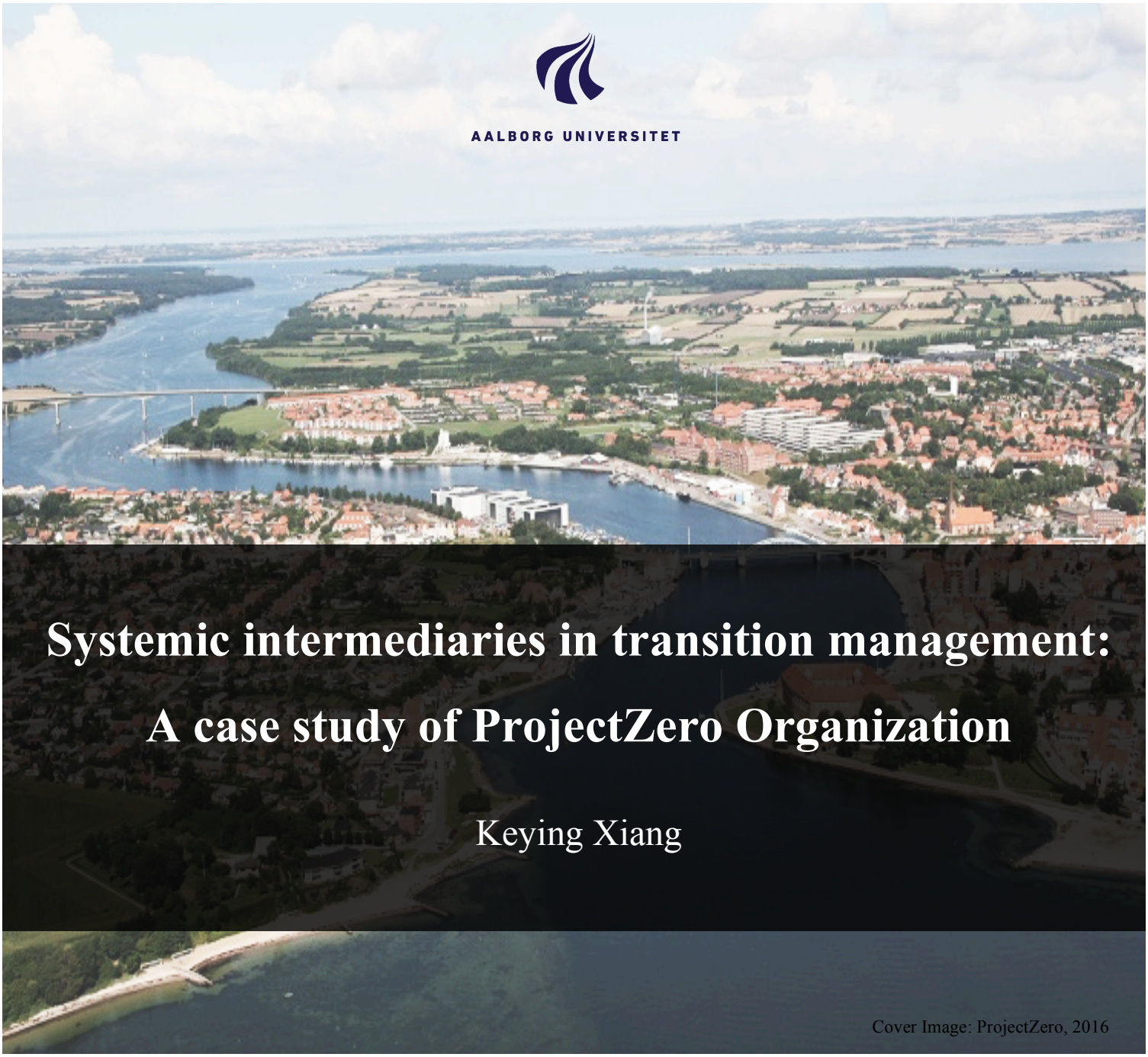

Systemic intermediaries in transition management: A case study of ProjectZero Organization

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ABSTRACT

Transition management has emerged as a new governance approach of sustainable development. It proposes a four-level management framework, aiming to transform socio-technical systems towards sustainable development trajectories through a multi-domain and multi-actor management process. Based on this management framework, this study focuses on a particular type of actor, the systemic intermediaries, and analyzes their contributions to transition management by building an analytical framework which identifies their roles at each of the four management levels. In addition, a case study of the carbon neutrality transition in Sonderborg is conducted, the management of which has involved a systemic intermediary ProjectZero Organization. The case study has shown that the transition management has been an incremental, reflexive and dynamic process based on collaboration, learning and innovation, and the ProjectZero Organization has contributed to this process mainly by aligning actors through networking, enabling and catalyzing.

Keywords: sustainability transition, transition management, systemic intermediaries

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1. Introduction

In the explorative journeys towards more sustainable societies, a transition perspective that recognizes transforming the societal systems as the key mission of sustainable development has risen in the recent two decades (Grin, Rotmans & Schot, 2010; Markard, 2012). Such perspective emerges from the understanding of unsustainability being a complex problem, which on the one hand requires long-term efforts, while on the other hand, is rooted in and entangled with other persistent problems in social domains such as energy, transportation, construction, housing and so on (Grin et al., 2010; Loorbach, 2007; van den Bosch, 2010). It is difficult to tackle with such problems, because they are embedded in societal structures, they are in constant change leading to large uncertainty, and they require continuous efforts from multiple domains and actors (Loorbach, 2007). Therefore shifting from current unsustainable development trajectories to more sustainable ones requires "a fundamental change in structure, culture and practices" (Rotmans & Loorbach, 2010, p.109), which is defined as a transition.

In the academic field, the transition perspective on sustainable development has evolved into a strand of study: the sustainability transition theories (Grin et al., 2010). Among the theories in this area of study, the transition management theory introduced by Loorbach (2007) is the founding theory of this study. Transition management theory is a practice-oriented model that emphasizes the multi-domain and multi-actor characteristics of transition processes in urban contexts and attempts to understand, explain and analyze the dynamics between actors and their activities towards sustainability transitions. It takes a governance approach to influence sustainability transition by raising a management framework, which proposes and differentiates four levels of transition management activities, namely the strategic level, tactical level, operational level and evaluation level. This study aims to adopt the transition management theory as an analytical framework to analyze an empirical case of carbon neutrality transition in Sonderborg, Denmark, by identifying the key actors and their activities at each transition management level.

Another contribution this work aims to make is to explore what roles intermediaries can play at each level of transition management. Intermediaries are agents or agencies that function as

go-between or mediator to "work in-between, make connections, and enable a relationship between different persons or things" (Moss, Guy, Marvin, & Medd, 2010, p.5). This study focuses on a specific type of intermediaries defined as systemic intermediaries. In contrast to traditional intermediaries that work on bilateral relations and support individual organizations, systemic intermediaries focus on connections and relationships among a number of actors and their activities; in other words, they intermediate "at network or system level" (van Lente, Hekkert, Smits, & van Waveren, 2003, p. 249). Based on the theory of roles of systemic intermediaries in transition process proposed by van Lente et al. (2003) and the transition management theory raised by Loorbach (2007), this study attempts to build up a new analytical framework that connects these two theories by discussing what different roles systemic intermarries can play at each transition management level. Further, a case study of how the systemic intermediary ProjectZero Organization functioned in the management of a carbon neutrality transition in Sonderborg is analyzed through this analytical framework. The purpose of this case study is to understand in reality how a systemic intermediary operates for sustainability transition as well as to examine and refine the analytical framework being proposed.

The main goals this study work towards are distilled in the main research question:

What roles do systemic intermediaries play at different management levels in sustainability transition management and how have such roles been performed by ProjectZero Organization in a carbon neutrality transition in Sonderborg?

The answer to the main research question is based on corresponding analytical frameworks developed in answering two sub-questions:

1. How can transition management theory be used as an analytical framework for an empirical case of urban sustainability transition?
2. What are the specific roles of systemic intermediaries within a system of strategic, tactical, operational and evaluation cycle of transition management?

The third sub-question aims to reflect on the analysis of the roles of ProjectZero Organization in the case study:

3. What are the main contributions of systemic intermediaries as reflected in the case study of ProjectZero?

2. Methodology

The main purpose of Section 2 is to present the research design, which incorporates research questions, research strategy and data collection methods. Section 2.1 describes how the research interests generate the main research question and the three sub-questions, and how case study as the research strategy supports to answer to these questions. Section 2.2 shines light on why and how document analysis and interview are used as the data collection methods.

2.1 Research Design

This study conducts a qualitative research for "exploring and understanding the meaning individuals or groups ascribe to a social or human problem" (Creswell, 2013, p.4). It raises an open-ended and explorative research question, adopts case study as the research strategy and uses document analysis and interview as data collection methods. The research interest, which has led to the raise of the research questions, has been generated from literature review in two academic fields: sustainability transition theories and theories on systemic intermediaries. The understanding and reflection on the major theories in the two fields have led to the inquiry that whether connections can be drawn between two particular theoretical frameworks from the two fields, namely transition management theory (Loorbach, 2007) and the theory of roles of systemic intermediaries in transition process (van Lente et al., 2003). Such inquiry forms the first half of the main research question, aiming to make a new linkage between two existing theoretical frameworks. At the same time, the encounter with a carbon neutrality transition initiative in Sonderborg offers the opportunity to reflect upon this new theoretical insight by applying it to a real-life case. Such interest in contributing to the practical knowledge of sustainability transition and systemic intermediaries is implied by the second half of the main research question and the answer is generated by adopting case study as the research strategy.

In order to test the analytical frameworks proposed by this study, case study research is adopted the research methodology, because it can "enable the theorist to use the experience and learning from the real-world application of the theory to further inform, develop and

refine the theory" (Dooley, 2002, p.349) as well as adding onto the existing knowledge with the insights generated from the analysis of empirical experience. Corresponding to the main research question, the first two of the three sub-questions clarify how the two analytical frameworks are built and applied in the case study respectively, and the third sub-question supplements the main research question by demanding reflections on the analytical framework proposed as well as the knowledge gained from the case study.

2.2 Research Methods

The main data collection methods adopted for this case study are document analysis and interviews (Bowen, 2009; Farthing, 2016). They are tow common research methods for qualitative studies and the data obtained through the two methods supplement each other in forming a more comprehensive and detailed picture of the case and other relevant issues at hand (Bowen, 2009).

Both printed and electronic documents were used in document analysis for the following purposes. First, they provide background information and empirical knowledge about the case and relevant issues of interest. Second, using documents that cover activities over a period of time can track the changes in the targeted issues over time, thus contributing to the understanding of trend and development. Document analysis can also supplement the other research method of interview, for example in this study, most of the interview questions have been generated based on the knowledge and insights gained from document analysis.

As information needed could not be obtained completely through document analysis, five individual interviews have been conducted with key personnel involved in the case. According to communication methods, the five interviews conducted can be differentiated into three types: three face-to-face interviews, one VoIP-technology based (Skype) interview and one telephone interview. Face-to-face is the most common type of interview technique in the field of qualitative research (Opdenakker, 2006). It enables synchronous communication of both time and place, the main advantages of which include the visibility of social cues and an interview ambience relatively free of unexpected disruptions (Opdenakker, 2006). Compared to the other methods of interview, one disadvantage is the higher cost in terms of

time and money, especially when the interviewers and interviewees are geographically distant (Opdenakker, 2006). A Skype interview also offers synchronous communication in time and place, and the access to verbal and non-verbal cues is considered as authentic as in face-to-face interviews (Sullivan, 2012). However, due to its dependency on the Internet, the availability of speedy Internet, and the level of digital literacy of both the interview and interviewees can have significant impact on the efficiency and effectiveness of the interviews (Sullivan, 2012). The advantage on the other hand is it enables interviewers to transcend geographical boundaries to reach the interviewees at low cost but highly synchronous communication. Telephone interview has the same advantages of low cost and free of geographical restriction, but the communication it offers is asynchronous in place, leading to the unavailability of information on non-verbal expressions of the interviewees (Opdenakker, 2006). Based on the advantages and disadvantages of different interview methods, this study prioritized face-to-face interviews, while has also used Skype interview and telephone interview for the practical consideration on the limit of budget and preference of interviewees as well as research consideration that the information needed can be mostly conveyed in verbal communication, which justifies the using of telephone interview.

All interviews, despite the different communication methods, have been conducted in the same manner in that they are all semi-structured one-to-one interviews emphasizing on the depth instead of breadth of discussion (Farthing, 2016). In semi-structured interviews, interview guides containing questions and topics to be covered in order are prepared beforehand, but during the actual interview, interviewers can stray from the interview guide in terms of sequence as well as content when they consider it necessary (Farthing, 2016). It is chosen for this study because on the one hand, answers to specific questions are vital for filling up gaps of information for a better understanding of past activities from various points of view, on the other hand the freedom of interviewees to discuss around issues they consider important in addition to answering questions in the interview guide can enrich the details of the case and adding insights from different perspectives into the research. Each interviewee has been interviewed individually due to their personal preferences as well as the need of this study to obtain in-depth information from each individual. Thus the choice of semi-structured and individual interview style fit the research need of detailed information and in-depth discussion about the one case at hand (Farthing, 2016). Table 1 displays the detailed information about the five interviews conducted for this study.

Date of the interview	Name of the interviewee	Position of the interviewee	Method of the interview
2017/11/20	Peter Rathje	Managing Director, ProjectZero Organization	Face-to-face
2017/11/20	Torben Esbensen	Head of Unit, Dansk Energi Management & Esbensen	Face-to-face
2017/11/21	Carsten Lund	Vice Mayor, Sonderborg Municipality	Face-to-face
2018/05/09	Asger Gramkow	Former Director, Futura Syd	Telephone
2018/05/11	Peter Rathje	Managing Director, ProjectZero Organization	Skype

Table 1. Information about the five interviews conducted for this study.

