
Institutional change through local experimentation

The case of electric vehicles in the Netherlands

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Preface

This master thesis represents my final work of the master study 'Science and Innovation Management'. In this thesis, knowledge on innovation sciences and research skills are applied which I learned during my career as a student at the Utrecht University. This period brought me through the organization of a study tour to Hong Kong via a board function in SSU Foundation, and pursuing multiple interesting courses, towards writing this master thesis. The topic of this paper represents the content of 'Science and Innovation Management' particularly well and was therefore considered as a perfect opportunity to finish my master study with. I would like to thank some people that helped me during my master study and the last months of my life as a student.

First of all, I would like to thank my parents and brother for their support and love during my period as a student. This really helped me and provided me with the necessary strength to finish my study. Furthermore, I would like to thank my fellow students for helping me during the multiple courses and papers we cooperated in. Also, I would like to thank my friends for their support and the many moments of relaxation which provided me the possibility to combine hard studying with moments of chilling out.

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Abstract

Socio-technical transitions, like the transition towards electric vehicles, are really complex since they require creative destruction. Institutional change is at the heart of the process whereby new sustainable technologies gain ground. Current literature stresses local experiments as a solution to enable institutional change. However, the mechanisms and underlying activities through which local experimentation affects institutional change are only stated to a limiting extent in theory. Therefore, this thesis aimed to provide insights into mechanisms, activities, and related dynamics, that affect changes in institutions. Moreover, it provides initiators of experiments insights how to manage and design experiments in such a way that they enable specific institutional reforms. This qualitative research includes a case study of six experiments with EV in The Netherlands. Interviews were conducted and documents were collected that provided information on the relation between local experimentation and institutional change. From a comparative analysis of these cases it was found that eight different types of institutional change were found to be affected by a particular mechanism in more than one case. These mainly concern cognitive institutional reforms in technology, policy, and with respect to users, markets and distribution networks. Moreover, generalizations were made concerning the effect of local experiments on technology-normative and policy-regulative institutional changes. Three mechanisms were identified that affected institutional change: (1) network formation, (2) mobilization of people, and (3) learning, monitoring and problem solving. The functioning of these mechanisms were enabled by the employment of 11 different activities. From a comparison of these findings with the scientific literature, it can be concluded that current theories are not fully applicable to conceptualize the relation between local experimentation and institutional change. Current literature focuses predominantly on the functioning of mechanisms, and execution of respective activities, on the niche level. Moreover, theory states mechanisms and activities that are important for the development of niches but not directly affect institutional change. The practicability of this thesis resides in a list of activities that can be employed in order to affect specific types of institutional reforms, depending on the objective of the participant or initiator of experiments. Future studies are needed to confirm these observations as they constituted limited generalizations.

Keywords

Electric vehicles, institutional change, local experiments, socio-technical transitions, learning

Abbreviations

EV: Electric vehicle(s)
ICEV: Internal combustion engine vehicle(s)
SNM: Strategic Niche Management
TGEV: 'Texel Gastvrij Elektrisch Vervoer'
EH: 'Elektropool Haaglanden'
RTER: 'Rotterdam Test Elektrisch Rijden'
D4E: 'Drive 4 Electric'
DOB: 'Draadloos Oplaadbare Bus'
DS: 'Delta Stadsdistributie'
UMDB: Users, markets and distribution networks

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1. Introduction

Over the past decades, environmentally oriented innovations have been developed worldwide and in many sectors like transportation, energy and food (Brown & Vergragt, 2008; Farla et al., 2010). A transition to sustainable mobility is necessary for the Dutch transportation system as it suffers from societal problems like emissions, congestion, and accidents (Farla et al., 2010). The Dutch ministry of Economic Affairs, Agriculture and Innovation argues that a large-scale implementation of electric vehicles (EV) has the potential to realize a sustainable Dutch transportation system (AgentschapNL, 2012a). The substitution of internal combustion engine vehicles (ICEV) by EV promises benefits for the Dutch society, like (1) less polluted air (which will increase the liveability of urban areas), (2) a reduction of oil dependency and thereby increasing domestic energy security, and (3) the potential to establish a strong international competitive position (AgentschapNL, 2011a; NSOB, 2011). Because of these arguments, many developments in EV took place in the Netherlands stimulated by the Dutch government (NSOB, 2011). Some examples are (1) the establishment of a Taskforce, called 'Formule E-team', that aims to align the activities of different public authorities, knowledge institutes and firms, (2) tax reductions to stimulate the introduction of EV, (3) by acting as a launching customer, and (4) by executing local experiments and demonstration projects in large cities like Amsterdam, Rotterdam and Utrecht (AgentschapNL, 2011a; NSOB, 2011).

Despite these developments a transition to EV is still not occurring, at least not at a desired pace (NSOB, 2011). The goal of the Dutch agency 'AgentschapNL' is to realize 200.000 driving EV in 2020 and 1.000.000 driving EV in 2025 in the Netherlands (AgentschapNL, 2013). Currently, 9.256 EV are driving on the roads. Moreover, the Dutch charging infrastructure now consists of 3.067 public, 1.445 semi-public and 89 fast charging stations. The transition towards EV is not happening because it demands a change in the socio-technical mobility system (Brown et al., 2003; NSOB, 2011). The new system requires new elements – like a new technology, a new infrastructure, different behaviour by consumers, renewed institutions – and this is inherently complex as it requires creative destruction; breaking through strongly held convictions and interests of the current system (Brown et al., 2003; NSOB, 2011). Next to this complexity of system change, the transition towards EV is not occurring due to several uncertainties concerning technology, users (e.g. range anxiety), charging infrastructure, price and market (NSOB, 2011). These problems are pivotal for new sustainable technologies and require different solutions than general innovation processes (Schot & Geels, 2008). Institutional change is at the heart of the process whereby new sustainable technologies gain ground (Jacobsson & Bergek, 2011; Schot & Geels, 2008) and is thus needed for sustainable transitions (Geels & Raven, 2006; Hatton et al., 2009; KpVV, 2012). So current institutions will need to be changed and new ones have to be developed that support the change to EV (KpVV, 2012). Institutions are 'the rules of the game' and in this thesis defined as "*social structures that have attained a high degree of resilience. They are composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life*" (Scott, 2003, p. 880). Examples of institutions are technical standards and infrastructural requirements, regulations, policy goals, expectations, symbolic meanings and cultural values (Smith & Raven, 2012).

For institutional change to take place, the literature on technological transitions proposes small-scale experiments, aimed at developing, testing and introducing new technology, applications and markets, as key nurturing arena's (Berkhout et al., 2010; Brown et al., 2003; Geels & Raven, 2006; Hoogma et al., 2002;; Kemp et al., 1998; Smith & Raven, 2012). Experiments are carried out by several participants (e.g. business, government, technical experts, education and research institutions, NGOs and others) in order to introduce new technology on a local scale (Brown et al., 2003). More specifically, 'sustainability experiments' are proposed by Berkhout et al. (2010) as being important in realizing a sustainable transition of the mobility sector. Such experiments can be defined as "*planned initiatives that embody a highly novel socio-technical configuration likely to lead to substantial (environmental) sustainability gains*" (Berkhout et al., 2010, p. 262). A substantial sustainability gain could be the large scale implementation of EV. These experiments take place in

niches: protective spaces where the technology can develop (Kemp et al., 1998). Experiments are thus necessary to stimulate the transition toward EV by setting in motion societal learning processes and supportive institutional adaptation. This can subsequently stimulate the wider shift towards EV.

The current literature on niche development stresses the role of experiments for supportive institutional change (Smith & Raven, 2012). However, little systematic study has been done concerning the mechanisms by which experiments have an effect on (different types of) institutional change, and eventually their contribution to a socio-technical transition (Brown & Vergragt, 2008; Raven & Geels, 2010). Some articles stress processes or mechanisms on how a multiplicity of experiments, or single niches, interact with wider regime change processes (Berkhout et al., 2010; Brown et al., 2003; Geels & Raven, 2006; Hoogma et al., 2002; Raven & Geels, 2010; Smith & Raven, 2012). This includes changes at the level of the regime: the stable and ordered configurations of technologies, actors and institutions that constitute the basis for economic and social practices (Berkhout et al., 2010). In other words, through these mechanisms, multiple experiments can mobilize changes in the selection environment and thus can account for institutional change by altering mainstream selection pressures of regimes in ways favourable to the path-breaking innovation (Smith & Raven, 2012). Some examples of processes or mechanisms are (1) the articulation of expectations and visions, (2) social and technical learning, (3) social network building, and (4) the alignment of similar local experiments (Berkhout et al., 2010; Geels & Raven, 2006; Hoogma et al., 2002). Detailed insights into the mechanisms, and underlying activities, through which single local experiments contribute to changes in the institutional environment are not provided in detail yet in the current literature. Activities are defined as those operations or achievements that enable the functioning of mechanisms. This thesis will contribute to the scientific literature as it aims to suggest limited generalizations, specifying the effect of mechanisms on different types of institutions. Moreover, it provides insights into the activities that need to be performed for a mechanism to function properly. A comprehensive framework will also be provided that presents these generalized insights. This paper will also offer insights into dynamics between different activities employed and into dynamics between institutional changes. According to Raven & Geels (2010) dynamics between activities and mechanisms are an important phenomenon in socio-technical evolution. Some activities are performed that entail certain coherence in order to enable the functioning of the respective mechanism. Moreover, Raven et al. (2008) stresses dynamics between institutions. The generated insights can form the basis for further quantitative or qualitative research.

As experiments with EV are selected as a case study, this thesis will give advice on and create insights for initiators of experiments (e.g. policymakers) on how to manage and design projects in such a way that they enable institutional change. Experiments, in the long run, could make significant contributions toward technological change, if designed and managed in a specific way (Hoogma et al., 2002). This thesis provides understanding on the mechanisms, the underlying activities and their mutual dynamics, through which local experiments affect institutional change. Thereby it provides initiators of experiments insights how to facilitate institutional change through project management. Such understanding is necessary in order to further stimulate learning and thus the transition toward EV.

1.1 Research question, sub-questions and domain

The central topic studied in this thesis is the effect of local experiments on institutional change. The goal of this thesis is to suggest limited generalizations on mechanisms, underlying activities and their dynamics, through which local experiments affect (different types of) institutional change. These will be presented by a framework with conceptualizations of these instances. Experiments could in the long run significantly contribute to the development and societal implementation of sustainable technologies (Hoogma et al., 2002). In evolutionary terms, while co-evolution between variation and selection takes place continuously (i.e. society and technology co-evolve), experimentation provides

other interaction between variation and selection (Geels & Raven, 2006). Experiments provide this interaction by enabling selective exposure to the mainstream institutional environment and thereby the novel technology and existing institutional environment can adjust to each other (Schot et al., 1994). In this way, local experiments have a mediating (i.e. inducing) effect on the institutional reforms that take place continuously. Experiments with EV in the Netherlands are chosen as a case study. The research question to be answered in this thesis is: *'How do local experiments with electric vehicles affect institutional change?'*

In order to answer the main research question several sub-questions are central in this study:

- (1) What institutional change is induced by local experimentation with EV in the Netherlands?
- (2) What mechanisms, and activities, can be identified through which local experiments with EV in the Netherlands affect institutional change?
- (3) What dynamics, between the activities performed, can be identified that explain the functioning of the mechanisms?

Relevant scientific literature will be examined, which will result in a conceptual model. The literature is used: (1) to identify and describe the role of local experiments in socio-technical transitions, (2) to identify and describe the role of institutions and institutional change in socio-technical transitions, and (3) to identify and describe the mechanisms through which local experiments in niches may account for institutional adaptation. The first and second sub-questions will be answered through case study research of experiments with EV in the Netherlands. The second sub-question will be used to identify the mechanisms, and underlying activities, through which local experiments with EV in the Netherlands affected institutional change. Therefore, this sub-question will be used to reflect upon the developed conceptual model. The third sub-question provides information about which activities are necessary conditions for respective mechanisms and about the mutual dependency of activities. This thesis is not purely inductive; it aims to contribute to current literature by corroborating mechanisms, and by providing new insights into mechanisms, activities, and dynamics of these activities. Different local experiments (i.e. different cases) will be compared and limited generalizations will be made concerning mechanisms, activities and dynamics. Bryman (2008) calls these cases 'exemplifying cases'. Experiments with EV are thus selected because they represent the broader category of experiments with EV. Moreover, by studying several cases this thesis hopes to provide insights into the institutional reforms that are still necessary to further the transition toward EV in the Netherlands.

The Netherlands is chosen as geographical delineation for case selection since government inducements to innovation (e.g. regulations, incentives, R&D subsidies and tax credits) are to a large extent nationally bounded (Niosi et al., 1993). Moreover, the Netherlands is stated to be the perfect nation for the development of EV due to its size and urbanization (AgentschapNL, 2012a). Additionally, active governmental policy and a variety of business activities make it possible to inquire the effect of experiments on institutional change. The Dutch government has selected 5 key areas to focus on: metropolitan region of Amsterdam, province of Noord-Brabant, municipality of Rotterdam, Utrecht and province of Friesland (AgentschapNL, 2011a). These key areas are ahead of other areas in the Netherlands in the roll-out of a charging infrastructure for EV because of a variety of niche experiments and experimental projects with EV. The achieved domain of this thesis is constituted by the local experiments with EV that are studied in this thesis. These are researched through document analyses (e.g. project plans) and by conducting interviews with actors related to the respective projects: project managers, government agents, engineers, etcetera. Since the purpose is to limitedly generalize findings and to present these with a conceptual framework, the intended domain is constituted by all local experiments with EV. The variables, which are the features of the units studied, are the mechanisms, and activities, through which experiments contribute to institutional adaptation.

2. Theoretical framework

Socio-technical transitions imply shifts in the way societal functions, such as mobility, are fulfilled (Elzen et al., 2004). They involve technological and social dimensions that co-evolve and are systemic in nature. The literature on socio-technical transitions makes wide use of the Multi-Level Perspective as an outlook to understand shifts in socio-technical systems (Markard & Truffer, 2008). Transitions entail the change and reconfiguration of technologies, actors and institutions through the long-term interaction of niches, regimes, and a wider landscape. Niches constitute the locus where novel technologies emerge (Kemp et al., 1998). The socio-technical landscape is the exogenous environment that changes slowly but has a deep structural influence on niches, regimes and their interaction (Berkhout et al., 2010). The socio-technical regime is constituted by three dimensions that are interlinked and stable resulting in path-dependence and lock-in (Unruh, 2000): (1) network of actors and social groups, (2) institutions that structure the activities of actors, and (3) material and technical elements (Geels, 2005).

In order to avoid confusion between institutions and organizations, this thesis uses, in accordance with Geels (2004), the concept of ‘rules’, which are similar to institutions. The institutions on the level of the socio-technical regime can be grouped in regulative, normative and cognitive rules (i.e. institutions) (Geels, 2005). This is in accordance with the three pillars of institutions by Scott (1995) who states that institutions are “*composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life*” (Scott, 2003, p. 880). The regulative pillar stresses regulative rules as the basis of social order (Scott, 1995). The normative pillar emphasizes the creation of binding expectations, and the subsequent introduction of norms, standards and roles, as the basis of social order. The cultural-cognitive pillar involves taken-for-granted beliefs and shared conceptions that constitute the frames through which meaning is made. The socio-technical regime is stabilized by regulations and standards, while cultural-cognitive routines may blind actors to developments outside their focus (Berkhout et al., 2010). During transitions these institutions are weakened, allowing reframing of rules, subsequently allowing new regimes to grow, gain stability and to become dominant. Hence, for socio-technical transitions to take place, regime shifts must occur implying reframing of regulative, normative and cultural-cognitive institutions.

2.1 Local experimentation and learning

Local experimentation is a “*means for societal learning about technology and societal arrangements, for changing the prevalent perspectives on mobility and access, and for changing norms, values and institutions*” (Brown et al., 2003, p. 294). In this thesis experiments are defined as “*planned initiatives that embody a highly novel socio-technical configuration likely to lead to substantial (environmental) sustainability gains*” (Berkhout et al., 2010, p. 262). Such experiments are called ‘sustainability experiments’ and are considered important in realizing a sustainable transition of the mobility sector (Berkhout et al., 2010). Experiments are proposed as protective spaces for technology to nurture (Kemp et al., 1998). Hence, experiments allow for space where innovative activity can take place while time-limited protection is offered against the rules of the dominant regime (Berkhout et al., 2010). Local experimentation refers to conducting pilot and demonstration activities in places with local contexts, supported by local networks, and generating lessons within and between local projects accordingly (Geels & Raven, 2006; Smith & Raven, 2012).

Generating lessons can apply to two kinds of learning that can occur through experiments (Brown et al., 2003; Hoogma et al., 2002). While Brown et al. (2003) refer to lower-order learning and higher-order learning, Hoogma et al. (2002) refer to first-order learning and second-order learning. Higher-order learning is synonymous to second-order learning and entails social learning about user needs, societal benefits and negative effects, cultural meaning and regulation (Hoogma et al., 2002; van der Laak et al., 2007). Higher-order learning involves redefining policy goals, adjusting problem definitions and strategies, norms, values and operating procedures, and can take place at the local

level and at the societal level (Brown et al., 2003). This also includes reflexive learning, questioning underlying assumptions or motives, and the willingness to change if the technology does not match current assumptions (van der Laak et al., 2007). Next to this type of learning, the literature refers to lower-order learning (Brown et al., 2003) or first-order learning (Hoogma et al., 2002), which are identical and can also take place at the local and societal level. Lower-order learning involves learning within fixed policy objectives, problem definitions and procedures and mainly involves technical learning about technological design, infrastructure, marketing and pricing (Brown et al., 2003; Hoogma et al., 2002; van der Laak et al., 2007). In this way, both types of learning embody institutional change. However, as higher-order learning involves changes in norms, user needs, policy goals, assumptions and motives, new to the mainstream selection environment, it is necessary to be achieved at societal level for a transition to take place (van der Laak et al., 2007).

2.2 Local experiments as means to transform global rules

Local experiments are embedded in niches, which are the institutional environments where rules are more fluid and emergent than in regimes (Berkhout et al., 2010). According to the strategic niche management (SNM) literature three mechanisms at the local project level are important in the development of niches (Schot et al., 1994): (1) interactive learning and articulation processes, (2) articulation of expectations and visions, and (3) building of supportive social networks with complementary resources (Berkhout et al., 2010; Geels & Raven, 2006; Smith & Raven, 2012).

In the early phases of an innovation's lifecycle, the social network in which the novel socio-technical configuration becomes embedded is generally fragile (Berkhout et al., 2010). Local experiments are supported by local networks and generate lessons specific to their local context. The local networks consist of actors that execute projects, and develop and align heterogeneous elements on location (Geels & Raven, 2006). Local experimentation can bring new actors together and allow further establishment of actor networks and thereby assures the provision of necessary complementary resources.

Second, articulation and negotiation of expectations and visions is important to secure participation of relevant actors in local projects (Berkhout et al., 2010). It is important to build a broad local social network including users, incumbent regime firms, policy makers, researchers, etcetera (Geels & Raven, 2006). This enables the attraction of attention and resources, as well as the co-opting of new actors in the network, which are both significant in the early development of an innovation. Moreover, articulation of expectations and visions provide direction to the development of a novel configuration as they act as cognitive frames for making choices in the design process. Expectations should be made clear between the local actors involved in experiments. This requires the alignment of local expectations and visions in order to prevent divergence between the actors involved in projects. The circulation of local knowledge and experiences as well as the alignment of expectations between project actors occur through informal and formal participatory processes (Raven et al., 2008). Examples of participatory processes are meetings, workshops and joint forums. These activities allows the creation of shared visions and local rules. Shared local visions and respective goals are important as they *"provide a reference point through which networks can be built, gaining commitments to 'participate', orientating the actions of potential participants and constituencies"* (Raven et al., 2008, p. 467). These shared project visions and local rules subsequently need to be articulated among relevant project actors (Coenen et al., 2009).

The last mechanism that the SNM literature proposes is learning, as it enables adaptation of the technology and its embedding in practices and markets (Berkhout et al., 2010). Local learning and articulation processes concerning technical design, user preferences, regulation, infrastructural requirements and cultural meaning are provided by local projects (Geels & Raven, 2006). This reflects both local knowledge development as well as the alignment of heterogeneous elements into a working technical configuration. Continuous monitoring of local experiments with regard to specific new knowledge, insights, and how these are transferred, but also concerning social and institutional

learning, is necessary (Rotmans & Loorbach, 2009). Lessons need to be shared between different actors involved in the project. Examples of activities to share local lessons are discussing experimental results, user feedback and new scientific findings in meetings (van der Laak et al., 2007). The significance of learning by trying in a local project context is widely acknowledged (Fleck, 1994). Through learning techno-economic optimization occurs as well as alignments between technical and social aspects of the novel configuration, which can be noticed as second-order learning or higher-order learning (Berkhout et al., 2010; Brown et al., 2003; Hoogma et al., 2002). Through these identified mechanisms at the project level, local cognitive, regulative and normative rules are reframed (Geels & Raven, 2006; Raven et al., 2008).

More recently, the literature on niches and local experiments (i.e. Niche Development Theory) discusses more in detail the mechanisms by which niches develop and regimes transform (Raven & Geels, 2010). The literature distinguishes between concrete local experimental projects and a global niche level (Geels & Raven, 2006). The global niche level refers to an emerging institutional field or community comprised of a global network of actors. These actors are distanced to local projects but are related by providing resources that generated the protective space: finance, political support and technical specifications. This community shares global cognitive rules which form resources and guiding frames for the experiments at the local scale. However, there is room for local variety in activities and rules through different local interpretations and adjustments. The community enables local social networking by mobilizing different stakeholders in experiments (van der Laak et al., 2007; Quitzau et al., 2012; Seyfang & Longhurst, 2012). The mobilization of local stakeholders and subsequent maintenance of their involvement (e.g. using covenants) is necessary to ensure local implementation in practice and thereby facilitating local alignment (Quitzau et al., 2012). Other stakeholders include NGOs and (formal) network organizations that support further niche-development processes by enrolling actors, providing resources, distributing knowledge, lobbying and supporting new projects (Seyfang & Longhurst, 2012). Additionally, the emerging community allows social network building by involving incumbent regime actors, that have much resources and are competent with existing rules, government agencies and by involving new firms, users, scientists and research organizations that constitute a source of novelty (van der Laak et al., 2007). Smith & Raven (2012) refer to this community as an emerging proto-regime constituted by reframed institutions (cf. figure 1).

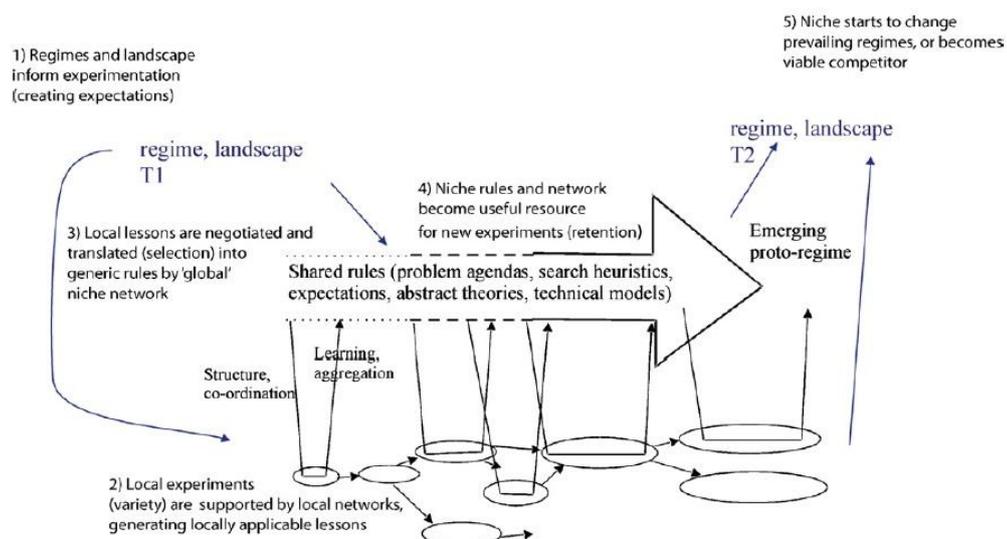


Figure 1: Local experiments and the reframing of global rules (source: Smith & Raven, 2012)

The emerging community is thus very important for the execution of local projects, mechanisms on the local level to take place and function properly, and respective activities to be performed. Several mechanisms can take place at the local level (discussed above) and at the global

niche-level that result in local institutional change as well as global institutional change (Geels & Raven, 2006). The interaction of these two levels is significant for the execution of local experiments and institutional change to take place (Smith & Raven, 2012). The global niche level is regarded as the context in this thesis as the domain is constituted by local experiments. Although the focus of this thesis is on local experiments, the interaction with the global niche-level, and respective mechanisms and activities, should thus be addressed.

Figure 1 shows how, through a sequence of local projects, experiments become connected (Berkhout et al., 2010). Central to this is the idea of a diversity of experiments that exist simultaneously and build on each other over time by diffusing ideas and creating links (Brown et al., 2003; Geels & Raven, 2006). When these become aligned, they can add up to the global niche network. Hence, global niche rules become more articulated, specific and stable in an emerging proto-regime as local networks perform work and local lessons are shared (Geels & Raven, 2006). Local networks circulate local experiences and compare these through conferences, knowledge workshops, technical journals, proceedings, newsletters, and meetings with policy makers and other interested actors (Geels & Raven, 2006; Smith & Raven, 2012). After local experiences are shared and compared, they are translated into trans-local norms and rules. The transformation of lessons from local experiments into generic lessons and global rules, occurs through so-called 'aggregation activities' (Geels & Raven, 2006; Raven & Geels, 2010). Some examples of aggregation activities are standardization, codification, model building, formulation of best practices, publication of manuals, and adaptations in policy and regulations (Geels & Raven, 2006; Smith & Raven, 2012). The community should create intermediary organizations (e.g. professional societies, industry associations, standardisation organisations) that perform circulation and aggregation activities (Geels & Deuten, 2006).

Next to de-contextualization of local lessons through local-to-global aggregation activities, there is global-to-local coordination in order to make new global rules fit local contexts (Berkhout et al., 2010). New global rules refer to reframed regulative, normative and cultural-cognitive institutions (Geels & Raven, 2006). Shared new global rules, including new positive expectations, provide direction to experimental projects which is favourable to the path-breaking innovation (Geels & Raven, 2006). In this way, the emerging proto-regime becomes a useful resource for subsequent experiments in new locations and applications (Smith & Raven, 2012). For expectations to guide further experimentation, in addition to shared local project visions and expectations, broad trans-local shared expectations and visions should be created (Geels & Raven, 2006). Therefore, expectations of relevant actors have to be aggregated into a broad accepted expectation and thereby forming a refined (cognitive) global niche rule (Seyfang & Longhurst, 2012). Vision building processes like debates and negotiation processes or structured visioning exercises can be deployed in order to create broad local shared visions and expectations and broad shared trans-local visions and expectations (Brown et al., 2003; Weber, 2003; Raven et al., 2008). Expectations can also draw new external actors in the community and attract attention and resources, by the use of claim making activities, and thereby support further niche-development (Seyfang & Longhurst, 2012). Moreover, when new cognitive global niche rules are articulated, the community can consequently refine regulative and normative rules of the emerging regime (Smith & Raven, 2012). Eventually, this may thus generate more local re-framing, learning, aggregation and coordination (cf. figure 2 on the next page).

