuls waarin marktpartijen zich voor hebben aangemeld. Hier zijn op verschillende thema's winnaars uit de bus gekomen met vernieuwende concepten op het gebied van flexibiliteit (bijv. Groenewijkstroom, Ecovat).

'Boerkracht' is een concept waarbij het probleem van ontoereikende grondbekabeling in het buitengebied voor zonnepanelen bij boeren wordt tegengegaan, door lokale consumptie of opslag te bekijken. Het verzwaren van de bestaande bekabeling is te kostbaar, maar is wel de verplichting van de netbeheerder.

Enkele voorbeelden van minder succesvolle Flex projecten:

- Interflex
- Gridflex
- Jouw energie moment

Het belang (als in core-business) van Enexis/Enpuls was in deze projecten erg onduidelijk. Daarnaast was het aantal partners te groot, de financiële inzet (eigen geld vs. subsidie) scheef verdeeld onder partners en werd het project samengevoegd. Voor meer info eind rapportage per mail ontvangen van Alexander.

Belangrijke key punten:

- Aantal partners in een samenwerking/consortium
- Beperking/focus van de onderzoeksvragen (scope)
- Belangen en gedeelde visies
- Gemeenschappelijk doel en alignment het belangrijkste
- Kenmerken van partners (funding, private/public, sector, etc.)
- Evaluaties aan het einde

Lisa Bisschop, Projectleider, 20-06-2018

Doel van Enpuls is om schaalbare, kopieerbare/overdraagbare concepten te ontwikkelen die in een later stadium zelfstandig worden opgepakt door de markt. Dit is echter nog niet echt terug te zien in het huidige portfolio.

Afbakening tussen een concept en project niet duidelijk, er wordt vaak samengewerkt om het samenwerken met andere partijen. De invloed vanuit de aandeelhouders (gemeente/provincie) hierin is ook aanwezig, vooral door de kijk op Enexis/Enpuls als 'eigendom'.

Samenwerken om het samenwerken: FOMO, "Dit moeten we toch doen?!"

Voorbeelden van succesvolle samenwerkingen: EV-atlas

Twijfelgevallen: 100.000 EV plan?

KPI's om de successen van projecten/processen in kaart te brengen ontvangen per mail.

Willem Alting Siberg, Thema-Eigenaar Duurzame Mobiliteit, 20-06-2018

Duurzame Mobiliteit kent als thema een aantal uitdagingen en kijkt naar ontwikkelingen/problemen, zoals bijv. de laadinfrastructuur. Het dienen van maatschappelijk belang is hierin belangrijk, ook dat alle marktpartijen bij inmenging van Enpuls profiteren en niet één bepaalde partij. Laadinfra verloopt met name via provincies en gemeenten. Met provincies lopen er contracten.

Bij samenwerking/consortia belangrijk:

- Gezamenlijke doelstellingen
- Verdeling van resource (tijd/geld) commitment
- DMU's alignment en commitment in een wendbare omgeving

DM werkt ook samen met DGO en Flex.

Tip: Organizing for collaboration in a rapid changing sustainable environment / eco-system.

Appendix C – Initial set of articles

Article title	Author(s)	Year	Journal	IF
Sustainability-oriented Innovation: A Systematic Review	Richard Adams, Sally Jeanrenaud, John Bessant, David Denyer Patrick Overy	2016	International Journal of Management Reviews	6.489
Sustainability-oriented innovation of SMEs: a systematic review	Johanna Klewitz, Erik G. Hansen	2014	Journal of Cleaner Production	5.651
One, no one, one hundred thousand energy transitions in Europe: The quest for a cultural approach	Mauro Sarrica, Sonia Brondi, Paolo Cottone, Bruno M. Mazzara	2016	Energy Research and Social Science	3.815
Growing grassroots innovations: Exploring the role of community-based initiatives in governing sustainable energy transitions	Gill Seyfang, Alex Haxeltine	2012	Environment and Planning C Government and Policy	2.30
Collaboration processes: Inside the black box	Thomson, Ann Marie Perry, James L.	2006	Public Administration Review	4.591
Coordination in Organizations: An Integrative Perspective	Okhuysen, Gerardo A. Bechky, Beth A.	2009	The Academy of Management Annals	9.281
Managing inter-organizational networks for value creation in the front-end of projects	Matinheikki, Juri Arto, Karlos Peltokorpi, Antti Rajala, Risto	2016	International Journal of Project Management	4.328
Competence- and Integrity-Based Trust in Interorganizational Relationships: Which Matters More?	Brian L. Connelly, T. Russell Crook, James G. Combs, David J. Ketchen, Herman Aguinis	2018	Journal of Management	8.080
Coopetition: a systematic review, synthesis, and future research directions	Ricarda B. Bouncken Johanna Gast Sascha Kraus Marcel Bogers	2015	Review of Managerial Science	1.483
Leveraging External Sources of Innovation: A Review of Research on Open Innovation	West, Joel Bogers, Marcel	2013	Journal of Product Innovation Management	4.305
Resource Dependence Theory: A Review	Amy J. Hillman, Michael C. Withers, Brian J. Collins	2009	Journal of Management	8.080
Open Innovation in SMEs: Trends, motives and management challenges	van de Vrande, Vareska de Jong, Jeroen P.J. Vanhaverbeke, Wim de Rochemont, Maurice	2009	Technovation	4.802

