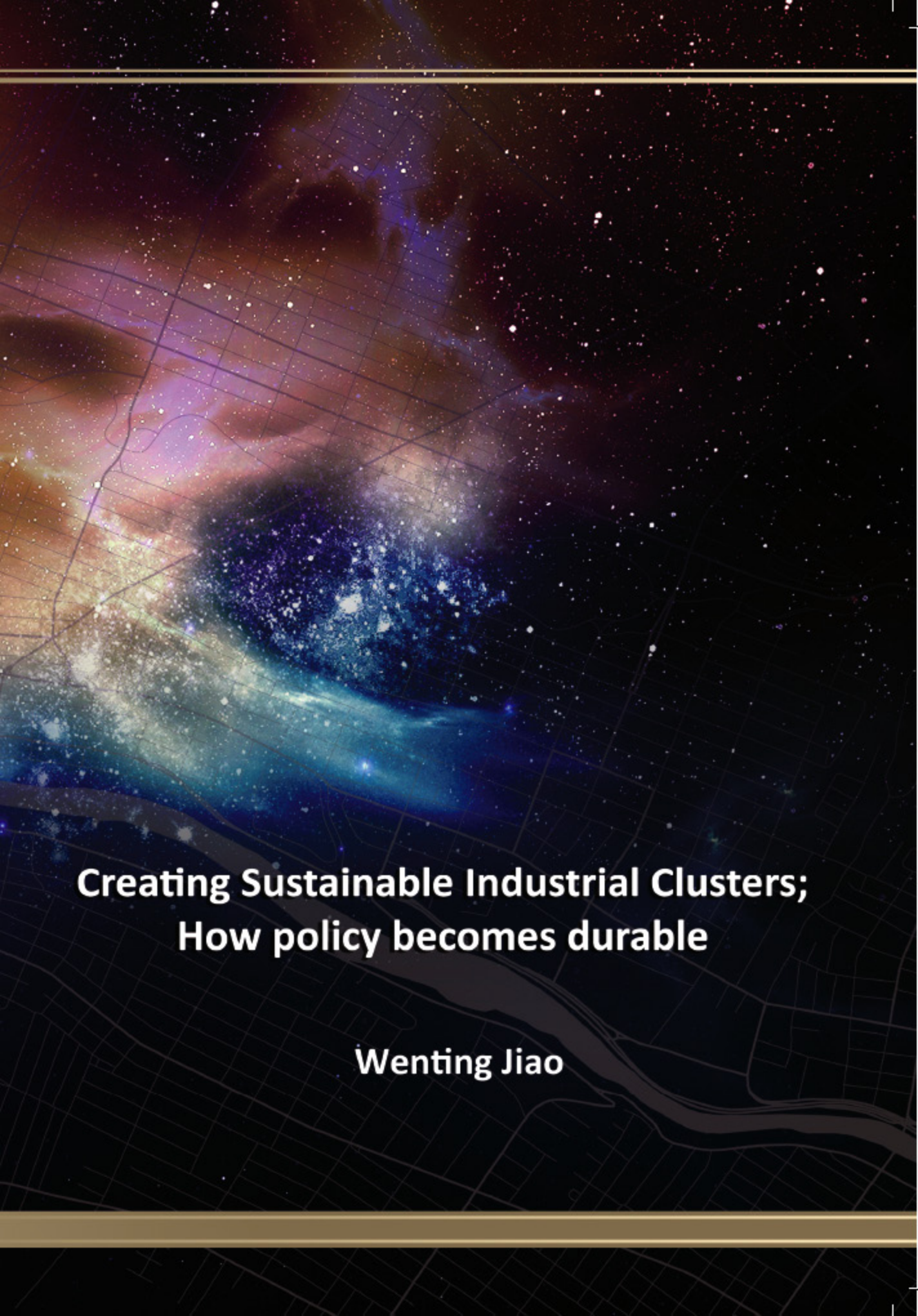

Creating Sustainable Industrial Clusters; How policy becomes durable

Wenting Jiao

Creating Sustainable Industrial Clusters

How policy becomes durable

Wenting Jiao

Cover Design: Deping Xie

Print: Optima Grafische Communicatie, Rotterdam, The Netherlands

Creating Sustainable Industrial Clusters

How policy becomes durable

Bestendig beleid:
Over het creëren van duurzame industriële clusters

Thesis

to obtain the degree of Doctor from the

Erasmus University Rotterdam

by command of the rector magnificus

Prof. dr. H.A.P. Pols

and in accordance with the decision of the Doctorate Board.

The public defense shall be held on

Thursday, the 27th of October 2016 at 13:30 hours

by

Wenting Jiao
born in Jiexiu, China

Erasmus University Rotterdam

DOCTORAL COMMITTEE

Promoters:	Prof.dr.ing. G.R.Teisman
	Prof.dr. F.A.A.Boons
Other members:	Prof.dr. J.F.M.Koppenjan
	Prof.dr. M.P.van Dijk
	Dr. H.Baumann

Table of Contents

CHAPTER 1

INTRODUCTION

1.1 INDUSTRIAL SYMBIOSIS AND SUSTAINABLE INDUSTRIAL CLUSTERS

The pursuit of a globally shared goal Sustainable Development (Ehrenfeld 2007) witnesses the disappointments of serious environmental deterioration, resource scarcity, and climate change. Meanwhile, it also expresses hopes for doing better in the future. On the path toward Sustainable Development, industrial ecology emerges (Allenby, 1999). Industrial ecology aims to facilitate the (re)development of industrial systems to be environmental friendly through mimicking the principles of ecological systems (Korhonen, 2004). Studies of industrial ecology cope with "the flows of materials and energy in industrial and consumer activities, of the effects of these flows on the environment, and of the influences of economic, political, regulatory, and social factors on the flow, use and transformation of resources (White 1994)". With the uncovering of exchanges of by-products and wastes between industries in Kalundborg, Denmark (Ehrenfeld and Gertler, 1997; Jacobsen & Anderberg, 2004), industrial symbiosis becomes a dominant idea of industrial ecology (Deutz and Ioppolo, 2015). Industrial symbiosis is about the mutual beneficial relations between industries through exchanges of by-products and waste, and utility sharing in a regional industrial system (Chertow, 2007). Regional industrial clusters are major fields of the application of industrial symbiosis, developing toward Sustainable Industrial Clusters (SIC). The iconic example of Kalundborg has triggered abundant policy actions worldwide to facilitate SIC, which has become a highly relevant policy topic (Dutze and Ioppolo, 2015). Table 1.1 is a brief summary of policy programs worldwide. Some of them set explicit aims of facilitating SIC and some take industrial symbiosis as an approach to solve environmental issues of industrial parks. These policies present diverse titles and practices but to a certain extent share common goals of (re)developing industrial clusters toward SICs. We adopt SIC as a general notion that subsumes the diverse policy practices.

1.2 POLICY FACILITATION AND POLICY DURABILITY OF SIC

The flourishing of SIC practices and policies has generated considerable scientific discussion (Chertow and Park, 2015). Some scholars seek to develop insight into SIC as a generic phenomenon. They assessed environmental or economic outcomes (e.g. Chertow and Lombardi 2005; Van Berkel et al. 2009;

Jacobsen 2006; Martin et al., 1996), analyzed factors and social mechanisms of SIC (e.g., Mirata, 2004; Boons and Howard-Grenville, 2009; Boons and Spekkink, 2012; Domenech and Davies,2011) and proposed typologies of stimulating industrial symbiosis/SIC development (e.g., Chertow, 2007; Costa and Ferrao, 2001; Gibbs and Deutz, 2007; Baas, 2011; Boons et al., in press). Some scholars seek to understand the variety of practices that are subsumed under the labels of SIC. In these studies, SIC is considered as a concept that can be adopted by policymakers and firms, and the analysis focuses on how the concept is adapted, disseminated, and transmitted among actors (e.g. Boons et al., 2011; Shi et al. 2012; Howard-Grenville, 2008; Boons et al., 2000; Cooke,2010).

In these studies, policy facilitation of SIC has become a salient research topic. Scholars have studied the role that policy plays and should play in facilitating SICs (e.g., Chertow 2007; Gibbs and Deutz, 2007; Elabras Veiga and Magrini 2009; Costa et al., 2010). In these studies, policy is often placed amongst many other factors, and there are few studies on the policy dynamics that underlie the development of SIC, partly leading to unclear understanding of the effects and mechanisms of policy facilitation. Moreover, a diversity of SIC policies can be observed (Table 1.1). The diversity is also observed in the policy implementation, varying from interactive approaches (Heeres et al. 2004), to voluntarism (Shi et al., 2012), to soft or binding laws (e.g. Circular Economy Promotion Law), and in the aspect of longitudinal scope and depth of implementation, changing from short-term rhetorical and symbolic adoption of SIC to long-term intensive policy changes and institutionalization. A comparative study of the diversity in implementation and its effect on the development of SICs greatly lacks, which, however, is crucial for the understanding of policy facilitation of SIC. Scholars argue that more efforts should be devoted to the dynamics of policy facilitation and intervention on the development of SICs (Boons et al., 2011). The thesis aims to contribute to this theme by concentrating on **the issue of policy durability**, which is an important dimension of policy implementation and policy facilitation of SICs.

Policy durability refers to the capacity of public policies to maintain stability, coherence, and integrity as time passes (Patashnik, 2003). Its significance for the success of most public policies has already been invoked (Patashnik, 2008), and its significance for the policy issues that can only be solved in the long run

Table 1.1 Examples of national-level policy programs worldwide

Policy Program	Short Description
US: Sustainable America - Eco-industrial Park	The President's Council on Sustainable Development issued the report of *Sustainable America: A New Consensus for Prosperity, Opportunity and a Healthy Environment for the Future* in 1996, where EIP was defined and the taskforce on EIPs was formed.
UK: National Industrial Symbiosis Program (NISP)	NISP was launched in 2003. The program aims to facilitate uniformity in the programs' development, and stimulate communication and interaction among regions.
Netherlands:Sustainable Industrial Parks	The program was implemented from 1999 to 2003 with the aim of stimulating the development of SIC through exploring the possibilities of cooperation between firms, and between firms and involved governments.
Sweden:Ecocycle Strategy Plan	In 1993, Swedish Government appointed the Ecocycle Commission to develop a strategy for a closed-loop system of products. One of the aims was to reclaim and recycle waste products.
Germany :Act of Closed Substance Cycle and Waste Management	The Act was issued in 1996. It focuses on recycling.
Finland :The National Waste Plan for 2016-Towards a Recycling Society	The plan sets objectives of waste management and prevention of waste generation for 2016. Industrial symbiosis is suggested as an important way to utilize by-products and waste.
Portugal :The environmental Framework Act(EFA); the National Waste Management Plan(NWMP)	In EFA(1987), the article 24 mentioned reuse/recycling of waste as raw materials and energy. NWMP (2011-2020) identified industrial symbiosis as a key strategy.
China :National Pilot EIP program(NPEIPP); National Pilot Circular Economy Zone Program(NPCEZP); Circular Economy Promotion Law	In 1999, State Environmental Protection Administration initiated NPEIPP and NPCEZP; In 2005, National Development and Reform Commission, in cooperation with several ministries issued a series of policy documents to facilitate the development Circular Economy. In 2009, Circular Economy Promotion Law was started to be enforced.
Japan :Eco-Town Program	The program was initiated in 1997. It integrated industrial symbiosis and urban symbiosis.
South Korea :National Plan for Eco-Industrial Park	The program was launched with three-stage objectives.
Thailand :Eco-Industrial Estates Development (EIED)	In 2000 Industrial Estate Authority of Thailand initiated EIED. German technical development corporation supported it.
Philippines :National Development Plan for the 21st Century(PNDP); Private Sector's Participation in Managing the Environment (PRIME)	PNDP adopted the principles of industrial ecology to guide the development of Philippine from 1999-2025. PRIME aimed to strengthen the participation of private sector in reducing environmental footprint of industries. One of the modules was about cleaner production and waste minimization through the adoption of industrial ecology principle.

(e.g. climate change, low carbon economy, and SIC) has been stressed (National Research Council, 2010; Lockwood, 2013). With regard to SIC, the novel aspect of SIC, i.e. establishing industrial symbiotic network through cooperation of industries, requires substantive changes of industries, which may encounter the

resistance from stakeholders (Ram, 1987; Klein and Sorra, 1996). Therefore, policies need to be active for an extended period, creating a long-term and stable governmental commitment on facilitating SIC. Such long-term commitment is important for convincing industries to make (continuous) investment of time, energies, and resources (Liang and Fiorino, 2013). Furthermore, SIC is a long-term process of transiting industrial parks toward sustainable ones (Boons et al., 2014) and the synergy between environment and economy can only be achieved in a long run. In this long-term process, there are possible tensions between short-term profits and long-term policy effects (Korhonen, 2004; Gibbs & Deutz, 2005). Low or absent short-term profits can lead to detachment of firms and further undermine previous policy outcomes.

The central assumption in this study, therefore, is that the policy durability is an important condition for effective policy facilitation of SICs. However, it has not been addressed in existing SIC studies. The central topic of this study is policy durability of SIC. In Public Administration and Policy Sciences, valuable insights into policy durability have been obtained, and meanwhile, some research gaps will be identified. This study aims to contribute to the knowledge of policy durability in general.

1.3 STUDIES OF POLICY DURABILITY AND RESEARCH GAPS

Existing studies of policy durability demonstrate that the policies formation alone does not generate policy success. The policy implementation faces various undermining forces (Patashnik, 2003). Policy durability cannot be taken for granted. It requires elaboration. Most studies of policy durability build on the assumption that policy durability is an important condition for policy success (Brinkerhof, 1996; Patashnik, 2003); however, the effect of durable policy on the targeting groups has not been empirically assessed. Studies strive to identify the factors enhancing or undermining durable policy, such as political factors, policy design, and environmental factors (e.g. Patashnik, 2008; Lockwood, 2013; Berry et al., 2010; Haselswerdt, 2014). These studies conceptualize and approach policies as “configuration of variables” (Howlett and Rayner, 2006), which are disembedded from the context and time.

It is argued that the identification of policy durability is difficult, because the policy undergoes various modifications and transformations over time, such as

renaming, consolidation or splits (Bosworth and Weaver, 2011; Cox, 2006) and the degrees of changes or modification can be quite different (Durlak and DuPre, 2008). In this situation, scholars may arrive at different or even controversial conclusions. For instance, Circular Economy policy in China underwent radical changes between 2004 and 2005. Although the label of Circular Economy survived, the coordinating body and key policy ideas changed, and the newly initiated programs replaced the previous implementation program. Regarding those changes, scholars may express different opinions. So a nuanced judgment of policy durability is required to manifest the various degrees of stability/changes of policy.

Three knowledge gaps with respect to policy durability can be identified: 1) a lack of nuanced judgment of policy durability, and 2) the ignorance of actual effects of durable policy on the targeting groups, and 3) the under-studied process dynamics of policy durability. To address these gaps, this study reveals the dynamics underlying policy durability and the effects of durable policy on the development of SICs, based on a nuanced identification of policy durability. I seek to accomplish this goal by studying policy as a translation process.

1.4 THEORETICAL FRAMEWORK

1.4.1 Policy Translation and Patterns

Some studies concentrate on how the SIC concept is adopted by policy actors and industries, and focus on how it is diffused, transmitted, and adapted across space and time. Translation is a powerful perspective to study the “traveling” (Czarniawska and Hernes 2005) of entities, such as concepts, knowledge, orders, practices, innovations, technologies, and other artifacts. Translation is a concept introduced and developed in Science and Technology Studies by Callon, Latour, and Law. It emphasizes that the transmission of entities is not a linear process of adoption, but is a nonlinear, iterate, and complex process with active reinterpretations and reactions of actors to fit actors’ preferences and tasks and local contexts (Latour, 1986). So the entities-in-movement often hardly resemble the initial ones (Fadeeva 2004; Mol, 2010; Pel et al. 2012). The significance of studying policy as a translation process has already been invoked by scholars, and the policy translation perspective has already been conceptually and empirically investigated (e.g. Gorur, 2011; Freeman, 2009; Koyama, 2011; White

and Richards, 2007; Johnson & Hagstrom, 2005; Mukhtarov, 2012).

Czarniawska and Joerges (1996) illustrated a phase model of local and trans-local processes of translation, through which a certain concept is selected as a solution to the defined problems, and then relevant ideas are objectified and materialized by human actors (Czarniawska and Joerges, 1996, p41). Some locally objectified ideas can be transformed beyond local boundaries and go through trans-local process, during which the idea dis-embeds from their local context and re-embeds within a new context (Czarniawska and Joerges 1996, p 26). With regard to policies, *policy translation process is defined as a sequence of policy events, during which policy ideas are generated, eventually objectified and materialized into linguistic and material objects. These objects and changes of contexts can further inspire new ideas and may lead to policy adjustment. As a result, policy evolves over time*. In this translation process, we do not clearly distinguish the different stages of policy, such as agenda setting, policy formulation, policy implementation, and policy evaluation, but take them as a sequence of dynamically intertwined policy events.

Although the translation process is complex, dynamic, contextual, and nonlinear (Gorur, 2011), we still aim for a certain level of generalization about these processes. So, to create the possibility of comparing the translation processes between cases and between different periods within a case (Haydu, 1997), we need to grip the patterns of the translation process. The various patterns imply different equilibriums of the translation process, and the equilibriums can change along with the unfolding of the translation process (Callon, 1986). It means that a specific pattern can be followed by another. The chain of different patterns constitutes successive phases of a longitudinal policy translation process. Moreover, in many cases, two or multiple policy translation processes are interacting, intertwining, and co-evolving over time. The interacting policy translation processes become the environment for each other, and the changes of one process can trigger the responses of the other. The co-evolution of policy processes has greatly increased the complexity of public policies (Pel, 2012) and requires further investigation (Geels, 2005).

1.4.2 Assemblage and toward a Typology of Policy Durability

As argued, a nuanced identification of policy durability is needed in order to

map the various degrees of changes of policy over time, which can be referred to as different types of policy durability. The changes can be the results of adaptation to the changes of environment. For policy durability, both stability and adaptability are important characteristics. Stability is required, because stable policy objectives, resource, and evaluation criteria are important for continuously interesting, enrolling, and maintaining clienteles, and for setting long term targets and building stable relationships between policy actors and practitioners (Provan and Kenis, 2007; Liang and Fiorino, 2013). Adaptability is also required, because policy goals and means should be actively and timely adjusted to create better fitness with the ever changing contexts (Gilsing, 2007; Provan and Kenis, 2007; Ardanaz et al. 2010). The importance of both stability and adaptability have been recognized (Scartascini&Tommasi, 2008), but the continuous tensions between the need for stability and the need for adaptability in order to fit with changes of contexts and to achieve effective policy outcomes need further elaboration. To refine these tensions in a longitudinal dimension the following two points need to be coped with.

1) Accommodating the evolving configurations of stable and adaptable policy components to map the various types of policy durability. Mapping the different types of policy durability requires the theories that can accommodate the policy components with differentiated stabilities. In Actor-Network Theory, translation is taken as the key mechanism for the gradual building up of the social and natural world (Callon, 1986). Actor-Network Theory emerged in the early 1980s. It takes the translation a step further from the micro process of re-interpretation and sense-making to the macro process of establishing assemblage (Boons and Strannegard, 2000). Actor-Network Theory encourages scholars to trace the detailed process of how heterogeneous entities, including human and non-human actors, gradually assemble, and how the relations between these entities are bolstered or dissolved (Latour, 2005). With regard to policy process, it means that, along with the unfolding of policy events, heterogonous policy components, such as central ideas, types of people, certain techniques, and resources, progressively mobilize, juxtapose, hold together and establish a temporally stable policy assemblage (Law, 1992; Gorur, 2011; Mol, 2011; DeLanda, 2006). The evolving policy assemblage can depict the diverse types of policy durability.

2) The translation patterns are typical ways of how policy assemblage emerges and evolves. The translation process with a certain pattern is typical ways of how policy assemblage emerges and evolves. Specifically, the dynamics of assembling heterogeneous policy components corresponding to each translation pattern are different, and thus different types of policy durability can be expected to emerge. We argue that policy durability is not the final product of a process, but is an ongoing effect of an active translation process. To understand the policy dynamics underlying policy durability, we need to focus on the relations between translation patterns and types of policy durability, and more importantly, between the successive translation patterns and sequential blends of different types of policy durability, in a longitudinal fashion.

1.4.3 The Policy Outcomes of Diffusion of SICs

The assumption of this study is that policy durability is an important explanation for effective policy outcomes. We will argue that the various types of policy durability can lead to different policy outcomes. The diverse types of policy durability manifest different qualities of policy process and they can fit or misfit with specific policy contexts of time and place. With policy contexts, we define it as a set of processes and structures of politics, economy, and society. The contexts shape the manners of policy making and implementation (Collins et al., 1999). For instance, when policy contexts change critically, adaptability is important characteristics for effective outcomes, because inert and stable policy contents and actions can increase the unfitness with the context, which is unlikely to bring about effective outcomes (Nissen, 2009; Scartascini et al., 2008). To gain in-depth understanding of policy durability as an important condition for effective policy facilitation of SICs, we need to know more about the relations between different types of policy durability and policy outcomes, and policy contexts. For the policy outcomes we are interested in the *diffusion of SICs, referring to the industrial parks within regional populations that adopt the policy concept of SIC*. The diffusion patterns can be depicted by numbers, continuity, diversity, spatial locations, and types of diffusion. It should be noted that we do not investigate the "qualities" of diffusion, because of the limitations of time and resources. We argue in this study that translation is adopted as an alternative perspective to "diffusion". However, the policy outcomes here are mainly about "quantities" of diffusion, without in-depth investigation of the

"qualities" of implementing the policy ideas in industrial parks. Therefore, we adopt the term of diffusion to refer to policy outcomes. This does not mean that we deny the translations occurring in implementing policy ideas in industrial parks. In addition, the term of diffusion can also help us distinguish the policy outcomes from the policy translation process.

The main concepts and their relations in this study are summarized in Fig.1.1.

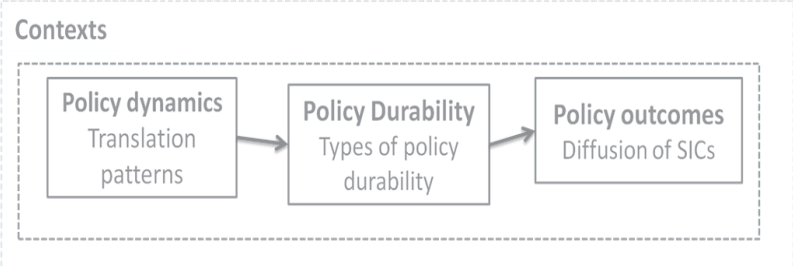

Fig. 1.1 Key concepts and relations

1.5 RESEARCH QUESTIONS

The central research question is:

How does policy become durable that effectively facilitate the development of SICs?

This question can be divided into a set of sub-questions.

> ***Q1:*** *What has been achieved and what are the research gaps in existing studies of policy facilitation of SIC? Moreover, how is policy durability addressed in these studies?*
> ***Q2:*** *What are the characteristics of different types of policy durability of SIC in terms of evolving tensions between policy stability and policy adaptability?*
> ***Q3:*** *What are the sequential patterns and co-evolution characteristics of the translation processes, and how and in what contexts do these two aspects bring about the evolving paths of policy durability of SIC?*
> ***Q4:*** *What are the effects of the evolving paths of types of policy durability on the diffusion of SIC, and in what contexts?*

Table 1.2 provides an overview of how these questions are addressed in the following chapters.

Table 1.2 Research Questions and Empirical Studies

Chapter	Research Questions				Empirical Cases
	Q1	Q2	Q3	Q4	
2	X				
3	X	X	X		*Eco-industrial Park policy in China*
4			X	X	*Circular Economy Policy in China*
5			X	X	*Co-evolution of Eco-industrial Park policy and Circular Economy policy in China*
6		X	X	X	*Sustainable Industrial Park policy in the province of South Holland, the Netherlands*
7		X	X	X	*Comparison: China and South Holland*

1.6 RESEARCH RELEVANCE

The thesis is theoretically and methodologically relevant for scholars working on policy dynamics. It is argued that studying policy as a long term dynamic process can raise new research questions and discover new social phenomenon, thus significantly benefiting policy sciences (Rose, 1976; Hill, 2005; Parsons, 1995, pp. 79-81; Pierson, 2005;Haydu, 1997; Howlett, 2009). Nevertheless, the intellectual underpinning of policy dynamics is still unclear (Kay, 2006, p4). Although many studies have adopted processual conceptualizations of policy, the conceptualizations have not been supported well by dedicated process-oriented approaches (Kay, 2006). This study conceptualizes policy as a sequence of translations and applies the approach of Event Sequence Analysis (ESA). ESA is a process-oriented approach underlined by the argument that the process-pattern of policy matters (Kay, 2006). ESA, which is introduced and developed in the studies of industrial symbiosis by Boons et al., (2014) and Spekkink (2013; 2014), is an approach of organizing and making sense of process data and enables us to study policy as a sequence of policy events unfolding over time and further to derive theoretical meanings through identifying patterns of the sequence.