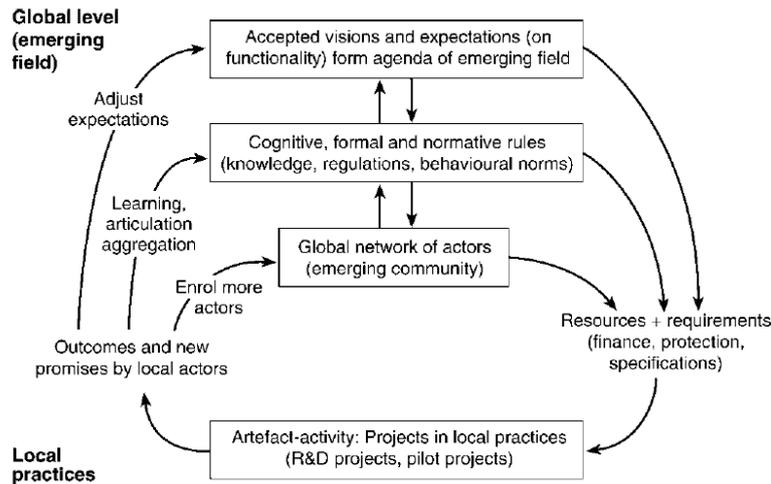


Figure 2: The dynamics of niche-development trajectories (source: Geels & Raven, 2006)

2.3 The stages of socio-technical experiments

The stages by which socio-technical experiments take place can be characterized using a combination of insights from Transition Management (TM) literature and Conceptual Niche Management (CNM) literature. Both theories describe the management of socio-technical experiments. The CNM literature represents a development of the Strategic Niche Management (SNM) literature by focusing on the societal embedding of new sustainable concepts (Hegger et al., 2007; Monaghan, 2009; Witkamp et al., 2011). Thereby, it focuses less than SNM on the technological aspect of experimentation and more on the fulfilment of societal functions (Monaghan, 2009). According to the CNM point of departure, changes in institutions are means towards the realisation of a certain concept of sustainable transformation of socio-technical systems. Changes in institutions are affected by coordinated management of socio-technical experiments. This management is executed by a variety of actors that are deemed relevant to realize the concept.

According to the TM literature, experiments can be subdivided into two stages: project initiation and project execution (Loorbach & Rotmans, 2006). The TM literature does not discuss in detail what these stages entail. However, the CNM literature supplements the TM literature on the content of these stages as it discusses concepts of co-ordinated management of socio-technical experiments (Hegger et al., 2007; Witkamp et al., 2011). Hegger et al. (2007) stress the steps of which the stages of project initiation and project execution exist. According to the authors, the management of socio-technical projects consists of the following iterative steps meaning that they take place repeatedly during the project (Hegger et al., 2007): (1) definition of a sustainable concept for the transformation of a socio-technical system, which forms the starting point of an experiment; (2) an exploration of how this concept socially could be embedded, stressing an examination of which actors could potentially have an interest in the concept, to which extent they are actually involved, and why they are involved; (3) starting exploratory talks with the potential actors, bringing them together and the construction of a form that fits a certain reality, highlighting the formation of a local project network that is characterized by the entering and leaving of actors and the creation of a mutually agreed-upon vision and the means of execution; (4) the execution of the socio-technical experiment, in which experimentation with technology is combined with experimentation with forms of social organization; and (5) the evaluation and summarization of the learning experiences that take place, which can form the basis for new projects. Following these descriptions, the stage of project initiation (i.e. project formation) consists of steps 1, 2 and 3. This stage consists of those events that enable a project to be executed. Accordingly, the stage of project execution consists of steps 4 and 5.

2.4 Typology of institutions

Although some literature only endogenizes cognitive rules, shared by the emerging community on the global-niche level (Smith & Raven, 2012), Raven & Geels (2010) and Geels & Raven (2006) recognize the importance of normative, regulative and cognitive rules. Following the three pillars of institutions of Scott (1995), and using different dimensions of socio-technical regimes, Geels (2004) and Smith & Raven (2012) both provide a typology of institutional changes that can take place in socio-technical transitions. These typologies are combined and summarized in table 1 and gives examples of institutions.

Table 1: Typology of institutions

	Regulative	Normative	Cognitive
Technology	Technical standards, product specifications, functional and infrastructural requirements, R&D subsidies	Companies own sense of itself, authority structures, testing procedures	Search heuristics, routines, expectations, technological guideposts, technical problem agenda, problem solving strategies, user representations
Science	Formal research programs, rules for government subsidies	Reviews procedures for publication, norms for citation	Preferences of established journals, paradigms
Policy	Administrative regulations, formal regulations of technology, subsidy programs, procurement programs	Policy goals, interaction patterns between industry and government, role perceptions of the government	Ideas about effectiveness of instruments, policy guiding principles, problem agendas
Socio-cultural	Media laws	Cultural value of innovation, ways in which user interact with firms	Media preferences, symbolic meanings of technologies, ideas about impacts
Users, markets and distribution networks	Market laws and rules, property rights, product quality laws, market subsidies, tax credits, competition rules	Role relationships between users and firms	User practices, user preferences, user competencies, interpretation of functionalities of technologies, perception of what 'the market' wants

Sources: Geels (2004); Smith & Raven (2012)

Institutions within and between dimensions of regimes are highly interdependent: *“Rules are not just linked within regimes, but also between regimes. The search heuristics of engineers are usually linked to user representations formulated by marketing departments. In stable markets, these user representations are aligned with user preferences. Search heuristics are also linked to product specifications, which in turn are linked to formal regulations (e.g. emission standards)”* (Geels, 2004, p. 905). Hence, the typology of institutions in table 1 needs further specification in order to classify institutions correctly. This specification, consisting of explanations and definitions of the different institutions, is provided in appendix A.

2.5 Conceptual model

The main mechanisms by which local experimentation affects institutional change, identified in current literature, are (1) alignment, learning and articulation, (2) social network building to enrol actors in local projects and form a global emerging community, and (3) articulation of local and trans-local expectations and visions to provide coordination (Berkhout et al., 2010; Brown et al., 2003; Geels & Raven, 2006; Hoogma et al., 2002; Raven & Geels, 2010; Raven et al., 2008; Smith & Raven, 2012). Sections 2.1 and 2.2 discussed these mechanisms and indicated some activities of these

mechanisms. In this paper, activities of mechanisms are defined as those operations or achievements that enable the functioning of mechanisms. So activities are performed so that the respective mechanism, on a higher level of abstraction, can be fulfilled. Table 2 lists the identified mechanisms, a definition of each mechanism and their function, and the activities by which these mechanisms are constituted. Each activity is marked to indicate whether they pertain to the global niche level (n) and/or local level (l).

Through the three mechanisms, and respective activities, identified in current literature, it is expected how local experimentation leads to changes in cognitive, formal and normative rules. The literature does not state the effect of mechanisms, and underlying activities, on the different types of institutions (i.e. cognitive, normative and regulative). As local experiments provide more interaction between society and technology (i.e. variation and selection) (Geels & Raven, 2006), it is assumed that they have a mediating effect on the institutional reforms that take place. This means that local experimentation influences institutional change that is taking place continuously and thus affects institutional change. The conceptual model in figure 3 (cf. page 18) presents the relation between local experimentation and institutional change.

Table 2: Mechanisms, their definition and function, and respective activities

Mechanism	Definition and function	Activity on global niche level (n) / local project level (l)
Alignment, learning and articulation	The alignment of different relevant local projects actors, generating and articulating local lessons by local networks and the connection of a diversity of local experiments by articulating global niche rules. This mechanism allows for retention and is called selection.	<ul style="list-style-type: none"> - Diversity of experiments (n) - Creating links between local networks (n) - Monitoring experiments (l) - Diffusion of ideas (l, n) - Circulating and comparing local experiences (l, n) - Aggregation activities (n) - Aligning expectations of actors through vision building processes like debates and negotiation processes (l, n)
Network building	The building of a global network of actors to form an emerging community and to transform global rules, and the building of (local) social networks providing resources. This mechanism allows for retention and variation.	<ul style="list-style-type: none"> - Providing complementary resources (l, n) - Involvement of outsiders (l, n) - Involvement of different (local) stakeholders (l, n) - Creation of intermediary organizations (n) - Ensuring practicability in local context (l) - Maintaining the involvement of local stakeholders (e.g. using covenants) (l)
Articulating expectations and visions	The articulation of shared visions and expectations in order to co-opt new actors, enable attraction of attention and resources, and to provide further guidance to experimental projects. This mechanism allows for variation.	<ul style="list-style-type: none"> - Deploying structured visioning exercises and performing claims making activities (l, n) - Voicing expectations at meetings, presentations and through lobbying activities by local actors (l)

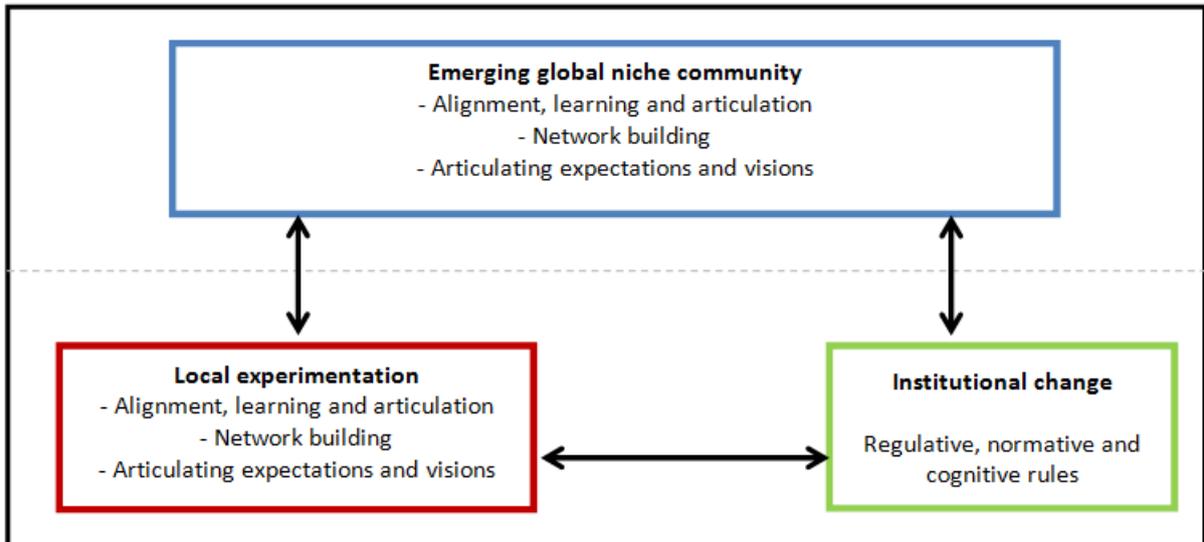


Figure 3: Conceptual model

The conceptual model exemplifies the mediating effect of local experimentation on the institutional change that takes place continuously. The three mechanisms identified in the literature can occur at the level of local experimentation and at the level of the emerging global niche. Table 2 (cf. page 17) listed the activities that pertain to the different mechanisms and marked whether they are performed on the global niche level and/or on the level of local experiments. These activities enable the functioning of the respective mechanism. When local lessons are generated, experiences and ideas are circulated and compared between relevant project actors, and expectations of different actors are aligned (through meetings, debates, etcetera), this can lead to reframed local rules (e.g. a shared local vision). When these local rules are articulated amongst local actors this can coordinate further local experimentation and lead to reframed cognitive, normative and regulative rules.

Next to local institutional change, institutional change at the level of the emerging global niche can occur. This requires the connection of a diversity of experiments. For the transformation of lessons from local experiments into generic lessons and global rules, ideas, experiences and lessons need to be circulated and compared between experiments. Aggregation activities need to be performed that allow reframing of trans-local norms and rules. Once these new global rules are articulated they provide guidance to further experimentation. Moreover, global niche actors can consequently refine regulative and normative rules of the emerging regime. The global niche community can be regarded as an important contextual influence for the effect of local experimentation on institutional change. In addition to local network building, an emerging global network of actors is necessary in order to provide local experiments with complementary resources and to secure the involvement of different actors. In this way, the global niche community and local social networks are interdependent as they can ensure enrolment of actors into each other network. Moreover, the global niche provides the protective space for local experiments (i.e. by the provision of finance, political support and/or technical specifications) and thereby secures their execution. The dotted line in the conceptual model shows that although the global niche community has an important contextual influence on local experimentation, local experiments constitute the main domain and focus in this thesis.

3. Methodology

3.1 Research design, strategy and functionality

The purpose of this thesis is to observe and investigate how local experimentation in practice affects institutional change. Subsequently, on the basis of observations made, this thesis suggests a framework with mechanisms, and underlying activities, through which local experiments affect institutional change. This thesis aims to contribute to current literature by corroborating mechanisms identified in the literature, and by providing new insights into mechanisms, underlying activities and respective dynamics. The conceptual model (cf. figure 3; page 18) provided these mechanisms and activities. In this way, it is partly deductive by verifying existing literature and inductive by providing new insights and suggesting a framework. This thesis thus aims to create more detailed insights into the mediating effect of local experimentation on institutional change. The results of this thesis need further verification by future research in order to develop a comprehensive framework on the effect of local experimentation on institutional change.

The research strategy is characterized as qualitative since data collection and analysis revolve around words. The epistemological orientation is rooted in positivism: the focus is on the gathering of facts (Bryman, 2008). Moreover, the ontological orientation is rooted in objectivism: social phenomena confront us as external facts and are beyond our reach or influence. This study has characteristics of a cross-sectional design, as observations are made at a single point in time (Bryman, 2008). Additionally, this study embodies characteristics of a case study, as exemplifying cases with experiments on EV are chosen that represent the broader category of experiments with EV. Due to these characteristics, this thesis is idiographic as well as nomothetic in its approach. It is idiographic in the sense that it will elucidate unique features of each case. Additionally, this thesis is nomothetic as it is concerned with generating statements that apply regardless of time and space. In order to identify mechanisms, activities and dynamics, a coding strategy is applied, which formed the core of the executed analysis. The methodological functionality is explanatory as the aim is to provide limited generalizations that explain how local experimentation can affect institutional change. Hence, policymakers are provided with insights on how to manage and design experimental projects with EV in such a way that it enables institutional change and thereby stimulates the development and diffusion of the innovation.

A comparative research structure is used in which findings among different local experiments with EV are compared (Bryman, 2008). This allows for corroboration of existing literature and for the generation of new insights that can be verified by future research. Two types of data are used to answer the last two sub-questions (cf. section 1.1). Semi-structured interviews with relevant actors of local experimental projects (engineers, project managers, governmental actors, users etc.) will be conducted. In total 14 interviews have been conducted with a minimum of 2 interviewed actors per case. The actors interviewed are listed per case in Appendix C. The interviewees are held anonymous on demand of some interviewees. The data for this approach is constituted by real-life observations of changes in institutions, the execution of activities, functioning of mechanisms and presence of dynamics. The sequence of questions (whether typical questions are asked or not) were not necessarily fixed as relevant actors are asked follow-up questions related to given answers that deviate from the predefined interview structure (Bryman, 2008). Moreover, document analysis is performed on project plans and other provided documents of experiments.

3.2 Case selection

This study focuses on local experiments with EV in the Netherlands because government inducements to innovation (which are institutions) differ between nations (Niosi et al., 1993). However, the geographical delineation to the Netherlands is also of societal relevance as the Netherlands is argued by the Dutch government to be the perfect nation for the development of EV (due to its size and its urbanization) (AgentschapNL, 2012a). In this paper experiments were defined

as “planned initiatives that embody a highly novel socio-technical configuration likely to lead to substantial (environmental) sustainability gains” (Berkhout et al., 2010, p. 262). The sampling frame that pertained to this study listed all experiments with EV in the Netherlands. Since this study highly relied on the availability of exemplifying cases no probability sample was drawn from the sampling frame. Therefore this thesis relied on a convenience sampling method (Bryman, 2008). Due to the non-probabilistic nature of the sampling method there was only limited possibility of generalizing findings to the population of local experiments in socio-technical transitions. Future research is needed to verify the findings of this thesis which will be presented in a framework.

The selection criteria of cases were constituted by the locality of experiments and the existence of a protective space. Locality of experiments refers not to geographical distinctions but to sociological distinctions between ‘local’ and ‘global’ (Geels & Deuten, 2006; Raven & Geels, 2010). Locality of experiments thereby entails the sharing of beliefs, orientations and schemas by practitioners which determine action in local practices (Hård, 1994). Therefore, the geographical scale of local projects generally includes a small-scale or no higher than regional scale (Brown et al., 2003; Raven et al., 2008). The presence of a protective space was determined by the provision of resources like finance, political support and technical specifications (Geels & Raven, 2006). In total six cases are studied (cf. Appendix C). The cases ‘Texel Gastvrij Elektrisch Vervoer’ (TGEV), ‘Elektropool Haaglanden’ (EH) and ‘Rotterdam Test Elektrisch Rijden’ (RTER) are located in a protective space provided by the prolongation of a government subsidy provided by the Dutch agency ‘AgentschapNL’. These experiments are part of the subsidy program ‘Proeftuin Hybride en Elektrisch Rijden’ (i.e. ‘Electric Testing Grounds’) (AgentschapNL, 2012b). Nine projects were selected by the government that together are provided with a 10 million euro subsidy for the period 01 January 2011 – 01 January 2013 (Overheid.nl, 2010; Rijksoverheid, 2010). These projects were selected by former minister of Transport, Public Works and Water Management (Dutch: ‘Ministerie van Verkeer en Waterstaat’) Camiel Eurlings in 2010. All projects embody the testing of several EV in combination with charging infrastructure (Rijksoverheid, 2010). Furthermore, three experiments are selected that are protected by the provision of political support by the associated province. This concerns ‘Drive4Electric’ (D4E), which is a project supported by the province of Friesland. Moreover, the project ‘Draadloos Oplaadbare Bus’ (DOB) is selected, which is supported by province of Northern-Brabant. At last, the project ‘Delta Stadsdistributie’ (DS) is selected, whose protection is provided by support from the municipality of Zutphen.

3.3 Analytical strategy

In this study, interpretation of data, collected through semi-structured interviews and document analyses, was at the core of the empirical procedure. Interpretation occurred through the procedures of open coding and constant comparison (Flick, 2009). In order to be able to analyse each case, excerpts of the interviews and documents were written that helped to provide case-specific results and to analyse the raw data. In these excerpts, whole interviews were not transcribed but all the relevant raw data was present. Thus, a descriptive summarized text of each interview and analysed document was produced. These excerpts were sent back to the interviewees in order to check whether no interpretation was present in the raw data. After the return of these excerpts, possible feedback of interviewees was processed. The (revised) excerpts formed the basis for the generation of case-specific results. Subsequently, the coding strategy was applied on these excerpts. The result of open coding was a large amount of concepts with a low level of abstraction (Goulding, 2002). Therefore, in order to group those to form higher level concepts (i.e. categories), a constant comparison method was applied by going back and forth between the raw data and resulting concepts. Moreover, memos were produced, during coding, that helped in providing guidance and overview in the analytical processes of open coding and constant comparison. These memos comprised short analytical explanations on the relation between experimentation and institutional change stressing mechanisms, activities, dynamics and reformed institutions. Open coding and

constant comparison processes were not sequentially executed and, therefore, they repeatedly referred back to each other. The coding strategy was applied using the analytical coding tool ATLAS.ti version 6.2. (ATLAS.ti, 2013)

The excerpts of the interviews and documents constituted the basis of the results and analyses chapters of the study. Using the excerpts case-specific information was provided on the projects, which comprise the case results chapter of this thesis. Case-specific information refers to (1) a description of the project and (2) a discussion of what actually happened during the project. The case results chapter does not embody any form of interpretation or analysis. First, each project is described on means, background, goals, actors involved, and the roles of the respective actors. Second, every project is discussed on what in practice has occurred at the local level. This part is structured using the combination of stages of socio-technical experiments discussed in the theory chapter. At first, each experiment is discussed on the events that took place with respect to project initiation (i.e. project formation). Subsequently, each experiment is discussed on the events that occurred during project execution.

Subsequently, the coding strategy was applied on the excerpts. The outcome of the coding strategy, constituted by concepts, categories and memo's, formed the basis of case-specific analyses. In the coding strategy, the mechanisms, activities and respective dynamics formed the empirical instances that were approached. The mechanisms, activities and dynamics, and their relation with institutional change are discussed per project, which resulted in case-specific analysis sections. The interaction with the global niche level is addressed per project. These sections are structured similarly to the results chapter. At first, the relation between institutional change and local experiments is per experiment discussed for the project formation stage. Subsequently, the relation is discussed for the project execution stage. Each case-specific analysis section ends with a short reflection. Additionally, by comparing these case-specific analyses limited generalizations are made on the mechanisms, activities, and related dynamics, through which local experimentation affects institutional change. These generalizations are provided in the comparative analysis section. This section is structured by the various specific institutional changes for which are observed to be affected by a particular mechanism in more than one project. The institutions listed in table 1 were used in this thesis as sensitizing concepts in the analytical strategy. In their role as sensitizing concept, the concepts gave general guidance in approaching empirical instances as they merely suggested directions along which to look for an explanation or an answer to the research question (Blumer, 1954). So using the institutions in table 1 as sensitizing concepts provided clues and suggestions on the mechanisms, underlying activities and respective dynamics that affected change in the indicated institutions. In the analysis of data, the concepts and categories that emerged were checked against the theoretical framework in order to allow for theoretical sensitivity (Suddaby, 2006).

3.4 Quality of research

The reliability of research is concerned with the objectivity and the reproducibility of findings. Objectivity is guaranteed by making use of methodology triangulation in data analysis. Two different methods of data gathering were used with same weighting: semi-structured interviews and documents (e.g. project plans and other provided documents). Moreover, reproducibility for future research is conveyed by clearly specifying the procedures of data collection (i.e. interview scheme and sampling strategy) and data analysis (i.e. coding strategy) (Bryman, 2008).

Internal validity is guaranteed when there is a good match between observations made and theoretical ideas developed. Theoretical ideas developed, were grounded in all relevant raw data by using quotes to exemplify the concepts and categories abstracted. This included a matter of 'fingerspitzengefühl' which cannot readily be codified and reported on. In this way, there was a high congruence between concepts extracted and observations made using interviews and documents. External validity includes whether results can be generalized towards the population under study.

Given the non-probabilistic nature of this sampling method there was limited possibility of generalizing our findings to local experiments in socio-technical transitions. However, since this study aimed to provide insights that need to be confirmed by future research, this was not considered a problem. Construct validity refers to whether the indicators used reflect the concepts they intend to measure. The indicators that were used to measure the effect of local experimentation on institutional change were grounded extensively in the literature used to develop the theoretical framework. Institutional change was assessed by changes in the rules provided in table 1. Moreover, the rules were used as sensitizing concepts (Bryman, 2008).

4. Case results

This chapter discusses the results of the cases researched. It is divided into three main sections per case. The first section provides a description of the respective project. This entails a description of each project on the means, background, goals, actors involved, and roles of the respective actors. Then a discussion follows of what actually has occurred during the formation of the project. This concerns the start-up of the respective project and mainly includes information on the formation of the project network and the creation of shared visions, goals and means. Hence, it provides information on events relevant for the project to be executed. The third section embodies a discussion on events relevant for the execution of the respective experiment, which also entails a summarization of learning experiences that took place. The experiences gained during the execution of the projects shall therefore be addressed.

4.1 Case 1: ‘Texel Gastvrij Elektrisch Vervoer’ (TGEV)

4.1.1. Description

‘Texel Gastvrij Elektrisch Vervoer’ (TGEV) is a project on the Dutch island Texel and is one of the nine projects within the Dutch subsidy program ‘Electric Testing Grounds’ (i.e. ‘Proeftuin Hybride en Elektrisch Rijden’) (AgentschapNL, 2012b). With the project TGEV, residents and tourists on the island are made acquainted with EV. In total, 23 organizations procured 28 EV and related (public and private) charging infrastructure (Project plan TGEV, 2012; Stichting Urgenda, 2013). The infrastructure is constituted by 40 charging points which are spread throughout the island. The acquisition of 28 EV and charging infrastructure are (partly) subsidized by the Dutch governmental agency AgentschapNL. The EV reflect different types of cars with respect to their use: rental cars, taxi’s, delivery cars, tuk-tuks, and cars for private and business use. The 23 participants in the project are ‘Stichting Urgenda’ (i.e. Urgenda Foundation), the municipality of Texel, ‘Texel Energie’ (i.e. ‘Texel Energy’) and 19 other Texel-based companies (Project plan TGEV, 2012). A list of the participants, including their (intended) role and accompanied purchased EV, is provided in appendix D.

The project is managed by Stichting Urgenda, which means that it has the secretary function of the project. In this way, Stichting Urgenda has the administrative function to procure the subsidy and to report to the agency. Additionally, managing the project includes guiding the project as well as guiding the monitoring, which was executed by an external organization called The New Motion. Furthermore, it includes guiding the behavioural research that took place among the participants. The municipality of Texel has a facilitating role concerning the implementation of charging stations and regulation. Additionally, the municipality is also a user of EV in the project. At last, a steering committee is formulated which is constituted by representatives of Stichting Urgenda, the municipality of Texel, Texel Energie, ‘Texels Verbond van Ondernemers’ (i.e. ‘Texels Association of Entrepreneurs’), and participants. The committee will watch the project and make strategic decisions.

The background of this project resides in the broader project ‘Duurzaam Texel’ (i.e. ‘Sustainable Texel’) started by Stichting Urgenda in cooperation with the sustainable front runners of

Texel in 2008 (Project plan TGEV, 2012). The vision of the project, called 'Texel geeft Energie' (i.e. 'Texel provides Energy'), entails realizing a climate neutral island in 2020 (ATO, 2010; Project plan TGEV, 2012). The vision formulates the execution of multiple sustainable projects. Next to this broader vision, some goals are stated in the project plan of TGEV (Project plan TGEV, 2012):

- Creating a bearing surface as well as increasing the degree of acceptance for EV among the residents of Texel and tourists. The aim is to have realized 50 EV driving on Texel at the end of 2012.
- Identifying under which conditions residents and tourists are made enthusiastic in the short term. This includes understanding how to create an island that completely drives using EV creates the basis for respective action.
- Researching the behaviour of different users of EV as well as their effect on the behaviour of the car and/or battery.
- Developing a follow-up project 'Texel Duurzaam Elektrisch' (i.e. 'Texel Sustainable Electric') with the aim of inciting and getting the whole island to use EV, for which this project (TGEV) forms the basis.
- Diffusing the knowledge and insights gained in this project.

The municipality of Texel, Stichting Urgenda and The New Motion are monitoring the project on juridical, cognitive, financial, technical and organizational aspects and hope to learn on these aspects to enhance the roll-out of EV on the island (Stichting Urgenda, 2013). By the use of computers, which are installed in the vehicles, the New Motion collects and analyses the project on some of these aspects. This was a prerequisite of every Electric Testing Ground project in order to procure the subsidy provided by AgentschapNL. The events relevant to the start-up of TGEV will now be presented.

4.1.2. Project formation

The events relevant to project formation are identified by conducting interviews with Stichting Urgenda and the municipality of Texel. Moreover, in order to collect information about the start-up, the project plan of TGEV is used to supplement the interviews conducted. The municipality of Texel was the initiator of the project. They intentionally involved Stichting Urgenda to start-up and manage the project. The start-up stage of TGEV included some major events. In order to launch the project a project plan was written (Project plan TGEV, 2012). The project plan was a result of intensive short-term collaboration of Stichting Urgenda, the municipality of Texel and all other actors that were mobilized to collaborate in the project. The project plan stated that a steering committee was formulated constituted by representatives of Stichting Urgenda, the municipality of Texel, Texel Energie, Texels Verbond van Ondernemers, and participants. The committee watched the project and made strategic decisions.

The municipality of Texel stated that the mobilization of organizations to participate in the project was facilitated by the context of the project. Since the project is executed on the island of Texel, the actors involved are acquainted with each other and are connected through prior established (in) formal relationships. Although the project plan had to be written in a relatively short time, more than 20 organizations were found to participate in the project. The municipality of Texel indicated that these prior established relationships were crucial for the start of the project and the formation of the local project network. After the project was started some organizations decided to quit their involvement by stepping out of the project, which delayed the formation of the project network. This was for instance due to a delayed availability of EV or influences of the financial crisis. Another aspect that hampered the start-up of the project concerned external regulation. In order to dig a hole in the ground, allowing the charging stations to be placed, external regulation demands a clean land declaration. This is solved by performing a broad research on soil at Texel. Furthermore, the role of Texel Energie was altered after the project plan was finished, which affected the

formation of the final local project network. Their intended role was to supply the energy flowing through the charging stations. However, due to a contract that the owner of the charging stations 'Stichting E-Laad' (i.e. 'E-Laad Foundation') concluded with another energy supplier, this was not possible. Eventually, Texel Energie acted as user in TGEV.