Appendix A – Initial set of articles - continued

Article title	Author(s)	Year	Journal	IF
Open Innovation in Small and Medium-Sized Enterprises (SMEs): External Knowledge Sourcing Strategies and Internal Organizational Facilitators	Brunswicker, Sabine Vanhaverbeke, Wim	2015	Journal of Small Business Management	3.248
When is open innovation beneficial? The role of strategic orientation	Cheng, Colin C.J. Huizingh, Eelko K.R.E.	2014	Journal of Product Innovation Management	4.305
Managing open innovation projects with science-based and market-based partners	Du, Jingshu Leten, Bart Vanhaverbeke, Wim	2014	Research Policy	4.661
Open R & D and open innovation: exploring the phenomenon	Enkel, Ellen Gassmann, Oliver Chesbrough, Henry	2009	R & D Management	1.857
Closed or open innovation? Problem solving and the governance choice	Felin, Teppo Zenger, Todd R.	2014	Research Policy	4.661
The Future of Open Innovation	Gassmann, O., Enkel, E., & Chesbrough, H	2010	R & D Management	1.857
The open eco-innovation mode. An empirical investigation of eleven European countries	Ghisetti, Claudia Marzucchi, Alberto Montresor, Sandro	2015	Research Policy	4.661
Open innovation: State of the art and future perspectives	Huizingh, Eelko K.R.E.	2011	Technovation	4.802
Open innovation in SMEs-An intermediated network model	Lee, Sungjoo Park, Gwangman Yoon, Byungun Park, Jinwoo	2010	Research Policy	4.661
Co-innovation: Convergenomics, collaboration, and co-creation for organizational values	Lee, Sang Trimi, Silvana Olson, David L.	2012	Management Decision	1.525
On the path towards open innovation: assessing the role of knowledge management capability and environmental dynamism in SMEs	Martinez-Conesa, Isabel Soto-Acosta, Pedro Carayannis, Elias George	2017	Journal of Knowledge Management	2.551
Antecedents, moderators, and outcomes of innovation climate and open innovation: An empirical study in SMEs	Popa, Simona Soto-Acosta, Pedro Martinez-Conesa, Isabel	2017	Technological Forecasting and Social Change	3.129
Policy mixes for sustainability transitions: An extended concept and framework for analysis	Rogge, Karoline S. Reichardt, Kristin	2016	Research Policy	4.661

Appendix D – Interview protocol

Interview questions in Dutch.

Mededelingen

- Dit interview wordt gebruikt om de data te verzamelen voor mijn onderzoek naar de samenwerkingsprojecten met externen binnen Enpuls
- Het interview neemt ongeveer 45 minuten in beslag en wordt opgenomen
- Alle informatie wordt vertrouwelijk en geanonimiseerd verwerkt
- Er wordt een anoniem transcript toegestuurd voor controle

Personalia

Naam	
Functie	
Thema	
Datum in dienst Enpuls	

Project

Naam project	
Startdatum project	
Deelnemende partijen	

Persoonlijke rol

1. Kan je kort iets vertellen over je professionele achtergrond voor Enpuls, in relatie tot duurzaam georiënteerde innovaties?
2. Wat is je rol binnen Enpuls en kan je deze toelichten?

Project gerelateerd

Onderwerp	Questions regarding
Structureel	<ul style="list-style-type: none">- Waar is het idee voor dit project ontstaan?- Hoe zijn de verschillende partijen aangehaakt of gezocht?- Hoe ziet de verdeling van resources eruit, FTE en €?- Is er sprake van een publieke/private samenwerking?- Is er sprake van een rolverdeling?
Relationeel	<ul style="list-style-type: none">- Op welke basis/manier word ter samengewerkt?- Met welke frequentie wordt er samengewerkt/vergaderd?
Relationeel	<ul style="list-style-type: none">- Hoe is het kennisniveau van iedere partij?- Hoe wordt er kennis gedeeld binnen dit project?
Cognitief	<ul style="list-style-type: none">- Wat is de aard van deze samenwerking of het gemeenschappelijke doel?

	<ul style="list-style-type: none"> - Wat is de inhoudelijke scope? - Wat zijn de belangen van iedere partij? - Wat is het belang van Enpuls?
Structureel	<ul style="list-style-type: none"> - Waarop wordt dit project gemeten? - Hoe ziet de planning / voortgang eruit? - Zijn er tussentijdse evaluaties?
Succes/Faalfactoren (Enablers/Barriers)	<ul style="list-style-type: none"> - Wat draagt het meeste bij aan het succes van dit project? - Wat zorgt voor de meeste remming/falen van dit project?

Literatuur reflectie

Open innovatie	<ul style="list-style-type: none"> - In hoeverre is er sprake van open innovatie tijdens dit project?
Rolverdeling in open innovatie	<ul style="list-style-type: none"> - Ollila & Yström (2017), <i>facilitator, tactician, sensegiver</i> - Zou een dergelijke rolverdeling bijdragen aan de organisatie van samenwerkingen?