This study is also informative for researchers who are interested in disseminations and transmissions of policy concepts or practices over time and space. As mentioned above, translation is a powerful alternative perspective to policy transfer and policy diffusion. There is growing interest to untangle “soft” transfer and policy complexity (Gorur, 2011; Freeman, 2009), and the translation perspective can add to this kind of interest in the following aspects. First, as noted in the iconic study of policy implementation, Pressman and Wildavsky (1984) argued that the policy contents undergo revisions during the

policy implementation, even if each actor is allowed to amend the policy slightly. The reshaping of policy contents have been emphasized in the translation perspective. The translation captures the fact that a policy concept can be interpreted and implemented in many different ways by heterogonous policy actors, and all actors affect the policy outcomes. Second, governmental actors often intend to change targeting groups through policies. In a long term process, there are interactions between the policy actors and the targeting groups, and they can (re)shape each other. In some cases, the targeting groups are physical systems (e.g. Gerrits, 2011) and then it is difficult to explain these evolving interactions. Through treating non-human actor equally with human actors, the translation perspective provides a new analytical framework for the study of the role played by non-human actors (e.g. Callon,1986).

The starting point of this study is to improve the understanding of policy facilitation of SIC. It is highly relevant for scholars and policy makers who devote time and energy to SIC policies. Policy facilitation of SIC is a fashionable policy practice and also a salient research topic. In extant studies, there is a gap between SIC literature and policy sciences in conceptualizing and approaching the term of policy. This thesis as a concentrated study of policy dynamics of SIC aims to bridge this gap. It can bring new insights about policies into the SIC studies, and also brings a new element, i.e. policy durability, for effective policy facilitations of SICs. The results and policy recommendations in this study will be helpful for policy actors in making and implementing SIC policies and other sustainability related policies. The insights into policy durability are also useful for policy makers.

1.7 STRUCTURE OF THE THESIS

The study includes two longitudinal cases: the SIC policies in China and in the province of South Holland, the Netherlands. The SIC policies were initiated in the late 1990s and have been actively effectuated for more than one decade in both cases. The Chinese case was about national policy programs in facilitating SICs. In these programs, industrial parks were selected as pilots or demonstrating examples. So the national level was the “interface” between dynamic policy process and diffusion of SICs. In the Netherlands, the SIC Program at the national level was sustained merely for four years, so it was not a ‘positive’ case for understanding the dynamics underlying policy durability.

However, embedding in this inactive national policy actions, we observed continuous policy actions to facilitate SICs in the province of South Holland. Similarly, in these programs, industrial parks or projects are selected and subsidized as pilots or demonstrating examples. So the province is the "interface" between dynamic policy process and diffusion of SICs. Through comparing the similarities and differences of the two cases, both of which are the "interfaces" between dynamic policy process and diffusion of SICs, we can reveal the policy dynamics underlying policy durability in different governmental levels, and more importantly, gain in-depth understanding about the causes and effects of these differences toward more general understanding of policy durability. The system boundaries of the cases are the policy decisions and actions aiming at intervening the (re)development of SIC, and the temporal boundaries begin from the initiation of first SIC policy program until their most recent development.

Chapters and academic articles constitute the thesis. Chapter 1 presents an overview of the research questions and a brief introduction of the theory of policy translation. It should be noted that the theory is not fully introduced in one specific chapter, but is gradually built up across chapters. It means that each chapter is built on the theory of previous chapters with the addition of new conceptual elements. Likewise, the empirical study in each chapter copes with different parts of the conceptual framework. To reduce the overlaps between chapters, when describing the theory that has been developed in previous chapters, we refer back to these previous chapters directly in new chapters.

Chapter 2 is a comprehensive literature review of the studies of policy in industrial ecology. It is published as an academic article. In this chapter, we attempt at identifying and bridging the gaps between industrial ecology literature and policy sciences/public administration in conceptualizing and approaching policy. It concludes with a research agenda toward the dynamics of policy facilitation and intervention on the development of SICs. ***Chapter 3*** zooms in on policy facilitation of SIC and concentrates on the topic of policy durability. This chapter is the first step of building up the theory. Through addressing the limitations of the studies of policy durability and policy implementation, the chapter centers on developing typical translation patterns and their relationships with policy durability, which are illustrated by the case

study of Eco-industrial Park policy in China. ***Chapter 4*** is a connection between chapter 3 and 5. Similar to Chapter 3, this chapter concentrates on the relations between policy translation patterns and policy durability, which is empirically investigated through the case of Circular Economy policy in China. This chapter further introduces the element of policy outcome of diffusion of SIC, which is taken as a strategy of creating durability, and as intended policy outcomes. The chapter concludes with a call for exploring the co-evolutionary effects of the policies of Circular Economy and Eco-industrial Parks on the diffusion of SIC in China. So in ***Chapter 5***, the co-evolutionary dynamics are incorporated into the theoretical framework. It allows me to study the interactions of multiple policy processes. I investigate the co-evolution of policy translation processes of Circular Economy and EIPs, and their effects on the overall diffusion patterns of SICs in China. ***Chapter 6*** is also an important chapter in building up the theory. In this chapter, four types of policy durability and their relations with policy outcomes of diffusion are conceptually developed. We investigate these relations through the case of SIC policy in South Holland. The four chapters (Chapter 3-6) are the core of this study, across which the theory is gradually built up. Chapter 4 has been published in an international peer-reviewed journal and we also intend to develop the other three chapters into journal articles.

Chapter 7 presents a systemic comparison of the cases of China and South Holland and identifies their similarities and differences in the aspects of translation patterns, types of policy durability, and diffusion of SICs. Through synthesizing all the chapters above, ***Chapter 8*** presents the answers to all the research questions and aims to gain in-depth understanding about policy durability. Future research agenda is proposed and policy implications are derived toward effective policy facilitation of global and durable “traveling” of sustainability related policy concepts. The chapter ends with insights into interdisciplinary studies.

CHAPTER 2

LITERATURE REVIEW

The Studies of Policy in Industrial Symbiosis Literature

This chapter is published as an article: Jiao, W. and Boons, F. A.A, 2014. T*oward a research agenda for policy intervention and facilitation to enhance industrial symbiosis based on a comprehensive literature review*. Journal of Cleaner Production.67:14-25.

Author Contributions. Jiao, W. collected the literature. Jiao, W. classified the literature, performed the analysis, and wrote the article under the supervision of Boons, F.A.A.. Boons, F.A.A. worked on the future research agenda and performed English editing.

Abstract: The normative question "what role should governmental policy play to facilitate the development of industrial symbiosis?" has received considerable attention of researchers. However, for several reasons the effects of governmental policy actions on industrial symbiosis are still unclear. This chapter proposes a research agenda to clarify the mechanisms of policy intervention and facilitation of industrial symbiosis based on a comprehensive review of industrial symbiosis literature, focusing on how policy is conceptualized and studied. The results show that existing research lacks an explicit definition of policy, and employs a static conceptualization of policy that is reinforced by comparative statics research methods. We argue that a dynamic process perspective is crucial to reveal the actual mechanisms through which policy intervention and facilitation affect the evolution of industrial symbiosis. Building on this view, industrial symbiosis research is connected with insights from policy sciences, and the case of policy translation of Circular Economy and Eco-industrial Park in China is investigated in order to illustrate that policy is at heart a dynamic process. We conclude with a research agenda proposing that the key to reveal the mechanisms is to identify the sequence of events connecting policy process and industrial symbiosis practices.

2.1 INTRODUCTION

The interlinked global issues of climate change, environmental deterioration and resource scarcity are at the heart of the field of industrial ecology which has been called the "science of sustainability" (Allenby, 1999, p40). One of the core topics in this field is industrial symbiosis (IS). The generic label of IS covers a variety of practices within countries that involve the linkage of industrial processes in regional industrial systems through by-product exchange and utility sharing. The uncovering of the iconic example of industrial symbiosis in Kalundborg sparked a multitude of actions from governmental officials, firms, NGOs, and researchers. Countries like China, Japan, the United States, and the Netherlands issued governmental policy programs to facilitate and stimulate IS development. Governmental policy here refers to the course of actions of governmental actors to provide intentional guidance to solve the collective issues. In the following sections, the concept of 'policy' is used for short[1], denoting both intervention and facilitation. The attempts to stimulate IS through policies have not gone unnoticed by researchers, who have studied the role policy can and should play in facilitating the practice of IS (e.g., Chertow 2007; Gibbs and Deutz, 2007; Costa et al., 2010).

Still, the effects of policy on IS practices are not completely clear, especially regarding the actual mechanisms of policy intervention and facilitation and their relation to the diffusion of IS (Boons et al., 2011). This chapter proposes a research agenda to clarify these mechanisms. Our underpinning of this agenda begins with a comprehensive literature review that shows the way in which 'policy' has been studied and treated in IS research, the understandings that have been achieved, and the shortcomings that we see (Section 2.2.2). Section 2.2.3 then brings in insights from policy sciences to address these shortcomings. In our view, this entails the study of policy as a dynamic process, which is conceptualized in section 2.2.4 using the concept of policy translation. The empirical cases of the development of the concepts of Circular Economy (CE) and Eco-industrial Park (EIP) in China are analyzed to show the added value of viewing policy as a dynamic process. We are then able to provide a research agenda aiming to reveal the mechanisms of policy intervention on IS initiatives.

[1] See Parsons(1995) and Hill (2005) for the distinction of the concepts of 'public', 'private', and ' policy'.

2.2 POLICY RESEARCH IN INDUSTRIAL SYMBIOSIS LITERATURE

2.2.1 Research Methodology of Literature Review

Our literature review aims to reveal the current state of academic insight into the role of policy in IS. We focus on academic insight as our purpose is to develop a scientific research agenda. We built a database extracting published articles from the Web of Science (science and social science database), using the following combinations of search terms: "policy & industrial symbiosis/ eco-industrial park/ EIP", "government & industrial symbiosis/eco-industrial Park/EIP", "governance & industrial symbiosis/ eco-industrial Park/EIP", "regulation & industrial symbiosis / eco-industrial Park/ EIP", "institution & industrial symbiosis/eco-industrial Park/EIP", "law & industrial symbiosis/eco-industrial park/EIP". This produced a total of 118 items. After removing conference papers that were not accessible to us, we scanned abstracts to remove papers irrelevant to the topic of this research, leaving 37 articles. Following the procedure outlined by Seuring and Müller (2008), relevant articles were selected and classified into categories through an iterative process. We arrived at a classification into four categories (see Appendix Table A2.1) based on the main aim and the treatment of policy in the paper. They are respectively: 1) descriptive overview of policy programs; 2) policy as a mechanism for stimulating industrial symbiosis; 3) evaluation of the impacts of policy programs; and 4) Lessons from practice: lessons learnt and policy implications. In the following section, the contents of each category are summarized and analyzed.

2.2.2 Four Categories

We used a further iterative interpretative process to create four categories and ten subcategories according to the policy aspect addressed (Table 2.1).

(1) Descriptive overview of policy programs

The articles classified into this category are aimed at providing insight into policy programs that facilitate IS. Some of these review a specific policy program (subcategory 1.1). Geng et al. (2012) introduce China's national CE indicator system that guides the implementation and evaluation of CE initiatives. They argue that the indicator system should be more comprehensive to cover economic performance, environmental quality, and social development of

sustainable development. They also identify barriers to its implementation: non-standardized data collection, the voluntary character of the indicator system, and the lack of specific goals. Behera et al. (2012) review the Korean EIP Master Plan with a specific focus on the strategies for IS network development in Ulsan. They stress the importance of policy on transforming conventional industrial complexes into EIPs. Van Berkel et al. (2009) review the management strategies of Japan's Eco-Town program, as well as the characteristics and motivations for each Eco-town. They find that recycling-oriented legislation, among many other factors, is crucial to the success of Eco-town program.

Table 2.1 Four categories of policy research addressed in IS literature

Category	Subcategory	Selective Examples
1. descriptive overview of policy programs	1.1 review of a specific policy program	Geng et al. 2012
	1.2 comparison between policy programs	Costa et al. 2010; Zhang et al. 2010
	1.3 evolution of policy programs	Laybourn & Lombardi 2012; Mathews and Tan, 2011
2. policy as a mechanism for stimulating IS	2.1 policy as a success factor or barrier to IS	Gibbs & Deutz, 2005, 2007; Mirata 2004; Van Beers et al. 2007; Liu et al. 2012
	2.2 governance and coordination strategies of specific cases	Brent et al, 2008; Shi et al. 2010;
	2.3 mechanisms underlining and favoring IS	Chertow 2007; Deutz 2009; Costa and Ferrão 2010
3. Evaluation of the impacts of policy	3.1 The development of cases influenced by policy	Lehtoranta et al. 2011; Park et al. 2008
	3.2 Quantitative performance assessment of certain cases influenced by policy	Ver Berkel et al. 2009
4. Lessons from practice: Lessons learnt and policy implications	4.1 implications from case studies	Adamides & Mouzakitis 2009; Kim, 2007
	4.2 implications from quantitative assessment of economic and environmental performance of IS	Chertow & Lombardi 2005; Liu et al. 2012

The second subcategory compares different policy programs (subcategory 1.2). Costa et al. (2010) analyze the waste management policies at supra-national, national, and sub-national levels in Denmark, UK, Portugal and Switzerland. They find that governmental policy can be the enabling context for IS development through setting clear objectives and supporting business

eco-efficient activities, while allowing flexibility for local implementation. Zhang et al. (2010) compare China's two national policy programs regarding EIPs, and find five flaws in the situation that have arisen: (1) the associated governmental agencies of the two programs and their fragmented management strategies create confusion about what an EIP should be; (2) the indicator system used to guide and evaluate EIPs fail to set different requirements because of the large geographical variation of EIPs; (3) a lack of necessary supervision may lead to rhetorical actions in industrial parks; (4) more coherence is needed as some existing policies conflict with EIP construction programs; (5) and unsuccessful planning schemes exist which overemphasize closed loop of materials, rather than the reduction of material and energy consumption. They then argue for a clear division and coordination of agencies in charge, more scientific and operational standards, and investment in research and capacity building. Also, policy instruments such as market-based solutions and public involvement proposed to be adequately adopted.

The third subgroup outlines the evolution of policy programs (subcategory 1.3). Laybourn and Lombardi (2012) summarize the recent progress of European policies regarding IS, and argue that the concept of IS has direct relevance to a broad policy agenda covering eco-efficiency, innovation, green growth, and economic development. But it is currently not connected to them by policymakers. In their investigation of the CE development in China, Geng and Doberstein (2008) find the following barriers to China's 'leapfrog' from environmentally-damaging development to a more sustainable path: fragmented regulation systems, low cost of discharging waste, and a lack of qualified personnel and budget in the enforcement of environmental regulations. Ren (2007) distinguishes core policy and enabling policy in Chinese policy programs to develop a CE and argues that central government is a main driving force to the development of CE. Mathews and Tan (2011) investigate the same topic from an evolutionary perspective. Based on the comparison of cases in China and several worldwide often cited cases (at the EIPs level), they find that the government plays a vital role in the early stage of EIPs development in China.

(2) Policy as a mechanism for stimulating Industrial Symbiosis

The most well-known example of Kalundborg industrial symbiotic network is interpreted to have evolved in a spontaneous (Jacobsen and Anderberg, 2004,

pp.313-315) and self-organizing manner (Chertow, 2007). The uncovering of this example inspired a considerable amount of political initiatives to develop IS through policies. As a result the potential for policy to be a mechanism for stimulating IS became a significant topic for researchers. Articles in this category can be further classified into three subcategories. The first subcategory (2.1) identifies success factors and barriers to the development of IS, and policy is often considered as one of these factors. Gibbs and Deutz (2005) reveal the difficulties and problems of developing EIPs based on cases in the USA, and they argue that it is difficult to build cooperation and trust between firms and further material exchange just by depending on policy intervention. Nevertheless, policy could play an enabling role in helping identify commercial opportunities and creating supportive conditions in order to make the exchange occur. Based on 16 EIPs in the USA and Europe, Gibbs and Deutz (2007) propose that a more fruitful approach to develop EIPs is to build upon existing and potential linkages within a locality, assisted by a pro-active policy to encourage interchanges. Drawing on early experiences of the National IS Program in UK Mirata (2004) identifies determinants and coordination challenges for the development of IS networks. He concludes that the policy framework in the UK has supportive elements to the evolution of IS networks by providing incentives for companies to improve their environmental performance, such as, a policy for increasing resource productivity, and fiscal incentives like the landfill tax and climate change levy. Based on an Italian chemical site, Taddeo et al. (2012) summarize a wide range of key drivers for EIP development. Among these, the regulatory system, particularly legislative, financial and operational support from local governments, can facilitate EIP development. Salmi et al. (2011) analyze the situation and potentials of building IS among heavy industries in the Gulf of Bothnia between Finland and Sweden, and they find that the regulation is a bottleneck to symbiosis, as now it is market-based governance system. They propose the governance model of Common Pool Resource as an alternative. Van Beers et al. (2007) summarize and compare the drivers, barriers, and triggers for regional IS development in the Australian minerals industry. They argue that regulation can be a barrier as well as a trigger to regional synergy development. Moreover, there is no 'one-size-fits-all' approach to develop regional synergies. Van Beers et al. (2009) find that in Kwinana, Western Australia, the current regulation is an obstacle to the reuse of inorganic by-product, and they propose,

in the short term, the development of regulatory protocols and standards on reuse are essential. Ohnishi et al. (2012) analyze the performance of recycling projects in Japanese Eco-Towns and find that policy intervention has been a success factor for the construction of facilities. However, because of a lack of operational subsidies the operating rates of recycling projects is low. Liu et al. (2012) reveal the crucial role of government in breaking the sectoral boundaries that is a crucial stage for the development of regional industrial ecosystem.

Researchers also seek to reveal the governance and coordination strategies of specific cases (subcategory 2.2). Through the investigation of the 16 years period in which the Tianjin Economic-Technological Development Area (TEDA) evolved, Shi et al. (2010) find that the TEDA Administrative Commission has played an important role to promote IS, cleaner production and waste disposal at the plant level, particularly by using the policy instrument of subsidies. They suggest that public policy should aim to adjust the incentive structure for IS activities, such as recognizing and rewarding positive environmental externalities, rather than establishing IS exchange themselves. Zhu et al. (2007) explain the coordination mechanisms used by the regional government for the development of Guitang Group in China. They find that the regional government sets the sugar price in order to increase the income of farmers, and stimulates them to plant sugarcane to guarantee the resource input for Guitang Group. Building on the principles of industrial ecology and ecological modernization, Anh et al. (2011) design a conceptual framework regarding waste minimization in agro-industries, and illustrate it with a case of frozen shrimp production in Vietnam. They find that there is no policy for advancing recycling industries related to industrial production in current Vietnam situation. Brent et al. (2008) also find there is no clear legislative guidance on the responsibilities of the parties associated with waste streams. They propose that coordination mechanisms should effectively encourage individual companies to manage waste streams with the necessary freedom of developing new and profitable uses for by-products.

In the third subcategory researchers explore the mechanisms that underline and favor IS (2.3). Chertow (2007) argues that the pursuit of IS is motivated by economic, social, environmental, as well as regulatory reasons, and industrial symbiotic networks can be achieved by self-organizing and planning. Moreover,

she gives policy recommendations according to the different development stages of the symbiosis network. These are: "(1) bring to light kernels of cooperative activity that are still hidden; (2) assist the kernels that are taking shape; and (3) provide incentives to catalyze new kernels by identifying 'precursors to symbiosis". Costa and Ferrão (2010) introduce a middle-out approach that combines top-down governmental directives and bottom-up business initiatives. They argue that the middle-out approach through careful monitors and positive feedbacks between actors can create favorable context. In addition, policy has the potential to affect the context over longer time frames. Boons and Spekkink (2012) take institutional capacity as the underlying concept for IS development. Through the case of the Dutch Stimulation Program (1999-2004) they find that "the link between institutional capacity and the opportunities for symbiotic linkages perceived by actors is not always present and is more complicated than has been recognized thus far". Deutz (2009) seeks to determine the potential of producer responsibility for the implementation of industrial ecology. She stresses the importance of cooperation among firms, and recommends that policy should be better informed by and more directly aimed at industrial ecology. Simpson (2012) finds that "without available knowledge resources, firms either do not know how to respond to recycling pressure or may employ tactics that do not effectively reduce their waste". Thus, she stresses the vital role of knowledge when firms translate the pressure from economy and institution of recycling into concrete actions. Deutz and Gibbs (2008) conceptualize industrial ecology as a distinctive concept of clusters of regional development, and suggest that a high level and protracted period of intervention is required to crystallize the potential for spontaneous inter-firm cooperation.

(3) Evaluation of the impacts of policy programs

The third category of articles evaluates the impacts of policy programs. Lehtoranta et al. (2011) review the policy programs concerning IS, specifically EU policies. They take a Finnish pulp and paper mill as an example, and find that government can promote IS development through indirect encouragement rather than direct obligations. Park et al. (2008) investigate the Korean EIP program, and the development of Ulsan Industrial Complex supported by the national policy program. They find that the Ulsan Industrial Complex has evolved from a conventional industrial complex to EIP by spontaneous IS due to

environmental regulations and economic benefits since mid-1990s.

There are also quantitative assessments of economic and environmental performances of specific cases influenced by policy programs. Van Berkel et al. (2009) assess the performance of Urban and IS in Kawasaki, and they argue that through the subsidy of Eco-Town program, the legislative framework for a recycling-oriented society has contributed to the realization of symbiosis.

(4) Lessons from practice: Lessons learnt and policy implications

The last category of articles deals with policy implications and lessons learnt based on evidence-based studies regarding the outcomes of IS practice. These implications are typically derived from case studies. Based on stakeholders' perceptions about Macheon Industrial Park, Kim (2007) finds that the existing policy is insufficient, and proposes that government should focus on incentives rather regulations. Adamides and Mouzakitis (2009) take industrial ecology as a novel state of industrial production and adopt the governance approach of strategic niche management to analyze the transition towards this new state. They conclude that strategic niche management can be a policy instrument for the transition. Meanwhile, industrial ecology projects should be part of national or regional technology policies.

Policy implications can also be derived from quantitative assessments of the economic and environmental performance of IS. Through quantifying economic and environmental benefits of a municipality in Puerto Rico, Chertow and Lombardi (2005) suggest that policy interventions sometimes do advance symbiosis. Liu et al. (2012) analyze the greenhouse gas emissions based on the energy-based Greenhouse gas emissions inventory of Suzhou Industrial Park in China, and argue that useful ways of reducing greenhouse gas include the on-site use of renewable energy facilities and the development of IS projects. Based on the quantification of CO_2 emission of a cement production in Kawasaki, Hashimoto et al. (2010) conclude that the existing Waste Disposal and Public Cleaning Law needs to be amended, because the responsibility for waste management is somewhat fragmented. Based on a bi-level fuzzy optimization model and two hypothetical cases, Aviso et al. (2010) explore the effects of decentralized decision-making on optimizing the water exchange network in an EIP. They suggest that it is possible to identify the right proportion of water

supply and sewage treatment fees, while it is unnecessary to completely subsidize costs incurred for recycling to minimize freshwater consumption.

2.2.3 Achievement: conceptualizing the role of policy

The above section 2.2.2 shows that considerable research has already been done, especially regarding the normative question of "what role should policy play?" We draw two preliminary conclusions about the impact of policy on IS. Firstly, although policy clearly has an impact on IS development, the nature of this impact differs *per* case. As different researchers focus on different elements and components of policy (Howlett, 2009), such as instruments, programs, or policy systems, it is difficult to extract and compare these impacts (Table 2.2). This diversity indicates that the mechanism of policy intervention and facilitation of IS is still unclear. Secondly, many proposals and implications are formulated in terms of the role of policy and policy instruments should play (Table 2.3). Within these implications, most researchers call for a "market-based" and indirect governmental intervention in order to create a favorable context to IS. However, Salmi et al. (2011) find that the market-based governance system is unfavorable in the Gulf of Bothnia between Finland and Sweden. So there is no "one-size-fit-all" approach (Van Beers et al., 2009) to facilitate IS, which indicates the importance of taking the institutional context into consideration. Although varying from case to case, these implications are valuable knowledge for policy makers when translating the concept of IS into policy reality.

2.2.4 Shortcomings of the Literature

Though the research covered above provides insight into the relationship between policy and IS, the actual mechanisms through which policy intervenes in the development of IS remain obscure. In part this constitutes a gap between policy sciences and IS research. Below we critically analyze the shortcomings of existing research regarding policy, particularly (1) its conceptualization of policy and (2) the research methods applied when doing policy research.

First, an explicit definition of the concept of policy is often missing. As a result, the research object is poorly delineated and the boundaries of what should be included or excluded are blurred. This leads to analytical statements that seem paradoxical. For example, Kalundborg is taken as a role model of self-organization without direct government policy and involvement (Chertow,

2007), while its development has been clearly influenced by regulations and environmental legislation (Jacobsen and Anderberg, 2004, pp.322-324). This is partly due to an unclear definition of what policy constitutes in this study. Chertow refers to policy with the explicit aim of facilitating IS, rather than the wider environmental policy system. Thus, the case of Kalundborg points to a distinction between policy as an initiator and as an influencing factor. Given the fact that the development of IS is a long-term process, it may be difficult to distinguish these two effects.