In order to execute the project a subsidy was provided by AgentschapNL. The subsidy included that purchasers of EV are compensated for 80% of the additional costs of an EV pertaining to a conventional car. Next to this subsidy, the financing of the project is constituted by an individual investment at the part of the participants. The interviewees stated that another factor influenced the formation of the project network, which was the presence of a broad local supporting climate for sustainability and EV. Both interviewees stressed that the dedication amongst the eventual participants benefited the start of the project as it eased the mobilization of them to participate in TGEV.

4.1.3. Project execution

According to the conducted interviews and the project plan, communication between the different participants is significant for the execution stage of TGEV. The municipality of Texel and Stichting Urgenda communicate a lot. Next to meetings regarding TGEV, the actors communicate in non-TGEV related meetings. In these meetings experiences are communicated, encountered problems are signalled, and, if possible, solutions are formulated. The interviewees both addressed the importance of non-TGEV related meetings which take place due to the involvement of the respective organizations in multiple (sustainability) projects. Additionally, some other meetings were organized in which the different participants of TGEV were present. According to the project plan, every six months meetings, workshops and seminars would be organized in order to share experiences, and diffuse knowledge. According to the interviewees, these activities actually happened every quarter of a year. Moreover, the interviewees stated that meetings of groups of users were organized in which users could exchange experiences and knowledge.

Both interviewees stated that the dedication amongst participants involved in the project not only stimulated the formation of the project, but also the further execution of the project by mobilizing people to make the change towards EV. Moreover, it was addressed that the dedication amongst participants constituted the basis for their involvement in multiple sustainability projects, which was important for the communication between Stichting Urgenda and the municipality of Texel. Important for the execution of the project was the role of the municipality of Texel. This was acknowledged in the interview conducted with Stichting Urgenda. The municipality of Texel is actively involved in stimulating EV. The municipality performed and currently performs multiple activities to promote EV. They act as a user of EV in the project. Next to this, they purchased two other electric cars later on. Second, they co-organized with Stichting Urgenda several demonstration events of EV as well as demonstration events of the charging infrastructure, in order to promote EV and mobilize people on Texel. While organizing these events, Stichting Urgenda and the municipality used their (in) formal relationships to mobilize participants to take part in the events. Both interviewees stated that with the project, they intend to get more people engaged with EV in order to set in a movement towards EV. In addition, the municipality of Texel highlighted that the media is used to refer to these events in which the link continuously is made to sustainability in general. Moreover, the media itself was used multiple times in order to mobilize people.

According to Stichting Urgenda and the municipality of Texel, people were really mobilized. The municipality of Texel stressed that some board of executives of the municipality have shifted their preference towards EV as a means to reach sustainability on Texel. Stichting Urgenda addresses that in the formation phase of a new project with EV, a lot of entrepreneurs showed their interest in participating in the project and actually buying EV. Additionally, as more people were mobilized to use EV, this influenced the decision of other people to change their transportation mode towards EV. Both interviewees addressed that such sequel events are organized with the purpose of creating a movement towards EV. Thus, in order to reinforce the creation of such a movement, other projects are initiated, that build on TGEV. The municipality of Texel for instance mentioned the organization

of a sequel project concerning public transport. With the use of TGEV, they would like to make public transport as much as possible electric.

At last, the role of the municipality of Texel can be characterized by the fact that they facilitated the implementation of charging stations in the public space by spreading them throughout the island and intentionally locating them on the most visited parking areas. Additionally, the municipality of Texel intended to facilitate the use of the EV parking lot by locating them next to the parking lot for disabled people, which indicates the best location for parking lots on parking areas. However, due to this location, drivers of ICEV parked their cars at the EV parking lot. This was experienced as a barrier by Stichting Urgenda and other participants in the project. Subsequently, Stichting Urgenda communicated the experience of this barrier to the municipality of Texel in order to look for a solution collectively. Moreover, the experience of this barrier led to looking for a solution on a national level, by exchanging experiences and knowledge with other projects. Stichting Urgenda argues that the solution to the problem is using different marking, which is a solution they received from actors involved in a project with EV in Den Bosch.

Another barrier that was experienced, and subsequently communicated to the municipality to be solved, concerns the use of parking fees. There is no single policy on the employment of parking fees. This problem was addressed in the interviews conducted with Stichting Urgenda. Another example of a barrier that was experienced concerns the implementation of private charging stations at homes that do not have a private area to locate the charging station. The observation of this barrier was communicated to other municipalities that are active in the field of EV. Technical barriers were also experienced by the users of EV. The problem of a low performing battery and the resulting low range of EV, were interpreted as barriers by the users of the EV. Therefore, both interviewees highlighted the significance of technological development in the battery. As a reaction on these barriers, the users of EV altered their behaviour.

Both interviewees thus highlighted that a lot of improvements still have to be made regarding the performance of the battery of EV. However, despite the experience of this technical barrier, the users in the project are generally positive about EV. Besides these barriers that are observed, some general and positive aspects of EV are experienced. An example, which was addressed in the interview conducted with Stichting Urgenda, concerns the quietness and acceleration of EV. Some users even decided to purchase more EV due to their positive experiences.

One of the goals of the project was to monitor the behaviour of the users as well as their influence on the performance of the car and the battery. In order to inquire user behaviour, interviews are conducted with the users of EV in order to collect user feedback and subsequently to diffuse this knowledge. The external monitoring by The New Motion (i.e. collecting statistics on the usage of the car and the effect on the battery) was a request of AgentschapNL and therefore their involvement in the project was arranged by the agency itself.

4.2 Case 2: 'Elektropool Haaglanden' (EH)

4.2.1. Description

'Elektropool Haaglanden' (EH) is also one of the nine Electric Testing Grounds projects and is thus part of the subsidy program of AgentschapNL (AgentschapNL, 2012b). It is situated in the region of The Hague. The concept of pool cars is being experimented by cooperating firms, leasing companies, car suppliers, energy suppliers and social companies and in the project (Project plan EH, X). The main goal of the project is to gain experience with electric (pool) cars, and to diffuse subsequent knowledge and lessons. Moreover, the intention is to spur the roll-out of EV, for instance by increasing the degree of acceptance. During the project 12 EV will be subject to test, of which 11 pool cars and 1 delivery car (AgentschapNL, 2012b). The charging infrastructure of the project consists of 12 NRGSPOT charging stations (Elektropool Haaglanden, 2013a). From the interviews it was made clear that the project is expected to end mid-2013. The project started in 2012 due to some problems setting up and starting the project (Stadsgewest Haaglanden, 2012).

The background of the project is constituted by the regional covenant 'mobility management' which is signed by a multiplicity of employers, intermediary organizations and governmental organizations in the region Haaglanden. This covenant forms the context of this project. The goal of the covenant is to reach at least a 6% reduction in the amount of kilometres by cars. Argued from the perspective of mobility management, pool cars (for business purposes) are a part of the solution to reach this goal. However, as EV are clean and sustainable, this cuts both ways. Moreover, pool cars offer the advantage to gain experiences for a diversity of drivers. This broadens the learning capability of this project to be monitored (Project plan EH, X).

The secretary of this project is 'Ontwikkelingsmaatschappij (OM) The Hague' (i.e. 'Development Company The Hague') which manages the project. They form a consortium, responsible for the execution of the project, with the following participants: Dunea, Eneco, Focus Koeriers, 'Fontys Hogeschool' (i.e. 'Fontys College'), Rabobank The Hague, RouteConnect, Stedin, VCCR and WagenPlan Autolease (Elektropool Haaglanden, 2013b). These participants have different roles and goals within the project (Project plan EH, X):

- Dunea: User of one EV.
- Eneco: Implementation, provision and monitoring of 12 NRGSPOT charging stations, testing of the smart charging concept 'Steered Charging' together with Stedin. Moreover they function as energy supplier and as user of two EV.
- Focus Koeriers: User of one EV.
- Fontys Hogeschool: Researches and analyses the data about the use of EV.
- Rabobank The Hague: User of two EV.
- RouteConnect: Provision of board computers as well as the monitoring of the use of EV.
- Stedin: Grid operator and testing of the smart charging concept 'Steered Charging' together with Eneco.
- VCCR: Implementation of the carpool concept, which includes leasing EV from WagenPlan and subsequently supplying them to users that are not part of the consortium. These are listed in Appendix E.
- WagenPlan Autolease: Leasing company of EV and thereby provides the EV within the project. The company has the aim to learn about the marketable value process of different types of EV as well as about insurance issues of EV.

The consortium aims to gain experience on and generate lessons concerning energy consumption and behaviour, safety and reliability, user experiences, mobility and logistics, and economical statistics. Thereby the project is actually comprised of a multiplicity of minor projects that focus on a particular type of learning area and comprehensively contribute to the main goal. An important learning dimension in this project is constituted by user experiences since all EV are provided with a board computer that monitors the use of the respective vehicle. Next to these participants OC Mobility Coaching, ANWB, Airborne Ypenburg, 'BAM Utiliteitsbouw', the municipality of The Hague, the Chamber of Commerce, 'Stadsgewest Haaglanden' and Staedion are involved in the project (Stadsgewest Haaglanden, 2012). A description of their roles is provided in appendix E. Some changes are made with respect to the project plan, as some intended participants were Mercedes, Community College Leiden (which is part of ROC Leiden), Haag Wonen and Alcatel Lucent (Project plan EH, X). These organizations quitted their involvement after the start of the project.

Although OM The Hague fulfils the secretary function in EH, a part of the management of the project is delegated to consultant company OC Mobility Coaching. Moreover, according to the project plan, a steering group and a project group are formulated in which representatives of the participants, Ontwikkelingsmaatschappij The Hague, Eneco and WagenPlan are present. The steering group has meetings several times a year, while the project group meets at least every 6 weeks. Next to these meetings, the participants in the project meet every 6 months in order to diffuse knowledge and experiences generated in the project (Project plan EH, X). Information relevant to the start-up of EH will now be discussed.

4.2.2. Project formation

The events relevant for EH are identified by conducting interviews with secretary OM The Hague, Eneco, Stedin and the municipality of The Hague. The data is supplemented with valid information included in the project plan. The initiation of the project was characterized by some events. At first, a project plan was written by OC Mobility Coaching in cooperation with all the aimed participants. In order to manage the project a project group (i.e. consortium) and a steering group were established in which all participants are represented (Project plan EH, X). The interviewee of Stedin stressed that the project plan of the project 'Rotterdam Test Elektrisch Rijden' (RTER) was used to guide the writing of the project plan of EH.

The start-up of the project was hampered by some problems that were experienced. The first problem that affected the start-up of the project was a lower subsidy provision than expected. The subsidy that was provided by AgentschapNL (i.e. €500.000) was lower than the amount that was determined a priori to the provision (i.e. €650.000). This influenced the financial planning of the project since financial structures had to be altered. Thereby, as a consequence, some participants had to invest more themselves. Moreover, the start-up of the project experienced some fine-tuning of actors. According to OM The Hague, the municipality of The Hague and Eneco, a major aspect of managing the project concerns the fine-tuning of interests and actions of different actors. This was for instance the case during the acquisition of one Mitsubishi i-MiEV. Due to the occurrence of an earthquake and a tsunami in Japan, the supply of EV was delayed. Therefore, the activities of WagenPlan, one user and RouteConnect had to be fine-tuned.

The execution of the project also differs substantially from what is described in the project plan. This concerns the formation of the local project network as well as the means of the project. The concept of shared carpooling could eventually not be executed because no policy existed on the implementation of public charging stations in The Hague. The municipality of The Hague has always favoured natural gas as fossil fuel and subsequently biogas as renewable energy source. Therefore, The Hague was not prepared for the roll-out of EV. Since no policy existed on public charging stations, no organizations could be involved in the project that had no private area for charging stations. A kink is thereby observed in the search for particular participants. Currently, the perception of EV has changed and a policy does exist.

Hence, this influenced project network formation and, for instance, resulted into the involvement of organizations like Dunea and Rabobank The Hague. The mobilization of these actors was quite difficult since they had to be convinced of the concept of carpooling. Moreover, it was hard to mobilize certain actors because of the existence of contracts with leasing companies other than WagenPlan, which made their involvement within EH impossible. All the organizations that are currently involved in EH have concluded a contract with WagenPlan. Nevertheless, a factor that facilitated the formation of the project network was the fact that OM The Hague executes project management of a broader platform of organizations called 'Duurzaam Den Haag' (i.e. 'Sustainable The Hague'). The mobilization of necessary actors was stimulated by contacts they established through this platform. Moreover, mobilization of actors was facilitated by the fact that these contacts are all sustainability oriented, which means that they all focus on sustainable technologies.

The formation of the local project network was affected by several other events. According to the project plan, Mercedes was one of the initial organizations that constituted the consortium. Mercedes would supply five EV in order to execute the 'Steered Charging' concept of Eneco and Stedin. These vehicles would be the first ones that could supply power back to the grid. However, due to claims inherent to the subsidy provision of AgentschapNL, Mercedes eventually decided not to supply these EV. One of the conditions of the subsidy provision by AgentschapNL is that the property rights of the respective EV are transmitted from organizations outside the project to organizations within the project. This meant that Mercedes (The Hague) would have to buy the EV from the Mercedes office in Germany. However, the Mercedes office in Germany did not want to transmit the property rights of the undeveloped EV to Mercedes (The Hague), which resulted into Mercedes finally leaving the project. Moreover, the project plan stated the involvement of ROC

Leiden in the project. ROC Leiden decided to quit their involvement because they moved to another office and because the company got a new board. The formation of the project network was hampered due to these events.

4.2.3. Project execution

The execution of the project started with a kick-off meeting in April 2012. Although the main goal was to generate lessons and not to promote EV some people were mobilized. Some organizations wanted to participate in the project, but that was not possible as the project was officially started and no participants could be added to the project network. These organizations were part of OM The Hague's prior established network.

'Elektropool Haaglanden' is characterized by the involvement of other organizations after the project group was established. These companies are not part of the consortium. This concerns the involvement of BAM Utiliteitsbouw, Staedion, Airborne Ypenburg and the municipality of The Hague. The EV they use are supplied by VCCR. For example, BAM Utiliteitsbouw was added to the project network because they possessed an EV (e.g. Nissan Leaf) that was not included in EH yet. Since gaining experience and lessons with EV constitutes the main goal of the project, the adding of a Nissan Leaf enabled more differentiated learning as multiple types of EV are included in the project. In total OM The Hague realized the inclusion of six different EV. The connection with BAM Utiliteitsbouw was the result of OM The Hague's involvement in the platform 'Sustainable The Hague', in which BAM Utiliteitsbouw is also participating.

The role of the municipality of The Hague for the execution of EH needs to be addressed. The absence of a policy on EV, including policy on the implementation of public charging stations, affected the start-up of the project. In order to encourage the municipality of The Hague to develop policy, OM The Hague indicated the importance of convincing them to participate in the project as a user. Moreover, OM The Hague stated that they continuously addressed the lack of policy to the municipality and that they experienced that as a huge barrier. The confrontation of this barrier and the involvement of the municipality in EH, as a user of two EV, had the intended effect. The municipality acknowledged the presence of this barrier and subsequently developed policy on EV. OM The Hague stated that the project indirectly caused the development of a policy on EV in The Hague. The municipality of The Hague predominantly emphasised developments external to the project as being significant for the development of the policy. The interviewee, who acts as a user of EV in the project, highlighted from experience that a lot of technical improvements need to be made. However, although the user experiences some technical barriers (e.g. problems when starting the vehicle and the uncomfortable experience of driving the vehicle), it is about to purchase a new EV. Thus, despite the experience of these technical barriers, the user is generally positive about EV and even intends to buy a new one.

Although policy on EV has been developed in The Hague, Stadsgewest Haaglanden, which is comprised of nine municipalities in the region of The Hague, intends to develop policy for the whole region of Haaglanden. Since E-Laad Foundation quitted their operations of implementing public charging stations, Stadsgewest Haaglanden felt the need for developing a more coordinated policy. Because of their involvement as secretary in EH, OM The Hague has been mobilized by Stadsgewest Haaglanden to execute a new (sequel) project. The project includes an examination of how to implement EV charging infrastructure in the region Haaglanden in the future. The policy of the front running municipalities in The Netherlands will be used as a basis for this project.

The different partners included in the consortium meet at least each 6 weeks in order exchange experiences and diffuse lessons and knowledge. Barriers and other experiences are addressed in these meetings. Moreover, OM The Hague, the municipality of The Hague and Stedin highlighted the importance of interaction and exchange of knowledge and experiences with other projects. AgentschapNL for instance organized several meetings in which the Electric Testing Ground projects diffused knowledge and experiences. Several barriers were experienced during the execution of the project. The absence of a policy on EV in The Hague was experienced as a huge barrier, which was addressed by OM The Hague. In the interviews conducted with the municipality of

The Hague and Stedin several technical barriers were highlighted. At first, barriers were observed with respect to starting the comfort of vehicles. Moreover, the performance of vehicles and the battery, and the related range of the EV were addressed as barriers. The interviewees state that (external) technological development is crucial to solve these problems. According to the municipality of The Hague, these technical barriers decrease the success of projects. Therefore, sequel projects should be employed that build on current projects but are accommodated with newer developed EV and charging stations. Despite the experience of these technical barriers, users are generally positive about EV and even decide to purchase new EV in the future. Eneco and the municipality of The Hague stress that users changed their driving behaviour due to the experience of these technical barriers. Users for instance employ more detailed planning before they start driving.

In the interview conducted with the municipality of The Hague, other technical barriers were addressed from which lessons were learned. For example, due to the execution of this project, Eneco learned that their old version of NRGSPOT charging stations could only store a limited amount of charging cards. Due to the experience of this technical barrier Eneco will improve the software of their NRGSPOT charging stations, so that they can store a lot more charging cards. Two other technical barriers that were observed are highlighted by Eneco. At first, during the execution of the project they experienced that not all EV are able to employ modulated charging. Furthermore, it was learned that a facility should be built within the charging stations that enables unbolting of the plug when the supply relays drops out. These lessons are learned through collecting feedback from users. Eneco stresses the importance of periodical questionnaires, interviews with users and collection through their back-office.

The municipality of The Hague stressed some other barriers that were experienced during the execution of the project. These problems were observed at multiple projects. This is due to the involvement of Eneco and Stedin in a variety of experiments. However, this project is significant for the observation of these barriers due to the technical approach of Eneco and Stedin. The experiences of these problems are exchanged between projects which subsequently resulted into lobbying activities by lobby organizations. The municipality of The Hague provided the example of the costs of charging stations. Currently, no viable business case can be developed due to the high costs of charging stations. This constitutes a large barrier for the roll-out of EV which was observed in EH as well as in other experiments. Two solutions that could lower these costs are (1) decreasing the connection values of charging stations and (2) removing the grid gauge. Since these solutions demand the change of national regulation (e.g. 'Energiewet') lobby organizations are involved in order to realize such reforms.

The main goal of the project was to generate lessons. Most learning takes place through experiences gained during the execution of the project. Furthermore, different monitoring takes place which demonstrated the presence of different barriers that were discussed above. At first, feedback of users of EV is collected by conducting interviews and through the distribution of online questionnaires. These were conducted and distributed at the beginning of the project as well as at the end of the project in order to examine the change in user behaviour. Second, statistics are generated on the behaviour of the vehicles and the battery. These are monitored and analysed by Fontis Hogeschool. Six different types of EV were included in the project in order to generate as much representative statistics as possible. The generated data, with respect to all minor projects, will be evaluated at the end of the project, which is set at August 2013. The minor project 'Steered Charging' of Eneco and Stedin is expected to be evaluated in June 2013 and will be executed by Eneco and Stedin themselves. The NRGSPOT charging stations of Eneco are also monitored by a back-office. The municipality of The Hague highlighted that due to the execution of the 'Steered Charging' concept, Stedin is more aware of the impact that EV has on their (future) business. Likewise, Eneco has higher expectations of EV due to the execution of the concept. Moreover, this project initiated another project by Eneco in which they aim to market the steered charging concept.

4.3 Case 3: 'Rotterdam Test Elektrisch Rijden' (RTER)

4.3.1. Description

'Rotterdam Test Elektrisch Rijden' (RTER) is the last Electric Testing Ground project that is researched and is thus part of the subsidy program of AgentschapNL (AgentschapNL, 2012b). The project is executed in Rotterdam and was started in September 2010. The experiment entails the testing of 75 EV and plug-in hybrid vehicles and related private, semi-public and public charging infrastructure by 100 employees of the following organizations: Stedin, Eneco, the municipality of Rotterdam, Joulz, Port of Rotterdam Authority, and the RET. The EV are used for different purposes as some are used as pool cars, as cars for municipal services, or as company cars (AgentschapNL, 2012b). A project group (i.e. consortium) is established in which representatives of the following three main actors of this project are present: Stedin, Eneco and the municipality of Rotterdam. The involvement of Joulz, Port of Rotterdam Authority and RET are ensured since companies these are organizational subordinates (i.e. subsidiaries) of the three main actors. The project is expected to end April 2013. The project is currently executed and monitored.

The project group meets at least every 3 weeks in order to exchange knowledge and experiences. Additionally, a steering group is formulated that consists of representatives of these three organizations. The steering group meets each quarter a year and makes strategic decisions. These main actors have different roles in the project. Stedin as a grid operator is responsible for the construction and maintenance of the grid. They specifically focus on the impact of EV on the electricity grid and decentralized generation of sustainable energy. Moreover, Stedin is secretary of the project. An external project coordinator was involved that pursued project management, including the communication with AgentschapNL as well as the procurement of the subsidy. In total, the acquisition and monitoring of 30 vehicles in the project are (partly) subsidized by AgentschapNL. All these vehicles are being used since April 2012 (RTER, 2013). A reference group of ICEV is constituted in order to enable a comparison of EV with ICEV on different aspects. Eneco as an energy company is responsible for the charging infrastructure, which is comprised by 70 NRGSPOT charging stations (AgentschapNL, 2012b; RTER, 2013). Additionally, Eneco manages the customer identification and payment systems in their NRGSPOT charging stations. Eneco intends to learn whether there is a sustainable business for them as service provider of charging stations. At last, the municipality of Rotterdam facilitates the project and is specifically focused on the effects on air quality and the contribution of EV in realizing the transition towards sustainable mobility in Rotterdam. The municipality of Rotterdam thereby participates as user of EV in the project.

The background of the project is constituted by the sustainability program 'Rotterdam Climate Initiative' (RCI). This initiative focuses on decreasing CO₂-emissions, adaptation to climate change and intends to strengthen the economy of Rotterdam (RIC, 2013a). The main participants of this initiative are Port of Rotterdam Authority, the municipality of Rotterdam, Deltalinqs and 'DCMR Milieudienst Rijnmond'. The main target of the program is to achieve a 50% CO₂-reduction in 2025 relative to 1990. The project RTER has five main goals through which it contributes to this target. These goals refer to the different roles and responsibilities of the three main actors in the project and revolve around monitoring and the subsequent learning of lessons in the project (AgentschapNL, 2011c). The monitoring is executed by Laboralec, which is a technical competence centre that executes scientific research in electric power and energy technology. In order to execute monitoring a board computer was installed in the EV. The goals of RTER are:

- Gaining practical experience with a large amount of EV that is differentiated by model and brand. This concerns the utilization of EV, management and maintenance, and the comparison with the reference group of ICEV.
- Getting insight into the energy flows (i.e. the exchange of energy between the EV with the electricity grid, and the charging behaviour of the batteries) and energy use of EV with respect to the different types of application.
- Gaining of practical experience with the client identification and payment systems.

- Getting insight into the decentralized generation of renewable energy and direct supply to EV.
- Getting insight into the complete safety of usage of EV for both company processes as well as the environment.

4.3.2. Project formation

The events relevant to the project formation stage are identified by conducting interviews with the three main actors of RTER: Stedin, Eneco and the municipality of Rotterdam. The information collected with these interviews is supplemented by information about RTER provided by AgentschapNL or the website of RTER. The start-up of the project was characterized by events in order to acquire EV and to prepare monitoring. The availability of EV was delayed, which postponed the start of the project and therefore the execution stage is extended to April 2013. Project initiation included some other events in order to execute RTER. A cooperation contract was concluded between the three main actors. This included agreements about manners and interaction if one organization would quit their cooperation. Moreover, a project plan was written including financial structures and the different goals of the project referring to the roles and learning objectives of the three actors. This plan formed the basis for the application of the subsidy that was provided by AgentschapNL. Next to this subsidy, the three main actors invested themselves in order to execute the project. An external project coordinator was involved in the project in order to execute project management. This also included reporting to AgentschapNL as well as managing other communication with AgentschapNL. This coordinator was intentionally involved so that the three main actors could primarily focus on their own goals and the collection of the monitoring data. The focus on the distinctive goals of the actors, and the main objective of learning, was predominantly emphasized by all actors in the conducted interviews. Thus, the project is mainly oriented on monitoring.

Some minor events were observed that influenced the structure of the project network. Some other organizations were involved in the project, which were Joulz, Port of Rotterdam Authority and the RET. According to Stedin the involvement of these organizations did not resemble any form of mobilization as they are subsidiary organizations of the three main actors. While Joulz is a subsidiary of Stedin, Port of Rotterdam and the RET are subsidiaries of the municipality of Rotterdam. Moreover, these organizations already had a positive perception on EV which means that they were already convinced of EV. Another event that influenced the project network was the quitting of AGV (i.e. All Green Vehicles). This Dutch company supplied the project with 29 converted EV, which were procured by Eneco (AgentschapNL, 2011b). However, they quitted the project since they went bankrupt. This delayed the acquisition of EV and thereby the actual execution of the project. The interviewee of Stedin addressed that the bankruptcy of AGV resulted into the conclusion that converted cars do not constitute a possible technical and market solution. The acquisition of EV was also influenced by the occurrence of a tsunami.

4.3.3. Project execution

The execution of the project involves the employment of the actors' own minor projects of gaining experiences, monitoring and learning subsequent lessons. This was addressed by the actors in all the interviews conducted. These minor projects reflect the (technical) goals and interests of the different actors. Thereby, the execution of the project is mainly focused on monitoring. The basis for monitoring is constituted by performing different monitoring activities by the various actors. Laboralec performs the scientific analyses on the data that is collected from the EV and the charging infrastructure. They provide the results of the different monitoring activities. The experiences, lessons and results in the project are discussed in project meetings that take place at least every two or three weeks. Additionally, meetings with the actual users of EV were organized in order to diffuse lessons and knowledge. Next to meetings, the different actors communicated at lot in other ways in order to diffuse knowledge.

For instance, the municipality of Rotterdam stressed the reporting of different types of analyses that indicate the effect of EV on air quality (e.g. total cost of carbon analyses) and on the costs of their fleet of cars (e.g. total cost of ownership analyses). The monitoring results affected the perception of the municipality on EV. From the monitoring results they conclude that important barriers, like range anxiety, can be taken away. This was also stated by Stedin. The municipality of Rotterdam stated that the execution of the project affected the perception of how to employ policy on EV in Rotterdam. The municipality is more aware of the fact that the goals that were initially set are not that realistic. Additionally, they have learned how to realize these goals. They argue that it is important for the policy to be executed on a longer term than initially stated. Moreover, they argue that an active role of the municipality is important to spur the development of EV in Rotterdam. Therefore, they state that being a user of EV themselves is significant.

Moreover, they changed their perception on the effectiveness of hybrid vehicles to increase air quality. According to the monitoring results, hybrid vehicles do not decrease CO₂ emissions that much like EV do. Therefore they propose to implement full EV instead of hybrid vehicles in the fleet of cars in order to increase air quality. The municipality of Rotterdam also noted that lessons with the charging infrastructure in the project affected the requirements of tenders on public charging stations. The policy on public tenders of charging infrastructure is modified on the basis of monitoring results generated in the project. In addition to requirements of tenders on public charging stations, the experiences in this project will affect the technical requirements of tenders on EV in the future. Currently, EV are acquired by the municipality of Rotterdam from lease companies. According to the municipality, the acquisition of EV will be done with public tenders.

Stedin stressed the importance of diversity, regarding the tested EV, in order to increase the representativeness of the monitoring results. Different types of EV (e.g. brands) are chosen. Therefore, Stedin for instance uses five electric Volvos, eight electric Opels, six Toyota Plug-in Priuses and some Peugeots. Moreover, the vehicles drive with the use of different types of batteries. Moreover, in order to increase the representativeness of the monitoring results different users are selected that differentiate in gender, age, ethnicity and education. This will generate different user behaviour patterns. At last, the scale of the project, which is large as 75 EV are being tested, increases the representativeness of the monitoring results.