3. Theoretical Framework

Section 3 introduces the theories on which this study is based. On the one hand they are the sources of research interest and the founding ground of research questions, while on the other hand they contain elements and insights that are used in building the analytical frameworks. The relevant theories lie in two academic fields: sustainability transition and systemic intermediaries. In the field of sustainability transition, three theories contributed to the understanding and conceptualization of sustainability transition in this study: the multi-level perspective (MLP), the transition management theory, and the urban context of sustainability transition. Among them, transition management theory is at core of this study, in that it lays the theoretical foundation for the formation of the two analytical frameworks, which are introduced in Section 4. Concerning the field of systemic intermediaries, the theorization by van Lente et al. (2003) of roles of systemic intermediaries in transition process is considered the most relevant to the interest of this study. This section is thus divided into two parts according to the fields of study, and then within each field, the particular theory/theories being addressed is/are introduced.

3.1 Sustainability Transition Theories

The concept of transition has emerged as a new perspective on sustainable development in

the recent three decades (Grin, Rotmans, & Schot, 2010). Precedingly, it has been addressed in disciplines such as biology and population dynamics, sociology, economics and political science, but none of the interpretations of transition in these areas was found applicable in studies of sustainable development (Frantzeskaki, Bach, Hölscher, & Avelino, 2018; Grin et al., 2010). With sustainable development increasingly gaining research attentions, scholars such as Rotmans, Grin, Kemp and Loorbach have introduced the transition perspective to sustainable development and have formed a unified research field of sustainability transition (Frantzeskaki et al., 2018; Grin et al., 2010; Loorbach, 2007). In sustainability transition studies, transitions are conceptualized as continuous non-linear and long-term processes that fundamentally change the structure of society (Frantzeskaki et al., 2018; Loorbach, 2007; van den Bosch, 2010). A sustainability transition is thus an intentional societal transformation towards sustainability as a normative end (Grin et al., 2010).

Theories related to sustainability transition have been developed in mainly two strands: transition dynamics studies, which develop conceptual frameworks around "understanding and explaining how transitions in societal systems (e.g. sectors or regions) come about and how they can be recognized" (van den Bosch, 2010, p.39), and transition management studies, which translate the conceptualizations in transition dynamics studies into governance approaches that can influence or guide transition processes towards sustainability (Grin et al., 2010). In the Section 3.1.1, the multi-level perspective is introduced as the fundamental theory that sets the ground for transition dynamics studies. In Section 3.1.2, the transition management framework, which is built based on concepts in multi-level perspective, is introduced as an important transition governance approach rooted in transition management studies. Section 3.1.3 shines light on how sustainability transition is theorized within an urban context by introducing relevant theories.

3.1.1 Multi-level Perspective

The multi-level perspective conceptualizes transitions as the outcomes of interactions between developments at three levels of sociotechnical systems: a micro level formed by niche innovations, a meso level formed by sociotechnical regimes and a macro level formed by sociotechnical landscapes (Geels & Schot, 2007).

Sociotechnical regimes, according to Geels (2005a), are composed of three types of semi-coherent rules: regulative rules, which "constrain behavior and regulate interactions", normative rules that are related to "values, norms, role expectations, duties, rights, responsibilities", and cognitive rules which "constitute the nature of reality and the frames through which meaning or sense is made" (p.13). Such rules guide the actions of actors in sociotechnical systems, while being shaped through their actions at the same time. As a result, regimes and regime actors together contribute to the stability of existing socio-technical systems, in that actors are embedded in existing system structures and social networks, and their action is influenced by and reinforces the existing rules, which in turn make themselves, their organizations and the systems resistant to radical changes (Geels, 2005b; Geels & Schot, 2007).

Niches are conceptualized as the loci of radical innovations emerging from unstable sociotechnical configurations outside of or at the fringe of existing regimes (Geels & Schot, 2007). Due to their initially low performance, niches are protected and nurtured by a small group of dedicated actors against mainstream market selection (Geels & Schot, 2007).

Sociotechnical landscape is the exogenous environment serving as "the technical, physical and material backdrop that sustains society" (Geels & Schot, 2007, p.403). It affects sociotechnical development while being "beyond the direct influences niche and regime actors" (Geels & Schot, 2007, p.400). Key elements at this meta level include macro-economics, deep cultural patterns and macro-political developments (Geels, 2005b; Geels & Schot, 2007).

From the multi-level perspective, transitions are resulted from the alignments within and between these three levels, which Geels and Schot (2007) have summarized briefly as follows: radical innovations in niches are the seeds of transition, which have potential to break into the mainstream and compete with existing regime; regimes can be destabilized by pressure from landscape, and such destabilization opens opportunity for niches' development and break-in; growth and aggregation of niches can then result in regime shift.

Although multi-level perspective has become a core notion in the field of transition dynamics,

its conceptualization of transition has been criticized from several aspects by scholars such as Smith, Stirling and Berkhout (2005): the description of the process of regime transformation overlooks contextual factors and is overly functionalist; discussion about agents in transformation is neglected; the process how niches link up to regimes and initiate regime shift is still not clear. They have called for attention for a governance perspective of transitions, which incorporates the concepts of context, agency and power into the overarching multi-level perspective (Smith et al., 2005). Such line of research interest in governance is related with another sub-field of transition studies, which is introduced in the next section.

3.1.2 Transition Management Theory

Different from multi-level perspective, which focuses on structural conceptualization and description of transition dynamics, transition management is another branch of transition studies that takes a governance approach in order to influence transition (van den Bosch, 2010). The concept of transition management is developed in close relation with sustainable development, of which it takes as a normative orientation (Loorbach, 2007). To achieve sustainable development, persistent problems rooted in social structures such as unsustainable production and consumption, non-renewable resource based energy supply and so on, need to be solved (Rotmans & Loorbach, 2010). Such solutions, demanding activities covering multiple domains and involving various actors in different context, can only be enabled through fundamental changes in social structure (Rotmans & Loorbach, 2010). As a response from transition perspective, transition management is developed "to enable, facilitate and guide transitions to sustainability" (Loorbach, 2007, p.24). Therefore transition management can be understood as a concept overarching transition, sustainability and governance.

In order to use the concept of transition management to facilitate practices, Loorbach D. (2007) has developed a cyclical transition management framework which distinguishes governance activities for a sustainable transition into four levels: strategic level, tactical level, operational level and evaluation level. The rest of this section introduces the main elements of each management level, which summarizes and distills the content of "Chapter 5: The cyclical, multi-level transition management framework" in Loorbach's (2007) work

The main activities at strategic level include problem structuring and vision development (Loorbach, 2007). Problem structuring is the process of developing a shared conceptualization of the problems that the system is facing. As the aim of transition is to solve a systemic problem at hand, the problem formulation can directly influence the orientation of the transition. It is also a participatory process that multiple actors are involved, who may have different perspectives on and various interests associated with the existing system and problems (Loorbach, 2007). On one hand, different perspectives can bring in new insights concerning the problems, while on the other hand it makes the integration of different perspective an important management task since the actors are not necessarily all on the same page. Together with the formation of a shared perspective is the emergence of a common discourse that the perceived problem needs to be tackled through systemic and fundamental changes, in other words, transitions. Based on such understanding, vision for desired future state of the system is developed. In transition management, the vision is not a "blueprint" that determines one way for one fixed destination; but it can be composed of multiple future images and transition pathways, and it can co-evolve with the transition process, meaning that it is adjustable to changes (Loorbach, 2007).

Activities at tactical level translate the vision into "specified goals, concrete actions and new ideas" (Loorbach, 2007, p. 120). A key task is to develop transition agenda, which is composed of following elements: strategic problem definition and vision, transition image, transition path and actor involvement (Loorbach, 2007). Problem definition and vision developed at the strategic level serves as the overall guideline. Transition images are formed based on the overall vision, but are at sub-system levels and thus more concrete and specific than the strategic vision. For example, if waste reduction is the overall vision, different transition images can be designed for non-hazardous and hazardous waste, or according to the sources of generation such as for wastes from household, commercial sector, industrial sector or institutional sector. Transition paths draw on more specific goals, strategies and actions leading to certain transition image(s). In addition, along with the process of agenda setting, other ideas, strategies and projects that are not connected with certain transition paths or transition images but still fit in the overall vision may also be developed. Actors involved in these activities are the ones who "have the capacity (competence) to 'translate' the

transition vision and the consequences of this to the agenda of their own organization" (Loorbach, 2007, p. 121), which implies that the actors while contributing to the shared vision by involved in agenda setting, pursue individual goals and interests at the same time. They form or break, enter or exit networks and coalitions through the process of shared agenda building, agenda implementation and self-interest pursuing. On the one hand, the transition agenda needs to be reviewed and updated periodically; on the other hand, the changes in its actor composition, networking and actions keep the development of transition agenda in dynamics, purposively or unexpectedly.

Transition experiments are at the core of operational level activities (Loorbach, 2007). They are defined as innovation projects that take persistent societal problems as a starting point and contribute to a transition through experimenting and learning (van den Bosch, 2010). Three central elements of transition experiments differentiate them from other types of experiments: innovation, learning and orientation of societal challenge (van den Bosch, 2010). Compared to a classic innovation experiment that is designed to test out a certain option, a transition experiment emphasizes on exploring and learning about different pathways towards certain vision(s). Transition experiments are initiated to tackle societal challenges and they can be technical, sociotechnical, financial, institutional or any other types of innovations (van den Bosch, 2010). The diverse natures of transition experiments also require the participation and cooperation of the increasing number of and various types of actors involved. The visions and agendas developed create space for their action, interaction and collaboration, based on which experiments emerge and synergize, while at the same time, actions and experiments reshape visions and agendas.

Activities that evaluate, monitor and reflect upon all activities at the other three levels as well as the transition itself are categorized as evaluation level activities. One distinctive difference of this cluster of activities is that it is not an identifiable phase, but is integrated into each management level and throughout the whole transition management process (Loorbach, 2007). The main activities include monitoring and evaluation, the objectives of which are to accumulate learning and generate insights for potential modulation and refinement of transition vision, transition agenda, transition coalitions and the management process for future transition management cycles. Such learning goes beyond generating knowledge from the collected information, but involves reframing perspective and design interventions based

on past experience (Loorbach, 2007).

In line with the cyclical visualization of the transition management framework, the above levels of activities are also termed as phases of activities (Loorbach, 2007). However, neither does the cyclic image nor the terminology implies any fixed pattern of carrying out different types of activities; they can be organized in parallel or in any sequence. Nevertheless, the empirical case studies have indicated that in practice, the most common approach is to start from strategic level activities of visioning and followed by agenda and pathway setting, which in turn guide experiments to be implemented. Such pattern is termed as a "top-down TM approach", since the management process starts from the "top" of the management cycle (van den Bosch, 2010, p.45).

3.1.3 Sustainability Transition in Cities

Criticism on the lack of attention to the contexts of transitions has stemmed the development of another strand of study, which relates sustainability transitions with space and places (Coenen & Truffer, 2012). In this direction of research, there exist two kinds of conceptualization of roles that cities play in sustainability transition: as actors of sustainability transition and/or as locations for sustainability transition (Loorbach & Shiroyama, 2016). Researchers such as Loorbach and Shiroyama (2016), and Holm, Søndergård and Stauning (2015) have argued that cities themselves can be the drivers of sustainability transition for several reasons. Cities are centers of human activities, creating massive impacts on the environment. Thus cities are often directly confronted with problems of unsustainability, and as responses to them, immediate solutions may emerge at city levels (Bulkeley, 2010). Such reactions may contain the elements of innovation and experimentation, and are thus possible to contribute to inspiring, driving or accelerating transitions at larger scales. Cities can thus become "transition machines" (Loorbach & Shiroyama, 2016, p.8) that produce seeds of transitions. The publication of documents resulted from international conferences on sustainability such as Agenda 21 and Aalborg Charter has also contributed to the increasing power of cities over governance of sustainable development (Bulkeley, 2010; Holm, Søndergård & Stauning, 2015; Loorbach, 2007). By emphasizing the importance of local practices and establishing frameworks for

implementation, these documents have promoted "a shift of power and competencies from the national level to supernational and local levels" (Holm, Søndergård & Stauning, 2015, p.255). The formation of C40 Cities Climate Leadership Group is an example of climate network based on city's global impact (Bulkeley, 2010; Loorbach, 2007). Such trend has empowered cities as agents of sustainability practices. However, there are also different voices. Hodson and Marvin, for example, suggest that to answer the question whether cities merely receive and reshape national transitions within their local contexts, or they are active actors of transition with autonomy, it is important to consider "(1) the different histories of the socio-technical organisation of regimes and their relationships to cities and (2) the regulatory states and multi-level governance relationships" (Hodson & Marvin, 2010, p.481). In short, understanding the profile of a particular city and the broader context it is embedded in is crucial. Nevertheless, such discussions themselves can also reflect that the "urban turn" has become an increasingly important topic in transition studies (Wittmayer & Loorbach, 2016, p.14).

Cities as drivers for sustainability transitions legitimize taking cities as the research focus; however, cities do not automatically become transition promoters. Such role is enabled by *its* actors (Wittmayer & Loorbach, 2016, p.14). Thus taking cities as locations for transition governance and zooming into the cities to investigate the actors, organizations and their activities is vital to understand how transition emerges in an urban context. Holm, Stauning and Søndergård (2015) have identified municipalities as "transition places — places where a diversity of innovation and creativity evolves, based on specific local configurations of actors, material settings, institutions, regulations, life practices and technologies" (p.253). They have also highlighted the importance of studying local actors and their actions as configurations situated in transition places in order to understand how sustainability transitions take place in specific contexts (Holm, Søndergård, & Stauning, 2015).