Table 2.2 Diverse impacts of policy on IS addressed in literature

subject	observed impacts
policy system	•broad policy framework enables IS in UK(Mirata 2004); •regulation and legal framework motivate IS in Italy and Japan (Taddeo et al., 2012; Van Berkel et al., 2009) •fragmented policy system hinder IS in China(Zhang et al., 2010; Geng et al., 2012) • existing governance system do not favor IS in Gulf of Bothnia(Salmi et al. 2011) • existing regulations hinder IS in Kwinana and China (Van Beers et al. 2009; Geng et al. 2012; Geng and Doberstein 2008)
policy program	•driving IS (National Demonstration EIP Program[2]-Shi et al., 2012; National Program of CE Pilots - Geng et al., 2012; Eco-town Program-Van Berkel et al., 2009) •facilitating IS (NISP-Mirata 2004) • Guiding IS (South Korea -Behera et al., 2012)
policy instrument	•catalysts for early exchanges in Puerto Rico (Chertow and Lombardi,2005) • unsuccessful planning schemes overlook material reductions in China (Zhang et al., 2010)

Table 2.3 Implications on the role of policy derived from literature

subject	Implications
policy system	• connecting IS with broad policy frameworks (Laybourn&Lombardi, 2012; Mirata, 2004; Adamides &Mouzakitis, 2009) • adopting the governance model of Common Pool Resource (Salmi et al. 2011)
role of policy in general	• the role of policy should be distinguished by the development stages of IS (Chertow 2007) • creating favorable context (Costa et al. 2010; Gibbs&Deutz 2005; 2007;)
policy instrument	• adopting market-based policy instruments (Zhang et al. 2010; Shi et al., 2010) • indirect interventions (Gibbs&Deutz 2005; 2007; Lehtoranta et al. 2011; Kim 2007) • setting clear objectives (Costa et al. 2010) • identifying commercial opportunities (Gibbs&Deutz 2005) • setting guidance on the responsibilities of involved actors (Brent et al. 2008)

[2] No financial support, only designating the label of National Demonstration EIP to industrial park.

Second, policy is implicitly conceptualized as a static object in much of the IS literature. Even in the research of the historical evolution of policy programs, researchers mostly outline the policy programs in qualitative narratives with emphasis on the changed objectives or instruments, without in-depth and detailed analysis of causal mechanisms underlying the policy processes. As argued in policy theories, policy is a dynamic process, rather than a static object (Heclo, 1972; Jenkins, 1978; Hill, 2005; Sabatier, 2005). To reveal the actual mechanisms of policy intervention on IS, it is important to conceptualize policy as a dynamic process (Boons and Spekkink 2012). The critical step to understand such mechanisms is to investigate the sequence of events that connects policy making and local IS practices.

Third, researchers often take a systemic approach to identify the key factors required for stimulating IS development. Policy is then mentioned as one of the factors. Nevertheless, more detailed research targeting the precise way in which policy influences IS is hard to come by. Such research would be helpful to understand the actual mechanisms of policy intervention within the large picture. Prescriptions for improving policy should be based on the understanding of how policy is made (Hill, 2005).

The shortcomings in the IS literature in terms of definitions, conceptualizations and research methods of policy can be filled by work that has been done in the fields of Public Administration, Governance, and Policy Sciences. There is a missing link between IS research and policy theories. Considering the shortcomings and the gaps identified, we introduce several policy theories in next section as an inspiration to the study of policy in the field of IS.

2.3 BRIDGING INDUSTRIAL SYMBIOSIS RESEARCH WITH POLICY SCIENCE

2.3.1 Defining Policy

The term ‘policy’ is used differently by researchers depending on the purpose at hand (Heclo, 1972). In this study, policy refers to the process where a governmental body aims to provide intentional guidance to the collective actions of a particular area of concern. Policy is defined in different ways according to the research aim at hand. For instance, when the aim is to compare the instruments adopted by public officials regarding certain subject in different

countries, policy is defined as an object that delineates a specific problem and provides a solution to that problem. When the research aim is to reveal the social mechanisms of policy influence, it is better to conceptualize policy as a sequence of events. Thus, Heclo (1972) defines policy as a course of (in) action rather than one specific decision or action. Jenkins (1978) considers policy as a set of interrelated decisions, and Easton's systems approach (1953) likewise emphasizes the web of decisions and actions. Based on Jenkins and Easton, Hill (2005) concludes that policy is a dynamic process, and researchers should be clear about the shifting definitions of issues as policy invariably changes over time (Hill, 2005,p8). Relating this to the IS literature, we see that for instance the three phases of South Korean EIP master plan do not stand alone, but constitute a progressive process of improvement and optimization for 15 years (Park and Won 2007; Behera et al. 2012).

The definition of policy also determines the boundaries of the research object. When policy is defined as an object (a specific program or instrument), the boundary is easier to draw compared with a definition of policy as a process. In that case, the research aim is to clarify policy as a part of the enabling context for IS development. As a consequence, the boundary of the research object will be broader, because various governmental agencies act with the direct aims or indirect aims to stimulate IS, and many actions potentially will hinder or promote EIP development[3].

2.3.2 Studying Policy as a Dynamic Process

As contended in section 2.2.4, in the IS literature policy is often conceptualized in a static way, identifying policy objectives and instruments. In the policy sciences policy is conceptualized and analyzed as a dynamic process based on the view that it is essentially complex and multi-layered (Hill, 2005: 4). Here we introduce policy theories that can be adopted or taken as inspirations to a processual approach to IS research (Boons et al. 2014; Spekkink, 2013).

Policy Stage Model. The different stages of policy making (Jenkins, 1978) and the policy cycle (Easton, 1953) can roughly be distinguished into stages of

[3] With this definition, the activities of state-owned enterprises (SOEs) are considered as being part of the economic process, rather than be a part of policy. The boundary is delineated because most often SOEs play a operational role in policy process (e.g. act as a policy instrument), which does not essentially provide intentional guidance as governmental actors.

agenda setting, policy formulation, implementation, and evaluation. Agenda setting refers to the process of defining problems (e.g. Kingdon, 2010) that are translated into authoritative decisions in the stage of policy formulation. Policy implementation means the "execution" of the objectives of a policy into an operating program, and it is usually conceived as a top-down hierarchy direction, and it is now critiqued by the bottom-up wave (Sabatier, 2005). Policy evaluation aims to determine whether a policy's effects are intended or unintended and whether the results are positive or negative for the target population and society as a whole (Theodoulou and Kofinis, 2004, 191). Each of the stages can be a focus of research, and the model of the policy cycle can be used as a reference point in IS research. Nevertheless, it is worth noting that the stages model does not provide an explanation of what happens during the policy process and the necessary sequential order that it represents itself has been questioned (Sabatier and Jenkins-Smith 1993, Teisman 2000).

Policy Transfer and Policy Diffusion. The concept of IS disseminated rapidly, and one important pathway was provided by governmental policies. Related to this, an interesting research focus would be the patterns of dissemination of IS concept through policy programs over time and space. For this, policy diffusion theory provides a useful framework, which focuses on finding patterns in the adoption of policy ideas or practices in sets of (governmental) actors, mainly based on quantitative studies (Marsh and Sharman, 2009). Along with this, another question would be how the policy ideas or practices developed in one context influence the policymaking in another context. Policy transfer theory is useful here. It studies the process "by which knowledge of policies, administrative arrangements, institutions and ideas in one political system (past or present) is used in the development of policies, administrative arrangement, institutions and ideas in another political system (Dolowitz and Marsh 1996)". Based on case studies, it traces the process of transfer to reveal the underlying mechanisms. As a good starting point, Wang et al. (2011) adopt this theory to investigate how experience from UK's performance-based devolution model of industrial symbiosis development was transferred to China.

Policy Evolution and Policy Change. Policy invariably changes over time (Hill, 2005), which can be seen as a process of evolution (Pressman and Wildavsky 1984). Sabatier (1987; 2007) seeks to understand the dynamic and complex

process of policy change over periods of one or several decades, and his Advocacy Coalition Framework was developed to study such process. This is a fruitful framework that could be introduced into the IS research, especially regarding long-term policy change and policy-oriented learning.

Policy translation, building on the Sociology of Translation, provides an alternative perspective on policy change, evolution, and the dissemination of concepts in general. Several articles cited in section 2.2.2 investigate policy evolution over a longer period of time. Although they do not focus explicitly on the dynamic nature of policy, they provide a good starting point for this kind of research. In section 2.4, the policy translation concept is further introduced and the case of policy translation of CE and EIP in China as an example is investigated to further illustrate the process perspective on policy.

2.3.3 Connecting Policy Making with Industrial Symbiosis Practices

The normative question of "what role should policy play?" and more specifically, the mechanisms of policy intervention on IS, is discussed by most of scholars. However, systematic studies regarding the mechanisms of policy intervention on IS are rare. Mechanisms constitute a causal relationship between the initial conditions and the outcomes, which involves a series of events linking certain initial conditions with a given effect (Mayntz, 2004). The social mechanism approach advocated by Hedström and Swedberg (1998; see also Elster,1989; Mayntz, 2004) is useful in this regard. For our purposes, mechanisms refer to the causal relationships between events in the policy making and IS as it evolves in local circumstances. These events and their relations can be identified through studying the sequence of events.

2.4 CASE ILLUSTRATION

2.4.1 Policy Process and Policy Translation

The investigation of this case builds on the conceptualization of policy as a dynamic process. The policy process typically involves governmental actors at multiple levels (national, regional, local), where a concept is selected (e.g. through agenda setting stage), developed into documents (e.g. policy formulation), and disseminated in both temporal and spatial dimensions (e.g. policy implementation). This is not a linear process; often, these stages are

intertwined. The policy process is an important channel through which concepts (e.g. IS or CE) disseminate. In the words of Czarniawska and Joerges (1996), policy allows concepts and takes concepts to "travel" across spatial and temporal dimensions.

The 'translation' perspective developed by Callon (1980; 1986), Latour (1986; 1992), Law (1992) and Czarniawska and Sevón (1996) provides a conceptual background for the analysis of such travels. Translation is a way of describing movements of different forms of knowledge, orders, practices, innovations, technologies and artifacts (Czarniawska and Hernes 2005). The dissemination of a concept should not be seen as a straightforward adoption. Instead, a concept is appropriated, interpreted, selected, resisted or modified, in one word: translated by involved actors in various ways to make it fit with the local context and the properties of actors (Czarniawska and Joerges, 1996; Pel et al. 2012) which are non-linear, iterative and complex (Fadeeva 2004). As it happens, the re-interpreted "object" may hardly resemble the original one (Fadeeva 2004, Pel et al. 2012). For instance, with scarce land, it is not hard to imagine that the element of spatial efficiency is one of the key elements of EIP in the Netherlands; while this element is not considered critical in other countries such as China.

Drawing on the Sociology of Translation, we conceptualize policy as a translation process. *It refers to the process through which a concept is selected and brought further into reality by policy actors. During this process, the concept is reshaped and transformed as a result of the translations made by heterogeneous actors over time and space.* For instance, the concept of IS is selected, then translated into the idea of EIP, and then into objects (policy documents) that define the problems and solutions (various policy instruments). The contents of the objects are further translated into the actions of civil servants (coordination), which impacts the activities in industrial parks (exchange between firms, technology and contracts). Similarly, the experiences from local EIPs may be translated into an object (annual report) and submitted to a regional government. The regional government may then collect and summarize reports from each EIP, and translate them into another object (regional EIPs annual report) that is submitted to a central government agency. The experiences mentioned in the report may be interpreted by national policy makers, which may lead to adaptive policy change. In writing, adopting, editing and

implementing the policy idea, actors move the concept between different levels, locations, and organizations in a continuous process in which the concept undergoes substantial modification (Freeman 2009).

Building on Actor-Network Theory (ANT; Callon, 1980; 1986; Latour, 1986, 1992), with the unfolding of policy translation process, the assemblage (Gorur, 2011) of four elements: actor, idea, object, and practice (Fig. 2.1), around certain policy label emerges and evolves. A major insight from ANT is that these elements emerge disjointly, and over time become more connected into stable assemblages. Ideas become solidified into objects such as policy papers, providing focal points for actors who start to engage with the idea through action and interactions. Such assemblages are a focus for empirical research: a major question is how in some cases the four elements become solidified, while in others, they remain more loosely connected. Also, in some cases the assemblage continues to grow, collecting more heterogeneous actors, ideas and objects, while other assemblages remain small, or even dissolve. To study policy processes along these lines, we use the following operationalization:

- IDEA refers to conceptual content of a policy program in terms of definitions of the problems and accompanying solutions. Policy scientists refer to this as the policy theory (Gusfield 1982).

- OBJECT refers to material objects. These can be physical infrastructures that are constructed in the policy process (such as EIPs), but importantly, objects also include the linguistic artifact that is the objectified idea, such as planning schemes, checklists of indicators, handbooks, and policy documents;

- ACTOR refers to involved actors, such as organizations, collectively acting groups, public officials, and firms.

- PRACTICE refers to repeated and regular activities. It relates to what actors do to objectify and materialize the concept, for example regulating procedures, initiating pilots, and inter-ministries cooperation.

In the following section, we investigate the policy translation of CE and EIP in China. The aim is to shed light on policy as a dynamic process that evolves over time in terms of the changes and transformations of the linkages between actor, idea, object, and practice, leading to a specific form of assemblage. We show how in this process the concept transformed and reshaped.

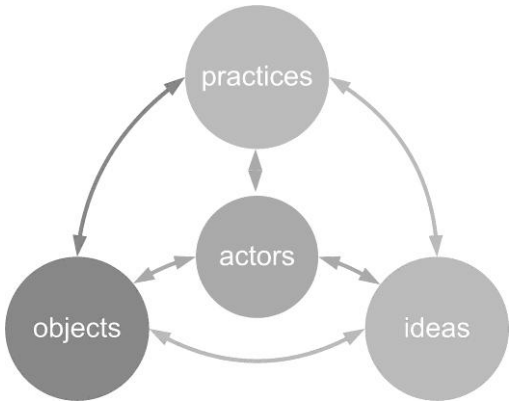

Fig. 2.1 Four Elements of Policy Translation: Idea, Object, Practice, and Actor

2.4.2 Policy Translation of CE and EIP in China

In China, the concept of IS is not explicitly defined and used by policy makers, but the idea of material exchange and utility sharing among co-located firms is addressed by two other concepts: EIP and CE. The two concepts were picked up by State Environmental Protection Agency (SEPA[4]) and were translated into two national programs in the year 2001 and 2002 respectively. The year 2001 therefore was chosen as the starting point of our investigation. With continuous efforts of governmental officials and other stakeholders, ten years later, the CE Promotion Law was put into effect. Furthermore, in the decade that followed, complex assemblages emerged around the two programs. In the next section, we trace the evolution of the two programs and analyze the policy translation processes to shed light on the dynamic nature of policy.

(1)Data Collection

The data for this case study were mainly collected and extracted from written materials. Main sources are the relevant policy documents that were accessed through the archives of MEP and National Development and Reform Commission (NDRC). The selection of policy documents is based on the following criteria: (1) they should take the development of EIP and CE as main policy themes, or (2) they should explicitly refer to these concepts. The second data source is constituted by national news report regarding the themes of EIP and CE. The third source is academic publications, especially the research about China's

[4] SEPA was reorganized into the Ministry of Environmental Protection(MEP) in 2008.

indicator systems of National Circular Economy Pilots Program and National Demonstration EIP program (Geng et al., 2012), the evolution of China's Policies of EIPs (Shi et al., 2012) and CE (Ren, 2007), and the comparison of different management systems of EIPs in China (Zhang et al., 2010).

(2) The policy evolution of EIP and CE in China

The Policy Evolution of EIPs. In 2001, SEPA picked up the concept of EIP and initiated its National Demonstration EIP Program (Fig. 2.2). In that year, two industrial parks were selected by SEPA to enroll in the program. Differing from the instruments applied in National Program of CE Pilots (see the following section), this program didn't provide financial support to industrial parks, but sought to use the designation as a recognized National Demonstration EIP as a means to improve the competitiveness of industrial parks (Geng and Doberstein, 2008). After two years of knowledge accumulation SEPA published two policy papers to provide guidance to the management of these pilots: *Provisional Method on the Application, Designation and Management of National Demonstration Eco-industrial Parks; and Provisional Guideline for Planning Demonstration Eco-industrial Parks*. In the beginning of 2006, SEPA evaluated the first National Key Technologies R&D program: *The theory of CE and the Technology of Industrial Ecology* that was started in 2003. Based on the research results and the knowledge from pilots, SEPA released Assessment Standards for EIPs (on trial) in 2006, which classified three types of industrial parks: sector-integrated EIPs, sector-specific EIPs, and Venous-industry-based EIPs.

Over time, SEPA realized the importance of eco-transition of existing industrial parks and inter-ministry cooperation (Shi et al., 2012), and consequently SEPA, the Ministry of Commerce (MOC) and the Ministry of Science and Technology (MOST) established a steering group in 2007. The steering group made efforts to facilitate the development of EIPs in the National Economic and Technological Development Zone, and National High-tech Industry Development Zone. Furthermore, they published the *Management Method of EIP (on trial)* which was the modified version of the 2003 document, and also revised the *Assessment Standard* targeting sector-integrated industrial parks set in 2006, and the *Guide for Established of Eco-industrial Park Planning that was the revised version of 2003*. In 2008, the steering group for the first time evaluated industrial parks and designated the label of National Demonstration EIPs to three industrial

parks.

In 2009, the concept of Low-carbon Economy was translated as an important aspect of National Demonstration EIPs. For this, the steering group published the *Notice on Promoting the Development of Low Carbon Economy*. After ten years' accumulation of knowledge, the steering group sought to set up exemplars and establish long-term development strategy for the development of EIPs. Thus, for the 12th five-year planning stage (2011-2015), efforts were targeted towards 50 exemplars of Demonstration EIPs with distinctive features and marked effects. In 2012, the Assessment Standard of *Sector-integrated EIPs* was revised again, making considerable changes in the definition of EIPs compared to that in 2006. The revised definition highlighted innovative ways of thinking, institutional reform, innovative mechanisms, the sustainable service system and efficient information feedback.

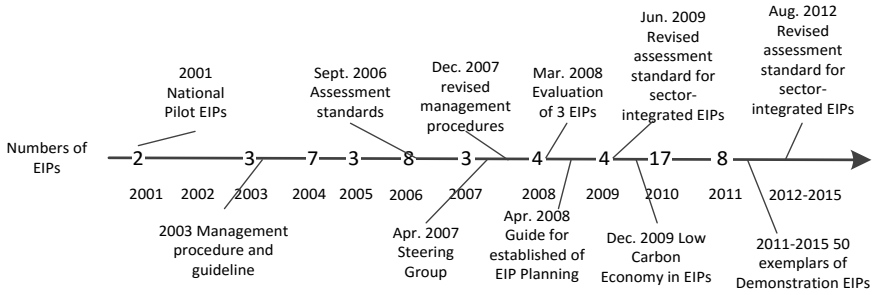

Fig. 2.2 Timeline of policy evolution of EIP

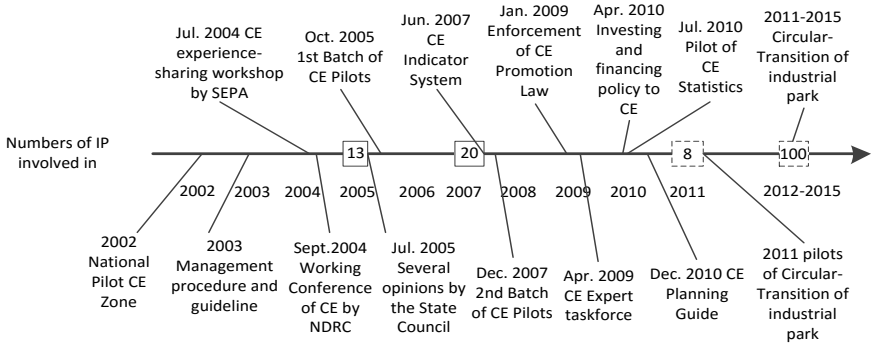

Fig. 2.3 Timeline of policy evolution of CE

Until September 2012, 65 industrial parks have enrolled in National Demonstration EIP Program, among which 15 have been designated the name of

National Demonstration EIPs. For the 12th Five-year Planning stage, the target of achieving 50 Demonstration EIPs with distinctive features and marked effects was planned.

The Policy Evolution of CE. In 2002, SEPA showed interest in the concept of CE and initiated the National Demonstration CE Zone Program in which CE was interpreted as an environmental protection method (Fig. 2.3). In 2003, SEPA published the following policy papers to provide guidance to the management of pilot projects: P*rovisional Method on the Application, Designation and Management of National Demonstration Circular Economy Zone;* and *Provisional Guideline for Planning National Demonstration Circular Economy Zone*. In the beginning of 2004, NDRC, together with Tsinghua University, set up a Research Group on *the Development Strategy of CE in China*. Taking this as an important reference, NDRC wrote and submitted a *Report of Strategies and Suggestions on Promoting CE in China to the State Council*. This report got positive feedback from the State Council. Following this, SEPA organized an Experience-Sharing Workshop of CE in 2004. The aim was to exchange and summarize experience, and to draw lessons and explore the ways of further facilitating the pilots. During this Workshop the preliminary interpretation was that SEPA was not the most important actor in the coordination of CE, although it had been the initiator. After the workshop, NDRC, as the major coordinator of CE, organized a CE working conference, in which CE was indicated to be included in *the 11th Five-Year Regional Economic and Social Development Plan*. In 2005, the State Council promulgated the programmatic document *Several Opinions regarding Promoting Circular Economy Development*, in which NDRC was appointed as the major coordinator for CE development. After these events, CE in China transformed from an environmental protection concept into a concept of sustainable economic development.

Following *Several Opinions regarding Promoting Circular Economy Development*, NDRC, together with SEPA, MOST, the Ministry of Finance (MOF), MOC and the National Bureau of Statistics of China (NBSC), announced the first Batch of CE Pilots, and the *Working Plan of the Circular Economy Pilots.* The Pilots were directed at four types: sectors based on focal firms; main arenas, such as e-waste recycling; industrial parks; and regions. One of the main instruments applied to

support these pilots were subsidies[5]. To guide the formulation of CE plans, the *Requirements of Circular Economy Action Plan* was introduced by NDRC. After 2005, several policy papers were published about CE, such as *Instructional Views of SEPA on Facilitating Circular Economy, Evaluation Indicator System of Circular Economy. A s*econd Batch of CE pilots was initiated by NDRC, together with SEPA, MOST, MOF, MOC, and NBSC in 2007. In 2009, the *Circular Economy Promotion Law* was put into effect. In the Law, CE was defined as a holistic concept covering the activities of 'reduce, reuse, and recycle' in the process of production, circulation, and consumption. With the enforcement of the *Circular Economy Promotion Law*, CE in China moved from pilot experiments and theoretical research into a period of institutionalization (Zhu, 2009).

As indicated by the *Circular Economy Promotion Law*, NDRC published the *Guideline for Circular Economy Planning*, and selected three provinces as pilots for CE Statistics. In addition, NDRC, together with The People's Bank of China, the China Banking Regulatory Commission, and the China Securities Regulatory Commission, issued *Views on Investing and Financing Policy to Support Circular Economy Development*. Moreover, in 2011, NDRC and MOF selected 8 industrial parks as the pilots of Circular-Transition of Industrial Parks. In 2012, based on the pilots, a new policy paper was published: *Several Opinions of Facilitating Circular-Transition of Industrial Parks,* in which circular-transition of 100 industrial parks were set as the targets for the 12th five-year planning stage (2011-2015).

Until 2012, two batches of CE Pilots were issued, including 33 CE pilot industrial parks. For the 12th five-year planning stage (2011-2015), circular-transition of 100 industrial parks was planned.

(3) Preliminary Results

Following the policy evolution trajectories of the concepts of CE and EIP in China, it becomes clear that each concept was reshaped during its "journey" at the national policy level. In terms of actors, SEPA was the initiator of CE and EIPs, while gradually more and more actors coalesced into a complex actor-

[5] In the instrumental level, this is a major difference between National Demonstration EIP program and National CE Pilot. The latter one provided subsidy, while the former one only designated the label of National Demonstration EIP, without financial support.

network in which NDRC became the most important coordinator of CE in 2005. Looking at the idea-dimension, the generic interpretation of CE transformed from environmental protection to a sustainable economic development model that was a holistic concept, including activities of 'reduce, reuse, and recycle' in the process of production, circulation, and consumption. In this sense, EIP was an important stepping stone to implement CE. Regarding the object-dimension, transformation and displacement were evident. For instance, the Assessment Standard of Sector-integrated EIPs was revised twice, in 2009 and 2012, and the Management Procedure of EIPs was revised in 2007. Meanwhile, 65 EIPs were enrolled as National Demonstration EIPs gradually, and 33 CE Pilot industrial parks were initiated as an important step in CE Implementation. Regarding the action-dimension, the Pilot EIPs, and CE at the industrial park level were under construction. Associated with that, the activities initiated by policy makers and practitioners, such as learning tour, experience-sharing workshop, and consultation, also took place.