The results of the monitoring are exchanged with various other actors and projects. The municipality of Rotterdam and Stedin stressed the importance of meetings of the different Electric Testing Ground projects which were organized by AgentschapNL. The experiences gained and lessons learned in the different project are diffused in such meetings. Moreover, Stedin stressed the occurrence of other meetings like the 'Beurs Ecomobiel' at which Stedin and the municipality of Rotterdam gave a presentation to 60 people on the results of RTER. In such meetings with non-project actors realistic results are being presented. At last, Stedin stated that experiences and lessons are exchanged with international actors like Oregon or people from Shanghai.

Furthermore, the experiences and monitoring results in the project affected some technical insights on how to foster the roll-out of EV. This was addressed in the interviews conducted with the municipality of Rotterdam and Stedin. The municipality of Rotterdam mentioned that the analysis of the monitoring results indicated that the air-conditioning of EV reduces the performance of the battery during the winter period and thereby decreases the range of the vehicle. A solution to this problem is stressed by the municipality of Rotterdam, which is the heating up of EV by using the electricity of the charging station instead of the air-conditioning. This solution is experienced in the project and changed the perspective of the different actors how to deal with the respective problem.

Another lesson learned in the project concerned the establishment of a back-office that monitors all the charging stations. The absence of a back-office constituted a large barrier to Eneco and even affected the perception on their role within the future market of charging infrastructure. According to the municipality of Rotterdam, Eneco learned that the role of supplier of charging stations is not an attractive core business activity for them. Next to experiences gained during the execution of the project, external technical development and market development with respect to charging infrastructure affected the perception of their future role. A lot of other organizations are

currently in the market that develop and supply charging stations. The perception of Eneco changed from the supply of charging stations as an attractive core business activity towards a kind of niche activity. This will probably influence the decision of the municipality of which future supplier of charging station to choose. The municipality of Rotterdam concluded at least that it constitutes an important lesson for them. Eneco stated that lessons learned and collected users feedback in the project influenced the development of new NRGSPOT charging stations. User feedback was collected through periodical questionnaires as well as through a back-office. This learning and subsequent technological development reflects both the charging stations as well as the software of these charging stations.

Stedin also learned some important lessons from experiences gained in the project and subsequent monitoring. The major lesson is that currently no risk exists on the roll-out of EV, meaning that the grid can manage it technically. However, another administrative risk is observed, which is constituted by the issue of how to manage all the requests of implementing charging stations. This is hindered by the long-time of licensing period (i.e. the request of a license by the respective municipality for the implementation of public charging stations) and the required time to connect the particular charging station to the electricity grid. This is acknowledged as a large barrier by Stedin and needs to be solved in the future. Another technical lesson learned by Stedin concerns the loss from the actual windmill to the vehicle. A large loss is observed there and results into a difference between the amount of charged kW that is stated at the pole and in the vehicle. The actor that will suffer for it needs to be decided upon in the future. Furthermore, a lesson learned in the project concerned the location of charging stations and the respective parking spot. According to Stedin, it was experienced in the project that the location of charging stations and the respective parking spot should be coupled to the parking problem in Rotterdam. This solves two problems with respect to the public space, which are the parking and charging problem.

Changes in the behaviour of users of EV were also observed from the monitoring results and by collecting user feedback through questionnaires and interviews. It is observed that the users charge less over time. This can indicate that they drive less or that they are more accustomed to driving with EV. The second option means that they trust the technology more and thereby drive more with a less charged battery. Thus they postpone actual charging. It seems the case that users do drive less since it was observed that many users decided to drive with ICEV instead of EV due to the experience of range anxiety. The municipality of Rotterdam stated that important changes in the perspective of users are needed in order to realize a roll-out of EV in the future. According to the interviewee, people need to change their perspective of vehicles as their own property towards vehicles as a shared property. This means that they are obtained with the possibility to use shared mobility solutions.

Next to these events concerning monitoring some other events took place during project execution. The municipality of Rotterdam and Stedin for instance noticed that the project facilitated the establishment of the 'Elektrisch Vervoer Centrum' (i.e. 'Electric Transportation Centre'), which is a centre with the aim to mobilize people to make the shift to EV. The municipality of Rotterdam is cofounder of this centre in which people can experience and test EV themselves and gain necessary information. Moreover, 'Stadsregio Rotterdam' (i.e. 'City region of Rotterdam'), which is comprised of 15 municipalities in the region of Rotterdam, is currently setting up a broader program to mobilize as many people as possible to make the shift to EV. The experiences gained in the project will serve as a basis for the program. At last, the municipality of Rotterdam is also trying to mobilize companies to spur the roll-out of EV. The municipality of Rotterdam stated the intention to mobilize lease organizations which are important for the provision of future tenders on EV. For example, the company Car2go is examining the possibilities to start a project similar to the one that is executed in Amsterdam. The concept includes the leasing of cars to people with membership cards. The interviewee of Stedin mentioned that some people are actually mobilized to change their transportation mode from ICEV to EV. The interviewee stated that due to the measurements executed in RTER, which refer to monitoring, BAM acquired 10 EV.

4.4 Case 4: 'Drive 4 Electric' (D4E)

4.4.1 Description

Drive 4 Electric (D4E) was started by the municipality of Leeuwarden, province Friesland and former project leader Hans Verwijs as an organization (i.e. project office) that executed various projects with EV for the period 2010-2012 (Drive4Electric, 2013d; Squarewise, 2009). The project was intended to finish at the end of 2012. Moreover, the project had to quit because there was no financing available anymore at the end of 2012. D4E constituted a subsidiary of the province Friesland. Electric propulsion is defined in Friesland as consisting of both electric driving and electric sailing. D4E can be regarded as a project on itself (Verwijs, 2009), that was comprised of the employment of multiple minor projects (Projectplan Drive4Electric, 2010). D4E consisted of the following participants: province Friesland, municipality of Leeuwarden, Essent, ProRail, Alliander, 'NHL Hogeschool' (i.e. NHL College'), 'Stichting Elektrisch Varen Friesland' (SEFF) (i.e. 'Electric Sailing Friesland Foundation'), Energy Valley and 'Noordelijke Ontwikkelingsmaatschappij' (NOM (i.e. 'Northern Development Organization') (Projectplan D4E, 2010). These actors had different roles and learning objectives in the project. Representatives of these organizations constituted, together with a main external project leader and a few other project leaders, the project organization Drive4Electric. Moreover, representatives of these organizations and the project leader constituted a steering group that met at least 4 times a year. The infrastructure in Friesland consists of dozens of public charging stations for electric driving and electric sailing (Drive4Electric, 2013a). This contributed to 500 electric boats that sail in Friesland in 2012. Currently Drive4Electric has stopped her operations (Drive4Electric, 2013b). The activities of Drive4Electric are currently being employed by the province Friesland. The financing of the project D4E is comprised of investments of all participants except for Energy Valley, NHL Hogeschool, NOM and SEFF.

The role of the province Friesland was to facilitate the realization of the public charging infrastructure (Projectplan D4E, 2010). Moreover, their role was characterized by acting as a launching customer of EV. The municipality of Leeuwarden aims to realize a 'Full Sustainable City' in 2020. Moreover, their goal is to increase employment by drawing in companies and knowledge institutes to Leeuwarden. It was initiator of the project D4E as part of the '100.000 clean vehicles plan' in the north of the Netherlands (provinces Drenthe, Friesland and Groningen) (NOM, 2008; Projectplan D4E, 2010). The province Friesland should realize 2.750 EV in 2015 and in that way contribute to the goal of 100.000 clean vehicles in 2015. The aim of the province Friesland and the municipality of Leeuwarden was to fulfil a front running role with respect to research and the roll-out of EV (Projectplan D4E, 2010). Several performance indicators (i.e. measurable variables of the roll-out of EV) were defined by the province Friesland and the municipality of Leeuwarden. D4E should contribute to the realization of these indicators that are specified in amounts to be realized in the period 2010-2015.

Essent as a supplier of electricity aimed to learn on the process of implementing charging infrastructure. ProRail is a manager of railways in the Netherlands. Hence, it is also manager of a private electricity grid. As part of the goals set by the Ministry of Transport, Public Works and Water Management and the Ministry of Economic Affairs in the 'nota Mobiliteitsbeleid' assigned at 03 July 2009, ProRail enables the use of the private electricity grid to charge EV. Alliander as grid manager aimed to learn on the implementation of charging infrastructure in order to create the basis for proper future investments. The NHL Hogeschool founded an expertise centre concerning the topics solar energy, wind energy, electric driving and electric sailing. By participating in D4E they intended to learn on technologies regarding driving and energy storage. Energy Valley had the objective to stimulate employment and to strengthen the economy by extending the sustainable energy sector and related knowledge infrastructure. Their particular role constituted the prevention of overlaps with other activities and facilitating the procurement of subsidies. NOM was geared on the facilitation of compensations on acquisitions, business development and financing, which was incorporated by the network of Drive4Electric. At last, SEFF aimed to facilitate the extension of

electric and hybrid sailing qualitatively as well as quantitatively. Thereby, they intend to stimulate employment in the aquatics sector as well as to improve the environment.

One of the most important minor projects concerned the execution of ‘Snel opladen in Leeuwarden’ (Drive4Electric, 2013c; Verwijs, 2009). This project entailed the realization of the first fast charging station in Europe, situated in Leeuwarden. The aim of this minor project is to gain technical experience with fast charging infrastructure (Verwijs, 2009). This minor project constituted the start of the project D4E and was initiated before the actual start of D4E. It became part of the project D4E in 2010. Because of the significance of this minor project it is examined in more detail in this thesis and comprises a part of the results and analyses of D4E. In collaboration with Essent, NHL Hogeschool, ABB/Epyon and Tamoil the implementation of this fast charging station was realized. The role of ABB/Epyon was to supply the fast charging station, which included the supply of the certified ‘UltraFastCharger’. Tamoil provided the location of the charging station. Taxi company ‘Kijlstra personenvervoer & ambulancegroep Fryslân’ tested the fast charging station for 1 year in the period 2010-2011 (Verwijs, 2009). Their role included thus being a user of the fast charging station. The fast charging station is currently open for public use (Drive4Electric, 2011; Drive4Electric, 2013b).

Next to the contribution to the objectives elucidated above, some goals were formulated in the project plan (Projectplan D4E, 2010):

- Development of knowledge concerning decisions on the implementation of charging infrastructure.
- Elaboration of a business model.
- Visualization of sustainability and communication between electric driving & sailing and sustainable production of energy.
- Technology development concerning the drive train: power of the motor, inverter, regenerative braking, built-in instructions, battery management system, charging technology and battery technology.
- Coupling with electric sailing, concerning built-in and conversion technology, propulsion, and the relation with solar energy.
- Creating insights on the impact of electric cars and boats on safety.

4.4.2 Project formation

The events that occurred during the start-up stage of the project are identified by conducting interviews with four actors of D4E: the municipality of Leeuwarden, the former project leader of Drive4Electric, ABB/Epyon and Kijlstra. ABB/Epyon and Kijlstra are selected because of their involvement in the minor project ‘Snel opladen in Leeuwarden’. This enabled the examination of the minor project as well as D4E through the perspectives of an engineer and a user of EV and related infrastructure. The project formation stage was characterized by the writing of a project plan and the conclusion of an agreement of cooperation by the initial participants. Moreover, a project organization was initiated by the province Friesland and the municipality of Leeuwarden. According to the municipality of Leeuwarden and the former project leader of D4E, the project organization itself constituted an experiment and involved the execution of minor projects like ‘Snel opladen in Leeuwarden’. The financing of D4E was comprised of investments by the different participants except for Energy Valley, NHL Hogeschool, NOM and SEFF. According to the project plan, the investments by the province Friesland and the municipality of Leeuwarden constituted the largest part of financing. Both actors financed the project through funds. The municipality of Leeuwarden used their ‘Ontwikkelfonds Duurzame Energietransitie’ (i.e. ‘Development fund sustainable energy transition’) in order to invest in the project. The province Friesland used the fund ‘Friesland vernieuwd’ (i.e. ‘Friesland innovates’) to finance the project. The procurement of the charging station and the taxis of the minor project ‘Snel opladen in Leeuwarden’ were partly financed using these funds.

The formation of the initial project network of D4E included the mobilization of organizations like NOM and SEFF. NOM was mobilized by the project leader. SEFF proposed themselves to

participate in the project. According to the former project leader, no real convincing was involved in the mobilization of these actors. The start of the minor project 'Snel opladen in Leeuwarden' (that later became part of D4E) facilitated the involvement of some other organizations. Because of this minor project these organizations were convinced and decided to participate. Moreover, the municipality of Leeuwarden stressed that the presence of a positive perception on sustainability and electric propulsion amongst intended participants enhanced network formation. The presence of a dedication for sustainability was also present at the province of Friesland and the municipality of Leeuwarden. These actors employ climate policy in cooperation with each other. One of the parts of the climate policy entails sustainable mobility. The mobilization of organizations was ensured through discussion in meetings of these actors.

The project network of D4E was altered after the actual start of the project. Some organizations that were part of the initial project network decided to quit their participation. These were Essent, ProRail and NOM. The former project leader of D4E argued why some of these organizations left the project. ProRail quitted their participation in D4E because of political pressure. ProRail had problems with managing the trains to drive according schedule. Therefore they could not focus on another activity (which concerned D4E). Essent left the project since they intended to enrol for a tender in Friesland.

The actual start of the minor project 'Snel opladen in Leeuwarden' was delayed by several technical problems. Moreover, the start was hampered by the bankruptcy of AGV. The start-up stage of this project is also characterized by the writing of a project plan and the conclusion of an agreement of cooperation. The mobilization of actors to participate in this minor project constituted no convincing. This was argued by Kijlstra. The taxi company participated in the project since they had the aim to execute sustainable projects like experiments with electric taxis.

4.4.3 Project execution

According to the municipality of Leeuwarden, the execution of D4E encompassed much knowledge development as well as the mobilization of a lot of people and organizations. Mobilization entails the convincing of many people of the concept of electric driving and electric sailing. The municipality of Leeuwarden illustrated the mobilization of people and organizations by the occurrence and inducement of multiple events. Although D4E has ended, these events are still being performed and organized by province Friesland in cooperation with the municipality of Leeuwarden. The municipality of Leeuwarden addressed the organization of the 'zonnebootrace' (i.e. 'Dong Energy Solar Challenge'), which is a contest of boats that sail with the use of solar energy. Much technological development is stimulated by this contest since winning the contest means increasing your knowledge about electric propulsion. Moreover, the contest affected market developments through the establishment of several technological spin-off firms in Friesland. The people that take part in this contest are employed at SEFF, schools and knowledge centre 'Jachtbouw'. According to the municipality of Leeuwarden, the contest enhanced the amount of electric boats that sail in Friesland. Moreover, it demonstrates the technological possibilities of electric sailing to people that are not convinced of electric propulsion yet. This contest was launched before the start of D4E.

Additionally, education concerning electric propel has been established at the 'Noordelijke Hogeschool' (i.e. 'Northern College'). The municipality of Leeuwarden also argues that the SEFF is really important for the objective of D4E to mobilize people and enhance the amount of electric boats. Currently, the SEFF is employed with the organization of areas where only electric boats are allowed to sail. This concerns the establishment of three or four areas. According to the municipality of Leeuwarden, this will stimulate electric sailing since conventional boats are not allowed to sail in those areas. Since there are currently many electric boats sailing in Friesland, the regulation has become a proper measure to implement. Another event that stimulated the amount of boats in Friesland concerns the establishment of a subsidy program regarding electric sailing. This program was a direct result of D4E. The subsidy program includes a performance norm, which means that people are only provided subsidy if they satisfy the norm. This norm will probably form the future European norm concerning the quality of electric sailing. According to the municipality of

Leeuwarden, the organization of the 'zonnebootrace', the activities of SEFF and the establishment of the subsidy program are the three most important events that actually mobilize people.

Furthermore, several conferences and symposia are being organized about electric propulsion in order to mobilize people. Knowledge is diffused at these meetings. Moreover, the objective of such meetings is to promote and make publicity of the intentions of D4E and Friesland. The municipality of Leeuwarden addressed the example of the first electric taxis and first fast charging station of the minor project 'Snel opladen in Leeuwarden'. Those activities really increased the brand awareness of Friesland by demonstrating that Friesland is an area that excels in electric transportation. Moreover, it increased the brand awareness of the companies participating in the project. This was argued by Kijlstra and ABB/Epyon. According to the municipality of Leeuwarden, such milestones are the result of the ambition to be a front runner in the field of electric propulsion. The province Friesland and the municipality of Leeuwarden try to realize this ambition through the employment of their climate policy. Subsequently, these milestones influenced the mobilization of people and the establishment of several organizations in Friesland.

During the execution of D4E other events occurred to promote electric sailing and electric driving in order to mobilize people. So-called 'vriendenclubs' were established in the project that were comprised of 100 people in some way related to D4E and occupied with the promotion of electric driving and sailing. The significance of these groups to mobilize people was stressed by the former project leader and by the municipality of Leeuwarden. The former project leader of D4E stated the example a sequel project at the island Schiermonnikoog which is the direct result of D4E and promotion activities by the 'vriendenclubs'. Next to this project at Schiermonnikoog, other sequel projects are organized by these 'vriendenclubs' in order to accomplish a further roll-out of electric driving and electric sailing. Other activities to promote electric sailing and driving were stated by the former project leader and concerned the provision of flyers and actually inviting and making visits to companies. These visits employed to ensure them to make the change towards electric propulsion. These 'vriendenclubs' also exchanged their experiences, achievements and lessons learned at meetings that took place every half a year. Thereby, they exchanged problems that need to be solved. The municipality of Leeuwarden stressed the importance of 'vriendenclubs' to exchange and solve problems encountered. Exchanging and problem solving also took place through interaction between 'vriendenclubs' so for example between a group competent in electric sailing and a group competent in electric driving. According to the former project leader of D4E, also some diffusion of knowledge occurred with international people. The project leader visited China and Hongkong during the execution of the project in order to inform people about the activities of D4E.

According to the former project leader of D4E, the execution stage can be characterized by the execution of multiple minor projects. The minor project 'Snel opladen in Leeuwarden' is elucidated above. The former project leader of D4E also stated the example of the organization of a discount regulation. This regulation included the provision of 500 euro discount on the acquisition of a private or semi-public charging station. This regulation was organized in order to mobilize people to make the change towards EV. In the interview conducted with the municipality of Leeuwarden it was addressed that people were actually mobilized. Many entrepreneurs started initiatives with electric propulsion. For instance, an entrepreneur is currently about to electrify its tourist vessel. In the interviews with the former project leader of D4E, Kijlstra and ABB/Epyon it was addressed that financial and fiscal instruments that really benefit EV in relation to ICEV are needed to further mobilize people.

Some problems were experienced in the project. At first, technical problems were encountered during the execution stage of the minor project 'Snel opladen in Leeuwarden'. This delayed the further execution of the respective project. A large problem concerned batteries that broke because of the fast charging technique. This was addressed by Kijlstra and the municipality of Leeuwarden. Due to these technical problems Kijlstra purchased another type of EV (i.e. a Nissan Leaf). According to Kijlstra, they purchased a new EV due to experiences gained in the project as well as knowledge about external technological developments. This knowledge was stocked through meetings and articles about technical innovation. The former project leader of D4E also stressed the

problem of the influence of the weather on the range of the cars. Second, according to the former project leader of D4E and Kijlstra, problems were observed due to the difference in interests and visions between the various participants in the project. For instance, during the execution of the minor project 'Snel opladen in Leeuwarden', the problem of broken batteries resulted into differences in visions between the participants. Moreover, several problems occurred due to discontinuity. At first, several persons that participated in the project (at the behalf of an organization) changed or quitted their job. This caused the participation of new persons, with other visions, that sometimes conflicted with the visions of the settled participants.

At the end of D4E an analysis was made concerning the developments in electric driving and electric sailing. According to the municipality of Leeuwarden, this analysis resulted into the conclusion that they achieved much more regarding electric sailing than electric driving. Because of this, they changed their vision almost completely towards electric sailing (and electric scooters). Currently, electric sailing is mainly being stimulated (financially) in Friesland. This change in vision has resulted into the continuance of many activities with electric sailing that were part of D4E. Moreover, it directly changed the content of policy through the establishment of the subsidy program that was discussed above.

The vision thus changed due to an evaluation of the developments that occurred. One of the developments concerned market developments. The vision on electric driving in Friesland (i.e. ideas about the possibility of increasing employment in Friesland by establishing a market of EV in Friesland) changed due to the establishment of automotive organizations like Opel, Toyota and Honda on the market. This made it evident that converted cars do not constitute the technological and market solution for EV. This was also stressed by the former project leader of D4E. He argued that from the project it was made clear that companies that produce converted cars do not constitute the future market of EV. Moreover, due to such market developments Kijlstra became more positive about EV.

Moreover, the vision of ABB/Epyon on EV was affected by their participation in the project 'Snel opladen in Leeuwarden' and external technological development in fast charging standards. Due to these aspects and since ABB/Epyon got the fast charging technology in-house, they learned that fast charging constitutes a main activity they should focus on. External technological developments included for instance the marketing of the Nissan Leaf and the CHAdeMO fast charging standard. The coming of the CHAdeMO standard (i.e. Japanese fast charging standard) also influenced the fast charging infrastructure of the project as the initial custom made fast charger was exchanged with the CHAdeMO standard. Later on the Combo standard (i.e. European fast charging standard) was implemented in the minor project.

At last, ABB/Epyon stressed that their participation in 'Snel opladen in Leeuwarden' influenced the growth of their company. Kijlstra stressed that experiences in the project caused them to continue with EV which is illustrated by the acquisition of new types EV after the project was finished. Moreover, ABB/Epyon stated that lessons learned during the execution of 'Snel opladen in Leeuwarden' contributed to the development of hardware (e.g. lessons about power converters and lessons how to install them). More specifically, ABB/Epyon learned how to develop fast charging stations so that you can install them at once.

4.5 Case 5: 'Draadloos Oplaadbare Bus' (DOB)

4.5.1 Description

The 'Draadloos Oplaadbare Bus' (DOB) project includes the testing of the first 12 meter electric public-service bus in 's-Hertogenbosch (i.e. Den Bosch) (EMOSS, 2012; Gemeente 's-Hertogenbosch, 2013). The bus is being charged with green power through wireless inductive charging technology. This type of opportunity charging means that the electric bus is being charged within the space of a few minutes time at the bus stop (EMOSS, 2012). The wireless inductive charging system consists of a primary coil in the road, which is connected to the power grid (EMOSS, 2012). Moreover, the system

entails a pickup coil fitted beneath the vehicle. These coils communicate with each other through magnetic resonance coupling. The bus rides between 'Transferium Pettelaarspark' and the town centre of Den Bosch (Gemeente 's-Hertogenbosch, 2013). The project started in 2011 and results of the project are currently being evaluated.

The background of the project is constituted by two former employed projects (Project plan DOB, X). At first, the successful implementation of electric buses in the town centre of Den Bosch preceded this project. Secondly, the technological breakthrough project that was executed by Conductix-Wampfler in cooperation with PROOV induced this project. This former project included the engineering of the wireless inductive charging system (PROOV, 2012). The perspective behind DOB is that electric public transport can comprise a large part of future concessions concerning transport. Recently, the Dutch authorities announced the aim for zero emission public transport in 2025 (EMOSS, 2012). The main goals of DOB are (1) to gain experience with larger electric public-service buses in order to appraise the potential of EV, and (2) to project potential future concession requirements for the year 2015 (Project plan DOB, X; PROOV, 2012). Therefore, an objective was to obtain proof of concept.

A consortium is being established that consists of the following participating actors: province North Brabant, the municipality of 's-Hertogenbosch, Conductix-Wampfler, Enexis, Heijmans, 'Bluekens Volvo Truck en Bus', and EMOSS. Moreover, Arriva takes part in the project as a user of the electric buses. They concluded a contract with the province North Brabant who provided a concession. However, they do not constitute a participant of the consortium. The province North Brabant provided a subsidy to finance the project (Gemeente 's-Hertogenbosch, 2013). The aim of the province is to increase employment in North Brabant. One of the aspects of their regional economic policy includes the economic cluster of heavy duty power trains and developments are therefore induced. The municipality of 's-Hertogenbosch is the secretary of the project and had to procure the subsidy. The subsidy period has currently ended. The primary idea behind their participation includes that electric public transport contributes to the improvement of air quality and a reduction of CO₂ emissions and noise nuisance in Den Bosch (Gemeente 's-Hertogenbosch, 2013). Project management was executed by an external project coordinator. Conductix-Wampfler supplied the project with the wireless charging system IPT (EMOSS, 2012). EMOSS supplied the powertrain and integrated the wireless charging system. Enexis manages the connection with the electricity grid and aims to gain experience with smart inductive charging. Heijmans implements the coil in the road. 'Bluekens Volvo Truck en Bus' constructed the electric buses.

4.5.2 Project formation

The formation of the project network can be characterized by a few events. At first, the start-up of the project entailed the writing of a project plan. According to province North Brabant, an important part of the project plan included the formulation of the covering of involved financial risks. Moreover, province North Brabant stated the significance of establishing a consortium during the start-up of DOB. The financing of the project included a subsidy provided by province North Brabant and own investments by the different participants (that are part of the consortium).

The province North Brabant stated that the former project by PROOV was important for the mobilization of some organizations. The former project introduced the concept of opportunity charging. This concept was then picked up by some organizations. Subsequently, these organizations were mobilized by the municipality of Den Bosch to take part in the project DOB. Arriva was mobilized to participate in the project due to the provision of a concession by the province North Brabant. They enrolled for this concession and were subsequently chosen by the province North Brabant. Arriva is not part of the project network. The formation of the project network was delayed due to the bankruptcy of AGV, which constituted one of the initial participants. Their quitting meant that a new constructor of electric buses had to be included in the project. Therefore, 'Bluekens Volvo Truck en Bus' was added to the project network.

4.5.3 Project execution

One of the goals of the project was to obtain proof of concept. According to the municipality of Den Bosch and the province North Brabant, this was actually gained. This demonstrated to local politicians that the concept works. This was confirmed by the province North Brabant. According to the municipality of Den Bosch, a mind shift was thereby caused at the part of these politicians. They had a negative perception on EV a couple some years ago. This was due to the observance of technical barriers like a small range and prolonged charging times. This shift in the mind set of local politicians is reflected by the fact that they intend to electrify the whole public transport in Den Bosch. Moreover, the project initiated a sequel project by the province North Brabant in which they would like to test whether the bus also functions in the daily timetable. This is currently being executed. The DOB project also partly caused the foundation of some new companies occupied with opportunity charging. Thereby, knowledge has been incorporated into the province North Brabant.

During the execution of the project a lot of questions were posed by local people, to the municipality of Den Bosch, whether they could initiate certain matters in which the electric bus is used. The municipality of Den Bosch noted the example of people that wanted to organize demonstration events of the wireless charged inductive bus. According to the interviewee, this indicated that they were mobilized by the concept of opportunity charging. This was predominantly done to demonstrate the concept to politicians and other deciders. Additionally, the province North Brabant stated that demonstration events were organized, throughout the Netherlands, in order to show the electric bus to people. The interviewee stated two examples: an event in Amsterdam and the Bus Tech event. According to the municipality of Den Bosch many people are mobilized in Den Bosch to shift their transportation mode towards EV because of the active policy employed by the municipality. The municipality of Den Bosch recently obtained the E-Award for municipalities in The Netherlands in 2012 (Helms et al., 2013). This Award is granted to the Dutch municipality that achieved most progression with the introduction of EV in 2012. The active policy of Den Bosch is characterized by the realization of charging stations that are intensively used and the conduct of multiple projects with private organizations.

Some events were addressed in the conducted interviews that are related with communication between participants and with people outside the project network. The participants diffused their experiences through project meetings that occurred every two weeks. According to both interviewees, some exchange of knowledge, experiences and lessons took place with non-project actors. The municipality of Den Bosch addressed communication with Utrecht where a small inductive bus has driven. Province North Brabant stated that some experiences were exchanged with 'Stichting Zero Emissie Busvervoer' (i.e. 'Zero Emission Bus Transport Foundation'). However, this occurred to a limited extent. The province North Brabant stated even that they intentionally chose to pursue low-profile communication. This means a low intensity of communication with actors not involved in the project.