Evaluatie en afsluiting

Evaluatie	<ul style="list-style-type: none"> - Wat is je ideale beeld van een goedlopende, innovatieve samenwerking? - Wat zou je willen veranderen aan dit project? - Welke invloeden zijn er volgens jou buiten de genoemde onderwerpen nog meer bij samenwerkingen? - Wat zou je willen veranderen binnen Enpuls om het innovatie succes te vergroten?
Afsluiting	<ul style="list-style-type: none"> - Is er nog iets wat je toe zou willen voegen buiten de besproken thema's? - Met wie zou ik zeker nog moeten spreken over deze onderwerpen?

Appendix E – Coding scheme

Coding categories and scheme.

Coding book

Personal information

Coding node	Description	Empirical indicators
Pers_case_role	Personal role of the employee in the case under investigation	Project manager, knowledge expert
Pers_company_role	Personal role of the employee in the company excluding case	Explorer, Developer, Theme-owner
Pers_professional_background	Information regarding previous employers or experiences	Employers, companies
Pers_start_date	Starting date at the focal company	Date
Pers_study	Study of the employee	Study

Case information

Coding node	Description	Empirical indicators
Case_description	General description of the case	Goals or targets, why and how, executed activities
Case_external_funding	Funding from outside the collaboration partners	Subsidies, loans
Case_originated	Where the idea for the collaboration is originated	Ideas, contacts, networks
Case_outcomes	Deliverables of the collaboration	Outcomes, results
Case_stakeholders	Participating partners in the collaboration	Company names, provinces, municipalities
Case_start_date	Initial start date of the collaboration	Date

Structural dimension (case specific data)

Coding node	Description	Empirical indicators
Stru_location	Meeting place or opinions about location	Geographical locations
Stru_meeting_frequency	Frequency of which meetings are held	Weekly, monthly
Stru_network	Resource networks of partners in the collaboration	Networks
Stru_operating_area	The operating area of the collaboration (not location)	Geographical area where collaboration focuses on
Stru_organization	General organization information about the collaboration	Meeting structure, hierarchy, agreements
Stru_performance_management	Indicators how progress or output is monitored in the collaboration	KPI's, other monitoring indicators
Stru_planning	Information about the planning or roadmap of the collaboration	Planning, roadmap, schedule
Stru_role_division	Information about role divisions in the collaboration	Facilitator, secretary, manager
Stru_stakeholder_commitment	Information on how commitment was kept or realized among stakeholders	Legal measures
Stru_stakeholder_resource_deviation	Deviation in interpretation of assigned resources	Divergent definitions
Stru_stakeholder_resources	Information about the resource division each stakeholder participates with	FTE, monetary values
Stru_tools	Information about tools that are used in the collaboration to keep structure	Workmanagement, cloud tools

Relational dimension (case specific data)

Coding node	Description	Empirical indicators
Rela_communication	Information about the communication between stakeholders	E-mail, phone, meetings
Rela_informal	Information about informal relations or activities in- or outside the collaboration	Get-to-know each other activities
Rela_political	Political influences and effects from provinces and municipalities	Elections, local councils
Rela_stakeholder_knowledge_competences	Information about knowledge levels of stakeholders	Inexperience, competences

Cognitive dimension (case specific data)

Coding node	Description	Empirical indicators
Cogn_company_goal	Goal of the focal company in the collaboration	CO2 reduction, transition acceleration
Cogn_goal_deviation	Deviations in the shared goal among the stakeholders	Changing interests
Cogn_shared_goal	The shared or collective goal of the stakeholders in the collaboration	Collective interests and goals
Cogn_stakeholder_participating_deviation	Deviations in collective interests by stakeholders	Commercial vs. public interests
Cogn_stakeholder_participating_motivation	Specific motivation of the reason why stakeholders collaborate	Monetary facilitators

Other information (general data or not case related)

Coding node	Description	Empirical indicators
Othe_failure_indicator	Failure indicators in collaboration management	Adverse effect, disadvantage, irritation
Othe_general_need	A general need in the context of the research	Market, law or regulations changes
Othe_general_organization	General feedback or opinions in collaboration management	Motivations, speed, incentives
Othe_ideal_situation	How an ideal collaboration would look like in the context of the research	Ideal situation
Othe_literature_feedback	Opinions on a role division model in open innovation management	Facilitator, Tactician, Sensegiver
Othe_success_indicator	Success indicators in collaboration management	Positive effects, advantage, progress

Appendix F – Concept design artifact

Concept design artifact in Dutch.

Gemeenschappelijk doel:

Partners	Rol/Competentie	Resources (€/FTE)	Verantwoordelijk persoon
1.			
2.			
3.			
4.			
Organisatie		Relationeel	
Samenkomst:.....		Besluitvorming:.....	
Locatie:.....		Planning:.....	
Kennisdeling:.....		KPI's/Management:.....	
Juridische vorm:.....		Informeel:.....	