In addition to the transformation of each element, assemblages emerged as the linkages between the four elements (actors, ideas, objects, practices) were evolving in the two programs. Moreover, the two assemblages were sprouting in a similar manner, but then developed into quite different trajectories with different translation dynamics. In the evolutional trajectory of EIP, the assemblage sprouted when SEPA picked up the idea of inter-firm exchange in 2001. With the publication of the formal procedures for the management of the program in 2003, a relatively small assemblage of actors, ideas, practices, and objects took shape. In 2006 this assemblage underwent a fundamental transformation, marked by the publication of the Assessment Standards of three types of EIPs. The categorization and abstraction of EIPs into different types and associated indicator systems and required values translated the complex EIP realities into a numeric matrix (Koyama, 2011), thus creating a focal point for both policy makers and practitioners. This was followed by a critical extension manifested by the establishment of the steering group whose establishment was triggered by the idea of inter-ministries' cooperation (Shi et al., 2012) and the idea of eco-transition of brownfield sites. The establishment of the steering group was not only about involving new actors in the assemblage, it also linked the assemblage with two legitimate assemblages regarding industrial parks. This connection led to changes and revisions of linguistic artifacts, such as

policy papers of management procedures and assessment standards, and also of materialized artifacts, such as the types of involved industrial parks. In 2009, the concept of low-carbon economy was translated into the assemblage and became an important element of EIP, which was impacted by another national policy process regarding climate change. By 2010, the assemblage had become very complex, which was fundamentally different from that in 2003. In China's 12th five-year planning period (2011-2015), new targets have been planned, aiming for continuation and further growth of the assemblage.

Compared to the continuous growth of the assemblage around EIP, the evolutional trajectory of CE is much more meandering and adventurous. By the end of 2003, a small assemblage took shape, of which the emergence and development were quite similar to that around EIP. Subsequent events led to a critical turning of the trajectory. This started with the interests of NDRC in CE, which led them to actively translate CE as a sustainable economic development model. This translation got much more support from the State Council than the translation that SEPA made of CE into an environmental protection method, because fitted better with the Chinese context as a developing country. Therefore, the State Council indicated DNRC as the major coordinator of CE, and NDRC initiated the National Program of CE Pilot (including 13 industrial parks). Thus a relatively new assemblage formed that partly built on the assemblage developed by SEPA in 2003. Meanwhile, many other actors became involved, such as MOST, MOC. Following these critical transformations, NDRC, similar to what SEPA did, also translated the complex reality of CE Pilot (at industrial park level) into abstract indicators. As a result this newly built assemblage temporally stabilized through developing the focal point for policy makers and practitioners. The assemblage was markedly extended in 2007 by enrolling 20 more CE pilot industrial parks whose selection was impacted by another nationally significant policy theme: Energy Conservation and Emission Reduction. The enforcement of the CE Promotion Law in 2009 became a conservative force (Rose, 1976, p25) for the development of CE. Under this Law, the assemblage went into the direction of publicizing exemplars and establishing long term development strategies. In the 12th five-year planning period, a relatively new assemblage regarding circular-transition of industrial parks emerged, aiming to grow further towards 2015.

As presented above, the two assemblages had similar starting points but turned into distinct development trajectories according to different dynamics. This preliminary analysis indicates that an in-depth exploration of the translation dynamics and patterns will help to reveal the mechanisms of policy translation process of EIP and CE in China and its impacts on IS practices.

2.5 RESEARCH AGENDA: UNDERSTANDING MECHANISMS OF POLICY INTERVENTION AND FACILITATION OF IS, CE, AND BEYOND

Clarifying the mechanisms of how policy intervention impacts on IS opens the black box of the nexus between policymaking and IS practices. Based on the shortcomings summarized in section 2.2.4 and the policy translation approach outlined above, we propose the following research agenda, which consists of 5 questions.

(1) How do actors in industrial parks translate national, regional and local policy interventions into their practices? And (2) how is experiential knowledge from these practices translated by local, regional and national policy makers into adaptive policy changes?

These first two questions call for a careful analysis of the two-way connection between policy making and the unfolding practice of IS. Here the translation perspective is helpful in understanding the direction of influence: do policy goals and instruments shape local practices, or the other way around? Also, it becomes visible to what extent policy concepts are used as a legitimation for already existing objects and practices (Meyer and Rowan 1977), rather than taking it as inspiration for innovative ways of acting and seeing. This analysis is also important to see to what extent the practices in one local situation are picked up and, through regional or national agencies, become a starting point for other local examples of IS and CE.

(3) How does the wider institutional context impact upon the policy translation process?

Policy research needs to take into account the nested character of institutional contexts. The processes of policy translation as analyzed above are embedded in a wider context of sectoral or even national policy styles (Richardson 1982). Alternatively, the concept of 'varieties of capitalism' highlights that economic activities are organized in different ways depending on the generic social-political system (Spekkink and Boons, 2010). There is little knowledge on

the way in which the translation of concepts such as IS and CE is affected by these wider institutional contexts. This requires the comparative analysis of the effects of institutional context in countries with diverging governance modes (Treib et al., 2007).

(4) In what way does the policy translation process of IS and CE relate to other policy processes?

The nature of policy research often delineates the object of study in such a way that the policy process for a single topic is studied. However, such policy processes are connected to other parallel policy processes, such as the process concerning financial and economic policy or climate change policy. These parallel processes can bear elements (actors, ideas, objects, practices) that become connected to the concept under study as sources of new 'ideas' in the IS policy translation process, causing policy changes. Alternatively, existing connections may be identified by policy actors, after which they seek to prevent connections. This is to some extent illustrated by the parallel translation channels in our case study. This makes clear that we need to design studies where such connections between policy processes are a focal point for study, rather than treated as exogenous events (for a proposed method for process analysis of IS, see Boons et al., forthcoming) .

(5) How does the concept of IS cross national borders to become translated into other nations' policy programs?

This question refers to why and how a concept such as IS or CE is able to 'travel' (Czarniawska and Sevón 1996) globally. Taking up a concept in a local situation requires a connection to that local context, but first it requires some form of 'disembedding' from its original context. Central points for analysis here would be the conditions that facilitate travel (existing international links among researchers or policymakers, or a document that is made available for other countries), and how the idea is formulated to facilitate travel (Blackmore 1999). Answering this question is important to understand how concepts that contribute to sustainable development can spread more rapidly. But it also calls for critical reflection on such global diffusion. Based on the case example in this chapter one may question the extent to which the concept of CE have the same meaning in China with that in Germany in terms of actors involved, problem definitions and associated solutions, emerged objects, and practices.

Developing research along the lines of these five questions will be helpful in increasing our understanding, not only the way in which policy interventions interact with the development of IS and CE practices, but also more generally into the ways in which policy actors can facilitate processes of sustainable development. As material and energy flows across the globe intensify, we need to know how such concepts and their associated objects, actors and practices assemble into meaningful networks at the local level.

CHAPTER 3

POLICY DURABILITY AS AN EFFECT OF ACTIVE POLICY TRANSLATION PROCESS

At the time of printing the thesis, the chapter was prepared to submit to an international academic journal with the title of *Policy Durability as an Effect of Active Policy Translation Process: Illustration from Eco-industrial Park Policy in China* (co-authors: Boons, F.A.A, and Teisman, G.R.).

Author Contributions. Jiao, W. collected the data and performed the analysis. Jiao,W., Teisman, G.R. and Boons, F.A.A. discussed and worked together on the theoretical development. Jiao, W. and Boons, F.A.A. analyzed and discussed the case. W. Jiao wrote the paper under the supervision of Boons, F.A.A. and Teisman, G.R..

Abstract: In order to achieve significant policy outcomes, implementation efforts need to be sustained for an extended time period. To improve our understanding of the durability of policy, we develop a typology of policy durability and study the realization of policy durability as an ongoing translation process. The study concentrates on the relationships between translation patterns and types of policy durability. The Chinese Eco-industrial Park (EIP) policy is selected as a positive case. The case study shows that the policy translation process underwent two phases and brought about an evolving path of durable policy from the type embracing more adaptability (phase 1) to the one embracing more stability (phase 2). The first phase was characterized by introducing and adapting the novel policy concept with new policy contexts; and the second phase was featured by stabilizing the previous policy outputs and regularizing the implementation process. The entire process was essentially a process of strengthening and stabilizing the tentative and weak beginning. The study implies a process dynamic that can generate durable policy in relatively stable policy contexts.

3.1. INTRODUCTION

A key concern of policy makers is maintaining a policy for years after it has been enacted (Lewis, 2012). The capacity to maintain stability, coherence, and integrity as time passes has been labeled as policy durability and is considered to significantly contribute to policy success (Patashnik, 2003). Taking this as the starting point of our contribution, we find that current knowledge of policy durability is weak. Existing research on policy durability analyzes the lifespan of a policy before its termination or reversal, and investigates its underlying explanatory factors (Berry et al., 2010), the success of policy implementation (Brinkerhoff, 1996), policy design (Haselswerdt, 2014) and political factors (Patashnik, 2003; Lockwood, 2013). This work has yielded considerable insights, but has two main limitations. First, the termination or reversal of a policy or parts of a policy is perceived as an indicator for non-durability. However, this is ambiguous (Lockwood, 2013), and we question this interpretation. Various modifications often occur to a policy, which are not *per se* a sign of bad implementation (Durlak &Dupre, 2008), but a sign of adaptive capacity to a new context. Thus, changes may serve durability rather than hamper it. In this study, we take this possibility into account through looking at several paths to policy durability, which show different ways of managing the needs for both stability and adaptability. Second, a lot of research conceptualizes the process of achieving policy results as a static state, which seems that getting results desires a fixed optimal "configuration of variables" (Howlett, 2009). Accordingly, it is assumed that a fixed set of variables can explain policy results. Few studies have conceptualized policy as a dynamic process of adaptation and stabilization at the same time. In this chapter we try to develop an adequate process-oriented approach (Kay, 2006), unpack the concept of policy durability and investigate the dynamics of the generation of the durable policy.

Policy durability cannot be achieved by adopting a policy at one moment. It has to be achieved in implementation, requiring constant policy "doing" (Gorur, 2011). To uncover the process dynamics, policy is studied as a translation process: sequences of policy events showing how a certain policy concept "travels" over space and time (Chapter 2). In this Chapter 3, building on the policy implementation literature, we construct six ideal-typical translation patterns, and argue that policy durability results from an active translation

process. In the translation process, policy actors assemble heterogeneous policy components (e.g. ideas) from diverse sources (Bardach, 1977). These components form a policy assemblage (Jiao & Boons, 2014; Jiao and Boons, 2015). As translation continues, the policy assemblage changes its shape to a greater or lesser extent. The (re)shaping of policy assemblage manifests the various degrees of modifications of policy in a detailed manner. These various degrees can present various types of policy durability (Jiao&Boons, 2015). Thus, our main aim is to show how certain ideal-typical translation patterns produce a certain type of policy durability.

Policy durability is particularly relevant to the realization of sustainable development. When coordinating their actions, actors have to combine economic, environmental, and societal values, which is a complex process that requires continuous and long term policy efforts. In such an intricate process, considerable translations need to be made (Boons and Strannegard, 2000). The EIP policy is a prime example of sustainable development that asks for long-term policy efforts to transform industrial clusters toward sustainable ones. An EIP is "a community of manufacturing and service businesses seeking enhanced environmental and economic performance by collaborating in the management of environmental and reuse issues. By working together, the community of businesses seeks a collective benefit that is greater than the sum of the individual benefits each company would realize if it optimized its individual performance only" (Martin et al., 1996). Chinese EIP policy has been successfully sustained for more than one decade, which still has a promising trend of development. It is a positive case, allowing us to illustrate our perspective of policy translation, and more importantly, to draw implications for generating durable policy about sustainable development. In addition we seek to introduce an approach to study the sequence of policy events and relate it to types of policy durability. The main research questions are:

1) What were the types of policy durability in the effectuating trajectory of the policy concept of EIP in China?

2) What were the sequential patterns of the translation process, and how and in what contexts do they bring about the types of policy durability of EIP?

3) How can the process features of policy development be systemically

studied?

In Sections 3.2 we review literature on policy implementation and durability and identify research gaps, and in Section 3.3, we develop the policy translation framework. Our method is presented in Section 3.4. In Section 3.5 we describe and analyze the case. We discuss the results and draw the conclusions in Section 3.6.

3.2 THE ISSUE OF DURABLE POLICY IMPLEMENTATION

3.2.1 Existing Studies of Policy Implementation and Durability

Policy implementation is a sequence of policy actions, which delivers governmental intentional guidance to local governmental agencies, representatives and contractors, and transforms policy expectations into policy outcomes (O'Toole, 2000). Policy durability as proposed by Patashnik (2008) focuses on policy implementation in a period of decades before policy outcomes become visible (Sabatier, 2007).

Studies of policy implementation mostly focus on explaining the characteristics of the implementation process and policy outcomes. Accordingly, there are two general types of dependent variables under study, namely policy outputs and policy outcomes (Hill and Hupe, 2002). Policy outputs refers to the extent to which administrative decisions are actually implemented, i.e. the responses of implementation agencies, such as resistances of implementing agencies, and implementation gaps between defined policy actions and practical initiatives of street-level staff (Hill and Hupe, 2002, p122). Policy outcomes are policy results, i.e. the changes achieved in society. It can be identified as the extent to which the defined policy goals are achieved, such as the amount of reduced CO_2 emissions, or can alternatively be defined according to researchers' interests. Policy outputs can be treated as independent variables that exert influences on policy outcomes (Hill and Hupe, 2002). Hill and Hupe (2002) presented a comprehensive summary of seven categories of these variables, including policy characteristics, policy formation, vertical policy administration, horizontal inter-organizational relationship, implementation agency responses, responses of objects affected by policies, and policy context. These variables can be simply classified into three groups. The first group is about the nature and type of policy, such as policy design (e.g. Haselswerdt, 2014), ambiguity of policy issue

(Matland, 1995; Berman, 1978), conflicts over policy goals and means (Matland, 1995). The second group is about policy environment, referring to the context within which the implementation process unfolds. The political environment, economic performance, or natural disasters can be grouped in this type (Collins et al., 1999). The third group is about the implementation process *per se*, including the structural and process characteristics of implementation. There are abundant studies about structural characteristics by examining the interactions between multiple actors (e.g. O'Toole and Montjoy, 1984). However, the process dynamics, e.g. process patterns in policy implementation, are less studied (Howlett, 2009; Schofield, 2001).

In studies of policy implementation, three models are typically distinguished: top-down, bottom-up, and synthesis. In the top-down model, researchers concentrate on authoritative policy decisions and identify the factors bringing about policy success/failure, with an underlying assumption of a relatively linear implementation from center authority to local practices. The top-down model is challenged by a bottom-up debate that centers on street-level bureaucrats (e.g. discretions and actions), arguing that policy is made at the local level (Matland, 1995). The debates reflect a shifting perspective from policy success/failure to the capacity of implementers in influencing target groups (Ryan, 1995). Both models have strengths and weaknesses, which have been widely recognized (Sabatier, 1986; Matland, 1995). As a result, attempts have been made to synthesize the two modes (O'Toole, 2000). The synthesis is done in two tracks. The first is incorporating both models into comprehensive frameworks. The Advocate Coalition Framework is a major example of this (Sabatier, 2007). The other track is flexible frameworks with different types of policy implementation (e.g. Matland, 1995; Berman, 1978). These frameworks do not judge which type is inherently better, but argue that each type is contingent on context (Berman, 1978). The attempts of synthesis illuminate that researchers increasingly intend to accept and integrate the complexity of policy processes (Sabatier, 2007; Gerrits & Marks, 2015; Howlett et al., 2015; Pressman and Wildavaky 1984). However, they focus on the impacts of (interactions of) factors on the types of implementation process, while overlooking the process policy dynamics in the theoretical and methodological wise (Kay, 2006). This is our focus. The limitations of the literature and our contributions will be elaborated in the following section.

3.2.2 Limitations of Existing Studies

Two main limitations can be identified in the existing literature. One is that most studies conceptualize policy as a "configuration of variables", which is disembedded from context and time (Howlett, 2009). For instance, in the synthesis of top-down and bottom-up approaches, Matland (1995) introduced two variables: the amount of conflict in implementation and the amount of ambiguity. He seems to assume that both variables are the characteristics of the policy, rather than of the context, and his model does not take the features of process sequence and change into account. Variable-based starting points often tend to lead to a static conceptualization neglecting process and context (Kay, 2006), which, however, are crucial for many policy issues (Schofield, 2001).

While existing studies are dominated by quantitative methods focusing on decisive variables and the comparison of static states, we present a process oriented theory and methodology to understand the contributions of (the combinations and sequences of) top-down and bottom-up approaches to durable policy implementation. We propose that implementation is an ongoing and compounded process of doing what is decided and adapting to challenges of time and place. This allows researchers to obtain in-depth understanding of the multi-faceted and dynamic character of implementation (Schofield, 2001). Such a process perspective has particular advantages for a study about policy durability that requires actors to work hard and safeguard policy against undermining forces (Patashnik, 2003).

The second limitation of existing studies is the ambiguous way in which policy durability is assessed. Most empirical work identifies durability by examining the length of time until policy termination or reversal (Haselswerdt 2014). However, it is ambiguous to judge durability in this sense (Lockwood 2013). Berry et al. (2010) argued that the lifespan of a program is not easy to identify. An important reason is that the various transformations occur as time progresses. Renaming, substantial consolidation or splits are normal in implementation and have to be incorporated into the study of durability. Furthermore, the "irreversibility" of policy processes, which means the effects of previous policies, makes judgment difficult (Lockwood, 2013). Thus, researchers may get controversial results on durability. The modifications and changes of policy, which are 'normal' in implementation, have been recognized in studies of

implementation. Scholars argue for a careful study of how and to what extent policy components are changed (Durlak & Durpre, 2008). We will face this challenge and elaborate the various configurations of differentiated stability of policy components: newly attached, lost, and static components. To accommodate these various configurations in time, we introduce the concept of types of policy durability.

3.3 CONCEPTUAL FRAMEWORK

3.3.1 Policy as a translation process and translation patterns

We argue, in Chapter 2, that studying policy as a translation process emphasizes the re-construction, re-interpretation, and re-edition of the concepts-in-movement to fit the temporal and spatial context (Latour, 1986). The translation perspective is already applied in policy studies. Gorur (2011) suggested that translation is helpful in understanding the complexity of policy work. Freeman (2009) argued that policy consists of words, and policy actors interpret and convert them into programs and projects, which is a translation process. Oborn et al. (2011) investigated the translation process of policy entrepreneurs in creating and aligning policy windows. Translation is also used as a framework to highlight "soft" transfers of policy concept across different institutional context (Johnson & Hagstrom, 2005). Taking this one-step further, we argue that translation does not stop after the "transfer" of policy concept to a new context, but continues to fit changing social contexts. We conceptualize policy implementation as a translation process which becomes visible and researchable in a sequence of policy events, in which policy ideas are picked up by policy actors and translated into decisions, objects, actions, and (local) initiatives.

To generalize and compare policy sequences, six ideal-typical translation patterns are constructed from policy implementation literature and translation theories. In contrast to variable-based typologies of implementation, the translation pattern emphasizes the typical sequence of policy events concerning both vertical and horizontal dimensions of implementation. In a layered governance structure, a translation process emerges from initial policy decisions and consecutive events covering both horizontal (e.g. interacting governmental agencies at one layer) and vertical (e.g. interaction between layers) coordination.

We describe the characteristics of vertical and horizontal dimensions, respectively, and then configure the two dimensions into six typical translation patterns.

Horizontal Dimension: Single Actor Approach or Multiple Actors Approach

With respect to horizontal dimension of implementation, a large body of literature identifies the structure of implementation through investigating the involved policy actors. Single actor approach and multi-actor approach are distinguished as two general types (Hall and O'Toole, 2000). When multiple actors are involved, studies adopt networks of relationships as an analytical approach. These studies identify the structures of implementation through examining the relations (e.g. intensity of interactions, distribution of objectives, or types of interdependencies between actors) between the multiple actors (e.g. O'Toole and Montjoy, 1984; Bressers and O'Toole, 1998), and evaluate the impacts of the implementation at the network level (Provan & Kenis, 2007). Apart from taking it as an analytical approach, networks can be regarded as a type of governance, which is captured under the label of policy network (Marsh and Rhodes, 1992; Klijn and Koppenjan, 2012). Generally, regarding the horizontal dimension of implementation, existing studies focus on identifying the snapshot structural features of relationships among multiple actors. However, they neglect the coming into being of the diverse structures, which can manifest the process characteristics of implementation. Therefore, we build on translation theory and propose three general typical processes of how multiple actors connect and interact with each other. First, an inclusive multi-actor coalition is established, in which a focal actor defines goals, means, roles of other actors, and single Obligatory Passage Point (OPP), which is a situation that has to occur to satisfy all the actors' interests(Callon, 1986). After all actors reach consensus about these definitions and pass the OPP, a stable alliance can be achieved (Callon, 1986). To pass the OPP, strategies like persuasion, negotiation, bargaining, or exercising power, can be adopted. Second, the consensus of all actors is not always obligatory for joint actions, and several passage points (PPs) can co-exist (Star & Griesemer 1989). Small coalitions with diverse ideas, tasks and ways of implementation can act independently. These small coalitions can be connected through an object that is referred to as the boundary object (Star and Griesemer 1989). The boundary object helps to maintain coherence among coalitions, and enables coalitions jointly to achieve the overall policy goals

(PPs-coherence). Third, the relations between small coalitions are not always coherent; they can be quite diverse, and even compete with each other (PPs-competition). This often happens when there are salient policy symbols (e.g. a slogan) and ambiguous and referent policy goals (Matland, 1995). Many small coalitions proliferate to relate to these symbols and goals. These small coalitions lack overall coordination. The three typical processes provide general process dynamics of how multiple policy actors rework on their relations in the horizontal dimension of implementation, which can add to understanding of the impacts of snapshot structures on policy outcomes.

Vertical Dimension: Administrative, Experimental or Hybrid Approaches

Vertical dimension focuses on the interactions between the higher and lower levels of governmental policymaking and implementation. The organization at the top can apply two general approaches: administration and experimentation. In an administrative process, policy decisions are translated into programs, targets, plans, and rules, which are delivered in a hierarchical manner and carried out by local actors with little discretion. The process is relatively closed to its environment (Matland, 1995) and changes of policy are expected to be low. An efficient and linear execution of ideas into reality is assumed to be the best way for durability. In an experimental process policy makers adopt tentative attitudes in order to discover contingencies (Heclo, 1986). They are uncertain about explicit policy objectives, and they lack knowledge and power to design the best programs, plans and rules from scratch. Consequently, they seek to maximize learning from bottom-up experiences. Experimentation is an iterative and reflective process of searching the "second-or-third best answers (Brinkerhoff, 1996)" and is relatively open to its context (Matland, 1995). Experimentation welcomes policy changes, because these changes are helpful for generating durability. In some situation, hybrid approaches can be adopted. When the horizontal dimension embraces co-existence of several passage points and coalitions (PPs-coherence or PPs-competition) as described above, the approach (e.g. experimentation) adopted in one coalition does not necessarily exclude the approach (e.g. administration) adopted in another coalition.

Translation Patterns

Configuring both vertical and horizontal dimensions of implementation, six typical translation patterns are derived (Table 3.1). Figure 3 depicts briefly the

main building blocks of the event sequence. The detailed description of the event sequence can be found in Table 4.1 in Chapter 4. For a longitudinal process of policy implementation, we expect that the process may be characterized by a succession of these patterns.

Table 3.1 Six Translation Patterns

Horizontal / Vertical	Single Agency	Multiple Agencies		
		Obligated Passage Point (OPP)	Several passage points (PPs)	
			Coherence	Competitive
Administration	*Single agency – administrative implementation*	*Cooperation-administrative implementation*	*Boundary implementation* (hybrid approaches in vertical dimension)	*Symbolic implementation* (hybrid approaches in vertical dimension)
Experimentation	*Single agency – experimental implementation*	*Cooperation-experimental implementation*		

3.3.2 Types of Policy Durability

Policy durability means that the essence of policy is stable and persistent, while adaptabilities to the dynamic context are achieved. Stability means sustainment of key policy components (e.g. central actors, stable criteria and subsidies) and their relations, which are important for setting long-term targets and continuously interesting, enrolling, and maintaining target groups (Liang and Finorino, 2013). Stability is an important part of durability, but not the whole story. Adaptability is also important to make timely responses to changing contexts or undermining forces to reestablish fitness, thus sustaining policy efforts over time (Scartascini et al., 2008). So durable policy does not just mean static, but configures both stable and changeable policy components. Furthermore, policy durability should show multiple types featuring various configurations of stable and adaptable policy components, such as the different types with reduced stability.

To probe into these different types of policy durability, we take the translation perspective a step further from reinterpretations and sense making in the sequence of policy events to the macro dynamics of progressive building up and reshaping of policy assemblage (Boons and Strannegard 2000; Czarniawska and Sevón 1996; Langstrand 2012; DeLanda, 2006; Gorur, 2011). In Chapter 2, we define the policy assemblage as an association of heterogeneous policy components, including actors, ideas, objects, and practices, and policy labels.

The (re)shaping of policy assemblage over time can denote the different types of policy durability. We firstly adopt the sustained policy theme (e.g. EIP in our case) as a signal of durable policy. We further distinguish policy labels from other components of policy assemblage to depict four types of policy durability (Fig. 3.2)[6]. From type A to type D, the policy durability shows reduced stability of policy assemblage (Jiao and Boons, 2015).