During the execution of DOB project some problems were experienced. The municipality of Den Bosch provided two examples of problems. At first, the accessory battery caught fire. This problem was solved by the substitution for another accessory battery. Secondly, technical problems were observed in the communication in order to start charging, which were subsequently solved. Province North Brabant stated that technical barriers were observed with respect to the (storage) battery. Some changes were made in the software in order to partly solve this. Moreover, some problems were observed regarding safety as radiation is released when the induction spoils are used. This was solved by positioning the bus precisely above the coil in order to decrease losses. At last, some barriers were observed regarding the application of licenses. This problem was addressed by both interviewees. The provision of a license to install an inductive charging system in the road involves different fields and thereby different departments within a municipality. This process of providing licenses takes a long time because different people (within the municipality) had to be convinced. Due to experienced obtained with the application of licenses this period is now shorter and thereby more efficient.

The participants also execute some monitoring. This was addressed by province North Brabant. The measurements they make concern their own interests and learning objectives. At this moment the project is being evaluated which generally entails a technical evaluation. In order to optimize monitoring an existing bus connection was chosen that travels from and to fixed spots (i.e. 'Transferium' connection). According to province North Brabant, the decision to choose a Transferium connection caused that no changes are observed in user practices or behaviour.

4.6 Case 6: 'Delta Stadsdistributie' (DS)

4.6.1 Description

'Delta Stadsdistributie' (DS), a project by social employment facility company Delta Zutphen in collaboration with the municipality of Zutphen, was started in 2009 (De Stentor, 2011). This project included a new system of sustainable urban supply using two EV (i.e. an electric delivery van and an electric truck) (Delta Zutphen, X). Delta Zutphen is a (public) company that supports people, who are distanced from the labour market, to acquire and retain a job. Thereby, the company contributes to sustainable employment of people in the region of Zutphen. The project DS was started as a reaction on the request of the municipality of Zutphen. The acquisition of the first EV (in order to transport goods) was financed by Rabobank (Logistiek.nl, 2009). Urban supply in the project includes the loading, unloading and delivering of goods and parcels by employees of Delta Zutphen. The participants in the project include: (1) Delta Zutphen, (2) the municipalities of Zutphen, Apeldoorn and Deventer, (3) conveyer organizations like DPD, Transmission and Middelkoop, and van Ganssewinkel (i.e. waste processing company), (4) and entrepreneurs of shops in the town centre of Zutphen (Connekt & Delta Zutphen, 2012; Delta Zutphen, X; De Stentor, 2011). The service is extended with parcel supply to citizens since January 2011 (AgentschapNL & Het Klimaatverbond, 2011).

Goods and parcels, which are delivered to Delta Zutphen by multiple conveyer organizations, are transported to the town centre (Connekt & Delta Zutphen, 2012). Thereby, the 'last mile' of conveying to the town centre is performed with EV and fewer kilometres are covered (Connekt & Delta Zutphen, 2012; Delta Zutphen, X). The EV of Delta Zutphen were allowed by the municipality of Zutphen to supply shops in times other than the prescribed delivery time windows (Delta Zutphen, X). These two aspects benefit conveyer organizations. At first, financially as they have to cover less kilometres. Secondly, they can load and unload on the outskirts of the town in broader time windows. Delta Zutphen takes over activities, and needs to establish collaborations, with conveyer organizations. Moreover, return-freight can be transported to a transshipment point. For instance, Delta Zutphen collects waste at the shops of entrepreneurs when they deliver goods and parcels (AgentschapNL & Het Klimaatverbond, 2011). This includes the take-over of activities of van Ganssewinkel. Subsequently, van Ganssewinkel collects the waste at the transshipment point of Delta Zutphen. In this way, Delta Zutphen contributes to society by (1) decreasing CO₂ emissions, (2) improving air quality, (3) increasing the liveability of the town centre and shopping centre of Zutphen, and (4) increasing road safety (Connekt & Delta Zutphen, 2012; Delta Zutphen, X). The objective of Delta Zutphen is to decrease CO₂ emissions by 52% at the end of 2014 (Connekt & Delta Zutphen, 2012). Performance indicators are formulated in order to realize this objective and to execute monitoring during the execution of the project. This project is supported by the municipality of Zutphen as the goal of the municipality is to be energy neutral in 2020 (Gemeente Zutphen, 2011).

The current aim is to scale up the project by performing urban supply of the municipalities in the 'Stedendriehoek' (i.e. municipalities of Apeldoorn, Deventer and Zutphen) and by involving more conveyer organizations in the project (Delta Zutphen, X). In this way, the project can entail a sustainable and sound business case in the sense that the project becomes financially independent and if possible self-employed.

4.6.2 Project formation

The initiation of DS is characterized by the occurrence of multiple events. When Delta Zutphen received the request of the municipality of Zutphen to perform a project with urban supply, they first contacted different organizations that are occupied with conveying. Therefore they contacted TLN, EVO, Syntus, the different municipalities and entrepreneurs located in the town centre of Zutphen. In the contacting of these actors, Delta Zutphen used prior established relationships, like the relationship with EVO. The director of Delta Zutphen was director of EVO prior to his occupation at Delta Zutphen. Subsequently, these organizations also used their prior established contacts. This resulted into a group of people that met in different meetings to discuss and orient what to do with urban supply. This had an experimenting character as they had no link with urban supply. The relationship with EVO benefitted this orienting as they had a link with urban supply in The Hague. These discussions are currently managed by Connekt, which is an independent network, consisting of private and public organizations, that aims to link organizations in order to employ improvements of sustainable mobility in the Netherlands. The sustainable concept of urban supply was added later to DS. This was due to influences of Dutch environmental policy. This also changed the goals of DS by adding main objectives of decreasing CO₂ emissions and improving air quality.

The formation of the project network can be characterized by the mobilization of actors to participate in the project. The mobilization of actors entailed convincing organizations of the concept of sustainable urban supply by Delta Zutphen. Several conveyer organizations were convinced of the concept of sustainable urban supply by Delta Zutphen. In the interview conducted, Delta Zutphen stated that the independent character of the company constitutes the main argument for conveyer organizations to participate. Because of the independent status of Delta Zutphen, the company is no competitor of conveyer organizations and thereby does not pose a threat to them. This solution was gained during a meeting with different stakeholders in March 2012. The interviewees stated the examples of the mobilization of DPD, Middelkoop, Transmission and van Gansewinkel. Additionally, the plan of procedure, that was written to win the Lean and Green Award, notes declarations of intent of more conveyer organizations: Althuis, 'Van Opzeeland', Entres and 'Centraal Boekhuis' (Connekt & Delta Zutphen, 2012). According to Delta Zutphen, conveyer organizations are met at various meetings that are not directly related to DS. For instance, the meetings that are organized by Connekt are addressed by the interviewee. During such meetings, knowledge about DS is diffused in order to mobilize conveyer organizations. Delta Zutphen decided to leave the meetings of actors managed by Connekt. Because of this they could primarily focus on the mobilization of conveyer organizations. Delta Zutphen stated that the first conveyer organizations, which were mobilized to participate in the project, included DPD and PostNL. According to Connekt & Delta Zutphen (2012), both actors decided to quit their participation in 2011/2012. PostNL decided to quit because they demanded exclusivity. Exclusivity concerned the following: (1) EV would get a PostNL exterior, and (2) other conveyer organizations would have to let their goods transported under the label of PostNL instead of Delta Zutphen. Concerning DPD, Zutphen fell under a different 'controlling area' and thereby the agreement with Delta Zutphen was cancelled.

The convincing, and subsequent mobilization, of entrepreneurs (located in the town centres) is really difficult. This is due to the fact that they do not observe any advantages by participating in the project. This conclusion was made in a meeting with actors occupied with urban supply of Nijmegen. Because of this conclusion, they changed their perspective from mobilizing entrepreneurs (which are located in the town centre) to mobilizing conveyer organizations.

According to the interviewees of Delta Zutphen and the municipality of Zutphen, the municipality of Deventer copied the concept. They currently execute similar sustainable urban supply in Deventer. Additionally, the municipality of Doetinchem and the social employment organization in Doetinchem are convinced of the concept. They aim to implement it in the future. In order to organize (integrated) urban supply for the municipalities of Zutphen, Deventer, Apeldoorn and Doetinchem, Delta Zutphen stated that they intend to found an organization called 'Stedendriehoek Plus'.

Moreover, a presentation was given at the town hall in Delft for the 'Nederlandse Vereniging van Binnenstadsondernemers' (i.e. 'Dutch Union of Town Centre Entrepreneurs'). Due to this, the municipality of Delft visited Delta Zutphen as they were enthusiastic about the concept of sustainable urban supply. The municipality of Delft was convinced, thereby mobilized, and currently orients whether they can join the project.

Rabobank was also mobilized by Delta Zutphen. Their mobilization comprised financing of the first EV. Rabobank participated since the director was convinced of the concept of the DS project. The convincing of the director took place at a meeting that was not directly related to DS. As a way to express their appreciation of the sponsoring, the Rabobank logo was put on the two electric trucks. Next to the external financing by Rabobank, Delta Zutphen itself invested in the project. Since Delta Zutphen is a social employment company, their investment entails some governmental finance.

4.6.3 Project execution

During the execution of DS the ambitions of the main participants, Delta Zutphen and the municipality of Zutphen, changed. Therefore, they currently intend to scale up the project and to make a sustainable business case for all the organizations involved in the project. This change in ambitions was achieved at the meeting in March 2012 organized by Delta Zutphen and Connekt. This was followed by a sequel meeting in April 2012. Scaling up of the project is needed in order to involve more multiple conveyer organizations, municipalities and entrepreneurs (situated in town centres). Thereby, they aim to organize urban supply for the municipalities Deventer, Apeldoorn and Zutphen (i.e. 'Stedendriehoek') coherently. This first involved the assignment to acquire a 'Lean and Green' award for the Stedendriehoek region. Lean and Green entails a program by Connekt in order to thrive organizations to realize a higher level of sustainability. They did get this award and constituted the first region that was provided a Lean and Green Award. The involvement of these actors is needed to make a sound business case. In this way, the project covers a larger region and larger cooperation. Since more actors are involved, the meetings of group of people that discuss result of DS on a regular basis, managed by Connekt, became too large. Therefore, they decided to limit the amount of actors present in those meetings.

The conclusion to increase the scope of the project was made from the monitoring results. Monitoring included questions like (1) what are we doing? (2) how do the matters stand?, and (3) what are the pros and cons of the project?. Moreover, the monitoring includes the results of other similar project with urban supply in Amsterdam, Arnhem, Nijmegen, Rotterdam and Delft. This part of the monitoring was executed by Connekt that has contacts with actors occupied with urban supply in those cities. The results of other similar projects were diffused in meetings with participants of those projects.

As an attempt to scale up the project Delta Zutphen participated in the contest for the Lean and Green Award. For the contest a plan was written that included the procedure of execution. Moreover, Delta Zutphen wrote a plan, including the procedure of execution, concerning the realization of the sustainable business case for the first half a year of 2013. With this Lean and Green Award, Delta Zutphen aims to: (1) increase the bulk of goods delivered, (2) mobilize more conveyer organizations and entrepreneurs in town centres, and (3) to copy the concept of sustainable urban supply to other cities. Recently it was announced that Delta Zutphen did acquire the Lean and Green Award (Delta Zutphen, 2013). In the interview conducted, it was addressed that a meeting (at 18 April 2013) would be organized in order to form a future project group that will execute monitoring. This group will consist of representatives of conveyers, Delta and municipalities.

A barrier that was observed in the project constituted the low level of noise EV produce. This caused that many citizens scared up by the sudden presence of the EV. They solved this problem by adding a flashing light and an ice-cream alarm to the EV. According to the interviewees, this comprises a temporary solution.

5. Analysis

This chapter includes the analysis of the results of this study and consists of two main sections. The first section entails case-specific analyses of results. The second section of the analysis chapter includes a comparison of the case-specific analysis sections and forms the basis for a derived framework. With the case-specific analyses the first sub-question is answered: What institutional change is induced by local experimentation with EV in the Netherlands? With the comparison the second and third sub-question are answered: 'What mechanisms, and activities, can be identified through which local experiments with EV in the Netherlands affect institutional change?', and 'What dynamics, between the activities performed, can be identified that explain the functioning of the mechanisms?'. These questions are answered through the making of limited generalizations and are presented with a framework.

The analysis section of each case discusses the institutional changes that are identified. Reforms in institutions refer back to the typology of institutions provided in table 1. The particular type of institutional change is thereby stressed (whereby 'UMDN' refers to an institutional change regarding users, markets and distribution networks). Appendix A, which provides definitions of institutions, is used as a basis for the observation of institutional changes. Subsequently, the activities that affected institutional changes are addressed. Moreover, dynamics between activities and institutional reforms are stressed. At first, these instances are discussed for the project formation stage. Additionally, a discussion of these instances is provided for the project execution stage. Each case-specific analysis section ends with a reflection on the institutional changes affected. The mechanisms that affected institutional reforms are introduced here. Additionally, it shows which types of institutional change occurred using a table similar to table 1.

5.1 Case 1: 'Texel Gastvrij Elektrisch Vervoer' (TGEV)

5.1.1 Project formation

During the project formation stage of TGEV, organizations were mobilized to become part of the project network. The mobilization of organizations to participate in the project concerns convincing organizations to take part in the project by using EV. Participating in the project as a user of EV includes changing their transportation mode from internal combustion engine ICEV to EV. Most organizations changed their *preference* on their primary transportation mode when they started their participation (UMDB-cognitive) (cf. table 1). The presence of a supporting climate for sustainability facilitated the mobilization of organizations to participate in the project (UMDB-cognitive). This climate was characterized by a large dedication for sustainability (and EV). *Expressing the dedication for sustainability* benefitted the start-up of the project as it facilitated network formation. The changes in preferences were also facilitated by *employing prior established formal and informal relationships* of the actors involved in the experiment. This relationship was addressed by both interviewees. The following quote by the municipality of Texel illustrates this:

"If you need to find possible participants within two days you can call them, since you know them. That's the beauty of Texel. So if you ask someone to do that, someone who has acquaintances and those names listed in his phone, within the shortest times you have mobilized people and you can start such a project with much enthusiasm". (The municipality of Texel)

According to both interviewees, the start-up of the project was hampered by external regulation (i.e. administrative regulations; policy-regulative) (cf. table 1). This constituted a lesson learned in the project. The problem demanded a solution and was added to the *political problem agenda* (policy-cognitive) (cf. table 1). This institutional change was affected by the *gaining of experiences*. The conduct of a broad research on soil at Texel solved the problem.

5.1.2 Project execution

Due to the execution of TGEV, other people (i.e. citizens and tourists that do not participate in the project) were mobilized to actually buy EV. This means that local people changed their *preferences* to EV (UMDB-cognitive). The result section provided two examples of this type of institutional change. According to the municipality of Texel, some board executives of the municipality decided to acquire two new EV. Moreover, Stichting Urgenda noted that during the initiation stage of a new project with EV, much more entrepreneurs stated they would like to participate and buy EV. This local cognitive institutional change is illustrated by the following quotes of Stichting Urgenda:

“The project did initiate changes. Even if the following project will not be performed and no subsidy is provided, at least 75% of the EV will be bought. This means that in 6 months we will have about 100 EV driving around at Texel which is a lot”. (Stichting Urgenda)

“A goal of the project is also to inspire people to change to EV, concerning both residents of Texel as well as tourists. And that has had a tremendous impact. For a new project we have applied for, there are at least 40 entrepreneurs interested in buying about 60 or 70 cars”. (Stichting Urgenda)

These changes in preferences were the direct result of TGEV as they were affected by *having the municipality as a user* of EV in the project. Moreover, both interviewees stated that the supporting climate for EV and *expressing this dedication for sustainability* enabled the mobilization of citizens, tourists and entrepreneurs. In addition, the municipality of Texel is actively involved in the project in order to mobilize people. According to both interviewees, the municipality executes particular activities to realize changes in preferences. The first activity was stressed above and concerns having the municipality as a user of EV in the project. Second, they directly mobilized people, and spurred changes in preferences, by *organizing demonstration events* of EV and charging infrastructure. Furthermore, the mobilization of people is directly realized by the *using the media* as a way to promote the project and EV in general. The link to sustainability in general is continuously made when using the media. This reflects addressing the larger goal of the project. Both interviewees also argued that the *organization of sequel events* is crucial in order to mobilize people. New experiments that build on TGEV are initiated by Stichting Urgenda and the municipality of Texel in order to change the preferences of people. The use of media as an activity to mobilize people is exemplified by the municipality of Texel with the first two quotes. The last quote by Stichting Urgenda illustrates the importance of organizing sequel events for subsequent institutional change. Inducing a movement implies the mobilization of people by changing their preferences.

“In the publicity we show to which it is linked, the bigger picture, the broader goal we want to achieve. We constantly connect that to every event that is discussed in the newspaper. Whether it is electric cars or solar panels or insulation, with everything that contributes to that goal we instantly make the link towards sustainability”. (The municipality of Texel)

“On the other hand it is also a good opportunity to be referred to positively. There are several articles in the newspaper about this project and the entrepreneurs who are involved are stated in the newspaper. In this way, it has charisma and people become engaged and enthusiastic”. (The municipality of Texel)

“But you also execute a project, not only for the project itself, but also in order to set in a movement, meaning that you should start new projects parallel to the project”. (Stichting Urgenda)

The changes in preferences affected other local cognitive institutional changes. Stichting Urgenda exemplified this twice in the interview conducted. They first state that the mobilization of people (which constitute new market developments) affected the decision of other local people to buy EV as well. With a (similar) second example, Stichting Urgenda stated that public accountants bought EV because one public accountant did. These mean changes in other people's preferences. The following quotes by Stichting Urgenda exemplify these two examples:

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“But at the same time they find it fun, useful and cool to drive electric because they go along with new developments”. (Stichting Urgenda)

“A thing I find very positive that when 1 public accountant bought 1 EV the other public accountants followed, which was due to social pressure effects”. (Stichting Urgenda)

At last, some users (i.e. participants in the project) decided to buy more and/or other EV. This institutional change in preferences was affected by the *gaining of experiences* in the project. This is illustrated with the following quote by Stichting Urgenda:

“Those who participated in the first Electric Testing Ground have purchased more EV since the project started or are going to purchase them in which they might make different choices”. (Stichting Urgenda)

The municipality of Texel intentionally located the parking lot for EV next to the parking lot for disabled people. This was performed in order to increase the local practicability of the charging infrastructure. However, due to this good location, drivers of conventional vehicles parked their cars at the EV parking lot. This was experienced as a barrier by Stichting Urgenda and other participants, and was added to the *political problem agenda* (policy-cognitive) of these actors (cf. table 1). This institutional change was initiated by the *gaining of experiences*. The experience of this barrier was addressed in *meetings with users* and in other activities to *collect feedback of users* (e.g. phone calls and e-mail conversations). Additionally, the modification of the political problem agenda was caused by the *addressing of barriers and learning to the municipality*. This activity was employed by Stichting Urgenda through *project-related meetings* and *non-project related meetings*. The project-related meetings concern meetings of participants in the project. The non-project related meetings occurred due to their involvement in other sustainability projects. The aim is to change policy on the use of the EV parking lot, indicating future institutional change (policy-regulative). The institutional change in the political problem agenda was illustrated by Stichting Urgenda with the following quote:

“We share the experience, together we will look for a solution, for example by changing marking. As soon as more and more cars will drive the roads, also tourists driving with EV, we have far too few charging stations. Then the question arises of how you will organize that. So that must be resolved in order to be prepared for future developments”. (Stichting Urgenda)

The adding of this problem to the political problem agenda resulted into the search for a solution on a national level. This was addressed in both interviews conducted. Stichting Urgenda argues that the solution is to use different marking on roads, which means a different employment of policy. The existence of this idea to solve the particular problem constitutes a reform in the *ideas about effectiveness of instruments* (policy-cognitive) of Stichting Urgenda and the municipality of Texel (cf. table 1). They received this solution from a project with EV in Den Bosch through the *diffusion of experience and knowledge with non-local actors*. This is illustrated by the following quote of the municipality of Texel:

“We are still working on the solution. You experience a barrier that you encounter. Of course you immediately look nationwide for a solution. That is not one you resolve on your own. So in that way you are also dependent on developments elsewhere”. (The municipality of Texel)

These relations between activities and changes in the political problem agenda were observed in two other examples. At first, this was the case for the problem of a lack of policy on the usage of parking fees. The second example includes the absence of policy on the implementation of private charging stations at homes that do not have a private area for the location of the charging station. However, the observation of a barrier does not always subsequently bring about an addition to the political problem agenda. The problem of a low performing battery, and the resulting low

range of the EV, was interpreted as a barrier by the users of EV in the project. As a consequence, they adjusted their user behaviour, which indicates a change in their *user practices* (UMDB-cognitive) (cf. table 1). According to the municipality of Texel, this institutional change was influenced by the *gaining of experiences*. This citation by the municipality of Texel illustrates the reform in user practices:

“But just the simple fact that you always take into account the range and charging if you stop or park somewhere. All those things make you use the EV differently than a conventional car and that is the way it is. It is about getting used to it, which is certainly the case for all who drive around with EV”. (The municipality of Texel)

5.1.3 Reflection

The sections 5.1.1 and 5.1.2 discussed the local institutional changes that occurred during the project formation and project execution stage of TGEV. The changes, including their count of observation, are shown in table 3. Furthermore, the sections discussed activities (and related dynamics) that affected these institutional reforms. All the institutional changes that are observed concern cognitive reforms. These cognitive changes reflect different types of institutional change that are affected by various activities. In total, three different mechanisms are identified: *network formation*, *mobilization of people*, and *learning and problem solving*. Their functioning is enabled by various employed activities.

Table 3: Institutional changes observed in TGEV (including count of observation)

	Regulative	Normative	Cognitive
Technology	X	X	- Technical problem agenda (1)
Science	X	X	X
Policy	X	X	- Ideas about effectiveness of instruments (1) - Political problem agenda (2)
Socio-cultural	X	X	X
Users, markets and distribution networks	X	X	- User practices (1) - Preferences (3)

5.2 Case 2: 'Elektropool Haaglanden' (EH)

5.2.1 Project formation

The formation of the project network included the mobilization of organizations to use EV. The formation of the project network was influenced by an absence of policy on the implementation of public charging stations. Therefore, only companies could participate that had private area for charging stations. Hence, this, for instance, resulted into the involvement of organizations like Dunea and Rabobank The Hague. The mobilization of these actors was quite difficult since they had to be convinced of the concept of carpooling. Eventually, they participated and were convinced indicating that their *preferences* (UMDB-cognitive) for the concept of carpooling have changed. The participation of the municipality of The Hague included a change in their ideas about EV as a way to realize sustainability, since politicians in The Hague have always been committed to natural gas. This shows that a change has occurred in the *ideas about the effectiveness of instruments* (policy-cognitive). These institutional changes took place due to the influence of *knowledge diffusion*, which occurred in *meetings of actors*.

5.2.2 Project execution

Some other companies and people (i.e. non-project actors) were mobilized to make the shift towards EV. This means that a change has occurred in their *preferences* (UMDB-cognitive) for EV. These people were mobilized due to the *organization of a kick-off meeting* of EH. This direct relationship was argued by OM The Hague. However, these companies could not be involved in the project as the project network was already established. Their mobilization was facilitated by *employing prior established (in) formal relationships* of them with OM The Hague. This is illustrated with the following quote by OM The Hague:

"We noticed after the kick-off meeting that there were some more questions and comments of The Hague based organizations if they still could participate. However, the answer was no. But those organizations are in that way mobilized, which was also due to the network of OM The Hague". (OM The Hague)

The start-up of the project was hampered by the absence of a policy on EV in The Hague. We see that this lack of policy was acknowledged by the municipality. This was due to changes in their ideas about EV as a way to realize sustainability. This reform in *ideas about the effectiveness of instruments* (policy-cognitive) (meaning that the municipality was mobilized) resulted into the addition of this barrier to the *political problem agenda* (policy-cognitive). According to OM The Hague, these institutional changes were realized by *having the municipality as a user* of EV. Moreover, *stressing the need for change in meetings of actors* affected these institutional changes. Subsequently, this continuous conduct of lobbying caused the development of *administrative regulation* (policy-regulative) on EV and the implementation of public charging stations in The Hague (cf. table 1). These relations are illustrated with the following quotes:

"The idea was if we achieve to get the municipality using one or two EV within the Elektropool Haaglanden project, they might indirectly be mobilized and realize themselves what they will encounter in the future. So this included the creation of a vision how to deal with EV and how to react on requests for public charging stations, and that has occurred". (OM The Hague)

"I dare to say that Elektropool really contributed to foster the development of policy. At a certain moment we were really complaining about when policy will be developed as well as about the content of future policy. This really reinforced the ideas of the municipality that they had to employ policy". (OM The Hague)

Although the execution of the project influenced actual policy, the municipality of The Hague stated that external developments were predominantly important for the development of policy. Thereby the *stocking of niche knowledge* also affected administrative regulations. This is illustrated with the following quote:

"It's just electric cars in general. It is really the user experiences and the charging stations from Stichting E-Load that are implemented. Everything that happened with respect to EV has much more impact on policy than the EV that we use ourselves". (The municipality of The Hague)

The municipality of The Hague stated from a user perspective that some technical barriers were experienced. Despite these technical barriers users are generally positive about EV and even decided to buy new EV, which means that their *preferences* (UMDB-cognitive) changed. Moreover, according to Eneco and the municipality of The Hague, it was observed that users changed their customary pattern of driving. This indicates changes in *user practices* (UMDB-cognitive). These institutional changes were caused by the *gaining of experiences*.

In the interviews conducted some other technical barriers were addressed. These barriers were discussed in the result section. The municipality of The Hague for instance stressed that during the execution of the project it was experienced that an old version of NRGSPOT charging stations could only store a limited amount of charging cards. The experience of this barrier resulted into an addition to the *technical problem agenda* (technology-cognitive) of Eneco (cf. table 1). This

institutional change is affected by the *gaining of experiences*. Eneco will improve the software of their NRGSPOT charging stations in order to solve this problem. The change in the technical problem agenda will thus cause a future change in requirements of the NRGSPOT charging stations (technology-regulative). The following quote by the municipality of The Hague demonstrates this:

“The manufacturer of the charging stations has also learned something. Because this project uses an old generation of charging stations, they experienced this week that they can only store, or the software can only handle, I think about 5000 charging cards. Currently there are more than 5000 charging cards. So there are now charging stations which cannot deal with this amount of cards. This constitutes a technical barrier they discovered with this project”. (The municipality of The Hague)

Two other technical barriers were experienced by Eneco and added to their technical problem agenda. These were discussed in the result section. Eneco argued that observation and adding of problems to their problem agenda was directly caused by *collecting user feedback*. The specific activities include the *provision of periodical questionnaires, conducting interviews with users and feedback collection through their back-office*.

The municipality of The Hague stressed that some other barriers that were experienced by OM The Hague, the municipality and Eneco during the execution of EH. The municipality of The Hague provided the example of the costs of charging stations. This barrier was added to the *technical problem agendas* (technical-cognitive) of the participants and was initiated by the *gaining of experiences*. This institutional change caused the *diffusion of experiences and knowledge with non-local actors* that also experienced the problem in their projects. OM The Hague stressed that this diffusion took place in *meetings with non-local actors*. Moreover, the institutional change resulted into lobbying activities by lobby organizations. The *involvement of lobby organizations* was pursued after the reform in the technical problem agenda. In order to decrease the costs of charging stations national regulation (i.e. 'Energiewet') has to be changed. More specifically, both infrastructural requirements (technology-regulative) and formal regulations of technology (policy-regulative) (cf. table 1) need to change in order to decrease these costs. The following quote by the municipality of The Hague illustrates this:

“And decreasing the connection values is of crucial importance in terms of finances. With respect to grid gauges, the stupid thing is that charging stations already have an electricity gauge in the pole in order to measure the amount of energy that is delivered per charging point. And of course that gauge could absolutely execute grid measurements. They agree with this implementation in experiments. Such things are discussed on a national level. Lobbying organizations like Stichting DOET, Stichting E-Laad and Netbeheer Nederland are dealing with such issues. I think it is extremely important that such things are taking place. Such national initiatives are the result from experiences and user data from projects and individual drivers”. (The municipality of The Hague)

The municipality of The Hague argued that Stedin's and Eneco's ideas about the impact of the technology on their future business (regarding EV) are increased. This means that their *expectations* (technology-cognitive) are altered. These institutional changes were affected by the *performance of analyses of monitoring results*.