3.2 Roles of Systemic Intermediaries in Transition Processes

Both MLP and transition management have been criticized for their lack of attention on actors and agencies as important factor in influencing sustainability transitions (Farla, Markard, Raven, & Coenen, 2012; Fischer & Newig, 2016). Stemmed by such criticism, a

line of researches has taken an actor-oriented perspective, focusing on the definition, structure and activities of actors and their roles in transitions.

Among the multiple actors that have been identified important for sustainability transitions, intermediaries are one type of actor that has received particular research interest. Based on their literature review of 386 journal articles which covers the topic of actors in the field of sustainability transition, Fischer and Newig (2016) have identified intermediaries as one category of actors based on the finding that intermediaries "are explicitly mentioned in the transition management literature as being crucially important in multi-actor transition processes" (p.3). These literature, however, has not agreed on one unified definition of intermediaries (Moss, Guy, Marvin & Medd, 2010). Moss et al. (2010) have argued that intermediaries can be "individuals, organizations, networks, institutions, processes or even technologies" (p.5), but what defines them is not their form, but the specific roles they play. Fischer and Newig (2016) also differentiate intermediaries from other types of actors based on their function of mediation. Hodson and Marvin (2009) have also based their definition of intermediaries on their functions of "intermediating between sets of different social interests (and technology), to produce an outcome that would not have been possible, or as effective, without their involvement" (p. 521). As a result, it is difficult to explicitly define intermediaries without discussing their roles and contexts.

An early research that has addressed the roles of intermediaries in sustainability transition is "Roles of Systemic Intermediaries in Transition Processes" by van Lente, Hekkert, Smits and van Waveren (2003), which has been repeatedly quoted and studied by later literatures on the same topic. This research has formulated the concept of systemic intermediaries highlighting their characteristic of operating at the network or system level to coordinate systemic efforts for sustainability transition, in contrast to the traditional intermediaries which focus more on "bilateral relations (knowledge transfer) and the support of individual organizations" (p.249). Van Lente et al. have suggested three main functions of systemic intermediaries in transitions "(i) articulation of options and demand; (ii) alignment between various actors and activities; and (iii) learning processes at system level" (p.267), and for each function the specific roles that systemic intermediaries take are listed below in Table 2. Based on their theorization of roles of systemic intermediary, this study attempts to combine it with the transition management theory (Loorbach, 2007) and identify which ones of these roles systemic

intermediaries can play within each management level. Each role is represented by an abbreviation shown in the brackets, which are used for identification of the roles in the case study.

Key functions	Specific Roles
Articulation of options and demand	Articulation of options and demand, including the stimulation of technological variety and the search for possible applications (Articulation)
Alignment of actors and possibilities	Identifying, mobilizing and involving relevant actors (Alignment 1)
	Organizing discourse, alignment and consensus (Alignment 2)
	Management of complex, long-term innovative projects (Alignment 3)
Support of learning process	Feed actors with tailor-made (strategic) information (Learning 1)
	Create conditions for learning by doing, using, interacting and searching (Learning 2)

Table 2. Functions and roles of systemic intermediaries in transition processes. Adapted from van Lente et al. (2003), p.256.

4. Analytical Framework

Section 4 presents the efforts made by this research in developing two analytical frameworks. First is an analytical framework for analyzing the management process of an empirical case of sustainability transition. It adopts the four-level management structure proposed by Loorbach (2007), while at the same time distills and highlights the main concepts and central tasks that characterize and distinguish each management level. The purpose is to use such elements to better identify, conceptualize and categorize different activities organized in the empirical case. The second analytical framework, which is a more ambitious attempt to make major theoretical contribution, is established based on the transition management theory (Loorbach, 2007) and the theory of roles of systemic intermediaries in transition processes (van Lente et al., 2003). Such attempt is encouraged by the identification of a theoretical gap: transition management theory (Loorbach, 2007) shows how transition can be managed but does not specify what roles the actors involved play; the theory of roles of systemic intermediaries in transition process (van Lente et al., 2003) recognizes intermediaries as a type of important actors and their contributions, but does not specify the particular roles they play for a particular transition management task or purpose. The second analytical framework thus strives to make new connection between these two theories in order to present how exactly intermediaries contribute to different activities required at different management

levels, in the hope that such effort can add on to the understanding of the importance and contributions of systemic intermediaries in sustainability transition management.

4.1 Transition Management Theory as an Analytical Framework

In order to adapt the transition management theory (Loorbach, 2007) to analyze an empirical case of urban transition development, this study first summarizes and distills different themes of activities, or in other words, the central tasks at strategic level, tactical level, operational level and evaluation level. Activities at strategic level emphasize on developing transition arena through problem structuring and envisioning; activities at tactical level are organized around developing transition agendas composed of transition paths and transition images; operational level activities center on stimulating, designing and implementing transition experiment; monitoring and evaluation are the key tasks at evaluation level. Guided by the question "who and what is managed" (Loorbach, 2007, p.103), at each level around different themes, who were the actors and what activities took place are discussed. This analytical framework is visualized in Figure 1 below.

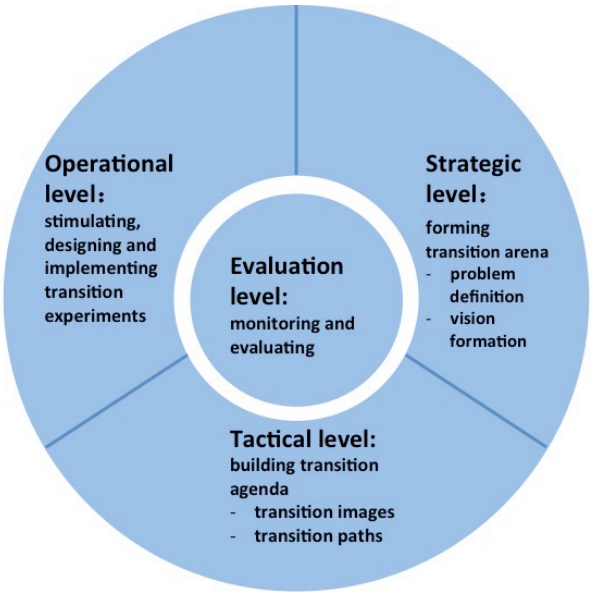

Figure 1. An analytical framework for case study of transition management. Adapted from Loorbach (2007), p.115.

4.2 Roles of Systemic Intermediaries at Each Transition Management Level

Based on the transition management theory by Loorbach (2007) and the research on the roles of systemic intermediaries in transition processes, this study raises an analytical framework, which specifies what different roles systemic intermediaries can play at different levels of activities in transition management. Such analytical framework, on the one hand, can be used to evaluate the performances of intermediaries in transition management, while on the other hand can provide guidance for future transition development, especially on how intermediaries can contribute to the management of sustainability transitions.

Strategic level

Problem structuring and future envisioning are the main activities organized at this level. Actors participating in these activities are "a small group of innovative individuals" (Loorbach, 2007, p.117) who shall from different backgrounds. More specifically, Loorbach (2007) have suggested "a critical selection of forerunners"(p.118) to be selected from governmental agencies, companies, NGOs, knowledge institutes and intermediaries. These actors can bring in different perspectives on problem at hand and expectations for future; therefore articulating demands and exchanging perspectives and expectations among the actors is an important task. Systemic intermediaries have the facilitation ability to build a more open and participatory environment for such articulation and exchange. At the same time, having an overall understanding of local conditions including resources, strength, weaknesses and opportunities is vital to "find out what is possible" as well as "change existing configurations" (van Lente et al., 2003, p.262). Through the scanning of the local environment, systemic intermediaries can collect, integrate, analyze and communicate information on demands and options in local context in a systemic way and make them more visible through articulation.

Another function of performing an overall scan of the local conditions is to identify potential actors of "a critical selection of frontrunners" (Loorbach, 2007, p. 118) who are often innovative, ambitious and visionary "opinion makers, trend-setters and generalists with overview and social authority" (p.117). The role of systemic intermediary in this respect is to design selection criteria, select actors based on their backgrounds and interests, and create space and conditions for them to exchange perspectives and develop a shared vision (Loorbach, 2007). To reach a shared perspective on the problem and on vision for future, it is also important to align the different interests of the identified strategic-level actors. Hodson

and Marvin (2010) have argued that the presence of systemic intermediaries is necessary for such alignment, in that the actors, likely to be social elites, are already embedded in certain social structures, and may thus restrained from their structuralized relationship with each other. Systemic intermediaries can break such restraints by creating a space relatively free from structuration and thereby can encourage thinking out-of-box and stimulate discussions. They can also intervene when vision is formed "around narrow coalitions of self-interest" (Hodson & Marvin, 2010, p.482) instead of an integrated perspective formed based on a variety of interests. However, Medd and Marvin (2008) also have pointed that although intermediaries are not arbitrary, neither are they neutral; although they function as mediator among different interests, such action can be influenced by certain interests too. Moss (2009) has thus commented that intermediaries should be viewed "both as products and as agents of shifting forms of governance" (p.1485-1486).

In conclusion, systemic intermediaries can be an important type of actor at the strategic phase of network. Referring to Table 2, they can take the main roles of articulation of demand and option (Articulation) contributing to voice out different expectations and ideas that can potentially be integrated into problem definition and vision formation, identifying innovative, visionary and influential strategic-level actors (Alignment 1), and aligning their perspectives and interests (Alignment 2) for vision formation.

Tactical level

The central element of tactical activities is building the transition agenda, of which the most important tasks are designing transition image and transition path, organizing relevant activities and projects and mobilizing relevant actors (Loorbach, 2007).

Articulations of demand and options is an important function of systemic intermediaries in the process of designing transition images and paths. Because transition images address specific sub-sectors of the system, how certain demands should be taken into consideration when forming future images and what options are available to design the corresponding transition paths are important questions to be answered. An example of articulation of demand leading to a certain transition image and path is how Sitra, a government-founded organization in Finland, emphasized the importance of energy-saving in communities, and further articulated the need to change building regulations in order to promote transition

towards energy-saving communities (Kivimaa, 2014). The California Fuel Cell partnership, on the other hand, is an example of shaping transition image and path through articulation of options, as it promoted fuel cell over other propulsion technologies for transition towards a green transportation system, which on the one hand, implying its framing of a clean transportation system through technological change, while on the other hand, by focusing on one type of technology it shaped the option towards the transition image it had framed (van Lente et al., 2003).

Forming networks and coalitions of actors is fundamental to all activities at this level, and therefore the alignment of actors and possibilities is of particular importance for an intermediary to organize (Loorbach, 2007). Actors participating at tactical level activities are different from those at strategic level in that more actors are involved with more diverse background than those at strategic level, because the overall vision is formed by a small number of forerunners, while to translate such vision into more concrete plans, strategies and activities require the mobilization of actors who have knowledge and specialty in different fields and can thus contribute to the building of transition agenda (Loorbach, 2007). Therefore a key mission of systemic intermediaries is to first identify such actors and then to encourage their commitment and collaboration with one another. Systemic intermediaries particularly focus on networking, in the sense that such coalition building is not bilateral, but among a number of actors (van Lente et al., 2003). Agreeing with the overall vision is a prerequisite for these actors to participate, but they do not necessarily work for the same transition image and path; instead, they form different networks and coalitions among themselves according to their interests, specialties and responsibilities (Loorbach, 2007). Systemic intermediaries can assist the process of coalition building by connecting different actors to interact and cooperate, who otherwise may not be aware of their potential partners or lack the opportunities or resources to reach out (Thomas, Balestrin, & Howells, 2013). Systemic intermediaries can also identify and tap new actors into the formed networks, while through the agenda building process, some actors may quit the networks (Loorbach, 2007). In such dynamics, systemic intermediaries need to constantly work on the interest aligning, consensus building and conflict resolving of the changing actors. As actual plans and actions are carried out at this level, they may be organized into forms of programs and projects.

As building up a transition agenda and forming relevant actor networks and coalitions are the

main tasks at tactical level, the main functions of systemic intermediaries that can facilitate the accomplishment of such tasks are the articulation of demand and option (Articulation) for addressing key aspects of the system in need of intervention as well as the identification, mobilization and involvement of relevant actors (Alignment 1) and the interest alignment and consensus building of these actors (Alignment 2) for the building of transition agenda.

Operational level

Developing and implementing transition experiments based on transition vision and transition agenda is at the core of operational level activities (Loorbach, 2007). Transition experiments are projects that are organized to tackle with societal challenges and at the same time they involve and encourage innovation and learning (van den Bosch, 2010). Such projects can be new ones directly derived from transition agenda or existing ones which can be integrated into the transition agenda and fit into the strategic vision (Loorbach, 2007). One the one hand they are activities that operationalize the transition agenda, while on the other hand they also influence the vision and agenda by opening new discourses and generating new alternatives to realize the overall vision (Loorbach, 2007).

To contribute to operational level activities, one of the first tasks that systemic intermediaries can take on is identify opportunity for new transition experiment to emerge or for existing experiment to connect with. Such opportunity is rooted in certain societal needs that are not satisfied, and such societal needs are syndromes of persistent social problems (van den Bosch, 2010). However, different from the persistent social problems that are structured at strategic level and addressed at tactical level, such societal need is more specific in terms of the problem itself, which have specific target group involved and requires concrete actions that can break the lock-ins in the systems that lead to the problem. Van den Bosch (2010) has given an example of such societal challenge in the Netherlands: “How can the elderly live independently with a higher quality of life, at acceptable costs?” (p.59) It is a challenge related to a persistent societal problem: life quality of aging population; at the same time, it constitutes a demand statement, implying that certain need of certain stakeholder group is not satisfied by existing system. Taking such societal challenge as a starting point, transition experiments were initiated in Apeldoorn, the Netherlands (van den Bosch, 2010). Such example has shown the importance of identifying social challenge as the start for transition experiments, and systemic intermediaries can assist or take on this task by their function of

demand articulation. They can scan the whole environment to identify demand and action points. When there exist multiple demands, they can use information to narrow down demand options and lead towards convergence, or when demands are in conflict, they can facilitate the processes of increasing mutual understanding and creating space for negotiation (Boon, Moors, Kuhlmann, & Smits, 2008). Such demand articulation can inspire and motivate actors who have the capacity to respond to the demand, and intermediaries can collect information about potential solutions, and share such information with actors such as actors who raised the demand, actors who can collaborate in the process of solution developing, actors who have alternative ideas and so on. Such process of articulation of options can present relevant actors with more possible alternative, and thus increase the diversity of transition experiments, which is considered as an important characteristics for experiments to contribute to transition vision, image and path (Loorbach, 2007).