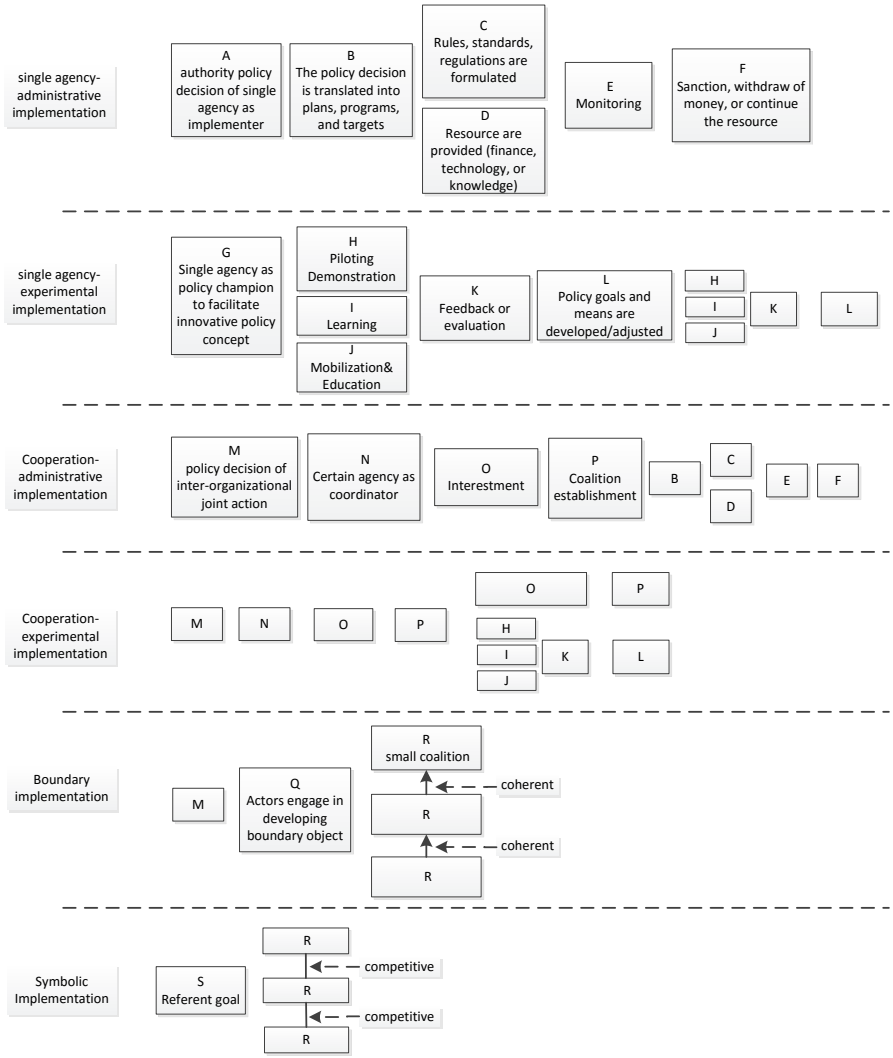

Fig. 3.1 Building blocks of policy translation patterns

[6] As the study adepts the design of progressive building up of the conceptual framework, the details of the four types of policy durability are developed in Chapter 6. So see Chapter 6 for conceptual meaning of the four types.

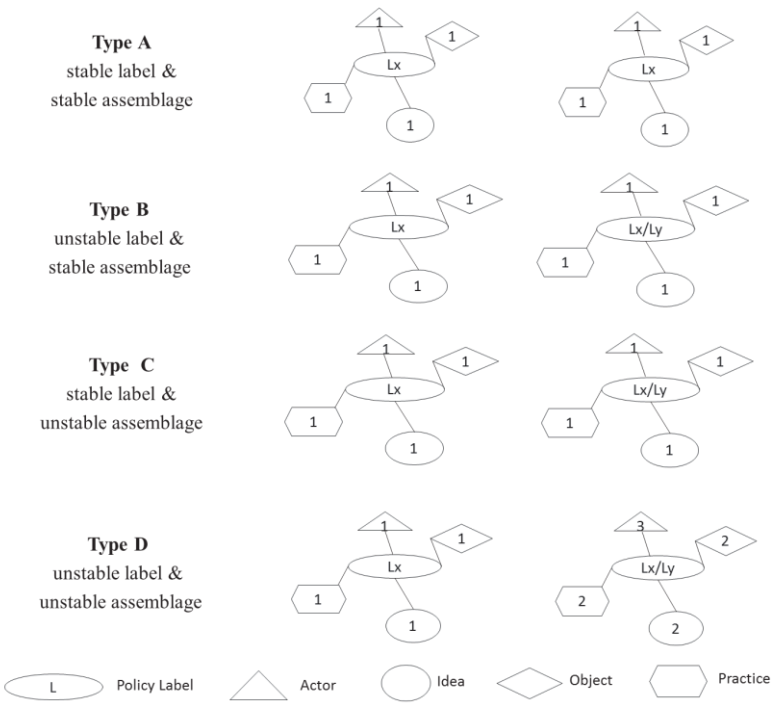

Fig.3.2 Types of Policy Durability

3.3.3 Linking Translation Patterns and Types of Policy Durability

Policy durability is perceived as an output of an active translation process. Along with the unfolding of translation process, the policy assemblage builds up gradually. Each translation pattern is unique in the dynamics of assembling heterogeneous (e.g. stable and adaptable) policy components, and thus a specific type of policy durability emerges. To link the translation patterns and policy durability, building on previous studies of policy implementation and translation of policies and innovations, we specify the dynamics of assembling and expected types of durability in Table 3.2. A longitudinal implementation process can constitute successions of translation patterns, delineating the process into phases. So attention needs to be paid to possible subsequences of phases. For instance, the pattern of "*cooperation – administrative implementation*" may consist of two subsequences, changing from centralized to decentralized cooperation. Sometimes, subsequences repeat themselves, referred to as a cycle. During the identification of policy durability, we need pay attention to the transitional periods between phases and subsequences.

Table 3.2 Dynamics of Assembling and Expected Types of Durability

Patterns	**Types of dynamic in assembly**	**Durability**
single agency – administrative implementation	Under a specific policy label, one central actor associated with a few explicit ideas, quickly link to objects of rules and regulations and practices with administrative features. The actors and other stressed components form a stable and patterned cluster as the central of the assemblage (e.g. Lo et al., 2000).	Type A
single agency -experimental implementation	An actor link to a policy label. And then many diverse ideas are associating with practices of experimental features and tentative objects, or other policy labels, connect to a cluster of a central actor and a policy label, which are the center of assemblage. Gradually, some stressed components also become parts of the central assemblage. The central assemblage can reshape over time. This type of assembling can refer to early stage of CE policy in China (Jiao and Boons, 2015)	Type C/ Type D
cooperation-administrative implementation	An actor, as the core of the assemblage, links to several other actors. And they form a cluster, during which diverse ideas or other policy labels, and objects about rules and regulations and practices with administrative features are attached to the cluster. The cluster of actors and some of the stressed components are stabilized into a patterned assembly. The political implementation described by Matland (1995) is such a type.	Type A/ Type B
cooperation-experimental implementation	There is a cluster under certain policy label, constituted by a central actor and some policy ideas. And some actors frequently link to this cluster, during which many diverse ideas and new policy labels emerge, and practices with experimental features and tentative objects are attached. The actors and some stressed components become a temporal center, which reshapes over time. This type of assembling can refer to the study of implementing a conservation strategy (Callon,1986).	Type C/ Type D
boundary implementation	An object becomes the center of assemblage. Many diverse actors and associated ideas, objects, and practices (and even labels) form different clusters, and each cluster tightly link to the central object, and these linkages are patterned. The type of assembling can refer to studies of curriculum policy implementation (Banner et al., 2012) and Museum of Vertebrate Zoology (Star and Griesemer,1989).	Type A/ Type B
symbolic implementation	There is a major policy idea in the central of the assemblage. Then many labels, ideas, objects, and practices emerge and form diverse clusters that link to the policy idea. Over time, some clusters dissolve. Some clusters grow, that, together with central idea, possibly become the new center of assemblage. (e.g. Bossong, 2008)	Type D

When identifying the relations between translation patterns and policy durability, policy contexts need to be considered, because policy translation process unfolds in specific policy contexts that shape the patterns of the translation process (Collins et al., 1999). When policy actors have gained enough knowledge about a policy issue, administrative approaches are likely to be adopted in a stable context (Berman, 1978), e.g. translation patterns of 'cooperation-administrative implementation', or 'single agency-administrative implementation'. When the policy contexts change substantially, adaptive approaches are more likely to be adopted (Berman, 1978), e.g. translation patterns of 'cooperation-experimental implementation' or 'single agency-experimental implementation'. Different contextual factors can be selected according to policy issues under study. For instance, demographic and epidemiological changes are important contextual factors for policy of health. In this study, we take into consideration the economic processes (e.g. economic growth, economic crisis), the political processes (e.g. elections and changes of political regime), and the progress of local industrial parks (infrastructure, environmental issues, and coordination issues).

3.4. RESEARCH METHOD

A process-oriented approach, which allows researchers to study the process patterns of a sequence of policy events, can enhance our understanding of generating policy durability in a more dynamic way. The method applied, Event Sequence Analysis, focuses on the reconstruction of sequences of events and the identification of process patterns that emerge (Boons et al., 2014). We follow Boons et al. (2014) and Spekkink (2015) for analytical steps of this approach, as follows.

Process Identification and Data Collection. The main types of policy events are national governmental actions in making and implementing China National EIP policies. The main data source is the archives covering the period of 1996-2011, including 1) governmental reports (policy documents, speeches, progress and reports), 2) news items, and 3) data on trial or demonstration EIPs. Documents were selected from the State Environmental Protection Agency

(SEPA[7]) database, taking EIP as the key word. The data were collected from November 2011 to March 2013.

Sequence Construction. We scanned all the documents focusing on when, whom and what. The raw data were recorded as incidents, chronologically arranged in Excel. Each incident includes a short description of policy actions. In total, we got 125 incidents. Based on the theoretical policy translation patterns, a coding scheme of types of policy events and building blocks as higher order events were developed (Appendix Table A3.1). We firstly coded incidents in terms of types of events, and colligated the incidents about the same event into events. We were open to emerging types of events, which were not mentioned in the coding scheme, but are relevant to our theoretical framework as they show changes of policy decisions and actions of policy process. We then coded connections between incidents when the incidents are about the same event, or when the later incident intentionally referred to earlier ones. In total, the analysis generated 60 events. We colligated the same types of events into building blocks (Appendix Table A3.2).

Pattern Identification. The building blocks constitute translation patterns. We analyzed these empirical patterns by matching their similarity to the theoretically derived patterns. First, we adopted the approach of "temporal bracketing" to examine the process data (Langley, 1999). This approach decomposes process data into successive adjacent phases with underlying ideas that there is continuity of process within each phase and discontinuity between phases (Langley, 1999). The bracketing was done by identifying "breakpoints" (Barley, 1986) that are about changes of main policy decisions on the ways of facilitating SIP. Based on the six theoretical translation patterns, four codes were selected as sensitizing attributes, namely single agency, multi-actor cooperation, boundary object, and referent policy goal, as they reflect starting or turning points of the process (Jiao and Boons, 2015). Through identifying the breakpoints, the overall policy process was preliminarily delineated into several temporal blocks. Then the number of the building blocks presented in each phase was checked by comparing them to the theoretical patterns. The theoretical pattern with the highest degree of correspondence was selected as

[7] SEPA was reorganized into Ministry of Environmental Protection in 2008. To be consistent, we adopted SEPA in the entire study.

the major reference. Finally, the sequential order of building blocks and events was investigated for the identification of subsequences and phases. This iteration was stopped until reasonable results of subsequences and phases were yielded.

Identifying Types of Policy Durability. To map the policy assemblage, we coded the policy components associated with each incident, taking IDEA, OBJECT, PRACTICE, ACTOR, and LABEL as five coding tracks. We coded descriptively and then conducted a focused-coding by grouping the descriptive codes into different categories (Saldana, 2013). The coding results were imported into a program for network visualization and analysis (Gephi) as policy assemblages: components as nodes, and edges between components were drawn if they were involved in the same incidents. The identification of types of policy durability requires analyzing the degrees of (re)shaping of policy assemblage. In the analysis, we combined qualitative interpretations and quantitative approaches of Social Network Analysis. We firstly drew the center of assemblage in order to analyze main policy components and their relations. To do so, we selected the indicator of Eigenvector Centrality, underlined by the idea that the component that connects other central components is more central (Ruhnau, 2000), which reflects authority or importance of components in the assemblage (Bonacich, 2007). We selected ten components with highest value but also this value not being lower than 0.5. Secondly, we normalized the weights of linkages, and gave different colors to compare the frequency of associations between components. Then, the analysis focused on how the central assemblage was evolving across subsequences and phases. We also investigated the peripheral assemblage in a similar way. The identification of types of policy durability was mainly based on the central assemblage and distinctive features of peripheral assemblage.

3.5 CONTEXTS AND THE PROGRESS OF EIP POLICIES IN CHINA

Contexts. In the late 1990s, solving serious environmental pollution started to gain priority on the Chinese policy agenda, because the environmental regulations and command-and-control instruments that have been adopted in the early 1970s had not effectively solved environmental pollutions. Firstly, the national government continued the implementation of environmental regulations (Geng and Doberstein, 2008). For instance, in 1996 the State Council

issued binding environmental targets for the years between 1996 and 2000. These targets focused on controlling the total amount of pollutants and meeting national and regional standards for discharge of pollutants. Secondly, the national government started to explore diverse and novel policy themes (e.g. eco-zone) and instruments (e.g. voluntarism, market based instruments, public involvement) to increase governmental capacity in environmental protection (Shi and Zhang, 2006). Industrial parks were regarded as an important area of such explorative attempts, because they were both the engines for regional economic development and sources for serious environmental pressures. From the early 2000s on, China started to undergo rapid industrialization, urbanization, and economic development that required a lot of resource and energy and meanwhile produced a large amount of wastes. So there were ongoing conflicts between economic development and environmental protection. So the policy contexts have prompted urgent calls for synergy between environment and economy. EIP policy was introduced and developed in such policy contexts.

2000-2005. In June 2000, SEPA organized an environmental investigation group in a sugar company. SEPA was impressed by the company's activities of waste reuse and recycling and recommended to improve these toward the level of EIP. In response, the local government started to develop the EIP Plan[8].The local EIP Plan was submitted and subsequently approved by SEPA as the first national EIP pilot. A second EIP pilot was also approved. In 2002, SEPA asked the two pilots to report on the progress. In 2003, the documents *Provisional Method on the Application, Designation and Management of National Demonstration EIPs;* and *Provisional Guideline for Planning National Demonstration EIPs* formalized the procedure of program management and outlined the framework of EIP plans. To increase environmental management capacity, the Ministry of Science and Technology (MOST) initiated a National Key R&D Program, which formed the basis for developing EIP indicators. In 2005, SEPA organized a trip to Japan to learn about EIP experiences there.

2006-2010. In March 2006, the National Key R&D was appraised by SEPA, and became a major reference for the publication of Assessment Standards of three types of EIPs (on trial) in June 2006. For each type, specific indicators, data

[8] The case is described according to the 5 year planning periods.

collection and calculation were provided, and the benchmark for the designation of the label of Demonstration EIP was specified. China has two main types of national level and sector-integrated industrial parks: the Economic and Technological Development Zone (ETDZ), coordinated by Ministry of Commerce (MOC), and the High-Technological Development Zone (HTDZ), coordinated by MOST. In 2006, MOC proposed the idea of ecological transformation of ETDZ and negotiated with SEPA about it. This idea triggered SEPA to develop the idea of ecological transformation of the two main types of national industrial parks. Then inter-ministries' collaboration became central to subsequent events (Shi et al., 2012). A Steering Group was established in 2007, consisting of SEPA, MOC and MOST. Then, the documents published in 2003 were revised and further formalized as an Environmental Protection Standards. This revision emphasized periodical performance evaluations and withdrawal of the EIP label if the designated parks would fail to pass the evaluation. In 2008, three EIP pilots passed the evaluation, and received the designation of National Demonstration EIP, following which an EIP Experience Sharing Meeting was organized. In 2009, the Assessment Standard of Sector-Integrated EIPs was revised and the *Notice on Promoting the Development of Low Carbon Economy* was issued. In 2011, the Steering Group solicited comments on the exposure draft of *Instructional Views on Promoting the Development of National Demonstration EIPs Further*, which was officially published in December 2011. It sets a target of 50 EIPs with high environmental and economic performance from 2011-2015.

3.6 RESULTS AND DISCUSSION

3.6.1 Policy Translation Patterns

Following the analytical steps of Event Sequence Analysis as described in Section 3.4, the translation process of EIP can be divided into two consecutive phases (Fig. 3.3).

Phase 1: 2000.06-2007.03. Phase 1 matches the theoretical pattern of *Single Agency – Experimental Implementation*. In this phase, SEPA was the single agency, which acted as the policy pioneer and gradually embedded the western innovative concept of EIP in Chinese context. SEPA adopted experimental approaches with the main dynamics of intentional learning from diverse sources (e.g. piloting R&D, and studying international experiences). SEPA also gradually

introduced provisional policy papers to formalize the implementation process. Phase 1 can be delineated into two subsequences (1 and 2), and each ended with outputs of policy papers after intentional learning. In Subsequence 1, based on empirical experience from pilots, SEPA published provisional documents to formalize management procedures and guide EIP contents (incidents 19 and 20). In subsequence 2, international experiences and R&D became significant references for the publication of Assessment Standards of three types of EIPs (incidents 48, 49, and 50). Phase 1 constituted a co-evolving process of policy-making and implementation, and it was a loosely coordinated process gradually making ways for a more structured approach.

Phase 2: 2007.04-2011.12. Phase 2 does not match the theoretical patterns. It started from the cooperation of three actors of SEPA, MOC, and MOST. The three actors agreed on the OPP that was the ecological transition of national level industrial clusters, and on the role of each actor which are defined by the focal actor of SEPA. So these actors quickly formed a coalition. The process of passing through the OPP differed from the process described in the theoretical section. Instead of beginning with the idea of joint actions and the efforts of a focal actor in defining and interesting other actors, the case was evolving in the opposite way. The other two actors intended to link to the EIP policy that had been already coordinated by SEPA for more than five years, thus interesting SEPA to develop the OPP for their cooperation. After the establishment of the coalition, the implementation process was characterized by the gradual infusion of administrative features into the experimental implementation. So this phase is an emerging pattern featured by cooperation and a mixture of experimental and administrative implementation. The translation process can be delineated into two subsequences (3 and 4). While learning was the main feature in phase 1, subsequence 3 was characterized by revisions and standardization (as environmental standards) that were built on the foundation of policy outputs of phase 1. Subsequence 4 began with the addition of emerging idea of Low Carbon Economy, and with the target of wide diffusion and evident environmental and economic performance. Although underlined by distinctive features, i.e. revision and standardization in subsequence 3 and fashioning and scaling up in subsequence 4, both the subsequences embodied increasing administrative features, indicated by standardization, periodic performance evaluation, withdrawal of EIP designation, and targeting objectives.

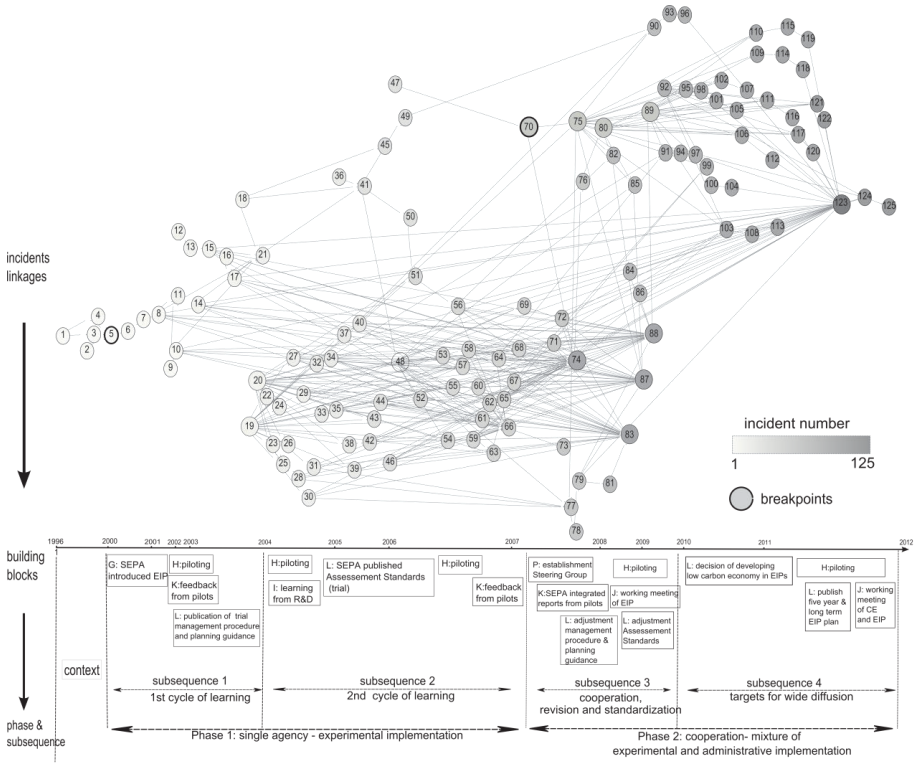

Fig. 3.3 Translation Patterns of EIP Policy in China

3.6.2 Policy Assemblage and Types of Policy Durability

Policy labels

The EIP policy in China has effectuated for more than one decade, during which it was able to maintain the stable policy label of EIP. In this period, the EIP label was linked to other policy themes, such as Climate Change, especially in phase 2. These linkages have brought about new ideas, such as energy conservation and emission reduction, and low carbon economy; however, they did not lead to the proliferation of new policy labels.

Phase 1

Policy Assemblage. Figure 3.4 shows how the assemblage is built up in subsequences 1 and 2. In the central assemblage, the actor of SEPA was the core in both subsequences. Apart from the actor, there emerged the clustering of vast ideas in subsequence 1, and most of them were eco-industrial approaches

collected loosely. These ideas were funneled into several key ideas in subsequence 2, such as industrial symbiosis, energy cascading/cogeneration, and venous industry. Moreover, several policy components were frequently associated as a patterned cluster in subsequence 1, and gradually became parts of the central assemblage in subsequence 2. In subsequence 1, SEPA (actor) engaged in selecting and organizing Expert Team and giving official approval to industrial parks (practice), through evaluating EIP plans (object) submitted by local actors. These actor, practices, and objects frequently associated as a cluster, and their connections were intensified in subsequence 2, forming a patterned association, referred to as *Application Cluster.* In the two subsequences, the peripheral assemblage shared the characteristics of practices of learning and involvement of regional actors. They differed in the aspect of how ideas were attached. In subsequence 1, vast ideas emerged at the same time, mainly through the publication of provisional documents by the central actor of SEPA. In subsequence 2, these ideas were scattered in the peripheral assemblage, because they were associated with the involvement of diverse regional actors. This means that regional actors can select certain ideas of the concept EIP according to the regional contexts. Meanwhile, the loosely collected ideas were systemically classified into categories of integrated energy/material/water system.

Policy durability: Across the two subsequences, the central assemblage showed a sustained central position of SEPA and a gradual formation of the patterned Application Cluster. Meanwhile, vast ideas funneled into several central key ideas and many loosely connected ideas were classified in a more structured way. The policy durability shows that type C manifests a major dynamic of reshaping policy ideas to adapt to EIP with the new context. Meanwhile, the emergence of patterned Application Cluster shows a gentle tendency toward stability.

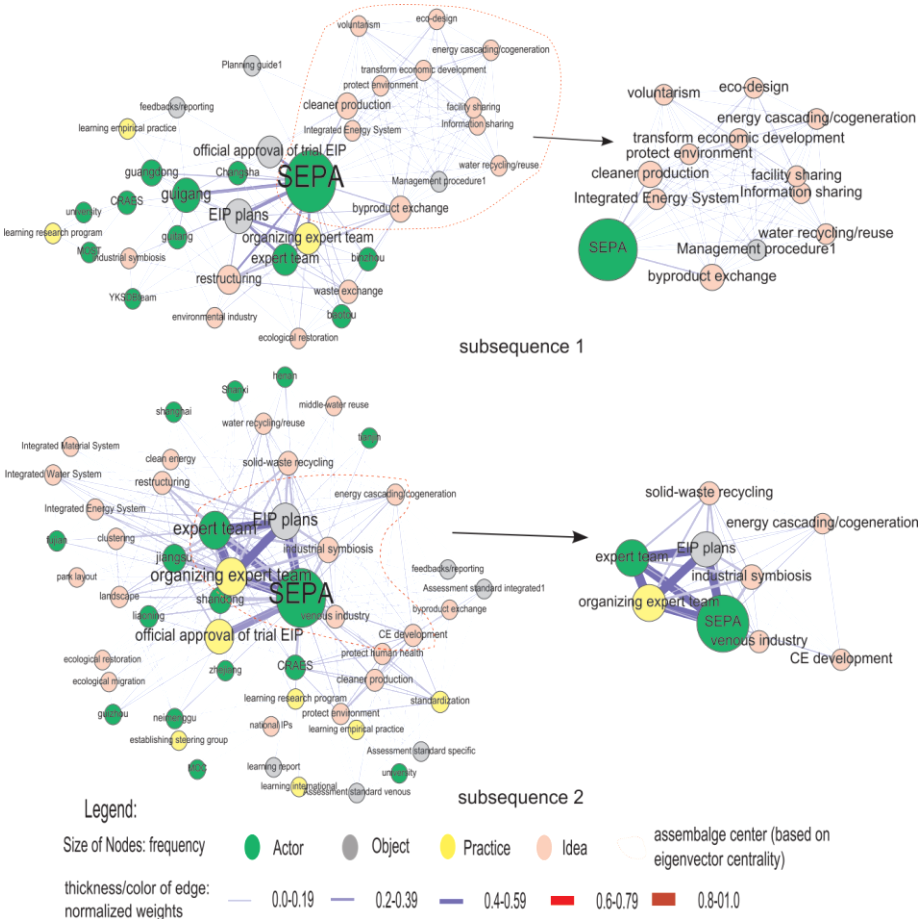

Fig. 3.4 Policy Assemblage in subsequence 1 and 2 of Phase 1

From Phase 1 to Phase 2

Policy Assemblage. From phase 1 to 2, the central assemblage presented critical changes of actors and associated main ideas (Fig. 3.5). First, in addition to SEPA, the ministries of MOST and MOC, which were in a peripheral position in phase 1, moved into a more central position in phase 2. Second, the stressed ideas in phase 1 were sustained as important ideas in phase 2; meanwhile, several new ideas were incorporated, which were tangible policy objectives (e.g. quantitative aim, performance of industrial parks) and fashionable policy ideas of the times (e.g. low carbon economy, and energy conservation and emission reduction). With regard to the peripheral assemblage, a clear change was the disappearance of regional actors, due to the idea of ecological transition of national level

industrial parks that were directly coordinated by MOC and MOST. In these national level industrial parks, the involvement of regional actors was less than those in provincial level industrial parks. Within phase 2 (Fig. 3.6), the association about three ministries was established in subsequence 3, and strengthened further and sustained as parts of the center in subsequence 4. Beside the actor-association, the key ideas from phase 1 were stabilized in subsequence 3, and several new ideas were incorporated into the stabilized ones in subsequence 4. In the peripheral assemblage, the patterned Application Cluster was sustained, associated with the attachment of Accreditation Cluster that was a cluster of components around the procedure of EIP accreditation (e.g. the practices of public notification and official designation in subsequence 4).