5.2.3 Reflection

The sections 5.2.1 and 5.2.2 discussed the local institutional changes that took place during the project formation and project execution stage of EH. The changes, including their count of observation, are shown in table 4. Furthermore, the sections discussed activities (and related dynamics) that affected these institutional reforms. Different types of institutional changes are identified, which are affected by various activities. In total, three different mechanisms are identified through which EH affected institutional change: *network formation, mobilization of people, and learning*. These mechanisms are constituted by the performance of multiple activities.

Table 4: Institutional changes observed in EH (including count of observation)

	Regulative	Normative	Cognitive
Technology	X	X	- Technical problem agenda (3) - Expectations (1)
Science	X	X	X
Policy	- Administrative regulations (1)	X	- Ideas about effectiveness of instruments (2) - Political problem agenda (1)
Socio-cultural	X	X	X
Users, markets and distribution networks	X	X	- User practices (1) - Preferences (3)

5.3 Case 3: 'Rotterdam Test Elektrisch Rijden' (RTER)

5.3.1 Project formation

An event that changed the formation of the project network concerns the quitting of AGV. The bankruptcy of AGV resulted into the acknowledgment that converted cars do not constitute a possible technical and market solution. This illustrates a change in the *expectations* (technology-cognitive) of participants on the possibility of this technological solution. This institutional change is caused by the *gaining of experiences* by AGV in the market of EV. The following quote by Stedin illustrates the changes in expectations:

“Innovation includes change. The weaker firms fail. For instance AGV has gone bankrupt and this is the case for more companies. Thus it is observed that smaller firms have a hard time, and converted EV do not constitute the solution”. (Stedin)

5.3.2 Project execution

The execution of the project included some institutional changes that are related to monitoring. At first, the municipality of Rotterdam stated that their ideas to which EV can contribute to increase air quality in Rotterdam became more positive. Their ideas to which hybrid vehicles can increase air quality became less positive. Moreover, the municipality of Rotterdam is more aware of the fact that their initial goals set are not realistic. They also changed the ideas about the timescale on which policy needs to be employed and that the municipality should act as a user of EV themselves. These reforms all indicate that their *ideas about the effectiveness of instruments* (policy-cognitive) have changed. These institutional changes are directly caused by *performing analyses of monitoring results*. These analyses for instance show that several large barriers, like range anxiety can be taken away. Conclusions from these analyses are made in *meetings of actors* in which the monitoring analyses are discussed. The following quotes by the municipality of Rotterdam indicate the shifts in institutions:

“Yes, we have the idea that our perception of the significance of EV has changed. We aim to realize sustainable mobility in Rotterdam and region. We now say that electric transport is given an important place in realizing that. This is also the case for Europe and we also support that through different associations. We believe that a role of using EV, by implementing it in our own fleet of cars, as well as the basis on which you can justify that, is clearer now. We can do that better now. On the basis of these considerations we continue with EV in a more curtailed way. We know that our goals are not realistic and that you need to realize them in a different way, for instance on a longer term”. (The municipality of Rotterdam)

“I can state on behalf of the municipality that the way we are going to substitute vehicles will mainly be done full electric. So we are going to alter and accentuate that were possible. We can do this on a scientific basis now. We can take away some large barriers like range anxiety using some of the studies we performed and I

think that constitutes a significant change. Moreover, we can indicate more directly how different organizational parts should prepare for that change". (The municipality of Rotterdam)

"We have for instance both plug-in hybrid vehicles as well as full EV in the project. The last quarter we have mainly been busy with hybrid vehicles because of the actual discussion on their emission efficiency. This has to do with the tax advantages that are currently present for EV and the question arises whether it is justified that plug-in hybrid vehicles are provided with an addition of 0%. On the basis of the monitoring results you can question that. You can say at least that it is not just like that plug-in hybrid vehicles decrease the emissions of the organization that much". (The municipality of Rotterdam)

Stedin experienced that no technical barriers (i.e. enough capacity of the electricity grid) exist with respect to a national roll-out of EV. This increased the *expectations* (technology-cognitive) of Stedin of what the technology can signify for them in the future. According to the municipality of Rotterdam, lessons learned in the project also affected the requirements of current tenders on the implementation of public charging stations. This means that *administrative regulation* (policy-regulative) has changed. Moreover, the result section discussed that basic ideas are obtained how requirements of tenders on the acquisition of EV should look like. *Ideas about the effectiveness of instruments* (policy-cognitive) have thus changed. These institutional changes resulted directly from *performing analyses of monitoring results*. The institutional changes in policy are illustrated with the following quotes:

"In the setting of the requirements of tenders, regarding the procurement of charging stations, the experiences, with charging infrastructure of our own fleet of cars, that took place in this testing ground project are used". (The municipality of Rotterdam)

"Through this testing ground we have gained some practical experience on which basis we can state that we do not want more emissions from the fleet with this amount of usage kilometres". (The municipality of Rotterdam)

Some technical barriers were observed in the project. For instance, the reduction in the performance of the battery during the winter period was observed and added to the *technical problem agenda* (technology-cognitive). This institutional change was the direct result of the *performance of analyses of monitoring results* that identified the reduction in performance. A solution to this problem (i.e. the heating up of the EV using electricity of the charging station) was argued by the municipality of Rotterdam. This shows that the idea exists how to solve the problem, which means that *expectations* (technology-cognitive) have changed. The obtaining of this solution was achieved by *gaining experiences*. The following quote by the municipality of Rotterdam illustrate the institutional change in expectations:

"Another aspect concerns the possibilities when the vehicle is connected with a charging station. If you know that the EV should be ready for use at 7.30 A.M., it could be heated at 7.00 A.M. using the electricity from the charging station instead of the battery of the car. Such provisions are present at some EV, so we think that we will come with some suggestions from practical experiences of how to increase the operational availability of EV. That is really important data and a changed insight of how to deal with such things when we roll-out EV". (The municipality of Rotterdam)

Some important lessons were learned by Eneco during the execution of the project. One barrier constitutes the absence of a back-office, which was added to their *technical problem agenda* (technology-cognitive). The experience of this barrier also affected the change in the perception of their role within the future market of charging infrastructure. Their initial perception of the supply of charging stations as a core business activity was altered towards a niche activity. This was argued by the municipality of Rotterdam and means that the *companies' own sense of itself* (technology-normative) in the market of charging infrastructure changed (cf. table 1). These institutional changes were the direct result of *gaining experiences*. The municipality of Rotterdam argued that next to the experiences gained in the project external influences (i.e. external technological development and

external market development) affected this normative institutional change. This means that the *stocking of niche knowledge* also affected the companies' own sense of itself. The following quote by the municipality of Rotterdam shows the normative institutional change:

Eneco initially profiled themselves as supplier of their NRGSPOT charging stations. During the execution of the project they concluded, due to experiences in and external to the testing ground project, that it is no attractive core business for them". (The municipality of Rotterdam)

The result section discussed that some lessons (concerning barriers) were learned by Stedin. A technical barrier that was observed by Stedin concerns the difference between the amounts of charged kW that is stated at the pole and in the vehicle, which is due to losses from energy production to the EV. Additionally, Stedin observed the barrier of the long time to connect charging stations to the electricity grid. The observations of these barriers led additions to the *technical problem agenda* (technology-cognitive). According to Stedin, these institutional changes were the direct result of *gaining experiences*. The following quote by Stedin indicates this second example:

"In the beginning we were afraid that a large technical risk, with regard to the charging infrastructure, would exist. We observe now that there is predominantly a large administrative risk. If everyone will apply for charging stations in the future, how in the name of God are we going to realize that with our current bureaucracy". (Stedin)

Another barrier argued by Stedin concerned the location of charging stations and the respective parking spot. Currently two problems exist with respect to public space in Rotterdam, which are the parking problem and the charging problem. The experience of these problems resulted into additions to the *political problem agenda* (policy-cognitive) of the municipality of Rotterdam. The lesson learned in the project regards the coupling of these two problems in order to solve them. The idea is thus developed how to solve both problems, which shows a change in *ideas about the effectiveness of instruments* (policy-cognitive). Additionally, this is implemented in Rotterdam, which meant a reform in *administrative regulations* (policy-regulative). These institutional changes were the result of the *gaining of experiences* during the execution of RTER. The following quote by Stedin illustrates these institutional changes:

"There is a parking problem. Second, there is a charging problem. Our grid is comprised of enough capacity, at least for the coming years. We do not care how the situation is in 2030 or 2040. We will experience that by then. Currently we have no capacity problem. [...]. However, there is a parking problem and Rotterdam has observed and acknowledged that. Therefore, we intend to mainly implement charging stations at garages, which is semi-public. You have to pay for it, but you can also charge your EV there. This constitutes a lesson we have learned in the project". (Stedin)

The result section discussed that the behaviour of users of EV changed in the project. Users charge less over time which means that *user practices* (UMDB-cognitive) changed. According to Stedin, users probably drive less with EV (and more with ICEV), which demonstrates that their *preferences* (UMDB-cognitive) are altered. The institutional changes are the direct result of *gaining experiences* with the use of EV.

The result section discussed some events that occurred in order to mobilize people or companies. Stedin stated that due to the project some people acquired EV, which shows that their *preferences* (UMDB-cognitive) changed. Stedin discussed the example of BAM (not involved in the project) that acquisitioned 10 EV. The mobilization of BAM was affected by the *performance of analyses of monitoring results* of RTER. They obtained these analyses through the *diffusion of knowledge* executed by participants during *meetings with non-local actors*. The following quote by Stedin illustrates this change in preferences:

“BAM purchased 10 EV at once, which was due to the measurements in the project. They would otherwise have acquired 10 ICEV”. (Stedin)

5.3.3 Reflection

The sections 5.3.1 and 5.3.2 discussed the local institutional reforms that happened during the project formation and project execution stage of RTER. The changes, including their count of observation, are shown in table 5. Moreover, activities (and related dynamics) that affected these institutional reforms were discussed. Different types of institutional changes are identified, which are affected by various activities. Four mechanisms are identified through which RTER affected institutional change: *network formation*, *monitoring*, *learning*, and *mobilization of people*. Their functioning is enabled by the employment of multiple activities. Monitoring is mainly enabled by performing analyses of monitoring results. Learning is mainly enabled by the gaining of experiences with EV.

Table 5: Institutional changes observed in RTER (including count of observation)

	Regulative	Normative	Cognitive
Technology	X	- Companies' own sense of itself (1)	- Technical problem agenda (3) - Expectations (3)
Science	X	X	X
Policy	- Administrative regulations (2)	X	- Ideas about effectiveness of instruments (3) - Political problem agenda (1)
Socio-cultural	X	X	X
Users, markets and distribution networks	X	X	- User practices (1) - Preferences (2)

5.4 Case 4: 'Drive4Electric' (D4E)

5.4.1 Project formation

The initiation stage of the D4E project included the mobilization of different actors. Some organizations were convinced of the concept of electric propulsion (i.e. electric driving and electric sailing) and decided to participate in the project. This means that *preferences* (UMDB-cognitive) of these organizations have changed. Convincing occurred in *meetings of actors*. According to the municipality of Leeuwarden and the former project leader of D4E, these organizations were mobilized to participate as they were attracted by the realization of the first charging station in Europe. The institutional changes are thus also affected by *introducing an entirely new technological innovation*. The following quote by the former project leader of D4E illustrates this:

“When we started working on the fast charging station I observed that a lot of organizations wanted to participate in the project. Then I asked some other organizations and Drive4Electric was started”. (former project leader of D4E)

The formation of the project network was hampered by the bankruptcy of AGV. Consequently, it was observed that converted cars do not constitute the technological and market solution for EV. Thereby the *expectations* (technology-cognitive) of the municipality of Leeuwarden and province Friesland regarding converted cars have changed. Moreover, the expectations about the role of Friesland based companies in the EV market were thereby altered. These institutional reforms were affected by the *gaining of experiences* by AGV in the project. Moreover, the *stocking of*

niche knowledge about external market developments affected this. The following quote by the municipality of Leeuwarden indicates this:

“At a certain moment in time the big brands took it over. No Opel Safira existed when we started, only some converted vehicles driving electrically, but we all knew this is not the solution we search for. Currently the Prius has changed, Honda started producing. At a certain moment in time you are asking yourself: should we continue with this? The big industry of electric propulsion will surely not establish itself in Friesland”. (The municipality of Leeuwarden)

5.4.2 Project execution

The result section discussed that several activities were performed in D4E in order to mobilize people and organizations. The municipality of Leeuwarden stressed that many people decided to acquire electric boats, which means that changes in *preferences* (UMDB-cognitive) occurred. Preferences of other organizations are also altered since new technological spin-off firms (concerned with electric propulsion) established themselves in Friesland. The municipality of Leeuwarden stressed the importance of the *organization of a demonstration event* (i.e. the 'zonnebootrace') to enable the mobilization of people and organizations. This is illustrated by the following quote by the municipality of Leeuwarden:

I have no knowledge of another area where there sail as many electric boats as here in Friesland. That has really got to do with the 'zonnebootrace'. Hundreds of juniors participated in this contest”. (The municipality of Leeuwarden)

The municipality of Leeuwarden stressed that preferences of other people were directly affected by *promoting and making publicity* of events, like the realization of the first electric taxis and the first fast charging station. Promoting and making publicity occurred through the *organization of conferences and symposia*. The former project leader of D4E and the municipality of Leeuwarden argued that promoting occurred also through *promoting groups* (i.e. 'vriendenclubs') that *exchanged experiences, provided flyers and invited and made visits to companies*. The following quotes by the municipality of Leeuwarden and former project leader indicate the importance of promoting activities:

“The ambition to be a front runner in this field is really present. This is illustrated by the first electrical taxis and the first fast charging station. This causes a sort of attractive power for others that say Friesland is an area where they really do extremely well in electric propulsion”. (The municipality of Leeuwarden)

Through such things, providing flyers to facilitate changes on the one hand, but on the other hand also stimulating through 'vriendenclubs' by inviting people, visiting companies in order to ensure that they make the change”. (former project leader of D4E)

A real big one concerns Schiermonnikoog. Six electric buses will drive there shortly. That idea emanates totally from Drive4Electric and includes millions of Euros. The consciousness is created through the organization of 'vriendenclubs'. Various people are busy with the promotion of electric driving by telling other people their experiences”. (former project leader of D4E)

Another event that caused changes in preferences of people is the *establishment of a discount regulation*. The discount regulation entails an institutional change itself as it can be regarded as a new *subsidy program* of the municipality of Leeuwarden and province Friesland (policy-regulative) (cf. table 1).

Due to lessons learned during the execution of D4E, the municipality of Leeuwarden and the province of Friesland changed their main focus of their sustainability policy, as well as their financing, towards electric sailing. They regard the chance of increasing employment (in Friesland) larger for the area of electric sailing than for the area of electric driving. The *ideas about the effectiveness of*

instruments (policy-cognitive) (i.e. electric sailing and electric driving) of both governmental organizations have changed. This was accompanied by a different distribution of funding concerning electric sailing and electric driving, which means that *subsidy programs* (policy-regulative) have changed. These institutional changes caused the development of the idea to implement areas where only electric boats are allowed to sail. This indicates another change in the *ideas about the effectiveness of instruments* of these governmental organizations. These institutional changes were the direct result of an *analysis of results* (i.e. developments) achieved regarding electric propulsion in Friesland. One of the important parts of the analysis included the external market developments that took place in the market of EV. The *stocking of niche knowledge* of these developments thereby also affected the institutional reforms. The institutional changes are illustrated by the municipality of Leeuwarden with the following first two citations:

“If you look at the developments in electric propulsion in Friesland you have to make an analysis at a certain point in time. We invested a lot of money in a broad array of activities, but after some years you find out that developments are much faster in some fields than in other fields. Therefore we changed our vision and shifted our focus towards electric sailing, which currently receives most financing. Actually electric scooters and electric sailing are the most important topics now in Friesland. We quitted Drive4Electric because that organization also had the feeling that there was no point to persist. There is development on a national scale, so we think that we do not have to encourage that regionally. So we said we stop with Drive4Electric, it has had its time, and its effects, and now we continue with those things that have progressed most due to Drive4Electric, which is for instance electric sailing”. (The municipality of Leeuwarden)

“A subsidy program is established regarding electric sailing. It contains a norm which needs to be satisfied in order to be provided with subsidy”. (The municipality of Leeuwarden)

Some other events were identified that are related to learning in the project. Several technical problems were experienced in the project. The observation of these problem resulted into an addition to the *technical problem agenda* (technology-cognitive) of the respective actor(s). An example included the broken batteries in the 'Snel opladen in Leeuwarden' project. This problem was addressed by Kijlstra and the municipality of Leeuwarden and added to their technical problem agenda. Kijlstra stressed that due to modification of their technical problem agenda a new type of EV was purchased, which shows that their *preferences* (UMDB-cognitive) have changed. ABB/Epyon learned that fast charging constitutes a main activity they should focus on. This lesson affected the idea of what fast charging means for their future business, which includes that their *expectations* (technology-cognitive) are altered. Both types of institutional changes were affected by the *gaining of experiences* with the use of EV or fast charging infrastructure. Moreover, the *stocking of niche knowledge* about external technological developments (e.g. marketing of the CHAdeMO standard, Combo standard and the Nissan Leaf) affected their expectations. The altered expectations of ABB/Epyon are illustrated with the following citation:

“We said that we should search for our core capacity. We should thus continue with the activities we excel in. At that time, the Nissan Leaf and the CHAdeMO standard were announced. We observed then that the conventional automotive industry was entering the market and that a lot of money could be earned there. So we thought oke we are good in fast charging, we have some proper ideas about it, let's proceed with it. We stop all other projects and we are entirely going to commercialize this”. (ABB/Epyon)

Another lesson of ABB/Epyon constituted how to develop fast charging stations so you can install them at once. This means that a *standard procedure* (technology-normative) of operating is created. This institutional change is caused by the *gaining of experiences* in D4E. The following quote by ABB/Epyon indicates this:

“The lessons we learned contributed of course hugely to the development of the hardware. We learned lessons about the power converter that was part of the fast charging stations. We have also learned lessons about how

to install such a thing. The fact that we were occupied there with eight persons for four days taught us that we need to develop and build the device in such a way that it can be installed at once". (ABB/Epyon)

5.4.3 Reflection

The sections 5.4.1 and 5.4.2 discussed local institutional changes with respect to the D4E project in Friesland. The changes, including their count of observation, are shown in table 6. The activities that affected these reforms are discussed for the project formation and project execution stages in these sections. Moreover, dynamics between activities were identified. The functioning of three different mechanisms is observed: *network formation*, *mobilization of people*, and *learning*. Their functioning is enabled by the execution of activities discussed above.

Institutional changes affected by the mobilization of people mainly include reforms in the institutions of other people. These changes however include the execution of other activities as well as the functioning of other dynamics between these activities. The institutional changes affected by learning are mainly affected by the stocking of knowledge about niche developments and the gaining of experiences. They constitute distinctive changes because of the presence of other dynamics and/or the execution of other activities.

Table 6: Institutional changes observed in D4E (including count of observation)

	Regulative	Normative	Cognitive
Technology	X	- Standard procedure (1)	- Technical problem agenda (1) - Expectations (2)
Science	X	X	X
Policy	- Subsidy programs (2)	X	- Ideas about effectiveness of instruments (1)
Socio-cultural	X	X	X
Users, markets and distribution networks	X	X	- Preferences (3)

5.5 Case 5: 'Draadloos Oplaadbare Bus' (DOB)

5.5.1 Project formation

The formation of the network of participants showed some changes in the ideas of organizations about opportunity charging. Some organizations decided to pick up the concept and to construct wireless inductive charging systems themselves. The *expectations (technology-cognitive)* on opportunity charging of these organizations are changed. This institutional change is initiated by the *conduct of a former project* by PROOV, which included the *introduction of the main concept* of opportunity charging. Through these activities the *diffusion of knowledge* about the concept of opportunity charging is employed. This is illustrated by the following quote:

"PROOV introduced the idea of opportunity charging to a large degree. That is been subsequently picked up by some organizations that thought they could construct that. At that moment in time PROOV was not occupied with it anymore". (Province North Brabant)

5.5.2 Project execution

The result section discussed that due to the execution of the DOB project some organizations were founded in the province North Brabant. The people that founded these companies were thus mobilized. These people perceive opportunity charging important for their future business, which shows that their *expectations (technology-cognitive)* changed. This institutional change is affected by the *gaining of experiences* (by participants in the DOB project) and subsequent *diffusion of knowledge and experiences to non-project actors*. This diffusion is assumed to take place since it is

needed for knowledge about experiences (gained in the project) to be received by non-project actors.

The municipality of Den Bosch stated that many people in Den Bosch are mobilized to shift their transportation mode towards EV, which means that their *preferences* (UMDB-cognitive) have changed. According to the municipality of Den Bosch, the *employment of active policy* by the municipality on sustainability and the *organization of demonstration events* affected this. The following quote by the municipality of Den Bosch illustrates the effect of organizing demonstration events:

“A lot of questions are received of people that wanted to use the bus for certain matters or that wanted to organize an event at which people could watch the electric buses projects in Den Bosch. For instance, that they go for a ride from the 'Paleiskwartier' to the Central Station with the electric bus. In that sense the project does have its effects. That is really due to the uniqueness of the project if you observe yourself what takes place”.

(The municipality of Den Bosch)

According to the municipality of Den Bosch, the perspective of local politicians on EV in general changed from negative to positive. This reform in *expectations* (technology-cognitive) took place because of the *diffusion of knowledge and lessons* about the *proof of concept* obtained in the DOB project. This change in expectations subsequently induced a change in ideas about the content of policy. The local politicians now aim to electrify the whole public transport in Den Bosch (in order to reduce CO₂ emissions) which means that their *ideas about the effectiveness of instruments* (policy-cognitive) have altered. The change in expectations is illustrated by the municipality of Den Bosch with the following quote:

“Important is that by starting a pilot project, like the wireless inductive charged bus, politicians observe and acknowledge that the concept works”. (The municipality of Den Bosch)

The result section discussed that some technical problems were observed during the execution of the project. These concern (1) the accessory battery that caught fire, (2) problems in the communication to start charging, and (3) technical barriers with respect to the (storage) battery. These problems were added to *technical problem agenda* (technology-cognitive) of the participants. This institutional change is initiated by the *gaining of experiences* in the project.

5.5.3 Reflection

The sections 5.5.1 and 5.5.2 discussed the few institutional reforms that took place during and due to the execution of the DOB project. The changes, including their count of observation, are shown in table 7. These sections also discussed activities (and related dynamics) that affected these institutional changes. Three mechanisms are identified: *network formation*, *mobilization of people*, and *learning and problem solving*. Their functioning is enabled by the execution of multiple activities. The institutional reforms influenced by *learning and problem solving* are mainly affected by the diffusion of knowledge and experiences gained in the project.

Table 7: Institutional changes observed in DOB (including count of observation)

	Regulative	Normative	Cognitive
Technology	X	X	- Technical problem agenda (1) - Expectations (3)
Science	X	X	X
Policy	X	X	- Ideas about effectiveness of instruments (1)
Socio-cultural	X	X	X
Users, markets and distribution networks	X	X	- Preferences (1)

5.6 Case 6: 'Delta Stadsdistributie' (DS)

5.6.1 Project formation

The municipality of Deventer, Doetinchem and Delft are mobilized as they are convinced of the concept of sustainable urban supply in order to decrease CO₂ emissions. This means that they changed their *ideas about the effectiveness of instruments* (policy-cognitive). They also currently execute it in Deventer which shows that *administrative regulation* (policy-regulative) has changed. Additionally, multiple conveyer organizations, the social employment organization in Doetinchem and the director of Rabobank were convinced by Delta Zutphen of the concept of sustainable urban supply, which indicates that their *preferences* (UMDB-cognitive) changed. Delta Zutphen stressed that the mobilization of these actors occurred through *meetings with local stakeholders* or through various *non-project meetings* (e.g. meetings organized by Connekt). During these meetings *knowledge diffusion* about the concept of DS took place which induced mobilization. The following quotes by Delta Zutphen indicate these institutional changes:

“Deventer already started, they coped our concept. We have also started cooperating with Middelkoop Duiven in January 2012. That organization collaborates with 10 companies of which Middelkoop constitutes the conveyer organization. Another conveyer organization is Transmission who also delivers their goods here that need to be transported to the town centre. The beautiful thing is that both actors say that the concept really works”. (Delta Zutphen)

“When we bought the first electric car we met the director of Rabobank at some meeting. He thought it was a wonderful project and said that he would sponsor the first electric truck. He did sponsor it and therefore the Rabobank logo was put on the two electric trucks as a way to express our appreciation”. (Delta Zutphen)

5.6.2 Project execution

It was observed that the perspective of the main participants changed during the execution of the project. According to Delta Zutphen and the municipality of Zutphen, they aim to scale up the project (i.e. including more municipalities, social employment companies, conveyer organizations and entrepreneurs) in order to make a sound business case. This indicates a change in their *ideas about the effectiveness of instruments* (policy-cognitive). This institutional change occurred through the *discussion of monitoring results* which took place in *meetings of actors* in March and April 2012. One aspect of the monitoring included knowledge on the results of other similar projects. This indicates that the *diffusion of knowledge and lessons with other projects* also affected the institutional change.

The low level of noise EV produced constituted a barrier in the project as many citizens were scared up by the sudden presence of the EV. This problem was added to the *technical problem agenda* (technology-cognitive) of Delta Zutphen. The adding to the problem agenda was initiated by the *gaining of experiences* in the project. This problem is temporarily solved by adding a flashing light and an ice-cream alarm to the EV.

5.6.3 Reflection

The sections 5.5.1 and 5.5.2 discussed local institutional reforms that occurred during the DS project. The changes, including their count of observation, are shown in table 8. The sections discussed activities that affected these institutional changes. Most institutional changes that were affected by activities in the DS project concern cognitive changes. These cognitive reforms reflect different types of institutional change and are affected by the execution of various activities. In total, two mechanisms are identified: *network formation* and *learning and problem solving*. Their functioning is enabled by various employed activities.

Table 8: Institutional changes observed in DS (including count of observation)

	Regulative	Normative	Cognitive
Technology	X	X	- Technical problem agenda (1)
Science	X	X	X
Policy	- Administrative regulation (1)	X	- Ideas about effectiveness of instruments (2)
Socio-cultural	X	X	X
Users, markets and distribution networks	X	X	- Preferences (1)

5.7 Comparative analysis

This section includes a comparison of the distinctive project-specific analysis sections. This section will form the basis of the limited generalizations that will be drawn upon the relation between local experiments and institutional change. Generalizations will be made regarding mechanisms and activities. The project-specific analysis sections showed that the different types of institutional change are affected by various mechanisms. When the six different projects are compared, the functioning of three distinctive mechanisms is observed. The mechanism *network formation* is observed in all projects. The mechanism *mobilization of people* is observed in five out of six projects. All the projects contribute to the observation of the presence of a comprehensive mechanism called *monitoring, learning and problem solving*. This section is structured by the various specific institutional changes that occurred. Specific institutional changes are discussed for which is observed that it is affected by a particular mechanism in more than one project.

5.7.1 Preferences (UMDB-cognitive)

When the six projects are compared it is observed that changes in preferences are affected by the mechanism *network formation* in four projects: TGEV, EH, D4E and DS (cf. table 9). In these projects preferences of participants or municipalities are altered. The institutional reform is affected by two activities. The employment of *knowledge diffusion* was observed in two projects (EH and DS). Moreover, preferences of participants were influenced through the occurrence of *meetings of actors* in three projects (EH, D4E and DS). It was observed twice that knowledge diffusion took place through such meetings.