The second cluster of activities that systemic intermediaries can play roles in is the alignments of actors for the planning and implementation of transition experiments. The actor alignment at operational level has different requirements for systemic intermediaries compared to that at the strategic level and tactical level. First, the actors at this level are more operation-oriented, and the main goal of aligning these actors are to accomplish concrete projects, instead of forming visions or agendas. This requires matchmaking of actors with project designs and goals, and within each project, high-level dedication and commitment of towards certain project goals is necessary (Howells, 2006). Second, a key concept of transition experiment is innovation, so how to help actors to organize projects that generate new ideas and practices is crucial to intermediation. An important approach to intermediate joint innovative projects is networking (Batterink, Wubben, Klerkx, & Omta, 2010). Batterink et al. (2010) have concluded two main tasks of systemic intermediaries in networking for innovative projects: network design activities and network management activities. To create a network, the first step is to identify actors that share interest and goals and have the capacity to contribute the goal. Individual organizations can also establish partnership by identifying partners themselves, but it is argued that such partnership-building activities are often limited by their tendency of always working with the same partners, which results in network closure and thus limit the possibility of new partnership, new ideas and new resources (Batterink et al., 2010). Systemic intermediaries, on the other hand, can scan the whole environment and identify and connect “the seeker of knowledge and resources

needed for innovation on one side, and the source of them on the other side" (Thomas et al., 2013, p.2) and thus create new collaboration possibilities. This is particularly important for innovation since innovation is often born from the interaction among actors that were not previously connected (Thomas et al., 2013). Once actors are identified and the network is created, intermediaries can start the facilitation of the interactions among the actors through a range of coordination activities such as creating platform for information exchange and communication to enhance understanding, establishing procedures to prevent shielding off of knowledge and free-riding, assisting formulation of contracts to secure commitment, and so on (Batterink et al., 2010).

In addition to articulation of need and options as inspiration for other actors and alignment of actors through networking, intermediaries can also initiate and manage transition projects by themselves (Backhaus, 2010; Roorda, et al., 2014; van Lente et al., 2003). Taking projects aiming to change energy consumption as an example, Backhaus (2010) has identified the following important steps that intermediaries take to manage the projects. First, intermediaries can analyze the context in which the projects are being initiated. Such context can be divided into several layers, including the broad context of the sociotechnical system, the more specific project context of which the intervention sector and strategies are defined, and the immediate intervention context of identification of target group and other actors having direct and indirect influence on the project (Backhaus, 2010). Through such analysis of context, intermediaries can design the project in a context-specific manner. Along with the process of understanding and analyzing the context, intermediaries also get familiar with the actor dynamics and acquaint with target group, based on which the process of actor network building and actor engagement starts (Backhaus, 2010). Through information and knowledge gained by the intermediaries as well as generated from the actor network, intermediaries can organize tailor-made activity that can contribute to achieve the project goals (Backhaus, 2010). Also, alongside the organization of activities and implementation of measures, intermediaries can also play the role of monitoring and evaluation to ensure the project to be on track (Backhaus, 2010). Such management process of formulating the project based on the context, laying out strategies, engaging actors and monitoring the processes can be viewed as a transition management cycle at a micro-scale. It fits Loorbach's (2007) argument that: "activities at the different levels can also be structured according to the three levels; and operational project will have a strategic ambition (to be realized within 5 years), an agenda

and a day-to-day operation" (p.112), which is a reflection of the recursive characteristic of the transition management framework.

In conclusion, at operational level, the main roles of systemic intermediaries are articulation of demand and option (Articulation), identification and mobilization of a broad range of operation-oriented actors (Alignment 1), alignment of these actors for projects in different sub-fields (Alignment 2), and last but not least, management of the projects by intermediaries themselves (Alignment 3).

Evaluation level

Evaluation level is fundamentally different from the other three management levels in that it is not "an identifiable phase" (Loorbach, 2007, p.123), but is composed of monitoring and evaluation activities within each of the other three management levels and throughout the whole transition management process. The main goal of monitoring and evaluation is to generate learning (Loorbach, 2007). Transition studies differentiate learning into two types: first-order learning that focuses on accumulation of facts and data and second-order learning that emphasizes on challenging and reframing perspectives and assumptions (Loorbach, 2007; van den Bosch, 2010). In relation with the concept of second-order learning, Loorbach raises the concept of social learning defined as "learning-by-doing and doing-by-learning" (Loorbach, p.123) and considers it at core of evaluation level activities. As a result, the main roles of intermediaries at evaluation level correspond to the different learning goals: enable the transfer of information and knowledge to facilitate first-order learning and create conditions for social learning (van Lente et al., 2003). Another aspect of monitoring and evaluation is that they target at the transition management process as well as the transition itself. Monitoring and evaluation of transition management process is about examining how the transition is managed, while monitoring and evolution of the transition looks at what changes are brought (Loorbach, 2007).

The facilitation of first-order learning takes two steps: first the generation or collection of facts and data and second the communication of the information (Howells, 2006). In terms of monitoring and evaluating transition management process, systemic intermediaries can themselves be the generator of facts, by keeping records of what activities are organized when and by whom and what are the status and results of the activities (Backhaus, 2010). In

terms of monitoring and evaluating transition, they can also identify and mobilize other actors who may possess the expertise they lack in measuring, calculating and analyzing certain data. The information collected for first-order learning constitutes the basis for stimulating social learning. In terms of monitoring and evaluating of transition management, such reflection is encouraged by systemic intermediaries at different levels. At strategic level, the exchange of perspectives and emergence of new ideas and insights are constantly monitored by systemic intermediaries to facilitate the process of problem definition and vision development. At tactical level, the process of forming transition images and paths and whether they correspond to the transition vision are evaluated by intermediaries. At operational level, monitoring and evaluation take place at system level as well as activity level in both processes and results. Intermediaries keep track of the development of transition experiments in terms of the availability of resources and their correspondence with transition agenda. Also the results of the activities and how they influence the overall transition are monitored and evaluated by intermediaries, so that more effective transition experiments are selected to be continued and up-scaled. Not only within each level of management but also the interaction among different levels do monitoring and evaluation take place. For example, systemic intermediaries can reflect on the performance of transition experiments and think about whether adjustment at tactical levels in terms of actor coalition, goal setting, strategy making and resource distribution need to be made.

The evaluation of transition management goes hand in hand with the evaluation of the transition itself (Loorbach, 2007). Transition can be the result of transition management activities as well as external influences. How these two factors influence the transition is an important issue to be reflected upon, because on the one hand whether the transition is going in the desirable direction is part of the evaluation criteria of the transition management and thus guide adjustments in transition management, while on the other hand, how less predictable and controllable external influences can enhance or hinder the transition needs to be understood for the adaptions of transition management activities to deal with challenges and opportunities rising from landscape-level changes.

In conclusion, supporting learning process in first-order learning (Learning 1) and more importantly in social learning (Learning 2) are the main roles played by systemic intermediaries at evaluation level, while actor mobilization (Alignment 1) can be used as an

instrument to assist the realization of the function of generating learning.

4.3. The Analytical Framework

Based on the analysis and theorization process above, an analytical framework is built as shown in Table 3. The left side column indicates the four levels of transition management. In the middle column, different roles of systemic intermediaries required to contribute to the accomplishment of the central tasks at each level of transition management are shown, represented in three different kinds of colors. White represents the function of articulation; light grey represents the function of actor alignment, which is further categorized into three types of alignment; dark grey represents the function of stimulate learning, which is further divided into two types of learning. The column at the right side indicates that such analytical framework can be used for the analysis of empirical case of transition management in which systemic intermediaries are involved. In this study, ProjectZero Organization is taken as the empirical case and is analyzed through such framework in Section 5.2.

Transition management levels	**Roles of systemic intermediaries**	**Performance of ProjectZero Organization**
Strategic level	Articulation of options and demand (Articulation)	
	Identifying, mobilizing and involving relevant actors (Alignment 1)	
	Organizing discourse, alignment and consensus (Alignment 2)	
Tactical level	Articulation of options and demand (Articulation)	
	Identifying, mobilizing and involving relevant actors (Alignment 1)	
	Organizing discourse, alignment and consensus (Alignment 2)	
Operational level	Articulation of options and demand (Articulation)	
	Identifying, mobilizing and involving relevant actors (Alignment 1)	
	Organizing discourse, alignment and consensus (Alignment 2)	
	Management of complex, long-term innovative projects (Alignment 3)	
Evaluation level	Identifying, mobilizing and involving relevant actors (Alignment 1)	
	Feed actors with tailor-made (strategic) information (Learning 1)	
	Create conditions for learning by doing, using, interacting and searching (Learning 2)	

Table 3. An analytical framework of the roles that systemic intermediaries play at each transition management level.

5. Case Study

Section 5 centers on the case study of a carbon neutrality transition initiative named ProjectZero in Sonderborg Municipality in Denmark. The case study is divided into three parts: first, management process of the carbon neutrality transition is analyzed in Section 5.1 based on the analytical framework developed in Section 4.1, addressing how various activities are organized by different actors around the themes and components of each transition management level; second, the roles of ProjectZero Organization as a systemic intermediary established for the transition ProjectZero are discussed in Section 5.2, using the analytical framework developed in Section 4.3; third, Section 5.3 evaluates the transition process described in Section 5.1 and the performance of ProjectZero Organization presented in Section 5.2, and at the same time reflects on the whole case study as well as the analytical framework used in the case study. In the beginning of Section 5.1, the background information about the carbon neutrality transition, the systemic intermediary ProjectZero Organization and the scope of this case study is briefly introduced.

5.1 Analysis of the Carbon Neutrality Transition in Sonderborg

ProjectZero is the name of the carbon neutrality transition in Sonderborg. It is officially defined as "Sonderborg's transition to a ZEROcarbon community" (ProjectZero, n.d.); more specifically, it incorporates "the vision of turning the Sonderborg area into a CO2 neutral area no later than 2029" and at the same time "to contribute to maintaining and generating workplaces in the knowledge intensive industries" (Master Plan, p.8). It was proposed by local stakeholders in Sonderborg in 2007 and initiated in 2010 through the launching of the Master Plan, which serves as the official guideline for the initiative. The time frame for reaching carbon neutrality is further divided into several phases with interim emission reduction goals all compared with the baseline emission in 2007: 25% reduction by 2015, 50% reduction by 2020, 75% reduction by 2025, and 100% reduction by 2029 (ProjectZero, 2018). A series of action plans, namely Roadmap 2015, Roadmap 2020 and Roadmap 2025 have been developed for guiding the strategies and activities that contribute to the realization of each interim goal following the overall development framework designed in the Master Plan.

In 2008, non-profit public-private organization ProjectZero (referred to as ProjectZero Organization henceforth) was founded to facilitate organizing this initiative. The ProjectZero Organization is composed of two parts: ProjectZero fund, responsible for financial arrangement, and ProjectZero A/S, the operational part of ProjectZero organization for administrative responsibilities. Details about the process of formation and running of the organization are revealed in section 5.2, with the roles of ProjectZero Organization has played as a systemic intermediary being discussed according to each transition management level.

The scope of this case study covers the activities took place from 2010 to 2015. For this period, an emission reduction of 25% has been set compared to baseline emission. The actual reduction has gone over this goal and reached 35% according to the monitoring report published in 2015. This case study considers the activities for the development period 2010-2015 constitute a complete transition management cycle, and thus analyze the management process at each level in Section 5.1.1-5.1.4, based on the analytical framework developed in Section 4.1.

5.1.1 Strategic Level Management: Defining the Problem and Forming the Vision

At strategic level, the transition management of the carbon neutrality transition in Sonderborg has gone through the processes of developing a shared problem definition and a shared transition vision. With regard to problem definition, Loorbach (2007) has suggested that "there is not one single problem but many problematic aspects of a given situation and of the solutions" (p.141), and it is the case in Sonderborg. In 2001, a competence report showed that the Southern Jutland was facing the risk of socio-economic decline due to the difficulty of attracting skilled labor (Danish Agency for Trade and Industry, 2001). Although Sonderborg is an area characterized by a strong knowledge-based industrial sector, with a number of companies focusing on clean energy-related technologies such as Danfoss, it has still suffered from out-migration and shortage of qualified labor due to the aging population (Madsen, 2016). To tackle with this challenge, a local think tank Futura Syd was founded by the local businessman Asger Gramkow, who built a team composed of people from a range of local

institutes and companies who were concerned about local development, including Jørgen M. Clausen, the managing director of Danfoss at that time (A. Gramkow, personal communication, May 9, 2018; P. Rathje, personal communication, May 11, 2018). Jørgen M. Clausen suggested to Asger that the way out was to make Sonderborg a "world-class" community so to attract labors and investments (P. Rathje, personal communication, May 11, 2018). Such suggestion resonated with the question of "how to brand Sonderborg with what it is good with" from the then mayor Jan Prokopek Jensen, who Asger also consulted with (A. Gramkow, personal communication, May 9, 2018).