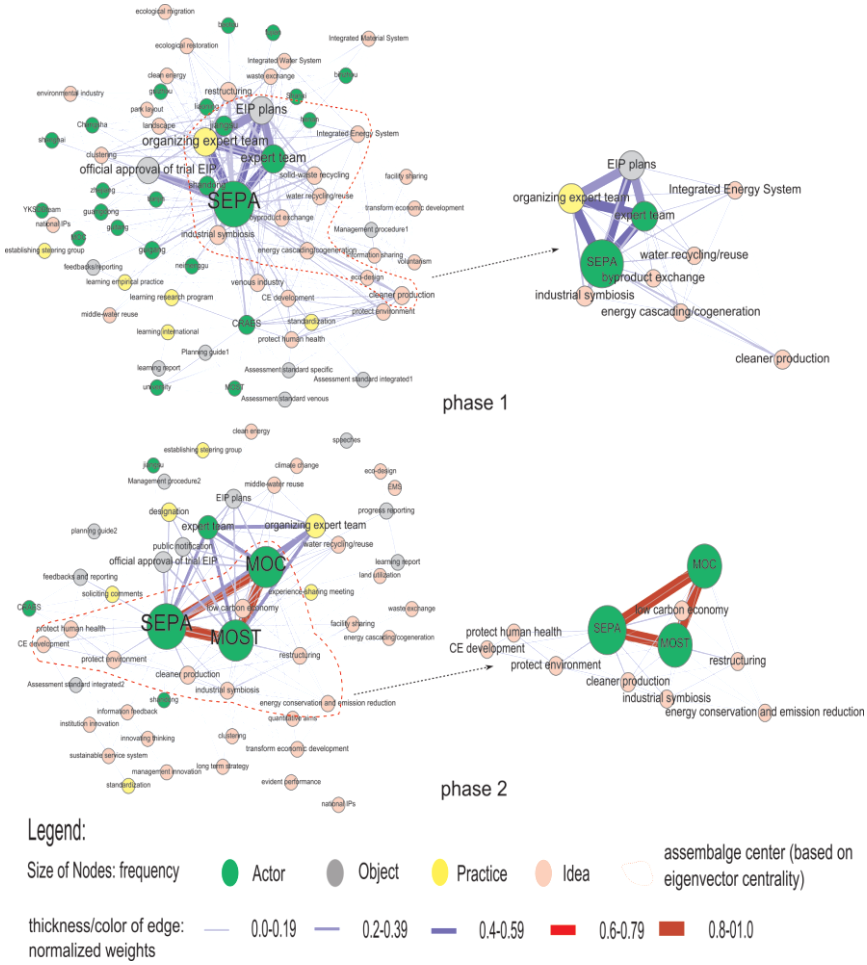

Fig.3.5 Policy Assemblage of Phase 1 and 2

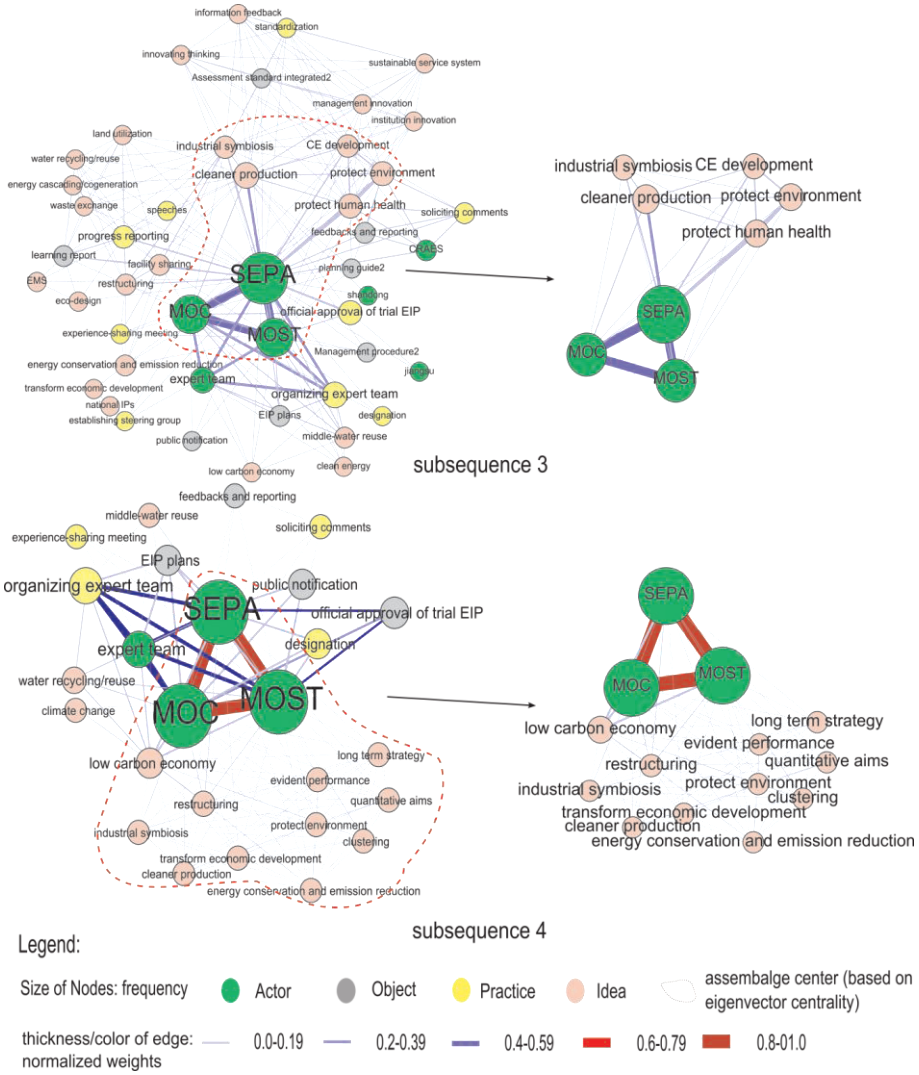

Fig. 3.6 Subsequence 3 and 4 of Phase 2

3.6.3 Discussions on How and in What Contexts the Translation Patterns Bring about the Types of Policy Durability

The study focuses on the relationships between the types of policy durability and the translation patterns. This is essentially about the dynamics of assembling stable and fluid policy components, corresponding to each translation pattern that unfolds in specific policy contexts.

Type C of Policy Durability and Translation Patterns

The type C of policy durability emerged and was sustained for about seven years in the beginning phase. It was brought about by the translation pattern of 'single agency- experimental implementation' in stable policy contexts. The result is consistent with the theoretical expectation in section 3.3. In the relatively stable policy contexts, the pattern of 'single agency- experimental implementation' emerged as a result of the policy contexts at that time and the lack of knowledge of policy actors about EIP. First, SEPA became the single policy pioneer in translating EIP into the Chinese policy contexts. As SEPA was coordinating the national environmental protection binding objectives at that time, it interpreted EIP as a useful approach to achieve the objectives. Second, to improve environmental governance capacity, the national government encouraged exploring diverse policy ways of environmental governance (Shi and Zhang, 2006) and experimental implementation *per se* fitted with the intensions of such exploration. The most important reason was that the tentative attitudes and experimental approaches were adopted by SEPA, as the EIP concept was quite new for both policy actors and industries and also required significant changes of them (Jiao and Boons, 2015; Mirata, 2004), e.g. solving environmental pollutions through building a symbiotic network among industries. So the experimental implementation aimed to adapt the new concept of EIP with the Chinese contexts. Due to the three reasons mentioned, the pattern of 'single agency- experimental implementation' was presented, and accordingly, heterogeneous policy components started to assemble around the label of EIP and the central actor of SEPA. The assembling was relatively fluid, and one evident feature was the dynamic of assembling ideas, which was a process from emerging a loose set of ideas to gradually classifying and funneling into key ideas about what EIPs were in Chinese context. So type C of policy durability emerged.

In addition, as discussed in section 3.3, the identification of policy durability also needs to consider the transitional period between phases, because the breakpoints between phases can often lead to the reshaping of the center of policy assemblage. In the EIP policy, the breakpoint between phase 1 and phase 2 was the shift from the single agency implementation to cooperation implementation. This shift led to a critical change of the center of the policy assemblage in terms of the number of and the linkage between the central policy

actors, and therefore type C of policy durability emerged. The cooperation was an attempt to link the EIP policy with the Chinese contexts. Specifically, in China, there were diverse types of industrial parks, and the coordination of them was fragmented, such as provincial level and municipal level industrial parks, and the national level industrial parks of ETDZ and HTDZ coordinated by MOC and MOST, respectively. The cooperation was derived from the idea of developing EIPs in national level industrial parks. So the establishment of cooperation was the adaptation to the fragmented coordination of diverse industrial parks. It should be noted that, SEPA sustained its leading role in the cooperative network. It was one of the reasons for the emergence of type A of policy durability in the later phase, which will be analyzed in detail in the following section.

Generally, the translation pattern of 'single agency/ cooperation–experimentation', which occurred in the initial and early periods, was dedicated to adapt the innovative concept, which originates from the West, to the new Chinese context. Accordingly, the type C of policy durability with high adaptability emerged, and the adaptability was manifested by the reshaping 1) of policy ideas about what EIPs were in Chinese context, and 2) of the number of central policy actors and their linkages in order to fit the fragmented coordination system of diverse industrial parks.

Type A of Policy Durability and Translation Patterns

The type C was followed by type A of policy durability. The type A existed for about five years. It was brought about by the emerging translation pattern of 'cooperation-a mixture of administrative and experimental features' embedded in relatively stable policy contexts. The results disagree with the theoretical expectations in the section 3.3. We will deliberate the disagreement further.

With the accumulation of knowledge and the creation of the primary fitness of policy in phase 1, the policy actors gradually infused administrative features into the experimental implementation, rather than immediately shifting to the pattern of "cooperation-administrative implementation'. The emerging pattern combined the characteristics of both the patterns of 'cooperation– experimental implementation' and 'cooperation–administrative implementation', and it brought about type A of policy durability. The result indicated that 1) the persistent role of the central policy actor and 2) the increasing administrative feature were crucial for the emergence of type A of policy durability. As

mentioned above, SEPA sustained its central role in the transition of translation patterns. The persistent central role of SEPA could sustain the coherence and stability of the previous policy outputs. Then the increasing administrative approaches gradually stabilized these policy outputs. Accordingly, the key policy components at the end of phase 1, such as key eco-industrial approaches of EIP, were stabilized as the center of assemblage. In addition, a major token of administrative approach in this case was standardization. The solidity of standards enables them to travel over space and time, during which new entities are enrolled while patterned interactions are maintained (Fenwick, 2010), such as the patterned Application Cluster observed in this case. So, due to the two reasons mentioned, the policy assemblage was sustained with a stable center, constituting stabilized key ideas, stable linkages between main policy actors, and patterned clusters, and thus the type A of policy durability was presented.

It is remarkable that the type A of policy durability here did not mean the overall solidification of the center of the policy assemblage, but it was featured by the incorporation of a few salient policy ideas into the center, such as low carbon economy. This resulted from the policy actions of fashioning, which reflected the reflective policy actions as one of the experimental features. The fashioning, which was done by incorporating other salient policy issues into the EIP policy, adapted the EIP policy with the changes of contexts and attracted politicians and social media, thus sustaining EIP over time. Meanwhile, the adaptation was achieved without undermining the previous stabilized key policy components, and thus, maintained the high stability of the policy.

3.7 CONCLUSIONS

The generation of policy durability is a continuous challenge for policy actors. Building on the argument that policy durability is the ongoing effect of active policy translation process, the study concentrates on the relationships between translation patterns and types of policy durability.

The results of EIP policy in China showed that the translation patterns and their relations with types of policy durability are more complex than expected. The entire translation process of EIP can be delineated into two phases. The first phase agrees with the theoretical expectation. The translation pattern of ‘single agency-experimental implementation’ brings about type C of policy durability.

This pattern emerges in the relatively stable policy contexts, and it is desirable for introducing and adapting the novel policy concept of EIP with new contexts in the beginning of the policy process. Accordingly, adaptability was the main feature of the durable policy, and the adaptability was evident in the aspects of the reshaping of policy ideas and key policy actors.

The result of phase 2 disagrees with the theory. Unfolded in relatively stable policy contexts, the translation pattern in phase 2 is featured by the gradual infusion of administrative features into the 'cooperation-experimental implementation'. This emerging pattern brings about type A of policy durability. It reflects that the increasing administrative features are necessary for the emergence of type A of policy durability, because these features can bring about patterned and stable center of the policy assemblage. A remarkable feature of the type A of policy durability in this case was minor additions of policy ideas into the stabilized center of the policy assemblage, which resulted from the strategy of fashioning, i.e. linking EIP with salient policy issues. The importance of making such linkage has been recognized for the stage of adoption of reforms (Patashinik, 2003), and the study indicates that it is also crucial in the ongoing policy implementation process.

The overall conclusion is that the successions of the two translation patterns constitute a process of strengthening and stabilizing the weak and tentative beginning. It reflects a virtuous cycle of the interactions between top-down initiatives and bottom-up policy actions (Weir, 2009) in stable policy contexts. It begins with the dynamics that an innovative policy concept is facilitated by the top; however, the facilitation depends greatly on the experimentation and the bottom-up process (i.e. local actions and infrastructures). This bottom-up process, diffusing ideas in the bottom, in turn leads to increasing administration on the top. This virtuous cycle seems to be a desirable policy translation process to achieve the durability of policy in relatively stable policy contexts, and more importantly, it proves successful in the diffusion of EIPs in China (e.g. Shi et al., 2012; Tian et al., 2014). More studies on translation patterns in diverse policy contexts can greatly enrich our understanding of generating policy durability, and can further enable global, enduring, and effective "traveling" of sustainability related concepts and practices.

CHAPTER 4

POLICY DURABILITY OF CIRCULAR ECONOMY IN CHINA

This chapter is published in an international academic journal: Jiao, W. and Boons, F.A.A. *Policy Durability of Circular Economy in China: A process analysis of policy translation*. Resources, Conservation and Recycling, in press. doi:10.1016/j.resconrec.2015.10.010. To fit the whole thesis and reduce the overlaps between chapters, minor modifications of the text have been made.

Author Contributions. Jiao,W. collected the data and performed the analysis. Jiao, W. and Boons, F.A.A. developed the theory and discussions. Jiao,W. wrote the paper under the supervision of Boons, F.A.A., and Boons, F.A.A. improved the English.

Abstract: In spite of many observations that governmental policy exerts significant influences on the development of Sustainable Industrial Clusters (SICs), such policy dynamics have not been systemically investigated, and policy durability as one of its important dimensions has been neglected thus far. This study aims to reveal the processes that are needed to bring about policy durability, in order to assess its impact on the successful stimulation of SIC. Building on previous work, we conceptualize policy durability as the result of an active translation process, during which key elements of policy (actors, ideas, practices, objects, labels) are assembled and reassembled over time. More specifically, we introduce a further analytical step through examining the materialization of policy ideas into physical objects. The case of the Chinese Circular Economy (CE) Policy is presented here for the first time as a translation process that evolves from being dominated by a single agency engaged in experimental implementation to centralized cooperation implementation with a mixture of experimental and administrative features. This process features a continuous interaction of primary policy translators, their central interpretations, and associated governmental selection patterns of industrial parks. During this process, we find a progressively better fitness with the context, while establishing conservative forces against policy undermining. In this way, the Chinese CE policy has been made durable.

4.1 INTRODUCTION

Sustainable development is a complex task requiring long term and continuous governmental efforts. For instance, to transit to a low-carbon economy, the United States National Research Council (2010) argues that climate policy must be sufficiently sustained for decades. This points to the concept of policy durability (Patashnik, 2003), which indicates the need for a policy to withstand the anti-forces of undermining or termination. Likewise, policy durability is a significant factor for transforming industrial clusters into SIC. Over the years, many countries have introduced policy programs to facilitate SIC, and SIC has become a buzzword in worldwide policies (Massard et al., 2014). However, some policies are only maintained for a short time and then dissolve, often failing to lead to effective policy outcomes. This is especially true for SIC, because they often display a long gestation time before synergies between environment and economy emerge. Industrial symbiosis, which is a key eco-industrial approach of SIC, is a long term process of emergence, evolution, and dissolution of symbiotic relationships of by-product exchange and utility sharing in industrial clusters (Boons et al., 2014). Such a process requires reflexive deliberation and adjustment of the policy over time to fit the different stages of industrial symbiosis (Chertow, 2007), and the evolving context in which it germinates and diffuses. This implies that policy durability cannot be achieved once and for all (Patashnik, 2003); it is a continuous process requiring hard work of policy actors. This study presents insights into the processes that are needed to bring about a durable policy of SIC.

In our previous studies we have grounded the concept of policy durability in the field of policy studies, governance studies and Actor-Network Theory (Jiao et al., under review), and developed a theoretical framework of policy translation and a processual approach to study the dynamics and complexity of policy processes (Jiao & Boons, 2014). We conceptualize policymaking as a sequence of events that brings a certain policy concept into practice, during which four key elements of policy (actors, ideas, objects, and practices) are assembled and reassembled. Following Czarniawska and Sevón (1996) we refer to this process as translation, as the policy concept and the assemblage that forms around it takes a particular form in relation to the context in which it is used, similar to

the way a text is translated into another language. This conceptualization allows us to look at:

- **policy durability**: the stability of the assemblage of policy elements around the policy concept;
- **translation patterns:** typical ways in which policy assemblies emerge and are maintained;
- **policy outcomes:** in the case of policies for stimulating SIC, this refers to the diffusion and implementation of the SIC concept to industrial parks.

Building on the Chapter 3, which focused on theoretical development, this chapter presents a thorough analysis of an empirical case to assess how policy durability affects policy outcomes. In the analysis we focus on uncovering the translation patterns, what kind of durable assemblies of policy elements they generate, and how this produces policy outcomes. We thus pay particular attention to the policy element of material objects that become part of the policy assemblage, i.e. the involved industrial parks. These objects are part of the assembly, as well as constituting the policy outcome. They thus help to provide policy durability (Law, 1992), as well as constituting the outcomes expected by policy makers.

Chinese CE Policy is selected as a positive case (Blatter and Haverland, 2012), because the concept of CE arrived in China in the late 1990s, and has been actively and persistently translated into policies for more than a decade. CE has become a comprehensive national strategy toward sustainable development. One of the important aspects of the CE policy is stimulating SIC. CE in China is entering the stage of institutionalization (Zhu, 2009). The case presents a positive result in terms of durable governmental facilitation on the development of SICs and a continuous materialization of CE ideas in industrial clusters. Our main research questions are:

1) How was the concept of CE translated in Chinese policy over time, and what typical translation patterns characterize this process?

2) How did key policy elements assemble and reassemble around the concept of CE in such a way as to generate a durable policy?

3) What were the characteristics of the involved industrial parks, and how did they connect to other policy elements in the policy assemblage to contribute to a durable CE policy?

The remainder of this chapter is organized as follows. Section 4.2 introduces the theoretical framework. Research methods are described in Section 4.3. Section 4.4 analyzes the translation patterns and delineates the phases of the policy translation process. The results of policy assemblage and policy durability are analyzed in section 4.5. Section 4.6 provides discussions, and Section 4.7 concludes the study and derives policy implications.

4.2 THEORETICAL FRAMEWORK

4.2.1 Policy Facilitation and Policy Durability of SIC

Both the academic and policy driven literature have recognized the importance of policy efforts to facilitate SIC, and many studies strive to uncover the dynamics of policy facilitation and intervention on SIC. However, such mechanisms are still relatively unclear (Jiao and Boons, 2014). One of the key dimensions to understand in this context is policy durability (see its definition in Chapter 3). Policy durability relates to persistent policy formation and implementation, which starts from the adoption of a certain policy concept by policy makers, and which is then developed into decisions, programs, and actions. These decisions can be modified, and programs and actions can be adjusted. As a result of this dynamic process, policy evolves over time; policy durability thus refers not to policy elements remaining identical; it refers to the persistent pursuit of applying a policy concept and associated goals under changing circumstances.

Policy durability has particularly importance for SIC. First, SIC requires local environmental and economic practices shifting from a single firm perspective to cooperation among firms. This requires a high degree of changes in organizational routines and local industrial systems, which can be expected to result in resistance to policy implementation, especially when stakeholders are uncertain about the outcomes. Thus, trust building, which is a long term endeavor, is crucial in establishing industrial symbiotic network (Gibbs, 2003). For SIC, this is complicated by the fact that in the context of CE policy in China, there are gaps between national policy making and local governmental implementation (Xue et al., 2010). Thus, a persistent policy effort is necessary to lead to successful establishment of SICs. Secondly, the development of a SIC is itself a long term process (Boons et al., 2014), and environmental and economic

effects are achieved only in the long run. Stakeholders or industries may lose interest in SIC if the short term profit is not evident. In this situation, a persistent core of certain policy makers who have long term commitment on SIC can be crucial (Brinkerhoff, 1996).

Such policy durability is not self evident. Governmental actors may be unable to bind themselves to the same policy for extended periods of time (Patashnik, 2003), leading to a shift of attention from SIC to other policy issues. This can be caused by numerous factors: changed interests of government (due to changed public and/or media attention), the reshaping of the dominant political coalition (as a result of elections), or the emergence of other urgent policy issues (e.g. economic crisis). Due to the existence of such factors, policy durability requires analysis, the framework for which is presented below.

4.2.2 Policy Translation, Policy Assemblage, and Materialization

(1) Policy as a Translation Process

When the policy concept, like SIC, dis-embeds from its original context, crosses national borders, and arrives in a new context, it confronts a new policy reality. In this new reality a specific translation of the concept emerges: it is shaped to fit with the new context. We conceptualize this policy process, a sequence of policy events as defined in Chapters 2 and 3, as the translation process. Six plausible policy translation patterns have been identified in Chapter 3. Table 4.1 describes the typical translation patterns.