It is observed that preferences of other people (i.e. not involved in the project) are affected by the mechanism *mobilization of people* in five projects: TGEV, EH, RTER, D4E and DOB (cf. table 9). The institutional change is influenced by the employment of some activities. *Organizing demonstration events* occurred in four projects (TGEV, EH, D4E and DOB). In the EH project this was employed by the organization of a kick-off meeting. In D4E this was executed by the organization of the 'zonnebootrace'. Three projects (TGEV, D4E and DOB) demonstrate the effect of *executing active policy by the municipality*. In TGEV this occurred through the municipality acting as user. In D4E this was employed by the establishment of a discount regulation. In the TGEV and DOB projects, it was observed that the organization of demonstration events was part of the policy employed by the municipality. Preferences of other people were also affected by *promoting and making publicity* of the project. This occurred in TGEV by using the media. The activity of *knowledge diffusion* was observed in two projects (RTER and D4E). In both projects, the diffusion of knowledge took place through *meetings with other (non-local) people*. In the D4E project this was executed by the organization of conferences and symposia and by inviting and making visits to companies.

Preferences of participants (which are also user of EV in the project) were also affected by the mechanism *learning, monitoring and problem solving* in three projects: EH, RTER and D4E. The change in preferences is affected by one recurring activity, which concerns the *gaining of experiences* by using EV. It was observed that this institutional change was accompanied by a change in user practices (UMDB-cognitive) of the participants in two projects (EH and RETR). Table 9 provides an

overview of the relation between preferences on the one hand and mechanisms and activities on the other hand.

Table 9: The relation between changes in preferences and local experimentation

Mechanism	Activities (count of observation)	Projects
Network formation	- Meetings of actors (3) - Knowledge diffusion (2)	- TGEV - EH - D4E - DS
Mobilization of people	- Organizing demonstration events (4) - Executing active policy by the municipality (3) - Promoting and making publicity (2) - Knowledge diffusion (2) - Meetings with other (non-local) people (2)	- TGEV - EH - RTER - D4E - DOB
Learning, monitoring and problem solving	- Gaining of experiences (3)	- EH - RTER - D4E

5.7.2 User practices (UMDB-cognitive)

In three out of six projects *user practices* (UMD-cognitive) of participants (that also used EV in the project) were affected by the mechanism *learning, monitoring and problem solving*. This was the case for the TGEV, EH and RTER projects (cf. table 10). These institutional changes are caused by the *gaining of experiences* by using EV. In two projects, the reform in user practices was accompanied by a simultaneous change in the preferences (UMD-cognitive) of these participants. Table 10 provides an overview of the relation between user practices on the one hand and mechanisms and activities on the other hand.

Table 10: The relation between changes in user practices and local experimentation

Mechanism	Activities (count of observation)	Projects
Learning, monitoring and problem solving	- Gaining of experiences (3)	- TGEV - EH - RTER

5.7.3 Technical problem agenda (technology-cognitive)

In all six projects a change in the *technical problem agenda* (technology-cognitive) was affected by the mechanism *learning, monitoring and problem solving*. These concerned agendas of participants (that sometimes used EV) and municipalities. The institutional reforms are affected by two activities, which are the *gaining of experiences* and *collection of user feedback*. The gaining of experiences is observed to affect the technical problem agenda in all projects. The influence of collecting user feedback is observed in TGEV and EH. Additionally, it is observed that the diffusion of knowledge is caused by the change in the technical problem agenda in these two projects. In the TGEV project this was employed by addressing barriers and learning to the municipality. This knowledge diffusion took place through non-project meetings. Thus, participants diffused knowledge through non-project meetings and thereby searched for their solution in a non-project context. Table 11 provides an overview of the relation between the technical problem agenda on the one hand and mechanisms and activities on the other hand.

Table 11: The relation between changes in technical problem agenda and local experimentation

Mechanism	Activities (count of observation)	Projects
Learning, monitoring and problem solving	- Gaining of experiences (6) - Collection of user feedback (2)	- All

5.7.4 Expectations (technology-cognitive)

In three out of six projects the mechanism *network formation* affected the *expectations* (technology-cognitive) of participants or the municipality involved (cf. table 12). The institutional change is affected by the execution of two activities. At first, the *gaining of experiences* affected expectations in the RTER and D4E projects. Additionally, it is observed that *knowledge diffusion* is employed in these two projects and thereby affected expectations. Diffusion of knowledge occurred in the D4E project through the stocking of knowledge about niche developments. Knowledge diffusion took place during DOB by the introduction of the main concept of opportunity charging.

The mechanism *learning, monitoring and problem solving* is identified to affect changes in expectations of participants and public authorities (e.g. municipalities and provinces) in four projects: EH, RTER, D4E and DOB. The influence of *knowledge diffusion* is seen in D4E and DOB. In the DOB project, this involved the diffusion of the proof of concept of opportunity charging to politicians. Second, the *performance of analyses of monitoring results* affected the changes in expectations during the execution of EH and RTER. At last, the *gaining of experiences* in the project affected expectations in the RTER and D4E projects. Table 12 provides an overview of the relations between expectations on the one hand and mechanisms and activities on the other hand.

Table 12: The relation between changes in expectations and local experimentation

Mechanism	Activities (count of observation)	Projects
Network formation	- Gaining of experiences (2)	- RTER
	- Knowledge diffusion (2)	- D4E
		- DOB
Learning, monitoring and problem solving	- Knowledge diffusion (2)	- EH
	- Performing analyses of monitoring results (2)	- RTER
	- Gaining of experiences (2)	- D4E
		- DOB

5.7.5 Political problem agenda (policy-cognitive)

During the execution stage of TGEV and RTER it was identified that the mechanism *learning, monitoring and problem solving* affected changes in the *political problem agenda* (policy-cognitive) of participants or municipalities. Only one activity is identified that affected the political problem agenda. This concerns the gaining of experiences. Table 13 provides an overview of the relation between changes in political problem agendas on the one hand and mechanisms and activities on the other hand.

Table 13: The relation between changes in political problem agenda and local experimentation

Mechanism	Activities (count of observation)	Projects
Learning, monitoring and problem solving	- Gaining of experiences (2)	- TGEV
		RTER

5.7.6 Ideas about the effectiveness of instruments (policy-cognitive)

Ideas about the effectiveness of instruments (policy-cognitive) of municipalities are affected by the mechanism *network formation* in the EH and DS projects (cf. table 14). Two activities are seen to affect these institutional changes in both projects. *Knowledge diffusion* influenced the ideas about the effectiveness of instruments in both projects. This diffusion took place through *meetings of actors*.

Additionally, the mechanism *learning, monitoring and problem solving* is observed to affect this institutional change in five projects: TGEV, RTER, D4E, DOB and DS (cf. table 14). This mainly involved institutional reforms of public authorities. Moreover, in the TGEV and D4E projects, it also concerned changes in the ideas of participants. Three distinct activities are identified. The *diffusion of knowledge with non-project actors* is identified in TGEV, D4E and DS. During the execution of D4E this

took place by stocking niche knowledge. Secondly, *performing analyses of results* is observed to be employed in three projects (i.e. RTER, D4E and DS). This does not necessarily have to take place through formal monitoring activities. At last, *meetings of actors* affected reforms in ideas about the effectiveness of instruments in the RTER and DS projects.

Some dynamics between these activities are identified. It is observed in two projects (i.e. RTER and DS) that the analyses of monitoring results are discussed in meetings of actors. Moreover, in the D4E and DS projects it was observed that knowledge external to the respective project constituted a part of the analyses of results. This means that knowledge diffusion with non-project actors was a prerequisite to the performance of analyses. In addition to these dynamics, it is also observed that dynamics exist between institutional changes. The reform in ideas about the effectiveness of instruments took place concurrently with a policy-regulative institutional change in RTER (i.e. administrative regulations) and D4E (i.e. subsidy programs). Table 14 provides an overview of the relation regarding mechanisms and activities.

Table 14: The relation between changes in ideas about the effectiveness of instruments and local experimentation

Mechanism	Activities (count of observation)	Projects
Network formation	- Knowledge diffusion (2) - Meetings of actors (2)	- EH - DS
Learning, monitoring and problem solving	- Diffusion of knowledge with non-project actors (3) - Performing analyses of results (3) - Meetings of actors (2)	- TGEV - RTER - D4E - DOB - DS

5.7.7 Policy-regulative institutional changes

No influences of mechanisms were identified concerning institutional changes in either *administrative regulations* or *subsidy programs* (policy-regulative). However, some generalizations are found when these institutional changes are comprehensively compared. The mechanism *mobilization of people* affected regulative institutional changes in policy in two projects: EH and D4E (cf. table 15). These concern changes in institutions of municipalities. However, no activities and dynamics are identified.

It is observed that the mechanism *learning, monitoring and problem solving* affected regulative institutional changes in policy in RTER (i.e. administrative regulations) and D4E (i.e. subsidy programs). These reforms are affected by the execution of one activity. The *performance of analyses of results* affected these institutional changes. This activity does not necessarily have to include formal monitoring activities. Dynamics are identified between institutional reforms. It is found that reforms in policy-regulative changes are accompanied by changes in the ideas about the effectiveness of instruments (policy-cognitive) in both projects. Table 15 provides an overview of the relation between policy-regulative institutional changes on the one hand and mechanisms and activities on the other hand.

Table 15: The relation between policy-regulative institutional changes and local experimentation

Mechanism	Activities (count of observation)	Projects
Mobilization of people		- EH - D4E
Learning, monitoring and problem solving	- Performing analyses of results (2)	- RTER - D4E

5.7.8 Technology-normative institutional changes

No influences of mechanisms are observed concerning individual normative institutional changes in *companies' own sense of itself* and *standard procedure* (technology-normative). When these normative institutional reforms are comprehensively analysed, it is observed that generalizations concerning activities can be drawn. In two projects (i.e. RTER and D4E) the *gaining of experiences* affected normative institutions of participants in the project. Table 16 provides an overview of this relation.

Table 16: The relation between normative institutional changes and local experimentation

Mechanism	Activities (count of observation)	Projects
Learning, monitoring and problem solving	- Gaining of experiences (2)	- RTER D4E

5.8 Framework and reflection on theory

The theoretical framework proposed three mechanisms through which local experiments could affect institutional change (cf. section 2.5; table 2). These were: (1) network building, (2) articulating expectations and visions, (3) alignment, learning and articulation. The comparative analysis indicated the functioning of three (other) mechanisms: *network formation*, *mobilization of people*, and *learning, monitoring and problem solving* (cf. table 17). When observations and literature are compared, differences and similarities are observed. The differences demonstrate that current theory is not applicable to conceptualize the effect of only local experimentation on institutional change. The similarities show that some theoretical insights can be confirmed. An overview of the mechanisms and activities derived from the comparative analysis is shown in table 17.

Table 17: Mechanisms, definition and function, and activities that affected institutional change

Mechanism	Definition and function	Activities
Network formation	The building of the local network of participants. This mainly involves the convincing of actors to participate in the project.	- Meetings of actors - Knowledge diffusion - Gaining of experiences
Mobilization of people	The convincing of non-local or other actors (i.e. people not involved in the project) to make the shift towards EV.	- Organizing demonstration events - Executing active policy by the municipality - Promoting and making publicity - Knowledge diffusion - Meetings with other (non-local) people
Learning, monitoring and problem solving	The learning of lessons, gaining of experiences as well as the identification and solving of barriers encountered in the project.	- Gaining of experiences - Collection of user feedback - Knowledge diffusion - Performing analyses of monitoring results - Diffusion of knowledge with non-project actors - Performing analyses of results - Meetings of actors

The theory stated the importance of the functioning of network building as it enabled the building of local social networks that provide resources (Geels & Raven, 2006). This is similar to the observed mechanism *network formation*, which includes the building of a local network of participants that execute projects. On the contrary, the mechanism identified in the literature also includes the building of networks that do not directly execute the particular local project, but support it, and are not necessarily local (Geels & Raven, 2006). This shows the functioning of the theoretical

mechanism at the niche level. The activities that are performed are all different. The organization of meetings of actors in order to diffuse knowledge was stressed by Raven et al. (2008). Additionally, the gaining of experiences is embodied by the generation of lessons (Berkhout et al., 2010).

Additionally, the observed mechanism *mobilization of people* shows some similarities with the theoretical mechanism network building. Both mechanisms include convincing people to make the shift towards EV. However, theory states that these people provide resources (van der Laak et al., 2007). This is not necessarily the case as people can be mobilized that are not related to the project at all (e.g. citizens, tourists, politicians). These differences seem to result from the fact that the theoretical mechanism network building also functions at the niche level. Moreover, differences can occur because theory states activities that contribute to the development of niches but not affect institutional changes. The activities that pertain to these mechanisms are generally different. However, some limited similarities are observed. The literature stresses the involvement of governmental agencies and outsiders in order to increase social networks (Quitza et al., 2012; van der Laak et al., 2007). The comparative analysis noted the employment of active policy on EV by the respective municipality, which entails the involvement of governmental agencies to some degree. An important aspect of active policy concerns the electrification of the municipalities' own fleet of car by acting as a launching customer. The significance of this activity is confirmed by Decisio & Appm (2012). They state that acting as a launching customer is one of the most effective measures by municipalities to stimulate the amount of sold EV. Moreover, the observations indicated meetings with other (non-local) people in order to mobilize them, which was stressed by Quitza et al. (2012). The importance of such meetings was argued by Geels & Raven (2006) and Smith & Raven (2012). An activity which was not included in the theoretical framework is the organization of demonstration activities. However, Geels & Raven (2006) and Smith & Raven (2012) do stress that local experimentation also refers to the conduct of pilot and demonstration activities.

The theoretical mechanism alignment, learning and articulation shows some similarities with the observed mechanism *learning, monitoring and problem solving*. Both theory (Geels & Raven, 2006) and observations show the importance of generating and articulating lessons (including the gaining of experiences) from local projects. However, according to the Raven et al. (2008), the alignment of participants is significant for institutional change to occur. This is not observed to affect institutional change in local projects. Moreover, Geels & Raven (2006) note the importance of a diversity of local experiments and the articulation of global rules. This actually takes place at the niche level and is not observed to affect institutional change at the local level. These differences seem to result from the fact that the theoretical mechanism also functions at the niche level. Additionally, differences can occur because current literature states activities that contribute to proper execution of experiments and development of niches, but not affect institutional changes. Four similarities between the theory and the observations exist since both stress the significance of knowledge diffusion. The theory notes the diffusion of ideas which entails knowledge diffusion (Raven et al., 2008; van der Laak et al., 2007). Secondly, the literature stresses circulating and comparing local experiences, and creating links between local networks (Geels & Raven, 2006; Smith & Raven, 2012), which is observed to occur in the field through the diffusion of knowledge with non-project actors. Additionally, the theory (Geels & Raven, 2006; Raven et al., 2008; Smith & Raven, 2012; van der Laak et al., 2007) and the comparative analyses both stress meetings of actors. The literature argues that vision building processes like debates and negotiation processes affect institutional change (Brown et al., 2003; Weber, 2003; Raven et al., 2008), which entail meetings of actors. At last, Rotmans & Loorbach (2009) and own observations both indicated the significance of monitoring in order to learn from experiments.

Current literature also stated the significance of the mechanism articulating expectations and visions (Geels & Raven, 2006). This is observed to constitute no mechanism at all. On the contrary, this seems to happen at the local level by enabling the mechanisms *network formation* and *mobilization of people*. The theoretical mechanism includes the articulation of visions and expectations in order to co-opt new actors and to enable attraction of attention and resources (Geels & Raven, 2006). This, and the underlying activities, are seen to constitute activities that enable

formation of the project network and the mobilization of other people. This is reflected in network formation through the organization of meetings of actors. Furthermore, it is reflected in the mobilization of people by activities to promote and make publicity.

It should be noted that the observations and Smith & Raven (2012) both addressed the important contextual influence by the global niche community. The observations show that technological and market developments affect mechanisms, activities and institutional changes. Moreover, actors distanced from local projects, but occupied with EV, affected these instances. This is shown in the framework by the dotted arrows that leave the global niche community. At last, institutional changes can affect local experimentation, and thereby literature is confirmed (Geels & Raven, 2006). This relation is presented in the framework by the dotted two-sided arrow between local experimentation and institutional change. Moreover, institutional changes can affect all other institutional reforms. This was argued by Raven & Geels (2010) and observed in the field. This is shown in the framework by the dotted arrows between institutional changes. Two dynamics between institutional changes are identified: (1) changes in preferences are generally accompanied by changes in user practices, and (2) changes in ideas about the effectiveness of instruments of municipalities are generally accompanied by a policy-regulative institutional reform.

The suggested framework with mechanisms, and underlying activities, is presented in figure 4 (cf. page 66). Table 18 explains the relations between mechanisms and institutional changes of the framework, which entail the activities.

Table 18: Activities that affect institutional change

#	Activity
1	Meetings of actors
2	Knowledge diffusion
3	Organizing demonstration events
4	Executing active policy by the municipality
5	Promoting and making publicity
6	Meetings with other (non-local) people
7	Gaining of experiences
8	Collection of user feedback
9	Performing analyses of monitoring results
10	Diffusion of knowledge with non-project actors
11	Performing analyses of results

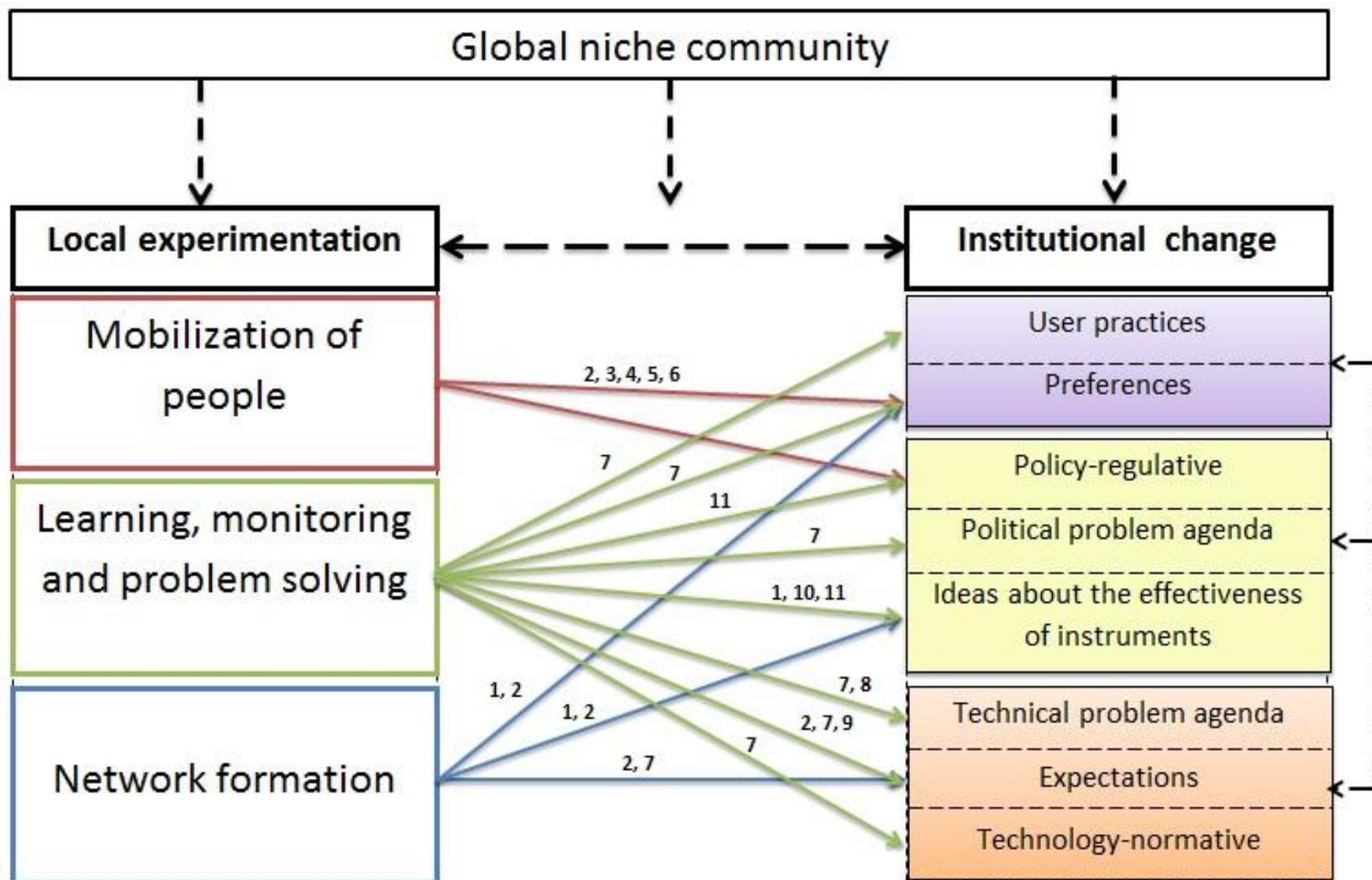


Figure 4: Framework

6. Conclusions

The transition to EV is not occurring at a desired pace. Creative destruction and institutional change are needed for sustainable transitions to take place. The literature proposes local experiments to affect institutional change. This thesis aimed to suggest limited generalizations through which local experimentation (mechanisms and underlying activities) affects institutional change. Experiments with EV in the Netherlands are chosen as a case study. The research question of this thesis was therefore:

“How do local experiments with electric vehicles affect institutional change?”

Three sub-questions were formulated to gain insight into this relation:

- (1) What institutional change is induced by local experimentation with EV in the Netherlands?
- (2) What mechanisms, and activities, can be identified through which local experiments with EV in the Netherlands affect institutional change?
- (3) What dynamics, between the activities performed, can be identified that explain the functioning of the mechanisms?

The first two sub-questions are answered by performing case study research of experiments with EV in The Netherlands. The answer to the first sub-question is provided by the case-specific analyses sections. More specifically, tables 3 - 8 give an overview of the identified institutional changes that were affected by the six projects examined. The comparative analysis indicated that eight patterns between local experimentation and institutional changes are observed. The following types of institutional change are affected by a particular mechanism in more than one project: (1) *preferences*, (2) *user practices*, (3) *technical problem agenda*, (4) *expectations*, (5) *political problem agenda*, (6) *ideas about the effectiveness of instruments*, (7) *policy-regulative institutional changes*, and (8) *technology-normative institutional changes*.

The second sub-question is answered by the comparative analysis. With the answer on this sub-question, a reflection on the theoretical framework is enabled. The functioning of three distinct mechanisms were identified from the comparison (cf. table 17): (1) *network formation*, (2) *mobilization of people*, and (3) *learning, monitoring and problem solving*. Network formation includes the building of the network of participants that execute local projects. It mainly involves convincing actors to participate in the project. Through this mechanism the preferences, ideas about the effectiveness of instruments and expectations are changed. The mobilization of people entails convincing other people (not involved in projects) to make the shift towards EV. This affected preferences and policy-regulative institutions in the projects examined. At last, learning monitoring and problem solving involves learning lessons, gaining experiences as well as identifying and solving barriers encountered in projects. This mechanism affected all the institutional changes.

The activities that enable the functioning of mechanisms are presented, per mechanism, in table 17. In total, 11 different activities are observed that affected institutional changes: (1) *meetings of actors*, (2) *knowledge diffusion*, (3) *organizing demonstration events*, (4) *executing active policy by the municipality*, (5) *promoting and making publicity*, (6) *meetings with other (non-local) people*, (7) *gaining of experiences*, (8) *collection of user feedback*, (9) *performing analyses of monitoring results*, (10) *diffusion of knowledge with non-project actors*, and (11) *performing analyses of results*.

Dynamics between activities performed, and between institutional changes, idiosyncratic to projects examined, were discussed in the case-specific analyses sections. The comparative analysis showed that some dynamics are observed. These constitute the answer to the third sub-question. It is found that knowledge diffusion took place in meetings of actors or in meetings with other (non-local) people. Moreover, analyses of monitoring results are generally discussed during meetings of actors, and knowledge diffusion with non-project actors constituted a prerequisite to the

performance of analyses. Additionally, it is observed that a change in the technical problem agenda caused knowledge diffusion through the conduct of non-project meetings. It is observed that all types of institutions can affect other institutional changes. The comparative analysis indicated some dynamics between institutional reforms. It is observed that changes in preferences are generally accompanied by changes in user practices. Both result from the gaining of experiences with the use of EV. Moreover, changes in ideas about the effectiveness of instruments of municipalities are generally accompanied by a policy-regulative institutional reform in administrative regulations or subsidy programs.

These limited generalizations together provide an answer to the main research question. Local experiments affect institutional changes through the employment of 11 different activities that enable network formation, the mobilization of people, and learning, monitoring and problem solving (cf. table 18). These conclusions have some practical implications for initiators, which are generally public authorities, and participants of experiments. Depending on the objective of the initiator or motive of participation of actors, several activities can be performed. Specific institutional changes can be affected through the employment of particular activities (cf. table 19). For instance, if a municipality initiates a project in order to mobilize people to make the shift towards EV, this means that preferences should be influenced. According to table 19, seven different activities could be employed to affect preferences of people. The municipality can for example diffuse knowledge about the innovation through meetings with interested actors. Additionally, the municipality can decide to execute active policy on EV, including organizing demonstration events of EV and charging stations and promoting this by using the media. On the contrary, if a company decides to participate in a project in order to develop its technological innovation, this means that institutions of the technological type should be influenced. Table 19 (cf. page 69) shows that four distinct activities can be performed that affect these institutional changes. The company can decide to experiment with the technology and thereby to generate experiences that provide the basis for learning. Moreover, generating information by collecting user feedback and performing analyses on monitoring results can affect technological institutions. At last, if local actors would like to develop proper policy on EV, they should aim to affect policy-regulative institution as well as ideas about the effectiveness of instruments. Performing analysis of results in the respective project and diffusing this knowledge to governmental actors (not necessarily involved in the project) should be employed.

The literature proposed three different mechanisms (i.e. alignment, learning and articulation, network building, and articulating expectations and visions) that would affect institutional change. Some similarities exist between theoretical mechanisms and the identified mechanisms. Network formation and the mobilization of people show some overlapping with the theoretical mechanism network building. Learning, monitoring and problem solving shows overlaps with the theoretical mechanism alignment, learning and articulation, which mainly reflect the underlying activities. At last, the theoretical mechanism articulating expectations and visions seems to occur at the local level by enabling the functioning of network formation and the mobilization of people. These similarities show that some theoretical insights can be confirmed. However, critical differences exist between theory and observations, which demonstrate that current theory is not applicable to conceptualize the particular influence of local experimentation on institutional change. This is reflected by the observation of three different mechanisms. Moreover, most activities differ from the activities stated in theory. These differences are observed since current theory also includes the functioning of mechanisms on the niche level. Moreover, differences can occur because theory states activities that contribute to the development of niches but not affect institutional changes. This means that current theories, like SNM and niche development theories, are not (fully) applicable to the relationship between local experimentation and institutional change. Thereby, this thesis contributes to current theory as it only states influences on institutional change which apply to the local level.

Table 19: Practical implications

Institutional change	Activities
User practices	- Gaining of experiences
Preferences	- Meetings of actors - Knowledge diffusion - Organizing demonstration events - Executing active policy by the municipality - Promoting and making publicity - Meetings with other (non-local) people - Gaining of experiences
Policy-regulative	- Performing analyses of results
Political problem agenda	- Gaining of experiences
Ideas about the effectiveness of instruments	- Meetings of actors - Knowledge diffusion - Diffusion of knowledge with non-project actors - Performing analyses of results
Technical problem agenda	- Gaining of experiences - Collection of user feedback
Expectations	- Knowledge diffusion - Gaining of experiences - Performing analyses of monitoring results
Technology-normative	- Gaining of experiences

7. Discussion

Some aspects require reflection in order to discuss the academic quality of this thesis. The first point considers the reliability of this research. Reliability is guaranteed as reproducibility and objectivity are insured. This study is reproducible as the procedures of data collection are clearly specified by providing the interview scheme in Appendix B and discussing the sampling strategy in section 3.2. Moreover, the steps of the analytical process are conveyed by explicitly specifying the coding strategy in terms of excerpts produced and subsequent application of open coding, constant comparison and memos (cf. section 3.3). Objectivity is insured by making use of method triangulation in data collection. In total, 14 different interviews were conducted. Where possible data is supplemented by data included in documents (e.g. project plans, other provided documents, internet documents). The project DS was examined through the conduct of one interview in which both interviewees were present. This could have influenced data by the provision of answers that are viewed favourably by the other interviewee (i.e. social desirability bias) (Bryman, 2008).