Based on challenges of local growth and improving profile, Asger, together with another two members of Futura Syd, director Bjarne Rasmussen and journalist Hanne Risgaard, raised up the idea of a local development project focusing on adopting new energy solutions and thus making Sonderborg a showroom for energy technologies (A. Gramkow, personal communication, May 9, 2018; Andersen, 2006). They approached local energy companies, which, however, showed little interest in their idea (P. Rathje, personal communication, May 11, 2018). It is explained that back then the energy companies were mostly busy with their own business and were content of business-as-usual because industries were in rapid growth (P. Rathje, personal communication, May 11, 2018).

Therefore, in the beginning, the problem definition of a local growth and business creation challenge did not attract much attention. According to Peter Rathje, who later became the manager of ProjectZero, the situation changed due to a few events happened later in 2006 (personal communication, May 11, 2018). One of them is the release of Al Gore's movie *An Inconvenient Truth* in autumn 2006, which contributed to the public attention and understanding to the urgency of combating climate change (P. Rathje, personal communication, May 11, 2018). Futura Syd quickly picked up the message of urgency of sustainable development conveyed by the movie and also used it as a selling point to lobby among clean-tech and energy companies, with the argument that by developing and selling technologies and solutions focusing on energy-efficiency which most clean-tech and energy companies had already been doing for long, they can contribute to develop a sustainable energy system as well as receiving profits for themselves (P. Rathje, personal communication, May 11, 2018). At the same time, another journalist hired by Futura Syd Ole Sønnichsen completed a report "ProjectZero: Sønderborg as the first sustainable and CO2 neutral area in

Europe" (Sønnichsen, 2007). It is written based on his research of global sustainable projects such as the Chinese zero-carbon project in Dongtan City and the sustainable development plan for Treasure Island in the United States (Sønnichsen, 2007). This report has had several influences on the problem definition process: it has highlighted the urgency of climate change; it has raised the ambition of Sonderborg being an zero carbon area based on the cases of other carbon-neutral cities; last but not least, it has suggested the wording "ProjectZero", which was later used as the official name of the transition (P. Rathje, personal communication, May 11, 2018). This report was spread and circulated around the local business community by Futura Syd, which is considered as another important factor that created the sense of urgency to act against climate change among the business community and changed the framing of the problem: Sonderborg needs initiatives that not only address the growth problem, but also take sustainability into account. There was also political pressure to promote an image of a new Sonderborg which was formed by the former municipalities of Augustenborg, Broager, Graasten, Nordborg, Sundeved, Sydals and Sonderborg due to "The Municipal Reform" (Kommunalreformen), using sustainability as a branding strategy (A. Gramkow, personal communication, May 9, 2018). Based on the interests of different actors mentioned above, in 2007, a shared problem definition that Sonderborg needs a carbon neutrality transition which can contribute to sustainability, create new business opportunities, revitalize local growth and brand the new Sonderborg was reached (ProjectZero, 2009a).

Based on such problem structuring, the vision that "turning the Sonderborg area into a CO2 neutral area not later than 2029" (ProjectZero, 2009a, p.3) and at the same time to "maintain and create new work places within the Cleantech area" (ProjectZero, 2009a, p.21) was created in the autumn of 2007. Such framing of vision has illustrated "a desired state of the system" (Loorbach, 2007, p.142) by specifying a sustainability criteria of being zero-carbon with an ambitious time limit. It has also incorporated different interests, as in addition to sustainability, employment generation which was considered key to local competences is also included in the vision. Along with the vision, three over-arching strategies focusing on the energy sector are also raised as possible transition pathways, which are increasing energy efficiency, promoting renewable energy as main sources of energy supply, and developing a dynamic energy system based on optimization of production and consumption (ProjectZero, 2009a, 2009). Such vision was created through formal meetings with the participation of local public actors, primarily the Sonderborg Municipality and the University of Southern

Denmark, local private energy companies, and the think tank Futura Syd (ProjectZero, 2009a).

In addition to the formation of transition vision, another important result of the envisioning process is the formation of ProjectZero Organization. It is formed based on a public-private partnership between the Sonderborg Municipality, Bitten & Mads Clausen's Fund from Danfoss, Syd Energi, Sønderborg Supply (SONFOR), DONG Energy, and the Nordea Fund (ProjectZero, 2009a). The formation of ProjectZero Organization is a mean as well as an end. It is a mean for actor collaboration, as it enables and safeguards the commitment of the above actors in terms of both finance (their investments in ProjectZero Organization Fund) and human resource (representatives at the boards). It is also an end in itself, in that an organization that stands a relatively neutral position between actors from public sector and private sector while having the capacity to operationalize the transition vision was needed for the transition, because the workload needed was considered too large for any one of the public and private actors to carry alone, and also because creating such an organization can relatively fairly represent both public and private interests. The activities and contributions of ProjectZero Organization are introduced in details in Section 5.2.

5.1.2 Tactical Level Management: Building the Transition Agenda

At tactical level, the strategic vision of a desirable future is connected with the present and a central question to be answered is how to get there (Loorbach, 2007). In the carbon neutrality transition in Sonderborg, the translation of the vision into more concrete goals and strategies is conducted through producing Master Plan 2029 (ProjectZero, 2009a) and Roadmap 2015 (ProjectZero, 2009b).

The Master Plan 2029 (referred to as "the Master Plan" henceforth) is the overall guideline for the transition. It incorporates the vision and guiding strategies formed at the strategic level. Furthermore, the Master Plan translates the vision into transition images, which are "collective images of the future that fit within the overall vision and make this concrete on a sub-system level" (Loorbach, 2007, p.120). The Master Plan has formulated two types of transition images. One type is time-specific transition images, which set interim goals based

on timeline. Taking the CO2 emission in 2007 as baseline emission, the Master Plan breaks the overall objective of 100% CO2 reduction by 2029 compared to 2007 into four phases, of which after the first phase from 2010 to 2015, an interim goal of reducing 25% of the emission in 2007 needs to be achieved (ProjectZero, 2009a). The time-specific transition images are not only qualitative in emission reduction goals, but also qualitative, in that the different focus area of strategies of each time phase are listed out. Another type of transition images is theme-specific transition image. The Master Plan (ProjectZero, 2009a) has assigned seven working groups: a reference and demography group, the main functions of which is to calculate and analyze the initial conditions including the calculation of CO2 emission in 2007 as the baseline for comparison and the analysis of demographic conditions in Sonderborg; five task groups each for a specific technical sector that involves energy production and/or energy consumption, including buildings, manufacturing processes, transport, agriculture, and renewable energy; an energy plan group that incorporates the recommendations from the five specific task groups into the making of action plans. Through this process, the Master Plan has raised a general framework composed of guiding strategies, main focusing areas, intervention sectors and deadlines. The overall making of the Master Plan is managed and facilitated by a "steering group for the Master Plan Process" composed of personnel from ProjectZero Organization, municipality and local energy company (ProjectZero, 2009a, p.111).

The Master Plan has resulted in a number of action plans that focus on a specific period of time, and the Roadmap 2015 is the first action plan targeting at 2010 to 2015 (ProjectZero, 2009a). From the transition perspective, the main function of Roadmap 2015 is to draw out transition paths that lead to the transition image of 25% CO2 reduction by 2015 (ProjectZero, 2009b). Based on the work of the task groups, within each intervention sectors, the initial conditions in 2007, the goals to be reached in 2015, and measures to be taken to reach the goals were laid out. For example, for manufacturing processes, 52,800 tons of CO2 reduction is to be made by 2015, through measures such as reducing 5% of energy consumption by 2015 and redistributing consumption of non-renewable fuels to renewable sources (ProjectZero, 2009b). For the details of CO2 baseline analysis, one task group CO2 baseline and Projection composed of 20 members, half from the municipality and half from private energy companies and consulting companies, was assigned to conduct the work (ProjectZero, 2009a).

5.1.3 Operational Level Management: Stimulating, Designing and Implementing Transition Experiments

In the Roadmap 2015, six projects were listed as "Beacon projects" (ProjectZero, 2009b, p.10): installation of individual heat pumps in areas not covered by district heating system; building of a green heating system based on waste incineration, geothermal heat, biogas and biomass burning, electricity and solar heating; building new onshore and offshore wind turbines; energy renovation of buildings; energy-saving programs targeting at local shops and companies. The Beacon projects possess the following characteristics: they are in coherence with transition agenda and vision; they are diverse in terms of scales, intervention areas, and actors involved; last but not least, they can be conceptualized as transition experiments that tackle with societal challenge through encouraging innovation and learning.

The Beacon projects are "expected to contribute significantly to the CO2 reduction already during the period 2010-2015" (ProjectZero, 2009b, p.10), which mean that they are projects derived from the transition image and paths designed at tactical level. At the same time, they are projects that "in the long term are expected to be important for Sonderborg to reach its 2029 objective" (ProjectZero, 2009b, p.10), implying their coherence with the overall vision created at strategic level.

The Beacon projects also reflect the diversity in measures for sustainability transition: they are projects of different scales in different intervention areas with various kinds of actors involved. Some of the projects are further divided into smaller individual programs. For instance, building green district heating system are supported by several experimental programs: the building of a district heating transmission pipe to connect Sonderborg, Augustenborg and Nordbord to the same district heating network; the building of solar-heating plant, geothermal power plant and bio-gas plants based on manure recycling (ProjectZero, 2009b). These sub-projects are closely interconnected as they have been initiated to collectively contribute to a greener heat supply based on renewable sources. On the other hand, although building wind turbine is only one of the measures to make the electricity supply greener, it is listed as one individual beacon project. In addition to the

coherence among different sub-projects of the same beacon project, there exists correlation among different project as well. Bio-gas and waste incineration can be sources for both heat and electricity production, implying that the beacon project of green district heating and the building of wind turbines for electricity have mutual impacts on each other. These beacon projects and their sub-programs also belong to different intervention sectors and involve different technology, infrastructure and actors. Building green district heating system and new wind turbines both involve large-scale physical transformation of the infrastructure, in which the municipality plays significant roles due to its responsibility of managing public infrastructure and considering the potential impacts on the citizens. On the other hand, in energy renovation of buildings and energy-saving campaigns for local shops and companies, the key tasks have been raising local awareness and changing behaviors related to energy saving by involving local citizens, owners and employees of shops and companies, and craftsmen, in which the ProjectZero Organization has taken important roles as in program design, management and coordination, as is discussed in Section 5.1.3.

One vital question to be answered is do these Beacon projects and their sub-projects count as transition experiments? The judgment depends on whether they include the three vital elements that distinguish transition experiments from classic innovation projects: societal challenge, innovation and learning (van den Bosch, 2010). As being derived from the transition vision and agenda, in a broader sense these projects all aim to contribute to the challenge of CO2 reduction in cities. At the same time, each of them starts from specific challenge from different aspects of an energy system: installations of heat pump and building heating system on renewable sources mainly concern the challenge of building a greener and more inclusive heating supply network; setting wind turbines aims for greener and economically-feasible electricity supply; energy renovation of buildings and energy-saving campaigns target at increasing energy efficiency and lowering energy consumption through engaging local individuals and business communities. In terms of innovation, although the technologies adopted in these projects are not the world's first and have also been utilized in other contexts, these projects collectively contribute to system innovation, defined as innovation which "fulfills a new or existing need in a new way" (van den Bosch, 2010, p.60). They aim to change the norms of fossil fuels being the predominant sources for energy supply, cost-performance and quality being the only criteria for building renovation or lack of environmental awareness in small businesses. They also bring about innovation in how

different actors cooperate for energy system transition. Planning and changing energy infrastructures is not determined by local government with a blueprint plan, but is supported by on-going negotiation among the government, energy companies and residents. Energy renovation involves homeowners, craftsmen, banks and even local educational institutes. Through such innovations, learning is generated accordingly in thinking, doing and organizing.

5.1.4 Evaluation Level Management: Monitoring and Evaluating

At the evaluation level, monitoring and evaluation are conducted throughout the transition management process. Both monitoring and evaluation take place on two dimensions, referred to as "the transition itself and the transition management process" (Loorbach, p. 119).

In terms of transition management, the monitoring and evaluation are conducted at activity and project level as well as at system level. At activity level, whether the on-going events are effective in achieving the goals of certain activities at each level of the transition management are monitored and reflected. At strategic level, system scan was conducted constantly by the forerunners who advocated for the envisioning process to analyze changing local conditions and identify trends of interest, demand, and activities of key actors. The identification of sustainable development as a growing concern both locally and globally is one result of the monitoring of internal and external system. At tactical level, monitoring and evaluation were continued throughout the processes of the making of the Master Plan and Roadmap 2015. The making of the Master Plan, for example, has been through several rounds of discussion and reflection. Upon the reflection of the first round of Master Plan making, which focused on collecting ideas and proposals for CO2 reduction from 13 working groups, it was concluded that many of the ideas and proposals were still constrained by the business-as-usual thinking and also the number of groups were too many for effective management (Gramkow, 2009). Therefore it was proposed in the second round that reducing the number of working groups to nine and assigning more responsibility to leaders of each team to encourage proposals based on transition thinking (Gramkow, 2009). With the focus areas of the Master Plan became more clear with continuous discussion and consultation, the number of working groups was eventually limited to seven (Gramkow, 2009). Such process

indicates monitoring and reflection on both the substance (focus areas) and process (the management of the working groups) of tactical level activities were conducted regularly. At operational level, the monitoring and evaluation is mainly conducted by ProjectZero Organization with respect to each individual project as well as in a holistic manner so to encourage their synergies, which is discussed in details in Section 5.2.4. In addition to activities at different levels, the performance of all CO2 reduction efforts as a whole was monitored and evaluated as well. The ProjectZero Organization is in charge of conducting the monitoring of CO2 emission from Sonderborg annually, and impact analysis has also been done by NIRAS on job creation and investment created by the transition activities in line with the vision of strengthening local growth (ProjectZero, 2015). The monitoring and evaluation at system level do not only provide information and knowledge for the past development, but also serves as a basis for future transitions. The Roadmap 2020, the second action plan for the next stage of transition was based on the insights concluded and reflections made upon the development of the previous stage. The reflections that there was too much focus on technology solution but not enough stakeholder engagement especially for the citizens and market-based solutions are important for future development have led to the change in the framework of Roadmap 2020. In Roadmap 2015, the planning was structured around different sectors based on mainly analysis and proposals of technical measures, while in Roadmap 2020, the structure has changed to three focus sectors on three types of stakeholders, namely community and citizens, businesses and public sectors, as well as three business-oriented development themes of smart grid, bio-economy and green transportation (ProjectZero, 2014a). Best practices such as the programs of ZeroCompany and ZeroShop in the previous development have been identified to be continued and up-scaled in future development, while goals that were failed to be achieved such as the weak performance in CO2 reduction in the public sector have been pointed out, based on which new measures for improvement have been made (ProjectZero, 2014a). Such evaluation and reflection were conducted through activities such as the ProjectZero Summit held on April 18, 2013, which was a 12-hour session participated by more than 70 people from businesses, educational institutes, think tanks and public authorities from all over Denmark, not only to generate ideas and proposals based on their own expertise and interaction with each other, but also to inspire cross-sectoral and multi-level cooperation so to tap the transition of Sonderborg into regional and national development as well (ProjectZero, 2013). The Roadmap 2020 was launched in January, 2014 and the report was published in 2015, showing a timely link-up

with the end of the 2010-2015 stage of development.