(2) Policy Assemblage and Policy Durability

In Actor-Network Theory, translation is a key mechanism for the process of gradual (dis)assembling of heterogeneous elements, including both human and non-human actors (Callon, 1986). For instance, when the concept of CE, which originated in Germany (Geng et al., 2013), arrived in China, it needed to connect policy issues at hand (ideas), policy actors' preferences (actors), as well as contextual factors (e.g. the development of industries and all kinds of industrial clusters). Such connections are not static after its arrival in the new context, but continue to evolve over time in the policy implementation process. The translation process is thus characterized by the emergences and evolution of policy assemblage (see Chapter 3). The stability of this policy assemblage over

Table 4.1 Policy Translation Patterns

Pattern	Process Description	Examples
single agency – administrative implementation	The process begins with an authoritative policy decision, and a governmental agency is appointed to implement the decision. The agency translates the decisions into programs, tasks, or objectives, which are designed to deliver to the locals through hierarchical manner. The implementation is regulated, and sometime resource is provided. The policy outcome is monitored, based on which policy makers decide to withdraw or continue resource.	It often emerges when heavy-handed state regulations are needed. For instance, to prevent pollutants discharge and emission (e.g. COD), environmental regulations in many countries adopt a command and control instruments. And the pollution control authority monitor and evaluate local performances.
cooperation – administrative implementation	The process starts with the policy decision of joint actions of multiple actors. And one agency acts as the major coordinator. The coalition among the relevant actors is formed through a series of actions of interestment (e.g. negotiation, persuasion, or power). After the establishment of coalition, the policy decisions are translated into programs or tasks. The following sequence is similar to the single agency – administrative implementation.	The binding policy of energy conservation and emission reduction in China is jointly implemented by the State Environmental Protection Agency and National Development and Reform Commission. And five-year objectives are allocated to all the provinces.
single agency – experimental implementation	Experimental implementation is often adopted when policy actors have ambiguous knowledge about certain policy issue. The starting point of this pattern is the policy decision with single agency as the implementer. Or a single agency serves as a policy pioneer to facilitate certain innovative policy concept. As the policy concept is relatively new and knowledge lacks, policy actors tentatively implement it through piloting. Meanwhile, learning by doing, mobilization and education are going on. Based on the experience from empirical practices and learning, policy makers adjust policy goals and means accordingly.	The early stage of Eco-industrial Park Policy in China presented this pattern. State Environmental Protection Agency was the single actor who initiated the demonstration program, and developed policy documents while piloting and learning.
cooperation – experimental implementation	The starting point is policy decision of joint actions of multi-actors and certain agency served as the coordinator. The coordinator tentatively defines the goals	In the province of South Holland, the Netherlands, at the early stage of

	and roles of other actors, and also strives to form a coalition through a series of actions of interestment. After the formation of a temporal coalition, the coalition tentatively develops policy goals and means through piloting and learning, and also explores efficient ways of cooperation. The empirical knowledge and learning can lead to new ways of cooperation and adjustment of policy goals/ means.	Eco-industrial Park policy, the experimental implementation was jointly conducted by the Department of Economic Affairs, and Department of Environmental Protection.
boundary implementation	The key of boundary implementation is developing the boundary object. Boundary Implementation starts with the policy decision of joint actions of multi-actors, and highlights the importance of heterogeneity of actors to achieve the overall policy goals. So actors are engaging in developing boundary objects to connect the actions of different policy actors. These activities are coherent, and they together achieve the overall policy goals.	The term of "environmental modernization" is argued as a boundary object of the European environmental policy programs (Giorgi and Redclift, 2000).
symbolic implementation	It emerges when the policy goals and means are referent and ambiguous, and the conflicts between policy actors are high (Matland, 1995). The starting point is a referent policy goal (e.g. a symbol, a slogan), and many actors interpret that they relate with the goal, and start to act, as a result, many small coalitions formed. Most often these coalitions compete with each other.	The Community Action Agency in the United States developed a referent goal of facilitating local citizen empowerment. However, this goal was unclear to all the policy actors. Thus, many controversies emerged among these policy actors when implementing the policy (see Matland 1995)

Table 4.2 Types of Policy Durability

Type	Characteristics
A	Persistent policy label +stable other policy labels+ stable structure of the policy assemblage
B	Persistent policy label + unstable other policy labels+ stable structure of the policy assemblage
C	Persistent policy label + stable other policy labels + unstable structure of the policy assemblage
D	Persistent policy label + unstable other policy labels + unstable structure of the policy assemblage

time is an empirical phenomenon: it may (re)shape as time passes (DeLanda 2006; Jiao & Boons, 2014). We take such stability as an indicator of policy durability. We note that the original policy label can gradually connect with other policy labels, and thus become connected to other policy assemblages. Therefore, we elaborate four types of policy durability (Table 4.2), ordered from A-D in terms of decreased stability (which in turn indicates decreased policy durability). Below we operationalize these types of durability in terms of measures taken from Social Network Analysis. This provides us with an analytical tool to assess policy durability. We can then relate durability to typical translation patterns (discussed above) and policy outcomes as defined in the following section.

(3) Materialization and Physical Objects

In the context of analyzing CE policy, the policy element 'object' deserves more elaboration. Firstly, translating ideas into objects indicates policy outcomes: an increased number of SIC can be taken as an indicator for policy success. In our conceptual framework the translation of ideas into objects is referred to as materialization (Czarniawska and Joerges, 1996). Materialization is seen here not so much as a policy outcome, but is argued to be a good translation strategy to overcome resistance and to sustain the policy (Law, 1992). Thus, material objects such as SICs have an expressive role: they signify the policy and its goals, communicating its success to potential adopters. At the same time, the strategy of materialization should be analyzed with caution (Law, 1992), because policy durability cannot be guaranteed by this strategy only: durability is a collective and relational effect of the four policy elements: objects, ideas, practices, and actors. This requires researchers to elucidate the characteristics of objects, such as the types of industrial parks, and its connectedness with other elements of the policy assemblage. For instance, a stable linkage between key actor, central idea, and the regulated subsidy provision are important to maintain their long term relations with their clients: industrial parks. In this study, in addition to the general questions of typical translation patterns and varying levels of policy durability, we further highlight the characteristics of selected industrial parks and its intertwinement with other elements in the total policy assemblage.

4.3 METHODS

As described in Chapter 3, we adopted and followed the analytical steps of Event Sequence Analysis to investigate the policy translation, specifically:

4.3.1 Boundary Decision and Central Subject

The Chinese CE policy is selected as the case. In China, CE is defined as a rather comprehensive concept, which includes the activities with the principles of "reduce, reuse, and recycle" in the process of production, circulation, and consumption (Circular Economy Promotion Law). Here we focus on the part of CE which seeks to stimulate SIC, which is seen as one crucial stepping stone of CE[9]. So the central subject is defined as "Chinese CE policies on facilitating SIC". The translation process began with the arrival of the concept of CE in the Chinese context, and was then picked up by national policy actors and underwent various translations in the national policy process that unfolded. Our original system boundary was thus drawn to include national policy actions. In developing a further understanding of these actions, we followed the method of progressive contextualization (Vayda, 1983) to evaluate the initial system boundary and identify further relevant policy events. This is because in the unfolding national process, events at other levels, such as international experiences, and local actions, can be found to trigger actions and events at the national level.

4.3.2 Data Collection

Data were mainly collected from written materials, including government policy reports and news reports, and speeches by important policy makers. These documents were collected in a search of the database of State Environmental Protection Agency (SEPA) and National Development and Reform Commission (NDRC), using the keyword 'Circular Economy'. If certain documents were mentioned but couldn't be downloaded in these databases, we located them through Google search engine. The data covered the period from 1995 to 2013. We further gathered two types of data about individual industrial parks. The first type was date of inclusion of an industrial park into one of the relevant national policy programs. The data was mainly collected from the database of SEPA and NDRC. The second type was the administrative type of industrial

[9] It is difficult to study the longitudinal policy development of CE with such comprehensive and wide conceptual and practical scopes. So we mainly focus on the aspect of CE on stimulating SIC.

parks, referring to the administrative level of the coordinating body in the industrial parks. We classified industrial parks into two types: national level industrial parks and provincial level industrial parks (including municipal level industrial parks). The data were mainly collected from the website of each industrial park.

4.3.3 Event Sequence, Phases, Patterns, and Assemblage

Following the steps as described in Chapter 3, we got 78 events. We coded the events according to the coding schemes. In the coding process, we added several other codes to cover the types of events that do not match any of the existing categories of the coding scheme, because these actions were important for the evolution of policy process. One example is the code of policy entrepreneurship, which means that policy entrepreneurs (e.g. a professor in this case) from the outside of the formal positions of government, introduce, translate, and help to implement new ideas into public practice. The intentional linkages between events were then coded, and this indicates that actors or their documents refer to the previous event as a condition of the current event (Boons et al., 2014). We further colligated the same type of events as one building block (Appendix Table A4.1). The events and their linkages were visualized as event sequence unfolding as time passes (Spekkink, 2014). Such visualization reveals how the process unfolds, and also identifies important or critical events. The identification of patterns and phases was based mainly on our careful interpretations on the event sequence. Through identifying the breakpoints (Chapter 3), the policy process was separated into five successive phases. Then we checked the percentage of the appearance of translation pattern building blocks in each phase. Thus we can match each phase with the typical patterns.

We conducted two cycles of coding, i.e. descriptive coding and focused coding, of each event in terms of the four key policy elements. IDEA, OBJECT, PRACTICE, and ACTOR were taken as four separating coding tracks. The coding results were imported into Gephi as a network of elements. When analyzing the assemblage, we combined the interpretive analysis to provide qualitative assessment and the Social Network Analysis to provide quantitative measurement. Social Network Analysis strengthened the interpretive analysis of the (re)shaping of the policy assemblage in the following way. Firstly, we selected the indicators of Degree Centrality and Eigenvector Centrality to

uncover what policy elements were of key structural importance in the assemblage in the different phases (Borgatti et al., 2009). Degree Centrality can reflect activeness of policy elements, as increased connectedness implies that the policy element in question is more often a point of connection in events. It is the ratio of the numbers of linkages of an element to the total numbers of linkages of the assemblage. In contrast to equal weighting all linkages as Degree Centrality, Eigenvector Centrality gives different weights to elements according to their centrality (Bonacich, 2007). Secondly, we normalized the weights of linkages of the assemblage. We gave different colors to the linkages based on this normalized weights. The combination of centrality and normalized weights helps us distinguish a core-periphery structure of the assemblage.

4.4 POLICY TRANSLATION PATTERNS AND PHASES

Great political significance has attached on CE for more than 15 years in China. Following the analytical steps of Event Sequence Analysis as mentioned in section 4.3, the overall translation process is delineated into five phases.

Phase 1: Emergence of Local Initiatives. Translating CE into a nationwide policy was a bottom-up process with the emergence of regional initiatives (Fig.4.1). The regional initiatives were about two parallel policy processes. One was the *China Agenda 21st*, through which CE was introduced from Germany to Shanghai. The other was National Demonstration Program of Eco-Zone, based on which two regional governments made the decision to embark on an ecological transition of the regional system through promoting CE. The initiatives were supported by SEPA, and subsequently became the pilots of National Demonstration Program of CE Zone. It was the starting point of the national policy translation process of CE.

Phase 2: Single Agency – Experimental Implementation. The national policy translation trajectory of CE formally began with the initiation of the National Demonstration Program of CE Zone (Fig.4.1). Phase 2 matches the pattern of Single Agency – Experimental Implementation. In this phase, SEPA was the policy pioneer, who strived to introduce CE into the Chinese policy context. At that time, SEPA had limited knowledge about this novel concept. Thus, tentative and experimental ways of policy making and implementation were adopted. The Provisional Procedures of Application, Management, and Designation of the

Program and Provisional Guideline for CE Plan Making were only published one year later. Furthermore, R&D was also taken as an important source for knowledge accumulation. Mostly, the main dynamics in phase 2 was experimentation and learning by doing. However, this phase was only sustained for about two years, and then interrupted by the emergence of another policy actor who proactively advocated CE.

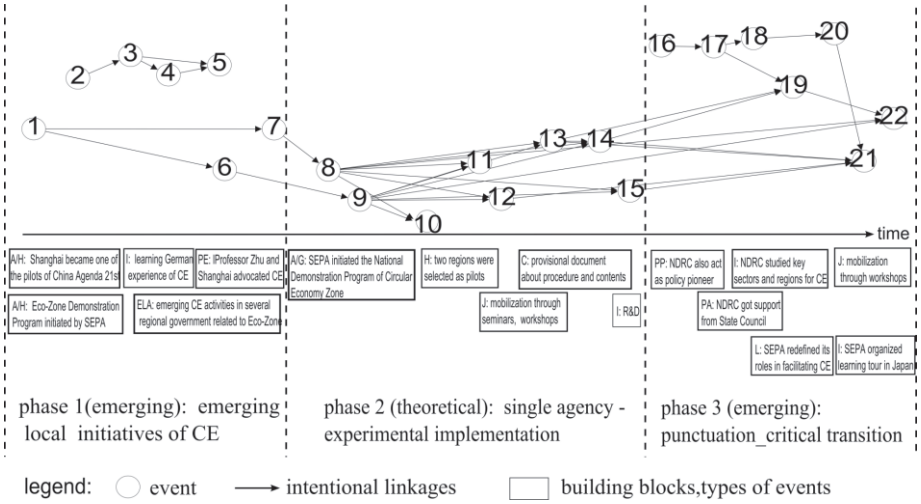

Fig. 4.1 Event Sequence and Translation Patterns of Phase 1, 2, and 3

Phase 3: Critical Change and Punctuation. Phase 3 does not match any of the theoretical patterns (Fig. 4.1). It featured intensive changes, resulted from the emerging activities of NDRC. NDRC endeavored to act as policy champion to boost CE, through which a controversy around CE started to emerge. Controversy refers to shared uncertainty, which unfolds when accepted ideas start to be questioned and discussed, and new ideas are still not accepted (Venturini, 2010). In phase 3, the emergence of controversy led to hybrid framing of CE; in addition, a new framing was selected and supported by the powerful actor: the State Council.

Phase 4: Cooperation – Experimental implementation. Phase 2 was interrupted by the events that constitute phase 3, after which phase 4 unfolded with a pattern of *Cooperation – Experimental Implementation* (Fig.4.2). Phase 4 began with the publication of the programmatic document Instructive *Opinions of State Council on Speeding up CE Development (Instructive Opinions on* Promoting CE for short*)* with the decision of ministries to cooperate, and of

NDRC as the key coordinator, based on which SEPA compromised through reinterpreting the concept and redefining its role in facilitating CE. This concession by SEPA enabled the establishment of a coalition constituted by NDRC and SEPA, and four other ministries. More importantly, the involvement of the powerful actor of the State Council accelerated this process.

The coalition of the six ministries initiated two batches of CE pilots as source for empirical experience accumulation. Meanwhile, NDRC, cooperating with different ministries according to the purposes at hand, developed CE indicators and CE standardization, and more importantly, drafted CE Promotion Law in order to orient and formalize the implementation in more structured ways. It is worth noting that this was a reflective and learning-by-doing process, such as initiating pilots for CE standardization and several rounds of thematic discussions. In addition, mobilization was performed through speeches, seminars, forums, and expositions. Mostly, phase 4 was a co-evolving process of policy making and implementation, during which policy goals and instruments were progressively developed. One important product was the CE Promotion Law that led the shift into Phase 5.

Phase 5: Cooperation Implementation –A Mixture of Experimental and Administrative Features. The enforcement of CE Promotion Law became a conservative force for the continuous CE development (Fig.4.2). The CE Promotion Law was the first CE law in the world taking CE as a national social and economic development strategy (Mathews & Tan, 2011). CE has eventually stabilized into institutions (Zhu, 2009). Shaped by the Law, the translation process showed the mixed features of experimental and administrative implementation. On one hand, the implementation displayed reflective learning in programming. For instance, these programs were voluntary in nature and implemented through piloting and demonstrating. Also, two batches of CE Pilots were evaluated after eight years' implementation, which could be regarded completing a full cycle of learning. On the other hand, the implementation process was administratively structured. Specifically, the *National CE Plan* has developed five-year targets and programs, and the application of subsidies was disciplined through periodic performance evaluation and contracting and refunding system. That was, to get the national subsidy, local actors need to sign contracts, and the allocation of funds was based on periodic performance-based

evaluation. Furthermore, a refund system was applied if the local actors failed to meet the targets as signed in the contract. And importantly, the CE Promotion Law bound industrial activities that were against the aim of CE, although it was a soft law. In general, the maintained experimental and reflective implementation gradually became intertwined with increasing administrative features in phase 5.

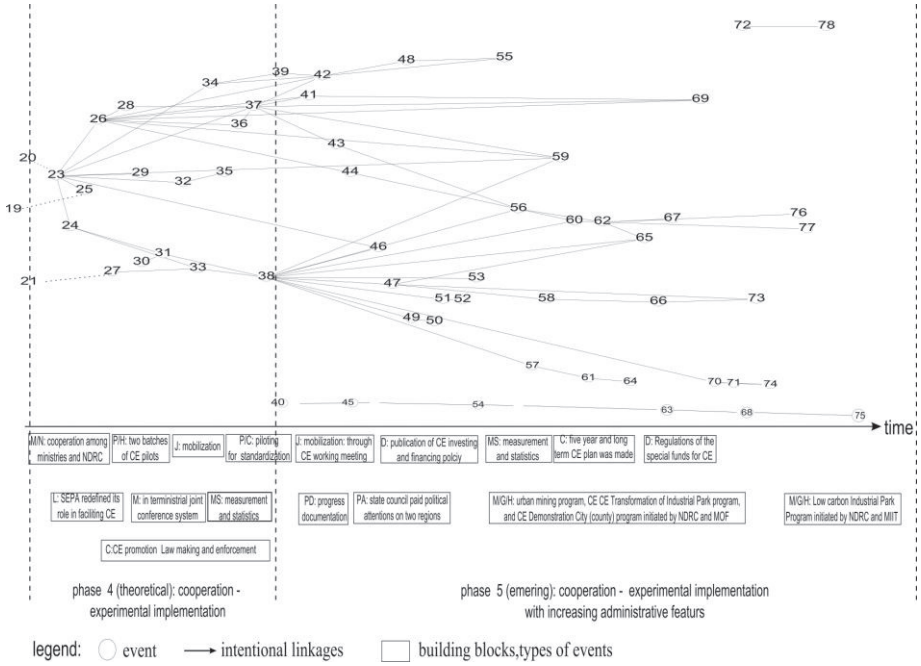

Fig.4.2 Event Sequence and Translation Patterns of Phase 4 and 5

4.5 POLICY ASSEMBLAGE, MATERIALIZATION, AND POLICY DURABILITY

4.5.1 Total Policy Assemblage

CE has been sustained as a significant policy concept in China for over than 15 years. Figure 4.3 provides an overview of the total assemblage for the complete period (phases 1-5), and Table 4.3 shows some structural features for the same period. Connecting to the general label of CE, the frequently recurrent and central ideas revolved around transforming the economic development mode, which took Resource Productivity as the core and “Reduce, Reuse, and Recycle” as combined principles. Three important and frequently connected actors were NDRC, SEPA, and Ministry of Finance (MOF). Within them, NDRC was the

primary policy translator, who was the most active and powerful actor. And SEPA and MOF independently occurred or co-occurred together with NDRC. To materialize these ideas, the recurrent practice was selecting pilots. For the whole period we see a complex assemblage under the persistent label of CE, meanwhile, many diverse labels emerges, which reflects the durability of CE policy at least at level D (see Table 4.2). To assess if durability also achieved higher levels, we need to look at the evolution of the assembly over the different periods.

Table 4.3 Centrality and Frequency of Elements in the Total Assemblage (highest five)

Degree Centrality (Fig. 4.4)		**Eigenvector Centrality (Fig. 4.4)**		**FREQUENCY (Fig. 4.3)**	
0.867	DNRC (actor)	***1***	NDRC(actor)	***58***	CE (label)
0.84	CE (label)	***0.966***	CE (label)	***48***	DNRC (actor)
0.580	Transform economic development mode (idea)	***0.884***	Resource productivity (idea)	***23***	Recycle (idea)
0.573	SEPA (actor)/MOF (actor)	***0.875***	Transform economic development mode (idea)	***22***	Selecting pilots (practice)
0.553	Resource productivity(idea)/recycle(idea)	***0.864***	MOF (actor)	***20***	SEPA (idea)

4.5.2 Policy Assembling in Each Phase

The structural features of the total policy assemblage did not remain static; instead it was changing across phases. We will analyze these dynamic features of the policy assembly in this section. Figure 4.4 depicts the assemblage of each phase, and Table 4.4 and 4.5 show the Eigenvector and Degree Centrality.

Phase 1. In Phase 1, the emergence of CE related to two independent clusters of elements assembled around two existing policy labels: China Agenda 21st and Eco-zone, both of which were popular policy themes relating to the international discourse of Ecological Modernization and Sustainability at that time. In the China Agenda 21st cluster, Shanghai Municipality was an active and important actor, who introduced CE into the Agenda 21st _Shanghai Action Plan, joined by one professor who helped in translating the German experience into the Action Plan. The other cluster around Eco-zone did not explicitly relate to the aim of CE, but created a favorable context for the development of CE. First,

the principle of Eco-zone was 'ecological economics', taking the environmental dimension into account in economic development, which also was an underlying idea of CE. Second, Eco-zone triggered the actions of two regional actors who started to work on the idea of CE Eco-zone. Generally, CE started to emerge in several local contexts, which helped to trigger the policy translation process of CE at the national level.

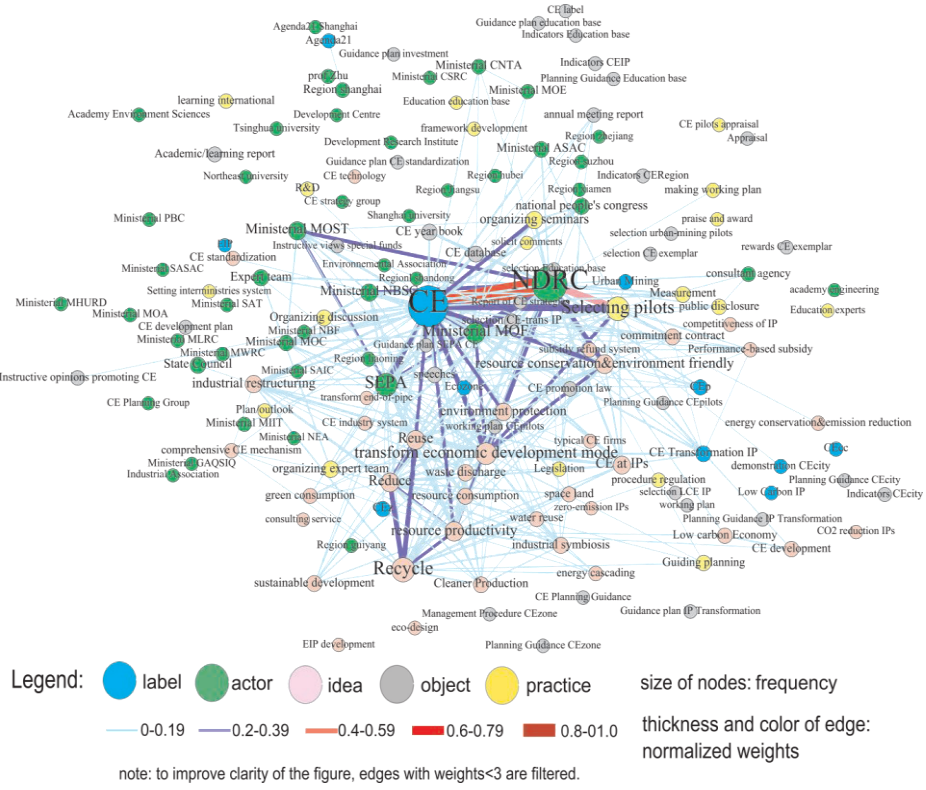

Fig.4.3 Total Policy Assemblage

Phase 2. As the most active and important actor, SEPA introduced CE in the national policy context through initiating the Demonstration Program of CE Zone. SEPA made this novel concept with western origins tangible in China through developing significant ideas regarding the conceptual representation of CE and policy goals. The conceptual representations referred to the eco-industrial approaches covered by CE, such as the frequently mentioned and central ideas of Cleaner Production, Eco-design, and "Reduce, Reuse, Recycle", etc. Also, the policy goals were to transform the economic development mode

Table 4.4 Degree Centrality in the Assemblage of Each Phase (highest five and value≥5)

Phase 1		**Phase 2**		**Phase 3**		**Phase 4**		**Phase 5**	
0.5	Prof.	***0.80***	SEPA	***0.87***	CE	***0.90***	CE	***0.99***	NDRC
		0.63	CE Zone	***0.83***	DNRC	***0.82***	NDRC	***0.87***	CE
		0.58	Cleaner production/reuse	***0.6***	Instructive opinions on promoting CE/ Organizing seminars	***0.78***	SEPA	***0.74***	MOF
		0.53	Eco-design	***0.57***	Academic/learning reports	***0.75***	Resource productivity	***0.66***	Transform economic development mode
				0.5	Speeches	***0.66***	Resource consumption/ waste discharge	***0.65***	Resource conservation and environment friendly society

Table 4.5 Eigenvector Centrality in the Assemblage of Each Phase (highest five &value≥5)

Phase 1		Phase 2		Phase 3		Phase 4		Phase 5	
1	Prof. (actor)	*1*	SEPA (actor)	*1*	CE (label)	*1*	CE (label)	*1*	NDRC (actor)
0.92	Learning international experience (practice)	*0.95*	CE Zone (label)	*0.99*	NDRC (actor)	*0.99*	Resource productivity (idea)	*0.96*	CE (label)
0.84	Shanghai municipality (actor) /Agenda 21st (label)	*0.94*	Cleaner production, reuse (idea)	*0.87*	Instructive opinions on promoting CE (object)	*0.97*	DNRC (actor)	*0.92*	MOF (actor)
0.60	Recycle, Reduce, Reuse(idea)/learning reports (object)	*0.88*	Eco-design (idea)	*0.86*	Organizing seminars (practice)	*0.96*	SEPA (actor)	*0.88*	Transforming economic development mode (idea)
0.59	Agenda 21st_ Shanghai Action Group (actor)	*0.79*	Recycle, Reduce, waste discharge, Resource productivity, industrial symbiosis (ideas)	*0.80*	Speeches (object)	*0.94*	Resource consumption, waste discharge (idea)	*0.85*	Resource conservation and environment friendly society (idea)

and improve resource productivity, as well as reduce waste discharge and lower resource consumption. To summarize, the general dynamic features of the assembly in phase 2 were that the single actor of SEPA became the center of the assemblage, and many ideas assembled with an emphasis on the interpretation of what CE should be in the Chinese context.

Phase 3. There was a critical change in the policy assemblage in phase 3. The central position of SEPA vanished and was replaced by NDRC. This critical replacement was stabilized by the publication of the linguistic object of *Instructive Opinions on Promoting CE*. The emerging new actor of NDRC engaged in disseminating CE ideas and mobilizing actors through spreading learning reports about international CE experience and important speeches, as well as organizing seminars. Mostly, the assembly of phase 3 featured the emergence of the controversial force against SEPA, which later on became the dominating force in directing the translation trajectory. This abrupt change was accompanied by frequently recurring practices of learning and mobilization.