Internal validity is guaranteed as results are grounded in all relevant data. This data is included in the written excerpts. Additionally, the theoretical ideas (i.e. mechanisms, activities and dynamics) are, if possible, grounded in data by using adequate quotes of interviewees that illustrated the respective instances. Construct validity is insured as indicators used to measure the effect of local experiments on institutional change were grounded in literature. The different types of institutional change, grounded in the typology of institutions in table 1 (Geels, 2004; Smith & Raven, 2012) were used as sensitizing concepts.

The external validity of this thesis needs closer attention. The cases were selected on the basis of availability. Because of this non-probabilistic way of sampling, the findings of this thesis are only limitedly generalizable. Future studies are needed to corroborate the results of this thesis. Some projects, like TGEV, EH and DOB, did not include the different types of actors represented in projects (e.g. secretary, project manager or coordinator, engineers, governmental actors, users). Since

interviewees are knowledgeable of particular types of institutional change, it is thereby possible that not all actual institutional changes, and employed activities, are observed. This could have influenced the results of this thesis. Future studies should try to interview as many different types of actors as possible for each case examined.

In total, six different experiments were researched by interviewing 15 different actors with different roles and responsibilities in respective projects. The results of this thesis give good insights into the relation between local experiments with EV and institutional changes in the Netherlands. Six cases were selected that differ in their means, goals, geographical scale, and in the way the protective space is provided. This increased the external validity of findings. However, it is unclear to which extent the results are generalizable to other sectors. Therefore, further research, including cases with various sustainable technologies, is needed in order to generalize to the population of local experiments in socio-technical transitions. Moreover, in order to generalize to other countries, experiments executed in various countries need to be examined. Further research is thus needed in which one must control for government inducements to innovation that differ nationally (Niosi et al., 1993).

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9. Appendix A: Specification typology of institutions

In this appendix the types of institutional change are described (UMDB, technology and policy) that are generalized by the comparative analysis.

9.1 Technology

9.1.1 Regulative

- Technical standards: “*documented agreements containing technical guidelines to ensure that materials, products, processes, representations, and services are fit for their purpose*” (Allen & Sriram, 2000, p. 172).
- Product specifications: the set of requirements to be satisfied by a product or service (ASTM, 2012).
- Functional requirements: A request articulated by users or marketing departments that defines complete product specifications (Geels, 2004; Tseng & Jiao, 1997)
- Infrastructural requirements: A request that articulates the specifications concerning public and private systems (e.g. service, delivery, information, transportation, electricity or water) that facilitate the diffusion process of an innovation (Brown, 1975).
- R&D subsidies: Public funding of R&D projects by the government to prevent market failure (Almus & Czarnitzki, 2003).

9.1.2 Normative

- Companies own sense of itself: company’s idea of what kind of company they are and what kind of business they are in (Geels, 2004).
- Authority structures: devices for formulating and enforcing rules that become the basis for managerial and maintenance subsystems of organizations (Katz & Kahn, 1978).
- Testing procedures: An established method of examining a product under controlled conditions or real-life conditions (Cooper & Kleinschmidt, 1986)

9.1.3 Cognitive

- Search heuristics: routinized cognitive arrangements (of engineers) of which particular problems to focus on and certain cognitive notions how to deal with them (Nelson & Winter, 1977).
- Routines: basic components of organizational behavior and repositories of organizational capabilities (Nelson & Winter, 1982).
- Expectations: Wishful enactments of a desired future (Borup et al., 2006).
- Technological guideposts: principles that lay out certain paths of development of a technology (Sahal, 1985).
- Technical problem agenda: Technical problems, demands or mode of acceptance are articulated and subsequently become the center of attention (van der Poel, 2000).
- Problem solving strategies: fruitful ways of how to solve problems in an organization’s immediate environment (Henderson & Clark, 1990).
- User representations: elements through which designers may seek to prefigure the user in the eventual use of the artifact (e.g. incorporating the user in the design of artefacts and aligning actual users to that view) (Williams et al., 2005).

9.2 Policy

9.2.1 Regulative

- Administrative regulations: law/rule that provides the details to put policy in practice and enforcing it in order to control society. It specifies requirements, responsibilities, step by step procedures and do’s and don’ts (Elliot & Schuck, 1990).

- Formal regulations of technology: Regulatory mechanisms that include command and control instruments (e.g. effluent concentration standards, technology standards, safety standards, emission norms) (Pargal et al., 1997).
- Subsidy programs: funding programs set by the government in order to correct market failure (Todaro & Smith, 2000).
- Public innovation procurement programs; programs concerning the “*purchase of innovative products, services or processes through public demand with the aim to improve the performance and functionality of public services or to solve important socio-economic challenges*” (OMC-PTP, 2011, p. 4).

9.2.2 Normative

- Policy goals: objectives to be achieved by policy (procedures that are implemented in order to achieve certain outcomes).
- Interaction patterns between industry and government; the association between industry and government (e.g. corporatism).
- Role perceptions of the government: the position of the government with respect to expectations and behaviour (Flynn & Lemay, 1999).

9.2.3 Cognitive

- Ideas about effectiveness of instruments: thoughts about the contribution of policy tools in the realisation of policy goals when implemented.
- Policy guiding principles: statements concerning policy intentions (e.g. liberalization).
- Problem agendas: list of articulated problems to which people are giving attention to (Rocheffort & Cobb, 1993).

9.3 Users, markets and distribution networks

9.3.1 Regulative

- Market laws and rules: regulatory mechanisms that construct markets and include instruments like emissions charges, abatement credits, tradable permits (Geels, 2004; Pargal et al., 1997).
- Property rights: instrument of society (and implemented by the government) that convey the right to benefit or harm oneself or others based on controlling and transferring property (Demsetz, 1967).
- Product quality laws: rules that govern the determination of product quality and performance claims in order to ensure that buyers get the full benefit of their bargain (Rice, 1985).
- Market subsidies: subsidies that influence the market by either lowering the price paid by buyers or by increasing the quantity sold, which will effect the market equilibrium and thereby correcting market failures (Todaro & Smith, 2000).
- Tax credits (to users): decrease in the total amount a taxpayer owes to the state (e.g. R&D investment tax credit) (Bernstein, 1986).
- Competition rules: policy that ensures competition is not distorted in the internal market by guaranteeing that similar rules apply to all firms in the market (e.g. antitrust legislation, rules concerning mergers and cartels) (Hovenkamp, 1994).

9.3.2 Normative

- Role relationships between users and firms: the position of the user and firm with respect to each others expectations and behaviour (Flynn & Lemay, 1999). This is changing due to the shift to an open innovation model (Chesbrough, 2003) and interlocking due to the wide recognition of user innovation (Von Hippel, 2009).

9.3.3 Cognitive

- User practices: customary pattern of consumption of a technology (Barkhuus & Brown, 2009).
- User preferences: the need for certain products or services, which is perceived as a trade-off between what one has to offer in order to get the product and what one gets, in terms of the characteristics the technology embraces (Grunert et al., 2008).
- User competencies: the ability of an individual to perform an activity and results from the combined implementation of knowledge, know-how, abilities, attitude and behavior (Worley et al., 2005).
- Interpretation of functionalities of technologies: the perceived quality of a technology to serve a purpose well when used.
- Perception of what 'the market' wants: insights concerning the selection criteria of users on the market (Geels, 2004).

10. Appendix B: Interview scheme

The interviews are conducted in Dutch. Therefore, the interview scheme is provided in Dutch:

Voordat we het interview starten heeft u er bezwaren tegen dat ik een opname maak van dit gesprek? Dan kunnen we nu van start gaan.

10.1 'Inleiding interview'

Hallo mijn naam is Rowan van de Weerd en neem dit interview af in teken van mijn afstuderen aan de Universiteit Utrecht. Voordat we beginnen zou ik eerst graag wat algemene informatie van u willen:

- Wat is uw naam?:
- Bij welk bedrijf/organisatie bent u werkzaam?
- Wat is uw positie in het bedrijf?
- Klopt het dat bedrijf X actief is/was in project(en) A (, B en C)?

10.2 'Inleiding onderzoek'

Ik zal eerst een korte inleiding geven van mijn onderzoek. In mijn scriptie onderzoek ik welke lessen getrokken worden uit lokale experimenten/projecten (met als case elektrische vervoer) en wat voor invloeden deze hebben. Meer specifiek onderzoek ik de invloeden op huidige instituties. "Instituties" is een begrip uit de innovatieleer en omvat de samenraap aan formele en informele regels waar partijen betrokken in een projecten zich aan houden. Ik maak een onderscheid tussen drie soorten instituties:

- Reguleren/regulatieve regels (bijvoorbeeld: technische standaarden, infrastructurale eisen, subsidieprogramma's, administratieve regelingen, formele onderzoeksprogramma's);
- Normatieve regels (bijvoorbeeld idee van een bedrijf wat ze zijn en doen, beleidsdoelstellingen, perceptie van de rol die de overheid speelt, culturele waarde van de innovatie, rolverhouding tussen gebruikers en bedrijven);
- Cognitieve regels (bijvoorbeeld routines, verwachtingen, technische en politieke probleemagenda's, oplossingsstrategieën, ideeën over de effectiviteit van beleidsinstrumenten, ideeën over de impact van de innovatie, gebruikersgewoonten, gebruikersvoorkeuren, interpretatie van de functionaliteit van de innovatie en percepties van wat de markt wilt).

Deze regels worden gedeeld door alle partijen (overheidsinstanties, bedrijven, gebruikers) betrokken in het project. Ik onderzoek hoe lokale projecten met elektrisch vervoer voor veranderingen in deze instituties kan zorgen. Meer specifiek onderzoek ik welke processen en bijbehorende activiteiten uitgevoerd worden tijdens en rondom projecten die ervoor zorgen dat geleerd wordt uit projecten en uiteindelijk institutionele verandering plaatsvindt.

10.3 'Opbouw interview'

Het interview is ingedeeld in 6 delen. Het eerste deel bestaat uit algemene vragen over de uitvoering van het project. Dan volgen 5 delen met vragen waarin elk deel de verschillende typen instituties (regulatief, normatief en cognitief) op een verschillend gebied (technologisch/infrastructureel, wetenschappelijk, politiek, sociaal-cultureel, gebruikers en markt) wordt behandeld. Deze vragen gaan om veranderingen door de uitvoering van het project zelf, welke activiteiten daartoe hebben geleid en vragen daarom om een reflectie sinds de start van het project.

Het interview heeft geen vaste structuur met vragen. Er zijn een aantal hoofdvragen waar op doorgevraagd zal worden.

10.4 'Vragen'

10.4.1 'Het project zelf':

- 1) Wat houdt het project in?
- 2) Wat is het doel van het project?
 - a) Is deze veranderd gedurende de loop van het project?
 - i) Zo ja, waarom?
 - ii) Wat is het effect van deze verandering geweest?
- 3) Wat is de omvang van het project (budget)?
- 4) Wat is de status/looptijd van het project?
 - a) In welke fase bevindt het project zich nu?
- 5) Wat zijn de belangrijkste activiteiten bij het uitvoeren van het project?
 - a) Waar heeft het project haar invloed op en waar wordt de uitvoering van het project door beïnvloedt?
- 6) Wat is uw rol / de rol van uw organisatie binnen het project?
 - a) Is deze veranderd gedurende de loop van het project?
 - i) Zo ja, waarom?
 - ii) Wat waren de gevolgen van deze verandering?
- 7) Welke partijen zijn er nog meer allemaal betrokken binnen het project?
 - a) Wat is hun rol binnen het project?
 - b) Zijn deze rollen veranderd gedurende de loop van het project?
 - i) Zo ja, waarom?
 - ii) Wat waren de gevolgen van deze verandering(en)?
 - c) Zijn er partijen bijgekomen of afgehaakt gedurende het project?
 - i) Zo ja, waarom?
 - ii) Wat waren de gevolgen van deze verandering(en)?
 - d) Is er sprake van communicatie/interactie tussen de verschillende partijen?
 - i) Zo ja, hoe en wanneer?
 - e) De betrokkenheid van welke partijen beschouwt u als belangrijkste en waarom?
 - i) Is dit veranderd gedurende de loop van het project?
- 8) Hoe wordt ervoor gezorgd dat het project in goede banen wordt geleid / goed wordt gemanaged?
 - a) Hoe zorgt men ervoor dat er voldoende middelen aanwezig zijn om het project uit te voeren (resources)? Bijv. financiering.
 - b) Hoe wordt ervoor gezorgd dat iedereen zich vol voor het project blijft inzetten (motivatie)?
 - c) Hoe zorgt men ervoor dat iedereen op één lijn zit (alignment)?

- d) Hoe zorgt voor men voor een optimale lokale uitvoering van het project (practicability)?
- 9) Is er sprake van communicatie/interactie met andere projecten met elektrisch vervoer / partijen/ organisaties niet betrokken in dit project?
 - a) Zo ja, welke, hoe en waarom?
 - b) Wat zijn de gevolgen van deze communicatie/interactie?
- 10) Heeft het project nog een vervolg gehad (andere pilots/projecten/activiteiten veroorzaakt of gestuurd)?

10.4.2 'Technologische institutionele verandering':

- 11) Welke belangrijkste lessen heeft u / zijn getrokken gedurende het project op technologisch/infrastructureel gebied? Of welke belangrijkste veranderingen hebben plaatsgevonden op technologisch/infrastructureel gebied?
 - a) Hoe is de conclusie getrokken dat deze veranderingen nodig waren?
 - b) Toen duidelijk was dat deze veranderingen nodig waren hoe heeft men vervolgens daarop gehandeld / wat is er gedaan met de resultaten en lessen getrokken uit het project?

Voorbeelden bij onduidelijkheden:

- 11.1) Welke veranderingen zijn er op technologisch en/of infrastructureel gebied aangebracht en waarom (denk bijvoorbeeld aan standaarden, specificaties en eisen)?
 - i) Zo ja, waarom?
 - ii) Hoe is de conclusie getrokken dat deze veranderingen nodig waren?
 - iii) Toen duidelijk was dat deze veranderingen nodig waren hoe heeft men vervolgens daarop gehandeld?
- 11.2) Is de perceptie verandert van wat voor soort bedrijf u bent (door een verandering in uw technologische basis)?
 - i) Zo ja, wat voor effect heeft dat gehad?
- 11.3) Zijn bepaalde routines (organisatorische manier van handelen / gewoontes) veranderd?
 - i) Zo ja, waarom?
 - ii) Hoe is de conclusie getrokken dat dit veranderd moest worden?
 - iii) En hoe heeft u deze veranderde routines gecommuniceerd binnen uw organisatie?
- 11.4) Zijn er verwachtingen / doelstellingen m.b.t. de technologie/innovatie/infrastructuur gedurende de loop van het project veranderd?
 - i) Zo ja, waarom?
 - ii) Hoe is de conclusie getrokken dat deze bijgesteld moesten worden?
 - iii) En hoe is vervolgens op deze bijgestelde verwachtingen gehandeld?
- 11.5) Is de technische probleemagenda (de technologische/infrastructurele problemen waar uw organisatie zich mee bezighoudt) verandert gedurende de loop van het project?
 - i) Zo ja, waarom?
 - ii) Hoe is de conclusie getrokken dat deze gewijzigd moest worden?
 - iii) En hoe is deze gewijzigde agenda door gecommuniceerd naar anderen (binnen uw organisatie en naar andere betrokkenen binnen het project)?

- 11.6) Is de manier waarop de gebruiker betrokken wordt in het elektrisch vervoer verandert gedurende de loop van het project?
- i) Zo ja, waarom?
 - ii) Hoe is de conclusie getrokken dat dit moest worden veranderd?
 - iii) Hoe is daar op gehandeld door uw organisatie en de gebruiker van de innovatie?
- 12) Hebben er nog andere veranderingen op technologisch / infrastructureel gebied plaatsgevonden gedurende de loop van het project die nog niet zijn behandeld?
- b) Zo ja, welke veranderingen
 - c) Waarom hebben die plaatsgevonden?
 - d) Hoe is men tot die conclusies gekomen?
 - e) Hoe is daar op gehandeld?

10.4.3 'Wetenschappelijke institutionele verandering':

- 13) Welke belangrijkste lessen zijn getrokken gedurende het project op wetenschappelijk gebied? Of welke veranderingen hebben plaatsgevonden op wetenschappelijk gebied?
- i) Hoe is de conclusie getrokken dat deze veranderingen nodig waren?
 - ii) Toen duidelijk was dat deze veranderingen nodig waren hoe heeft men vervolgens daarop gehandeld?

Voorbeelden bij onduidelijkheden:

- 13.1) Is er een verandering in formele onderzoeksprogramma's geweest?
- 13.2) Hebben wetenschappers van een betrokken onderzoeksinstelling of universiteit veranderingen aangebracht in hun onderzoekoriëntatie?

10.4.4 'Politieke institutionele verandering':

- 14) Welke belangrijkste lessen heeft u / zijn getrokken gedurende het project op politiek gebied? Of welke belangrijkste veranderingen hebben plaatsgevonden op politiek gebied?
- i) Hoe is de conclusie getrokken dat deze veranderingen nodig waren?
 - ii) Toen duidelijk was dat deze veranderingen nodig waren hoe heeft men vervolgens daarop gehandeld?

Voorbeelden bij onduidelijkheden:

- 14.1) Hebben er veranderingen plaatsgevonden gedurende de loop van het project met betrekking tot subsidieprogramma's van de overheid of andere overheidsinstellingen als provincies of gemeenten?
- i) Zo ja, waarom?
 - ii) Hoe is de conclusie getrokken dat deze veranderingen in subsidies nodig waren?
 - iii) Toen duidelijk was dat deze veranderingen nodig waren hoe is vervolgens daarop gehandeld? Hebben de gewijzigde subsidies invloed gehad op het aantal activiteiten en actoren?
- 14.2) Zijn er bepaalde formele reguleringen als administratieve reguleringen verandert gedurende de loop van het project?
- i) Zo ja, waarom?
 - ii) Hoe is de conclusie getrokken dat deze bijgesteld moesten worden?
 - iii) Hoe is vervolgens hierop gehandeld? Heeft dit invloed gehad op het aantal projectgebonden activiteiten?

14.3) Zijn beleidsdoelstellingen van overheden (gemeenten, provincies) verandert naar aanleiding van het project?

- i) Zo ja, waarom?
- ii) Hoe is men tot de conclusie gekomen dat deze doelstellingen aangepast moesten worden?
- iii) Hoe is hier op gehandeld? Hebben de gewijzigde doelstellingen bepaalde invloeden gehad op de activiteiten binnen het project?

14.4) Is de perceptie verandert van de rol die de overheid speelt binnen het project?

- i) Zo ja, waarom?
- ii) Hoe komt het dat deze perceptie is verandert?
- iii) Wat voor invloed heeft deze veranderde perceptie gehad?

14.5) Zijn politieke probleemagenda's gewijzigd sinds de loop van het project? Dus hebben er wijzigingen plaatsgevonden in de problemen die de overheid wilt aanpakken?

- i) Zo ja, waarom?
- ii) Hoe is men tot de conclusie gekomen dat deze problemen prioriteit moesten krijgen?
- iii) Hoe is vervolgens hierop gehandeld door de partijen betrokken in het project?

14.6) Heeft men andere ideeën over de effectiviteit van beleidsinstrumenten (bijv. het effect van taxen of subsidies) sinds de loop van het project?

- i) Zo ja, waarom?
- ii) Is iedereen binnen het project het eens met dit idee?
- iii) Hebben veranderde ideeën bepaalde invloeden gehad op activiteiten binnen het project?

15) Hebben er nog andere veranderingen op politiek gebied plaatsgevonden gedurende de loop van het project die nog niet zijn behandeld?

- i) Zo ja, welke veranderingen
- ii) Waarom hebben die plaatsgevonden?
- iii) Hoe is men tot die conclusies gekomen?
- iv) Hoe is daar op gehandeld?

10.4.5 'Socio-culturele institutionele verandering':

16) Welke belangrijkste lessen heeft u / zijn getrokken gedurende het project op sociaal-cultureel gebied? Of welke belangrijkste veranderingen hebben plaatsgevonden op sociaal-cultureel gebied?

- i) Hoe is komt het dat deze veranderingen hebben plaatsgevonden / nodig waren?
- ii) Toen duidelijk was dat deze veranderingen nodig waren / plaatsvonden hoe is vervolgens daarop gehandeld?

Voorbeelden bij onduidelijkheden:

16.1) Is de culturele waarde van de innovatie veranderd gedurende de loop van het project? Hebben er veranderingen plaatsgevonden in de perceptie of de innovatie goed/slecht is voor de samenleving?

- i) Hoe komt het dat deze veranderingen hebben opgetreden?
- ii) Hebben deze veranderingen invloed gehad op bepaalde activiteiten in het project?

16.2) Zijn de ideeën/visies veranderd van wat de impact is van de technologie? Dus hebben er veranderingen plaatsgevonden in de ideeën hoe elektrisch vervoer kan bijdragen aan het oplossen van de problemen waarvoor het project gestart was?

- i) Zo ja waarom?
- ii) Delen alle partijen betrokken in het onderzoek deze veranderde visie?
- iii) Wat voor invloed heeft deze gewijzigde ideeën/visies gehad op activiteiten binnen het project?

10.4.6 'Institutionele verandering m.b.t. gebruikers en de markt'

17) Welke belangrijkste lessen heeft u / zijn door uw organisatie getrokken gedurende het project op sociaal-cultureel gebied? Of welke belangrijkste veranderingen hebben plaatsgevonden op sociaal-cultureel gebied?

- i) Hoe is komt het dat deze veranderingen hebben plaatsgevonden / nodig waren?
- ii) Toen duidelijk was dat deze veranderingen nodig waren / plaatsvonden hoe is vervolgens daarop gehandeld?

Voorbeelden bij onduidelijkheden:

17.1) Hebben er veranderingen plaatsgevonden in hoe gebruikers en andere organisaties zich tot elkaar verhouden sinds de start van het project? Dus hebben er veranderingen plaatsgevonden in de rol die de partijen spelen door veranderingen in elkaars verwachtingen en activiteiten?

- i) Zo ja, waarom?
- ii) Hoe is men tot de conclusie gekomen dat de rollen moesten worden veranderd?
- iii) Wat voor invloed hebben die veranderde rolverhoudingen gehad op de uitvoering van het project?

17.2) Zijn bepaalde gewoontes van gebruikers veranderd gedurende de uitvoering van het project?

- i) Zo ja, waarom?
- ii) Wat voor invloed hebben die veranderde gewoontes gehad (binnen de uitvoering van het project, of invloed op andere instituties)?

17.3) Zijn bepaalde voorkeuren van gebruikers veranderd gedurende de uitvoering van het project?

- i) Zo ja, waarom?
- ii) Wat voor invloed hebben deze veranderde voorkeuren gehad (binnen de uitvoering van het project, of invloed op andere instituties)?

17.4) Zijn interpretaties van de functionaliteit van de innovatie veranderd sinds de start van het project? Dus hebben er veranderingen plaatsgevonden in wat bedrijven en gebruikers vinden van de mate waarin de innovatie bepaalde doelen dient?

- i) Zo ja, waarom?
- ii) Waar hebben deze veranderingen hun invloed op gehad (bijv. binnen de uitvoering van het project, of invloed op andere instituties)?

17.5) Hebben er veranderingen plaatsgevonden van wat organisaties denken wat voor soort innovatie de markt / gebruiker wilt/willen sinds de start van het project?

i) Zo ja, waarom?

ii) Waar hebben deze veranderingen hun invloed op gehad (bijv. binnen de uitvoering van het project, of invloed op andere instituties)?

18) Ter afsluiting van het interview vroeg ik me af of u documenten ter beschikking heeft over het project. Denk hierbij aan evaluatiedocumenten of andere rapportages.

11. Appendix C: Actors interviewed per case

Table 19: The actors interviewed per case

Project name	Actor interviewed
Texel Gastvrij Elektrisch Vervoer	- Stichting Urgenda - The municipality of Texel
Elektropool Haaglanden	- OM The Hague - Eneco - Stedin - The municipality of The Hague
Rotterdam Test Elektrisch Rijden	- The municipality of Rotterdam - Eneco - Stedin
Drive 4 Electric	- The municipality of Leeuwarden - Kijlstra personenvervoer & ambulancegroep Fryslân - ABB/Epyon - Former project leader D4E
Draadloos Oplaadbare Bus	- The municipality of Den Bosch - Province of North Brabant
Delta Stadsdistributie	- The municipality of Zutphen - Delta Zutphen

12. Appendix D: Participants of TGEV and accompanied EV

Table 20: The role and purchased EV of participants of TGEV

Organization/company	Intended role/use of EV	Purchased EV (in this project)
1. Stichting Urgenda	Guiding the project, including the monitoring by The New Motion and the behavioural research among participants.	
2. Garage Rentenaar VOF	Renting to residents of the island and tourists.	1 Think and 1 Opel Ampera
3. Van Braak Accountants (VBA)	Transport of clientele and use by accountants in order to visit clientele.	1 Opel Ampera
4. TukTuk Express Texel	Renting to tourists that visit marina "Waddenhaven" as well as the marina of Oudeschild in order to make short trips.	2 Ape Calessino Electric Lithium
5. De Texelse Visspecialist BV	Delivering parcels of fish among Texel-based restaurants and catering companies .	1 Renault Kangoo
6. NBC Eelman & Partners Accountants	Visiting clientele.	1 Peugeot iOn
7. St. Texels Museum (Ecomare)	(1) Instructional service car, (2) ambulance for animals, (3) use by board of directors.	1 Renault Kangoo
8. Gemeente Texel	Transportation of the mayor and city council members, maintainers and inspectors.	1 Ford Transit and 1 Mitsubishi i-MiEV
9. Standpaviljoen Paal 9	Transportation from and to the beach pavilion	1 Peugeot iOn and 1 Opel Ampera
10. Sociale werkplaats De Bolder	Plantation service within cities and villages	3 Piaggio Porter Electro Pick-up
11. EN/OF ontwerp & communicatie	Transporting printed matter and visits on the island	1 Opel Ampera
12. CV VEM Elektrotechniek	Car for installation services. Intends to be forerunner as electrical installer.	1 Renault Kangoo
13. InstallatieBuro IBS Oele Schoo BV	Car for installation services. Intends to be forerunner as electrical installer.	1 Renault Kangoo
14. De Slufter Bungalowparken	Use at the holiday park and transportation on the island as well as to the ferryboat.	1 Renault Kangoo
15. Coöperatie Texel Energie u.a.	Responsible for the implementation of 20 public charging stations together with Urgenda.	-
16. R.J. Konijn beheer BV	Visiting clientèle.	1 Tesla Roadster
17. Restaurant Bosch en Zee VOF	Business car.	1 Renault Kangoo

18. KieftNoord, Ondersteuning bij Omgevingsbeleid	Visiting clientele.	1 Opel Ampera
19. Nederlands Instituut voor Onderzoek der Zee (NIOZ)	Picking up visitors and crossing the island in order to perform research.	1 Think, 1 Toyota Prius Plug-in
20. Expotise	Crossing the island.	1 Nissan Leaf
21. MB Groep/Den Boer Den Burg/B&B accountants	Transportation of clientele from the ferry boat to the office as well as visiting clientele.	1 Opel Ampera
22. Zelfpluktuin Texel	Transportation on the island.	1 Opel Ampera
23. Lighthouse Texel	Transportation on the island and to events.	1 Renault Kangoo

Source: Project plan TGEV, 2012

13. Appendix E: Roles of other organizations involved in EH

Table 21: Roles of other organizations involved in EH

Organization/company	Intended role/use of EV
1. OC Mobility Coaching	Execute a part of the project management. They wrote the project plan and submitted the request for subsidy provision.
2. ANWB	Leased EV from WagenPlan Autolease
3. Airborne Ypenburg	Provision of additional monitoring data by using multiple EV that are equipped with board computers
4. BAM Utiliteitsbouw	Provision of additional monitoring data by using an EV that is equipped with a board computer
5. the municipality of The Hague	User of EV and facilitating the execution of the project
6. Stadsgewest Haaglanden	Facilitating the execution of the project
7. Staedion	Provision of additional monitoring data by using multiple EV that are equipped with board computers