5. 2 The Roles of ProjectZero Organization as a Systemic Intermediary

By the official statement, ProjectZero Organization is a non-profit organization created based on public-private partnership in order to "inspire and drive Sonderborg´s transition to a ZEROcarbon community by 2029, based on improved energy efficiency, conversion of energy sources into renewables and by creating participation of all stakeholders" (ProjectZero, n.d.). Such description fits in the definition of systemic transition intermediaries, which are "entities that intermediate for a sector (such as electricity, transport, or agriculture) or a region (such as city or even a country) to move towards new and more sustainable (or socially just) system configurations" (Kivimaa, Boon, Hyysalo, & Klerkx, 2017, p.4); at the same time, in oppose to transitional intermediaries work at firm-level and bilateral relationships, they operate "on all scales and taking a system perspective on change" (Kivimaa et al., 2017, p.11; van Lente et al., 2003). Therefore, ProjectZero Organization is defined as a systemic intermediary for transition, as clearly revealed by the mission statement which shows the ambition of ProjectZero Organization to intermediate among all stakeholders and the nature of the carbon neutrality as a transition enabled by systemic changes in energy system. Holm et al. (2015) and the Danish Confederation of Trade Unions (2014) have both mentioned ProjectZero Organization as an intermediary for transition in their researches, but what exactly are the functions and roles of it as an intermediary and how they contribute to the transition has not been discussed. Section 5.2 thus aims to analyze the transition process taking ProjectZero Organization as a focus, based on the analytical framework proposed in Section 4.2.2.

5.2.1 Roles at Strategic Level Management

ProjectZero Organization was given birth due to a series of strategic level activities; to explore this process, another organization, the local think tank Futura Syd which was a key actor in creating ProjectZero Organization, is to be mentioned. Futura Syd was established in 2000 when the area was experiencing socio-economic decline and its sole purpose was to find and create opportunities for local growth based on local business development in the

clean-tech sector, which it had identified as a local pillar industry (A. Gramkow, personal communication, May 9, 2018; Holm et al., 2015). In 2006 and 2007, a few events added other perspectives to Futura Syd's ambition of local energy business development: Al Gore's movie An Inconvenient Truth intensified the sense of urgency in Sonderborg to act against global warming; a research report by Futura Syd journalist Ole Sønnichsen identified carbon neutral programs had become a trend of sustainable development worldwide; the municipality reform was taken by its new mayor Jan Prokopek Jensenas a pressure as well as an opportunity to brand Sonderborg (A. Gramkow, personal communication, May 9, 2018; P. Rathje, personal communication, May 11, 2018). Through interpretation of and inspiration from these events, the element of sustainable development based on the concept of CO2 neutrality was added into the discourse of local growth by Futura Syd, partly out of their concern of the general trend of sustainability as a normative end of development, partly as a strategy to win the support from local actors, such as mayor Jan Prokopek Jensenas who saw the possibility of branding Sonderborg in becoming CO2 neutral, and clean-tech companies which consider sustainability as a future business development direction (A. Gramkow, personal communication, May 9, 2018).

Futura Syd did not reach out to these potential actors by itself, but first approached Peter Rathje with the embryonic idea that an organization needed to be formed in anchoring the vision and asked Peter Rathje to be in charge of the organization (A. Gramkow, personal communication, May 9, 2018). Peter Rathje was endowed with management skills and local social capital by his extensive management experiences in a number of companies and industries as well as membership at boards of educational institutes (ProjectZero, n.d.); such individuals are categorized as "networkers" (2007, p.118) by Loorbach as one type of front-runners in building a transition arena. After being introduced to the vision, Peter Rathje also participated in identifying other local actors with political and financial interests and resources for the operationalization of the transition vision (P. Rathje, personal communication, May 11, 2018). Before ProjectZero Organization was created and he was officially appointed as the manager in July 2007, Peter Rathje and members of Futura Syd promoted and advocated for the vision at city council, local companies, educational institutes and other organizations through meetings and presentations, trying to understand, communicate and intermediate different interests and demands from different actors (A. Gramkow, personal communication, May 9, 2018). Finally among them, Sonderborg

Municipality, Bitten & Mads Clausen's Fund from Danfoss, SYD ENERGI, Sønderborg Supply (SONFOR), DONG Energy, and the Nordea Fund agreed to contribute to the creation of ProjectZero Organization by making to types of commitments: financial and organizational. All of the above organizations, through making initial investment and giving annual grants, participated in establishing ProjectZero Foundation, which funds the ProjectZero Organization and its activities. Another part of ProjectZero Organization is the ProjectZero A/S as the operational company for the management of and intermediation for the carbon neutral project. Except for Nordea and Sonderborg Supply, all other stakeholders invested in ProjectZero Foundation have their representatives at the board of ProjectZero A/S (ProjectZero, 2009a). The two boards at ProjectZero Foundation and ProjectZero A/S are on the one hand platforms for interaction among the actors, while on the other hand, they are also organizational arrangements that support the alignment of interest and safeguard continuous commitment from these actors.

In conclusion, the roles of demand and option articulations were played by the local think tank Futura Syd based on their knowledge of local context, interaction with local actors, and the understanding of boarder socio-economic trends. Such articulations have framed how to develop sustainably while utilizing local business strength in clean tech sector and generating local growth into a primary challenge, and ProjectZero Organization was created as an initial effort to take actions. Although as an organizational entity, ProjectZero Organization was created after the identification, involvement and alignment of key actors, its manager had been involved in the process of actor mobilization and alignment, which had laid the foundation for future interaction with and network building among different actors. In short, ProjectZero Organization did not play the roles of demand and option articulation since it was not established during the time of problem structuring, however, the key person of the organization had been in close contact with the main problem definers and also been involved in identifying, aligning and intermediating among different actors. Such effort had led to the positioning of ProjectZero Organization at a system level, in that its starting point was to deal with a systemic challenge, its arrangement was supported by main actors in the system and its main role was understood as to offer a platform for the interactions and collaborations among other major actors.

5.2.2 Roles at Tactical Level Management

Tactical level activities are centered at building a transition agenda, which requires the participation of actors that are different from those at strategic levels. They are people from different areas of specialties who, while may not have directly contributed to the vision formation, nevertheless have the capacities to translate the vision formed at strategic level into "increasingly concrete, tangible, possible and in general favourable alternatives" based on their expertise (Loorbach, p.120). ProjectZero Organization as a systemic intermediary mainly played the role of identifying and selecting such actors and creating coalitions and alignments among them.

Tactical level actors were identified and selected based on several criteria. First, they needed to agree with the overall vision, although they main had different stakes and interests in their participation; second, they needed to have the competences to contribute to the process of transition agenda building based on transition image and path formulation (Loorbach, 2007). Such judgments were made by ProjectZero Organization based on background check and interaction with the potential actors. ARUP, for example, was one of the very first consultancy companies that ProjectZero Organization contacted with, based on ARUP's past experience in consulting the building of other carbon-neutral cities such as Dongtan Eco-City in China and Masdar City in the United Arab Emirates (P. Rathje, personal communication, May 11, 2018). However, through meetings and discussions, ProjectZero Organization considered ARUP as incompetent for ProjectZero in figuring that it "had no knowledge of what-so-ever about Denmark" (P. Rathje, personal communication, May 11, 2018). Unlike in the cases of Dongtan Project and Masdar Project which are both about building new sustainable cities from scratch, the transition in Sonderborg is based on the transformations of existing urban infrastructures which requires a thorough understanding of local context (P. Rathje, personal communication, May 11, 2018). As a result, ProjectZero Organization turned to Danish consultancy companies such as SRC International with more knowledge about local conditions (P. Rathje, personal communication, May 11, 2018).

In terms of actor alignment, the main effort from ProjectZero Organization was having developed a framework of grouping actors with regard to different natures and themes of activities for the making of the Master Plan and Roadmap 2015, the main documents that

substantialize the transition agenda. Serving the function of managing, supervising and facilitating the overall plan making processes, a steering group composed of representatives from ProjectZero Organization, the municipality and energy consultancy company was formed (ProjectZero, 2009a). While the steering group was in charge of planning process, another six task groups were appointed for filling the substances of the plan (ProjectZero, 2009a). Among the six task groups, five of them were responsible for particular technical themes, while another reference and demography group was in charge of calculating and analyze the initial status including CO2 emission and demographic conditions in Sonderborg in 2007 (ProjectZero, 2009a). While these task groups made strategies and recommendations based on the analysis of key energy system elements on each thematic topic, an Energy Plan Group composed of local actors that were presented at the two boards of ProjectZero Organization as well as external energy consultants was responsible for collecting and integrating these contributions into the holistic plans of Master Plan and Roadmap 2015 (ProjectZero, 2009a). In addition, all of the above groups mentioned each contains one or more representatives from ProjectZero Organization (ProjectZero, 2009a).

Such structuralized arrangements reflects several contributions of ProjectZero Organization in terms of actor alignments: first, with representatives in all actor groups, ProjectZero Organization was able to supervise and facilitate work from all group, check the accordance with the overall vision, and identify opportunities for synergies among different groups' work; second, such framework offers a clear structure for the division of tasks and responsibilities, while at the same time, it is also flexible in that it was made clear that "status on the realization of the Master Plan progress will concurrently be taken in order to evaluate whether it is necessary to adjust the guiding stars" (ProjectZero, 2009a, p.25), showing the awareness of a balance between structualization and flexibility in the process of building transition agenda as well as in the content of the transition agenda.

It also needs to be pointed out that ProjectZero Organization itself did not perform the function of demand and option articulation at tactical level, like the previously mentioned example of California Fuel Cell partnership which selected and promoted a certain technological option to satisfy a certain demand and integrated such articulation in its transition agenda (van Lente, et al., 2003). Instead, ProjectZero Organization considered such tasks are missions for energy consultancy and engineering companies, while itself acted more

as an enabler for these actors to perform the task of demand and option articulation.

5.2.3 Roles at Operational Level Management

The contributions ProjectZero Organization has made to operational level activities include identification and alignment of actors for management and facilitation of individual experiments as well as coordination of different transition experiments to encourage interactions and synergies in a systemic manner.

ZERObolig is an example, the analysis of which can display both types of efforts: ProjectZero Organization on the one hand managed and facilitated the organization and implementation of this program, on the other hand connected it with other relevant programs and incorporated the insights generated from this program into transition agenda. ZERObolig is a program that aims to lower residential energy consumption by promoting energy retrofit of private houses (Jensen, Gram-Hanssen, & Friis, 2016). The idea of this program itself reflects the connection made by ProjectZero Organization between the demands of house renovation and the option of energy retrofit based on available local resources. The core of this program is to attract private house owners to conduct energy retrofit to their houses by offering free energy consultancy (ProjectZero, 2014b). Once the households got to know about this program through campaigns and media exposure promoted by ProjectZero Organization, they can sign up for enrollment of the program (ProjectZero, 2014b). An energy adviser would then visit the signed up households in order to have an overview of the structure and installations of the house as well as to communicate with the household to know about their energy-use behavior (ProjectZero, 2014b). Based on the evaluation and interaction, the energy advisor made recommendations on physical energy recommendations based on cost analysis, for example advising the household to invest in additional insulation for the ceilings, and also recommendations on changing daily energy-use behavior to reduce energy consumption (Tjørring & Gausset, 2015). If the household decided to conduct energy retrofit, the energy advisor would give a list of the builders for the households to choose from to work on the installations or transformations (Tjørring & Gausset, 2015). Besides designing an energy retrofit program in which the households get free and tailored evaluation in person, ProjectZero also engaged the local banks in the program to develop more favourable financial

scheme for the program (Tjørring & Gausset, 2015). The banks designed financial package for energy retrofit so that customers can receive loan at lower interest rate and also sent their employees for training in retrofit related knowledge so that they can offer better consultancy service for the customers (Tjørring & Gausset, 2015). ProjectZero Organization further connects ZERObolig with another educational program "Projekt ZeroByg", which is created by the municipality and the local trade training center to educate and qualify craftsman for retrofitting (Jensen et al., 2016). This synergy not only safeguard the human resource needed for conducting ZERObolig program, but also has built up a stock of qualified labor and up-scaled the local potential in energy retrofit.

However, in some of the projects, ProjectZero Organization has exerted less influence in terms of articulation and actor alignment. In the beacon project of wind turbine installation, although ProjectZero Organization was supported by the city council in pushing forward the implementation process, local residents close to the location of the installation campaigned against the project (Madsen, 2016). ProjectZero Organization failed to reach an agreement with the opposing residents, and due to concern of losing public support, city council later put a halt to the project, leading to a standby period of five years (Madsen, 2016; P. Rathje, personal communication, May 11, 2018). ProjectZero Organization has been conducting a survey of local opinions and concerns, but it has been a time-consuming process in terms of data collection (P. Rathje, personal communication, May 11, 2018). Such situation shows that in projects where intense conflicts of interest exists, articulation of demand and option as well as actor alignment become rather challenging.

5.2.4 Roles at Evaluation Level Management

Both the transition and transition management process are monitored and evaluated by ProjectZero Organization. In terms of the evaluation of transition, Turnheim et al. (2015) have summarized three approaches: quantitative systems modeling, socio-technical analysis and initiative-based learning. Quantitative systems modeling, which sees transition as "fundamental change in (performance) parameters (e.g. emissions, land use, etc), driven by changes in a modeled structure of drivers" (Turnheim et al., 2015, p.243), is the main approach adopted by ProjectZero Organization to evaluate the transition. Every year since the

initiation in 2010, ProjectZero Organization publishes a monitoring report including the calculation of the total CO2 emission of the year, the analysis of contributions of CO2 reduction from different sectors such as heat supply, industries, transportation and lighting contribute to the reduction of CO2 emission, and the evaluation of what interventions implemented enabled such changes (ProjectZero, 2015). The transition is also evaluated in a temporal manner in that whether the rate of change reaches the interim goals. For example, based on the comparison between the goal of 25% reduction and the actual reduction of 35% in 2015 compared to emission baseline, the Monitoring Report 2015 comments that "Sonderborg is thus well on the way" (ProjectZero, 2015, p.2). The Monitoring Report 2015 was also reviewed by the consultancy company NIRAS for its accuracy and validation, indicating that ProjectZero has also identified and involved other actors with expertise to assist the monitoring and evaluation process (ProjectZero, 2015).

The identification and summarization of best practices to be learnt from for future intervention in Roadmap 2020 (ProjectZero, 2014a) also imply the use of socio-technical transition analysis, which involves the conceptualization of configuration that works. However, detailed analysis on the "interplay between novelty creation, external pressure and re-configuration of socio-technical systems over time" (Turnheim et al., 2015, p.243) which is at the core of socio-technical transition analysis is missing. Therefore there lacks in-depth reflection on the influences of such practices on structural and cultural changes in societal systems.

In terms of transition management, the monitoring and evaluation by ProjectZero Organization stimulated learning within as well as across the other three transition management levels. At strategic level, the establishment of ProjectZero Organization itself can be considered as a product of learning by the forerunners involved in the process of envisioning. The main actors involved in problem definition process were the local think tank Futura Syd from the non-profit sector, Sonderborg municipality from the public sector and Danfoss from the private sector. They are entities of fundamentally different organizational nature, interest and responsibility and the interaction among them enabled them to learn each other's perspective and anticipation. ProjectZero Organization has become a platform for interaction and collaboration for the strategic level actors as well as the catalyst of expansion of actors for future activities since its establishment. Therefore, at strategic level, ProjectZero

Organization is not only the result of learning, but also a mean for furthering learning. Through such learning, new ways of thinking and organizing, or in other words, change in culture and in structure were initiated (van den Bosch, 2010).

At tactical level, knowledge production through interaction among actors is monitored, evaluated and diffused by ProjectZero Organization. ProjectZero Organization first encourages knowledge production by setting up structural framework for actor coalition based on their expert knowledge, so that actors can have a more holistic understanding about the current situations and strategies to improve based on knowledge exchange and diffusion. It also monitoring the content and the process of the knowledge production, through reflection process with all actors about questions such as whether the knowledge produced can contribute to build the transition agenda and whether the procedure set for knowledge production is effective and efficient. The meeting for the second round of Master Plan making as a reflection process upon actor coalition and ideas generated in the first round planning introduced in section 5.1.4 is an example of how learning is generated not only through knowledge production, but also reflection on knowledge production. Knowledge integration is another important role that ProjectZero Organization played based on the monitoring of knowledge produced during the tactical activities. The contents of Master Plan and Roadmap 2015 well display how different knowledge brought in by actors from different sectors is integrated for developing systemic strategies and how the short-term action plan is integrated into the holistic Master Plan.

At operational level, learning is generated through monitoring and evaluation of individual projects as well as the their collective contribution. For the projects of which ProjectZero Organization itself is the manager more detailed monitoring is conducted compared with the projects that it is less involved in. In ZEROhome project for example, monitoring of parameters of CO2 emission reduction, number of households involved, and number of jobs and amount of investment created were measured and publicized (Tjørring & Gausset, 2015). Based on such information, the program is evaluated as a good example for furthering energy retrofitting practices. In Roadmap 2020, it is stated that based on the learning from this program which was targeted at the private house owners, new initiatives of energy retrofit would be started in the public housing sector (ProjectZero, 2014a). However, in the case of wind turbine installation, which was put on hold by the city council due to local resistance

and political reasons, as it was not progressing as planned and the future development is still in the air, little evaluation was done other than keeping track of on-going activities. Operational activities are also monitored and evaluated in a systemic manner. Collective contribution of operational activities to CO2 emission reduction is calculated so to evaluate whether adjustment is needed for transition agenda and vision (ProjectZero, 2015). With an overview of all projects and programs organized and their contributions, it is realized that there needs to be more emphasis on job creation and business development as part of the transition vision and on stakeholder engagement as the overarching strategy, based on the evaluation that although the CO2 emission reduction goal has been achieved ahead of timeline, the progress booming employment was not as impressive and there was too much focus on technical measures (ProjectZero, 2014a). As a result, a new framework of transition agenda highlighting the "SixBigConcepts" (ProjectZero, 2014a, p.4) with the three focus sector of community and citizen, businesses, and public sector and the three new development themes of smart grid, bio-economy and green transportation, replacing the transition agenda framework of catalogue of technical intervention measures.

In conclusion, ProjectZero Organization has monitored and evaluated both the transition and the transition management process, by itself as well as with other actors who it identified as having the capacity to assist the process. How transition is evaluated by ProjectZero Organization reveals that through quantitative system modeling, learning about transition outcome is generated mainly to guide transition management; however there lacks attention towards a systemic evaluation of transition in physical, institutional and economical structures of the societal systems, changes in actor composition, interaction and perception and influence from external environment. In terms of transition management, two kinds of learning have been generated: learning from exchange of information and perspectives for actors involved in each level of activities enabled by ProjectZero Organization's function as a platform for interaction, and learning from reflection upon the processes and results for readjustment and adaptation of transition management, enabled by ProjectZero Organization's function of monitoring and evaluating.

5.3 Reflection on the Case Study

Section 5.3 reflects on the case study by discussing the contributions and limitations of the performance of ProjectZero Organization in the transition management process and also concludes the implications from the case study for refinement of the analytical framework and for further research.

Based on the analytical framework proposed in Section 4.2.2, the roles that ProjectZero Organization has played have been summarized in Table 4.

Transition management levels	Roles of systemic intermediaries	Performance of ProjectZero Organization
Strategic level	Articulation of options and demand (Articulation)	
	Identifying, mobilizing and involving relevant actors (Alignment 1)	✔
	Organizing discourse, alignment and consensus (Alignment 2)	✔
Tactical level	Articulation of options and demand (Articulation)	
	Identifying, mobilizing and involving relevant actors (Alignment 1)	✔
	Organizing discourse, alignment and consensus (Alignment 2)	✔
Operational level	Articulation of options and demand (Articulation)	✔
	Identifying, mobilizing and involving relevant actors (Alignment 1)	✔
	Organizing discourse, alignment and consensus (Alignment 2)	✔
	Management of complex, long-term innovative projects (Alignment 3)	✔
Evaluation level	Identifying, mobilizing and involving relevant actors (Alignment 1)	✔
	Feed actors with tailor-made (strategic) information (Learning 1)	✔
	Create conditions for learning by doing, using, interacting and searching (Learning 2)	✔

Table 4. Roles that ProjectZero Organization has played in the transition management process.

As shown in Table 4, ProjectZero Organization has performed the function of actor alignment (which is further divided into three types of roles, indicated by Alignment 1, 2 and 3) at all levels of transition management. Actor alignment is vital to transition management, because transition management is a multi-actor process, in which the number, compositions and coalitions of actors differ at each transition management level due to different skills, resources and interactions required at each level for the accomplishment of different central tasks. Therefore how to influence the dynamics among actors so that the individual and collective efforts can effectively and efficiently contribute to the management of the transition is a vital issue. ProjectZero Organization has made major contributions in this

respect by organizing and facilitating a dynamic network of actors, being a platform for their interaction as well as an enabler for their collaboration, and constantly monitoring and evaluating their relationships and activities. The probable reason behind such emphasis on actor alignment can be in the very nature of ProjectZero Organization as a systemic intermediary as well as a strategic intermediary. Strategic intermediaries are "deliberately positioned to act in between by bringing together and mediating between different interests" (Marvin & Medd, 2004, p.84), and the statement showing the core mission of ProjectZero Organization as "creating participation of all stakeholders to reach the ambitious goal: CO2-neutral growth and sustainable urban development" (ProjectZero, n.d.) clearly shows the ambition of an intermediary, which is strategically positioned to take actor alignment as its main role. The focus on actor alignment and the strategies used such as networking, enabling and catalyzing can be important implications for other and future intermediaries to contribute to transition management.

Generating learning is another important function ProjectZero Organization has played, which contributes to the incremental style of governance as an important characteristic of transition management. Transition management is a "search-and-learn process" (Loorbach, 2007, p.25), which emphasizes the awareness of intrinsic uncertainty and complexity, efforts to create flexibility for trials and alternatives, generation of learning from past experiences, and eventually the adaptations and adjustments made based on the learning. Such processes have been enabled by ProjectZero Organization, mainly by monitoring, evaluating and reflecting on the transition processes to produce "learning material" itself or by other actors and enable the sharing of the "learning material". It has enabled the transition management to take place in an incremental and reflexive manner, opposed to a blueprint-style governance approach.

However, ProjectZero Organization did not perform the role of articulating options and demands at strategic and tactical levels as shown in Table 4. For the absence of articulation at strategic level, it can be explained that ProjectZero Organization was created as a result of articulation, in that it was established in response to a demand that an organization that can intermediate the transition process was needed. However, if in other cases, the intermediaries are not newly created, but existing ones that become involved in transition management, the situation can be rather different. Therefore, an implication for the need of refinement of the

analytical framework is that organizational characteristics should also be taken into consideration, since they can also impact the roles that intermediaries can perform. At tactical level, ProjectZero Organization did not articulate demand and option itself but mainly assigned the role to energy consultancy and engineering companies. It implies ProjectZero Organization has assumed that the problem of matching demand and option can be solved through technical measures, and thus energy consultancy and engineering companies were more qualified for demand and option articulation. It shows at the time when transition agenda was made for 2010 to 2015, ProjectZero Organization considered technical solution as the priority; however according to the new transition agenda made for 2020, it seems that ProjectZero Organization has realized the limitation of such technical perspective, and attempts to emphasize more on stakeholder partnership, in which it can probably take on the role of demand and option articulation better. Therefore although demand and option articulation is missing at tactical level, ProjectZero Organization has reflected upon its roles and adjusted its strategies, which is another example of the importance of learning and reflection in transition management rather than doing the right thing in the first attempt.

In certain more controversial projects at operational level such as wind power installation, ProjectZero have also shied away from directly voicing out demand and option for any particular stakeholders. These projects are more controversial than others because there are intense conflicts among the stakeholders, including ProjectZero Organization itself. Take the wind turbine installation as an example, it is of ProjectZero Organization's interest to push the project forward as it can significantly curb CO2 emission, while a number residents have campaigned against it. City council permitted the project first, but then called a halt due to residents' resistance as well as its own concern of losing votes. In such situation, ProjectZero appears to have little agency over the decision, which brings the question of the degree of agency that intermediaries possess in pursuing transition. In other words, how much say do intermediaries have and what are the factors that influence the say they have? Are these factors more case-specific or more generic? Such inquiries are also related with the concept of neutrality: intermediaries are not absolutely neutral actors; in the case of systemic intermediaries in transition, their agency is the degree of freedom that they have to prioritize sustainability transition than other interests (Marvin & Medd, 2004; Moss, 2009). Neutrality is an issue that not only affects the roles of intermediaries, but also questions the very nature of intermediaries. Further research efforts are needed in understanding the power dynamics

among actors including intermediaries in order to have a more comprehensive understanding of management of sustainability transition.

Another reflection is the contextual and temporal limitation of this case study analysis, due to the dynamic nature of intermediaries themselves. As revealed by the transition agenda Roadmap 2020 for the next stage of transition from 2016 to 2020, the main approach adopted for transition has been changed from technical measure to stakeholder partnership. Such changes can be resulted from the intermediary's own understanding of transition and transition management, and also can be from the changing social, economic and political conditions. Such changes can have significant impacts on the roles that ProjectZero Organization play for the next round of transition management, implying the complexity of the study of intermediaries and transition management. Therefore this analysis of roles of intermediary is still contextual and temporal. A continuous analysis on the long-term evolvement and changes of intermediaries with the on-going transition can further contribute to a more comprehensive understanding of intermediaries in transition management.

6. Conclusion

The main contribution of this study is to the understanding of the roles that intermediaries can perform for different management tasks required by the transition management cycle. At strategic level, articulation of demand and option, identifying actors and organizing consensus among them for forming transition vision are the main roles of intermediaries. At tactical level, intermediaries play the same roles as at strategic level, but with different demands and options being articulated and with different actors involved for the purpose of building a transition agenda. At operational level, in addition to the roles intermediaries play at strategic and tactical level, they also manage and facilitate concrete projects to contribute to the stimulation and organization of transition experiments. At evaluation level, generating learning is the most important task that intermediaries help to accomplish, which is enabled by their ability of actor mobilization. Throughout the management process, actor alignment is of particular importance that it is required at all management levels and is the major contribution made by intermediaries, implying that future intermediaries involved in transition management should strengthen their capacity in engaging different actors.

Generating learning is also an indispensable function that intermediaries can perform, contributing to the incremental and reflexive process of transition management.

As the carbon neutrality transition process in Sonderborg is still in process, continuous analysis on the long-term evolvement and changes of ProjectZero Organization with the transition can contribute to a more comprehensive understanding of intermediaries in transition management. For other case studies that also attempt to analyze roles of intermediaries in transition management, one element that can be further explored is the organizational characteristics of the intermediaries, and how different characteristics can affect the roles intermediaries perform.

Zooming out from the analysis of internal transition process to a reflection on the two main concepts this study address, it is understood that both transition management theory and studies on systemic intermediaries have profound implications for the governance of sustainable development. Transition management theory suggests a new governance framework which is cyclic, iterative, reflexive and flexible in oppose to the traditional linear and deterministic way of governance. The emergence of systemic intermediaries emphasizes on the complexity and dynamics of actor networks, offering an alternative to a governance system composed of static set of actors with clear-cut responsibilities (Moss, 2010). In addition, both lines of research imply the importance of power dynamics to transform social, economic and technological systems. Transition management proposes managerial instruments to influence perspectives, interests and relations, while studies of systemic intermediaries directly advocate for the roles of intermediary and importance of intermediation to reconfigure power relations among the public sector, the private sector and the civil society (Moss, 2010). In this respect, it can be a future research topic to explore the power dynamics among actors involved in transition management and the way power is experienced and scaled-up throughout the transition with a focus on systemic intermediaries.

REFERENCES

Andersen, U. (2006). Sønderborg vil være laboratorium for energibesparelser. *Ingeniøren*. Retrieved from https://ing.dk/artikel/sonderborg-vil-vaere-laboratorium-energibesparelser-74102

Backhaus, J. (2010). Intermediaries as innovating actors in the transition to a sustainable energy system. *Central European Journal of Public Policy, 4*(1), 86–108.

Batterink, M. H., Wubben, E. F., Klerkx, L., & Omta, S. W. F. (2010). Orchestrating innovation networks: The case of innovation brokers in the agri-food sector. *Entrepreneurship and Regional Development, 22*(1), 47–76.

Boon, W., Moors, E., Kuhlmann, S., & Smits, R. (2008). Demand articulation in intermediary organisations: The case of orphan drugs in the Netherlands. *Technological Forecasting and Social Change, 75*(5), 644–671.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27-40.

Bulkeley, H. (2010). Cities and the governing of climate change. *Annual Review of Environment and Resources, 35*, 229–253.

Coenen, L., & Truffer, B. (2012). Places and spaces of sustainability transitions: Geographical contributions to an emerging research and policy field. *European Planning Studies, 20*(3), 367-374.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Los Angeles: Sage.

Danish Agency for Trade and Industry. (2001). *Kompetenceklynger i dansk erhvervsliv: en ny brik i erhvervspolitikken*. Danish Agency for Trade and Industry, Copenhagen.

Dooley, L. M. (2002). Case study research and theory building. *Advances in Developing Human Resources, 4*(3), 335-354.

Farla, J., Markard, J., Raven, R., & Coenen, L. (2012). Sustainability transitions in the making: A closer look at actors, strategies and resources. *Technological Forecasting and Social Change, 79*(6), 991-998.

Farthing, S. (2016). *Research design in urban planning: a student's guide*. Los Angeles, CA: Sage Publications.

Fischer, L.-B., & Newig, J. (2016). Importance of actors and agency in sustainability transitions: A systematic exploration of the literature. *Sustainability, 8*(5), 476.

Frantzeskaki N., Bach M., Hölscher K., & Avelino F. (2018). Introducing Sustainability Transitions' Thinking in Urban Contexts. In N. Frantzeskaki, K. Hölscher, M. Bach, & F. Avelino. (Eds.), *Co-creating sustainable urban futures: A primer on applying transition management in Cities* (pp. 63-79). Springer.

Geels, F. W. (2005a). *Technological transitions and system innovations: A co-evolutionary and socio-technical analysis*. Cheltenham, UK: Edward Elgar Publishing.

Geels, F. W. (2005b). The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860-1930). *Technology Analysis and Strategic Management*, *17*(4), 445-476.

Geels, F. W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy, 39*, 495-510.

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transition, 1*, 24-40.

Geels, F. W. & Schot ,J. (2007). Typology of sociotechnical transition pathways. *Research Policy, 36*, 399–417.

Gramkow, L. (2009). *ProjectZero Masterplanprocessen 2.0: Præsentation af processen* [PowerPoint presentation].

Grin, J., Rotmans, J., Schot, J., icw. Loorbach, D., & Geels, F.W. (2010). *Transitions to sustainable development: New directions in the study of long term transformative change*. New York, Routledge.

Grin, J., Rotmans, J., & Schot, J. (2010). Introduction: From persistent problems to system innovations and transitions. In: J. Grin, J. Rotmans, & J. Schot (Eds.), (in collaboration with Loorbach, D. and Geels, F.), *Transitions to sustainable development: New directions in the study of long term structural change* (pp.1-8). New York: Routledge.

Hodson, M., & Marvin, S. (2009). Cities mediating technological transitions: Understanding visions, intermediation and consequences. *Technology Analysis and Strategic Management, 21*(4), 515-534.

Hodson, M., & Marvin, S. (2010). Can cities shape socio-technical transitions and how would we know if they were? *Research Policy, 39* (4), 477–485.

Holm, J., Søndergård, B., & Stauning, I. (2015). The role of local governments in climate transition in housing and construction. In J. Holm, B. Søndergaard, I. Stauning, & J. O. Jensen (Eds.), *Sustainable transition of housing and construction* (pp. 283-326). Copenhagen: Frydenlund Academic.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy, 35*(5), 715-728.

Jensen, J. O., Gram-Hanssen, K., & Friis, F. (2016). Local initiatives for motivating Danish house-owners for energy improvements. In Sustainable Built Environment Conference 2016 in Hamburg: Strategies, Stakeholders, Success factors, 7th - 11th March 2016 ; Conference Proceedings (1 ed., pp. 826-835). Hamburg: ZEBAU, Hamburg.

Kivimaa, P. (2014). Government-affiliated intermediary organisations as actors in system-level transitions. *Research Policy, 43* (8), 1370-1380.

Kivimaa, P., Boon, W., Hyysalo, S., & Klerkx, L. (2017). *Toward a typology of intermediaries in transitions: A systematic review*. SPRU Working Paper Series (SWPS), 2017-17: 1-27.

Loorbach, D. (2007). *Transition management: New mode of governance for sustainable development*. Utrecht: International Books.

Loorbach, D., & Shiroyama, H. (2016). The challenge of sustainable urban development and transforming cities. In: D. Loorbach, J. Wittmayer, H. Shiroyama, J. Fujino, S. Mizuguchi (Eds.), *Governance of urban sustainability transitions: Theory and practice of urban sustainability transitions* (pp.3-12). Tokyo: Springer.

Madsen, S., H., J. (2016). C*hanging energy supply through urban sustainability experiments: A comparative case study of Sonderborg and Copenhagen, Denmark* (master's thesis). Lunds Universitet, Lund, Sweden.

Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy, 41*, 955–967.

Marvin, S. and Medd, W. (2004) Sustainable infrastructures by proxy? Intermediation beyond the production-consumption nexus. In D. Southerton, H. Chappels & B. van Vliet (Eds.), *Sustainable consumption: The implications of changing infrastructures of provision* (pp. 81-94). Cheltenham: Edward Elgar.

Medd, W., & Marvin, S. (2008). Making water work: Intermediating between regional strategy and local practice. *Environment and Planning D, 26*, 280–299.

Moss, T. (2009). Intermediaries and the governance of sociotechnical networks in transition. *Environment and Planning A, 41*, 1480-1495.

Moss, T. (2010). Intermediaries and the governance of urban infrastructures in transition. In S. Guy, S. Marvin, W. Medd, & T. Moss (Eds.), *Shaping urban infrastructures: Intermediaries and the governance of socio-technical networks* (pp. 17-34). London:

Routledge.

Moss, T., Guy, S., Marvin, S., & Medd, W. (2010). Intermediaries and the reconfiguration of urban infrastructures: An introduction. In S. Guy, S. Marvin, W. Medd, & T. Moss (Eds.), *Shaping urban infrastructures: Intermediaries and the governance of socio-technical networks* (pp. 1-14). London: Routledge.

Opdenakker, Raymond. (2006). Advantages and disadvantages of four interview techniques. *Forum Qualitative Social Research, 7*(4), Art. 11.

ProjectZero. (2009a). *Master Plan 2029*. Sonderborg, Denmark: ProjectZero.

ProjectZero. (2009b). *Roadmap 2015*. Sonderborg, Denmark: ProjectZero.

ProjectZero. (2013). Forretnings- og klimatopmøde den 18. april i Sønderborg. *brightgreenbusiness.com*. Retrieved fromhttp://www.projectzero.dk/da-DK/Artikler/2013/April/Forretnings--og-klimatopm%C3%B8de-den-18--april-i-S%C3%B8nderborg.aspx

ProjectZero. (2014a). *Roadmap 2020*. Sonderborg, Denmark: ProjectZero.

ProjectZero. (2014b). ZEROhome program: A holistic approach to energy retrofit. *brightgreenbusiness.com*. Retrieved from http://brightgreenbusiness.com/en-GB/Citizen-Participation/ZEROhome-program-2.aspx

ProjectZero. (2015). *Overall development in energy consumption and CO2 emission in the Sonderborg area in the period 2007 – 2015*. Sonderborg, Denmark: ProjectZero.

ProjectZero. (2017). Sønderborgs CO2-udledning falder fortsat. brightgreenbusiness.com. Retrieved from http://www.projectzero.dk/da-DK/Artikler/2017/Juli/S%C3%B8nderborgs-CO2-udledning-falder-fortsat.aspx

ProjectZero. (2018). Roadmap2025-processen igangsat. *brightgreenbusiness.com*. Retrieved from http://www.projectzero.dk/da-DK/Artikler/2018/Maj/Roadmap2025-processen-igangsat.aspx

ProjectZero. n.d. About ProjectZero. *brightgreenbusiness.com*. Retrieved from http://brightgreenbusiness.com/en-GB/TopPages/About-ProjectZero-2.aspx

ProjectZero. n.d. Peter Rathje. *brightgreenbusiness.com*. Retrieved from http://brightgreenbusiness.com/en-GB/TopPages/Om-ProjectZero/Medarbejdere/Peter-Rathje-2.aspx

Roorda, C., Wittmayer, J., Henneman, P, Steenbergen, F. van, Frantzeskaki, N., & Loorbach, D. (2014). *Transition management in the urban context: Guidance manual*. DRIFT, Erasmus University Rotterdam, Rotterdam.

Rotmans, J., & Loorbach, D. (2010). Towards a Better Understanding of Transitions and Their Governance: A Systemic and Reflexive Approach. In: J. Grin, J. Rotmans, & J. Schot (Eds.), (in collaboration with D. Loorbach, and F. Geels), *Transitions to sustainable development: New directions in the study of long term structural change* (pp.105-221). New York: Routledge.

Smith, A., Stirling, A. & Berkhout, F. (2005). The Governance Of Sustainable Socio-Technical Transitions. *Research Policy, 34*, 1491-1510.

Sønnichsen, Ole. (2007). *Visionspapir: Project Zero, Sønderborg som det første bæredygtige og CO2 neutrale område i Europa*. Sonderborg.

Sullivan J. R. (2012). Skype: An appropriate method of data collection for qualitative interviews? *The Hilltop Review, 6* (1), Art. 10.

The Danish Confederation of Trade Unions. (2014). *More green jobs: An inspiration catalogue on green transition and more jobs through employee participation and local cooperation* (LO-item number: 3239). Copenhagen, Denmark: The Danish Confederation of Trade Unions.

Thomas, E., Balestrin, A., & Howells, J. (2013). The role of intermediaries in collaborative innovation projects. In: XXXVII Encontro da ANPAD - EnANPAD, 2013, Rio de Janeiro. Anais do XXXVII Encontro da ANPAD - EnANPAD.

Tjørring, L., & Gausset, Q. (2015) Energy renovation models in private households in Denmark. In J. Hoff & Q. Gausset (Eds.), *Community governance and citizen driven initiatives in climate change mitigation* (pp. 89-106). London: Routledge.

Turnheim, B., Berkhout, F., Geels, F., Hof, A., McMeekin, A., Nykvist, B. & van Vuuren, D. (2015). Evaluating sustainability transitions pathways: Bridging analytical approaches to address governance challenges. *Global Environmental Change, 35*, 239-253.

van den Bosch, S. (2010). *Transition experiments: Exploring societal changes towards sustainability*. PhD Dissertation, University of Rotterdam.

van Lente, H., Hekkert, M., Smits, R. & van Waveren, B. (2003). Roles of systemic intermediaries in transition processes. *International Journal of Innovation Management, 7*, 247–279.

Wittmayer, J. M., & Loorbach, D. (2016). Governing Transitions in Cities: Fostering

Alternative Ideas, Practices, and Social Relations Through Transition Management. In: D. Loorbach, J. Wittmayer, H. Shiroyama, J. Fujino, S. Mizuguchi (Eds.), *Governance of urban sustainability transitions: Theory and practice of urban sustainability transitions* (pp.13-32). Tokyo: Springer.