Phase 4. In phase 4, the policy assemblage showed vigorous enrichment of heterogeneous national governmental agencies and industrial parks (Fig. 4.4; Fig. 4.5). The specific policy label of CE Pilots (CEP) emerged under which CE was now developed as a new and independent policy program, including two batches of industrial parks pilots. In addition, a large number of ministerial actors assembled, although most of them located in a peripheral position. Within this group of actors, NDRC established an alliance with SEPA and several other actors. This alliance displayed a centralized structure with NDRC as the core. Along with the enhanced importance of NDRC, the idea of improving Resource Productivity became the most important idea of CE. Generally, in Phase 4, the assemblage featured the sustained central role of NDRC, and its increased connections with many heterogeneous actors at the ministerial level. Within these connections, an alliance with centralized coalition between NDRC and SEPA was established. One remarkable development was the involvement of a large number of industrial parks as the pilots.

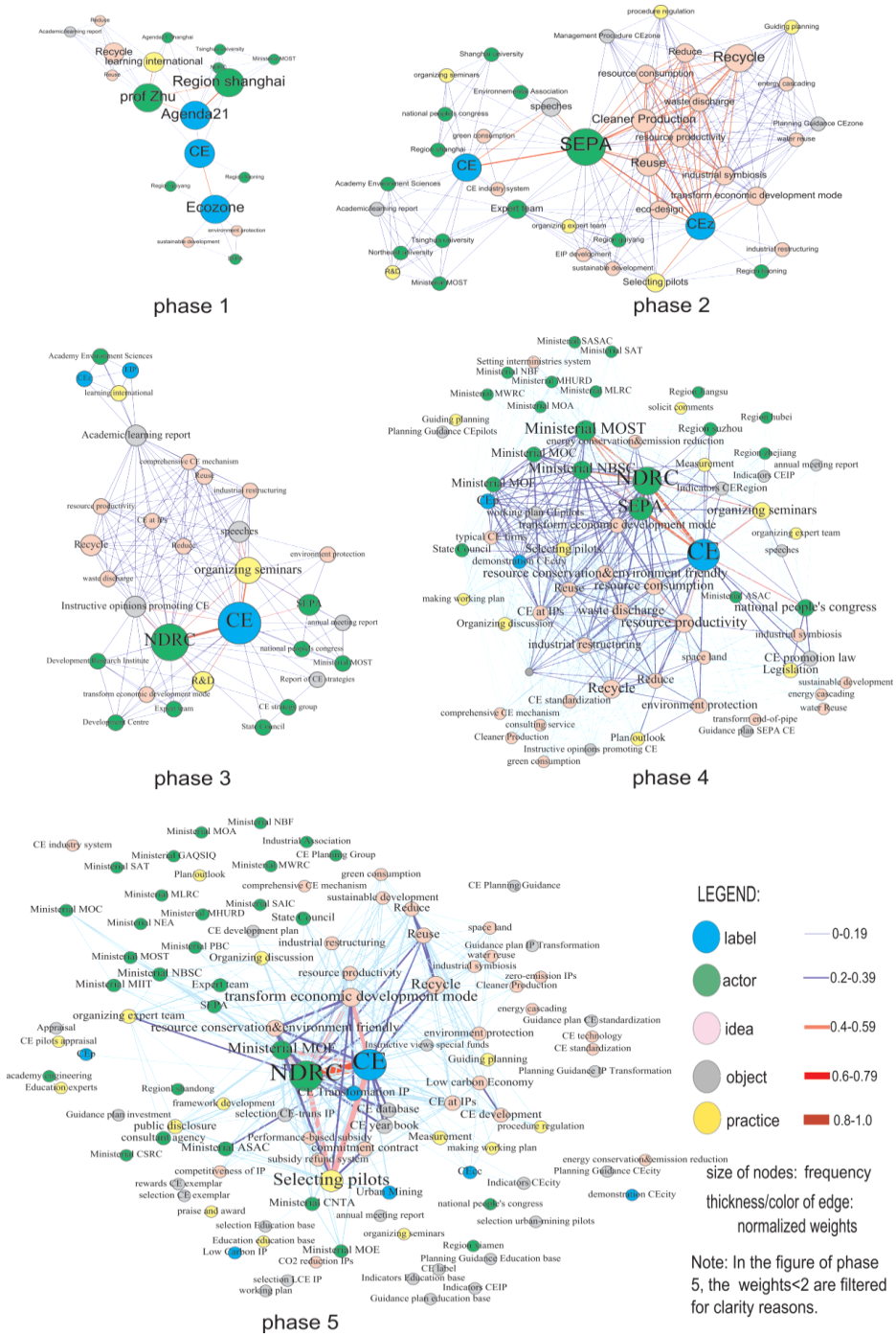

Fig. 4.4 Policy Assemblage of Each Phase

Phase 5. In phase 5, the policy assemblage grew intensively with the emergence of several specific policy labels, many linguistic objects, and a substantial number of industrial parks. Also, several specific labels emerged under which new programs were initiated to promote different levels of CE, such as Urban Mining (recycling industry), CE Transformation of Industrial Park, and CE city and CE county (CE at the regional system). Along with the initiation of many new programs, the most frequent practice was 'selecting pilots' and 'demonstration'. Accordingly, a large number of industrial parks started to connect with CE through these different programs (Fig. 4.5). In addition to the enrichment of the policy assemblage, the central assemblage featured weakened alliance between NDRC and SEPA, and emerging interactions between NDRC and MOF. Generally, the assembly in phase 5 was characterized by specialization of the comprehensive concept into independent and targeted programs.

4.5.3 Types of Policy Durability

Table 4.6 Changes of types of dynamic of assembly across Phases

Phase	Comparison of Policy Assemblage Across Phases
Phase 1 emergence of local initiatives	Emergence of the concept of CE from assemblies around existing policy labels.
Phase 2 Single agency – experimental implementation	**Type C** - Persistent label of CE - Critical change of the central assemblage from SEPA to DNRC;
Phase 3 Critical transition and policy punctuation	**Type C** - Persistent label of CE - Growth of the central assemblage from single core of NDRC to a cluster of six interacting actors. And in the cluster, the interactions between DNRC and SEPA were more frequent. - Many ideas that emerged in previous phases were sustained, while the stressed ones changed from cleaner production and eco-design to resource productivity.
Phase 4 Cooperation – experimental implementation	**Type B** - Persistent label of CE and emergence of several specific labels (e.g. CE transformation of IPs, Urban Mining, and CE-city, CE-County, and Low Carbon IP) -NDRC maintained its central role and also its linkages with diverse actors, while the more frequent interaction between DNRC and MOF emerge -Stabilized key ideas located in the central assemblage, and emergence of several important new ones, such as ideas about signing contract and refund system, reflecting administrative features of policy.
Phase 5 Cooperation implementation - a mixture of experimental and administrative feature	

Table 4.6 presents the types of policy durability by summarizing the persistent and changing features of the policy assemblage and policy labels across consecutive phases. It shows that:

1) The general label of CE was persistent over time, along with the emergence and dissolution of several specific policy labels, such as CEP, Urban Mining, CE Transformation of Industrial Parks;
2) The center of the assemblage changed from a single actor to centralized coalitions;
3)The major elements in the periphery of the assemblage changed from idea development, to mobilization, to involvement of large number of heterogeneous actors and a substantial number of industrial parks.

4.5.4 Policy outcomes

For assessing policy outcomes we are mainly interested in the diffusion of the CE concept in industrial parks. Figure 4.5 presents the newly added industrial parks in the CE policy programs in each year and each phase. It shows that from phase 1 to 3 there was no involvement of industrial parks. In phase 4, 33 industrial parks, including two batches of CE pilots, became involved. In the following years, CE ideas continuously materialized in more industrial parks, especially from 2012 onwards. In phase 5, 110 industrial parks were newly enrolled.

In parallel with the CE policy stream there was another national policy stream aiming for the development of SIC in China. This was the National Demonstration Program of Eco-industrial Parks, which was mainly coordinated by SEPA. As the two policies became intertwined with each other (Zhang et al., 2010),we investigated the overlap of the industrial parks (Fig. 4.6) and found that there was a decrease in the overlapping rate from phase 4 to 5. This related to the shift of the alliance between NDRC and other ministries, as will be discussed in the following section. We further investigated the types of involved industrial parks. Industrial parks were classified into national industrial park and provincial industrial parks, based on their administrative connection (see section 4.3). Figure 4.7 shows that the ratio of national industrial parks to the total number of industrial parks decreased as the number of provincial industrial parks grew.

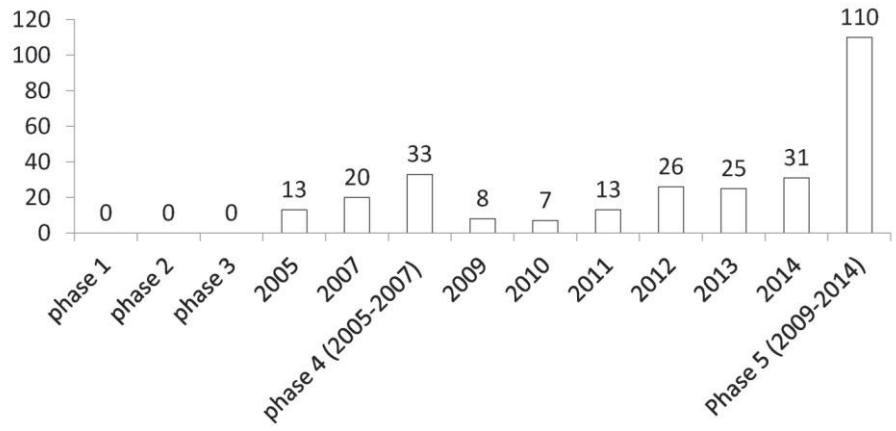

Fig. 4.5 The newly involved industrial parks each year and phase

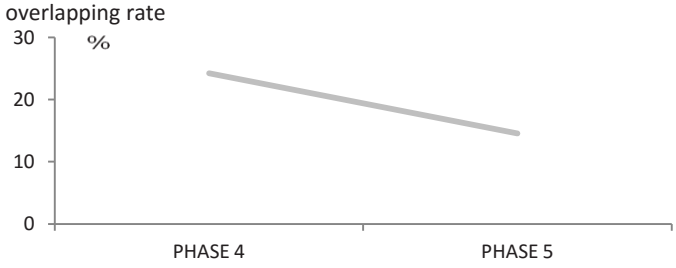

Fig. 4.6 Overlaps of Industrial Parks in CE and National Demonstration EIP Program[10]

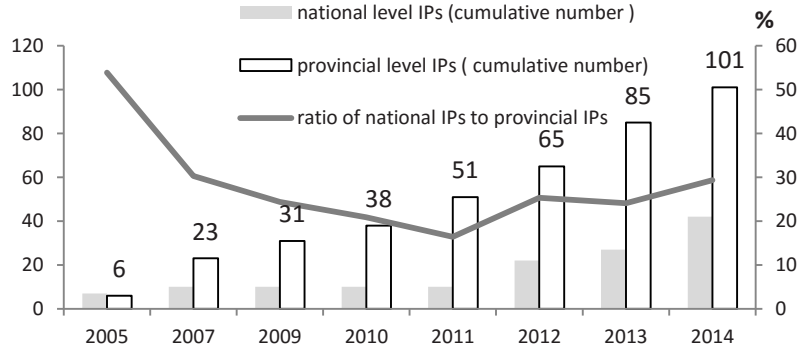

Fig.4.7 The number of administrative types of industrial parks

[10]The figure shows the ratio of the number of industrial parks involved in both programs to the total number of industrial parks involved in CE program only (newly involved in each phase).

4.6 DISCUSSIONS

We have now shown how the three main variables of our conceptual framework (translation patterns, assemblage of key policy elements, and policy outcomes) evolved in the course of the five phase translation process. We now discuss how these three variables relate to each other.

First, the national translation process of CE emerged from regional initiatives, and formally started with a pattern of *single agency –experimental implementation*. However, with a critical transitional phase, this pattern was enacted only for a short period, and shifted to *cooperation – experimental implementation*. During the different phases, the policy assembly displayed a change in the primary policy translator, as well as in associated central ideas. These changes created a better fitness with Chinese context and thus extended the lifespan of CE policy. Also, it resulted in effective policy outcomes. More specifically, CE was introduced from Germany and was framed as an environmental concept in China by SEPA. In Germany, CE was focused on waste management (Geng et al., 2013), while in the Chinese context, CE was translated into a strategy to solve environmental issues in the (rapidly growing) production and consumption system. Thus, it was elaborated by connecting it with the broader policy stream of Ecological Zone (City or Province). This reinterpretation of CE echoed the emerging environmental discourses of sustainable development and ecological modernization at that time, and it mainly took the region, rather than the industrial park, as the practical policy system boundary (e.g. CE Ecological -Province and CE Ecological –City). Subsequently, CE was reshaped and further embedded in China as an economic concept, as a consequence of the active involvement of NDRC which emerged in phase 3. The involvement of NDRC, which got powerful support from the State Council, to a large extent, eroded the previous central position of SEPA and the associated main conceptual interpretation. At the same time, this change sparked off the rapid diffusion of CE in industrial parks in the phases followed (Fig. 4.5). This was because the central idea of CE then highlighted that CE could fundamentally transform the economic development mode, which took resource productivity as the central tangible aim. The idea implied CE as an economic concept, while endowing economic development with a great value for the environment. Such an interpretation was distinctive when compared to the

translation of the concept in other contexts (Naustdalslid, 2014), and it created a better fitness within the Chinese context as a country that was rapidly developing in an economic sense. In China, economic growth and the improvement of living standards were still at the heart of political decisions; however, such growth has been constrained by the serious environmental pollution and resource shortage. Thus, CE as an economic term, which took the environmental dimension seriously, was more likely to be selected and supported by politicians and became the central framing of CE. Furthermore, the reframing of CE brought about rapid development of CE in industrial parks. Several researchers also found that CE developed faster after DNRC started to act as the major coordinator (Mathews and Tan, 2011; Ren, 2007). This was because when CE was interpreted as an environmental concept, it was open to be implicitly interpreted by stakeholders as a hindrance or a brake to economic development, resulting in low attractiveness to both industrial and governmental actors. In contrast, as an economic term, it increased the potential for industrial actors and practices to connect with the concept, leading to the enrollment of more actors and industries. Therefore, reframing of CE became a discursive strategy to attract more industrial parks.

Second, following the critical transition, the translation process presented a pattern of *cooperation- experimental implementation* (phase 4) that gradually became infused with administrative features (phase 5). As a result, the alliance between key policy actors became the center of the assemblage, as they constantly engaged in practices of learning, piloting, mobilizing, demonstrating, and evaluating. The establishment of alliance here showed two key features of stability. The first was the sustained stable and central role of NDRC. It has been argued that a long term commitment of a key policy actor is crucial for effective policy outcomes (Brinkerhoff, 1996). This is certainly the case for the development of CE, because transforming the economic development mode is a long term process, which means that the effectiveness of policy can only be achieved in the long run, while the short term profit can be low. Therefore, the persistent and active role of NDRC seems to have increased policy credibility and reduced policy uncertainties, thus, interesting the involvement of more industrial parks.

The other characteristic of stability was a stable structure of the central assemblage as a centralized alliance between DNRC and other ministries. Within such a centralized alliance, however, DNRC interacted with different actors according to the purpose at hand in different phases, reflecting its ability of increasing policy adaptability by reflectively interpreting the changing context and previous policy outcomes. The successful employment of this centralized structure relates to the nature of the policy issue and the numbers of participants (Provan & Kenis, 2007). CE was interpreted as a comprehensive and wide-scope concept, which can benefit from the actors' joint actions, however, the involvement of heterogeneous actors can lead to the extreme complexity of linkages between actors (Provan & Kenis, 2007). So the centralized coalition enabled NDRC to directly and selectively interact with other ministries according to the tasks at hand. For instance, phase 4 presented a pattern of experimental implementation, so NDRC frequently interacted with SEPA, because the experience that SEPA accumulated in earlier phases could advance the piloting. As phase 5 featured the scaling up of industrial parks and institutionalization, especially with the enforcement of CE Promotion Law, NDRC interacted more frequently with MOF, because MOF allocated and managed the financial resources to accelerate the materialization of CE in industrial parks. Such a stable structure, meanwhile, with certain level of adaptability, created the possibility of accommodating and coordinating the complex linkages of actors, and safeguarding the policy efficiency through avoiding time- and energy- consuming discussions to achieve consensus among all the actors. Meanwhile, it also resulted in continuous involvement of more industrial parks (Fig. 4.5).

Lastly, the connections between the central alliance and main policy ideas in different phases impacted upon the governmental selection patterns of industrial parks. It is evident (Fig. 4.6) that the overlap of newly involved industrial parks was higher in the period of alliance between NDRC and SEPA, than during the period of alliance between NDRC and MOF. This was because SEPA, as the major coordinator of Eco-industrial Park, performed a bridging role between two programs. Accordingly, the overlapping rate was high. Figure 4.7 shows a tendency toward a combination of national and provincial industrial parks. This may relate to the increasing administrative features that accompanied the experimental implementation, which led to the shift from

piloting industrial parks to scaling up and materialization, and institutionalization. Most often, national industrial parks, mostly National Economic and Technological Development Zone and National High-Tech Industrial Development Zone, show better conditions of economic performance, quality of infrastructure, national governmental support, and investment climate (Shi et al., 2012) than provincial industrial parks. In phase 4, the industrial parks were to a large extent selected to act as role models for demonstration and piloting in order to educate and mobilize stakeholders. Thus, these industrial parks fulfill more expressive roles, and industrial parks with good conditions, such as national industrial parks, were more likely to be selected to fulfill such role. While in phase 5 with the idea of scaling up and institutionalization, industrial parks mainly fulfilled the role of materialization, thus, the types of industrial parks are more likely to change from more national industrial parks to diverse industrial parks.

4.7 CONCLUSIONS AND POLICY IMPLICATIONS

The continuous governmental policy actions to facilitate SIC invite questions about the efficacy of mechanisms of policy intervention to diffuse SIC. An important element in understanding these mechanisms is the durability of policy programs. This study bridges the fields of environmental sciences and public administration by utilizing insights on policy durability and policy dynamics to understand the emergence and implementation of CE policies. This is done through conceptualizing the CE policy as an ongoing translation process, during which a policy assemblage, constituted by ideas, objects, practices, and actors, is emerging and evolving, thus, forming different types of policy durability. As a general translation strategy for durability and an indicator for the policy outcome, the characteristics of the materialization of the idea in the physical objects is brought to the fore.

Policy durability relates to persistent policy formation and implementation. The case shows that the implementation underwent sequential changes from a single agency and experimental implementation, to cooperation and experimental implementation, which increasingly became infused with administrative features. With these sequential changes, a centralized alliance employing an economic oriented interpretation of CE replaced the originating single governmental agency which worked with an environmental oriented

interpretation. This critical transition of the translation patterns in the earlier phases led to high instability of the central policy assembly; however, this critical change led to a better fitness of CE with the Chinese context, attracting more attention from politicians and regional actors, and helping to bring CE into local practice. It reflects that joint actions between governmental bodies are crucial to bring SIC, or more generally, a CE forward, because SIC and CE are rather comprehensive policy concepts that essentially relate to the environmental issues, economic issues, and also coordinating issues of industrial parks. Furthermore, a persistent central actor who coordinates the joint actions also seems crucial to continuously interest regional actors and industrial parks. With increasing administrative features in the later phases, the concept of CE evolved as an institution, creating conservative forces against undermining, as well as the possibility for scaling up and wider diffusion. This helped to extend the lifespan of the CE policy and materializing CE in more industrial parks.

Of particular interest is the finding that materialization of policy ideas in industrial parks, which is argued as a useful strategy for durability, serves a material as well as a discursive aim. While the diffusion of SICs is taken as a measure of the success of a policy, we have also shown that the selection of parks is at least partially guided by their usefulness in the policy translation process: as discursive anchors. This may have consequences for measuring the success of a policy program, as this may mean that SICs may not always contribute directly to reduced ecological impact in the short run, but may serve an important role as in the long run by enabling the durability of CE policy programs.

Policy processes are complex and contextual, and policy translation is local and variable (Law, 1992), thus, further studies about the interactions between different policy streams in the same institutional context and the comparison between different institutional context, are needed in order to identify the typical translation pattern and the configurations between ideas, objects, practices, and actors, which advances the durable governmental facilitation on the development of sustainable related concepts and practices.

CHAPTER 5

CO-EVOLUTION OF POLICIES OF CIRCULAR ECONOMY AND ECO-INDUSTRIAL PARKS IN CHINA

At the time of printing the thesis, this chapter was prepared to submit to an international academic journal with the title of *Policy Facilitation of Sustainable Industrial Parks in China: Policy Co-evolution of Circular Economy and Eco-industrial Parks*. The theoretical development, data collection, analysis, discussion, and article writing are done by Jiao,W.. Boons, F.A.A. and Teisman, G.R. commented on the earlier version of this chapter.

Abstract: China is a proactive country in facilitating the development of Sustainable Industrial Parks (SIPs), characterized by the co-evolution of the policies of Circular Economy (CE) and Eco-industrial Park (EIP) within existing contexts. The co-evolution of policies increases the complexity of public policy that challenges our understanding of the dynamics of policy facilitation of SIPs. The study concentrates on how the policies of CE and EIP co-evolved over time and the effects of the co-evolution on the overall development of SIPs in China. The results show that the tensions between the key policy actors emerged when the two policies started to show overlapping interests in SIPs. The tensions were reduced as a result of the intervention of the external powerful policy actor. And the intervention also resulted in a symbiotic relation of the co-evolving policy processes that mutually reinforced their durable policy development and continuous diffusions in industrial parks. The symbiosis, meanwhile, was accompanied with a strategy of differentiation that enabled the mutual survival of the two policies. Overall, the co-evolution and the differentiation led to the diffusion of SIPs in wide locations and diverse types of industrial parks. The results indicate that co-evolution is seemingly more important in the earlier periods of the policy process when policy actors strive to create the fitness of the policy with the broad environment and the coupling policy processes.

5.1 INTRODUCTION

China is a prime case of durable governmental facilitation to enhance the development of SIPs through nationwide policy programs of EIP and Circular Economy at the level of Industrial Park (CEIP). Positive policy outcomes of both the policy programs have been observed (e.g. Bai et al., 2014; Tian et al., 2014). The existing studies of SIP policy in China focus on either CE policy or EIP policy, such as the review of policy progresses (e.g. Shi et al., 2012; Su et al., 2013), the evaluation of performance of policy program (e.g. Tian et al., 2014), the critical analysis of policy instruments (e.g. Geng et al., 2012), and the evaluation of local SIP practices (e.g. Shi et al., 2010). The overlaps between CE and EIP policies have been indicated in the comparative studies of the two policy programs (Zhang et al. 2010). In previous chapters, we examine the policy dynamics that contributed to the durable policy facilitation of EIPs (Chapter 3) and CEIPs (Chapter 4). It is realized that the EIP policy and CEIP policy did not evolve independently but interacted over time, and their interactions further exerted influence on policy outcomes. The interactions, however, have been greatly neglected so far (Jiao and Boons, 2014). The insight into the interactions of policy processes, which share common interests in facilitating the development of SIPs, can significantly improve our understanding of the dynamics of policy facilitation of SIPs. Building on our previous studies as mentioned above, in this study, we deliberate 1) the interactions of the policy processes of CEIP and EIP, 2) the influences of the interactions on durable policy development of CE/EIP and the diffusions of CEIPs/EIPs, and 3) the effects of the interactions on the overall development of SIPs in China.

To this end, the concepts of co-existence and co-evolution are distinguished. Co-existence means that the policy processes evolve in parallel but independently. Co-evolution means that the policy processes, evolving in parallel, mutually influence each other. When co-evolution occurs, it is vital to identify the types of policy co-evolution, such as interference, parasitism, and symbiosis (Odum, 1971). The elaboration of types of co-evolution aims to understand the directions of co-evolution and to evaluate the strategies and approaches adopted by policy actors in order to respond and adapt to the coupling policy processes (Gerrits, 2008). Such results are in particular helpful for policy makers to cope with the complexity of public policies to facilitate the

development of SIPs. The identification of types of co-evolution requires scholars to consider the effects of the interactions on each other, such as reinforcing/undermining the durability of policy and the outcomes of diffusion. In addition, we are also interested in the overall effects of the co-evolving policy processes, such as the overall development of SIPs in China. This type of effect can reflect the extent to which the co-evolution facilitate or impede the diffusion of SIPs in China. The main research question is:

When and how did the policy processes of CE and EIP co-evolve since the concepts of CE and EIP were translated into national policies in China? And what were the effects of co-existence and co-evolution on the development of SIPs?

In section 5.2, we introduce the theoretical framework. In section 5.3, the method is described, and section 5.4 presents the results. In section 5.5 we discuss the results, and the section 5.5 concludes the case.

5.2 THEORETICAL FRAMEWORK

5.2.1 Co-evolution of Policy Processes

Co-evolution is a form of evolution. It is about mutual influences between two or more systems, species, and populations. Co-evolution is a concept originally from the coupling relations between evolving biological systems (Odum, 1971), and it is also adopted to study the interactions between social systems (e.g. Ruhl, 1999) and between social system and physical systems (e.g. Gerrits, 2008). The major difference is that the social system can "steer" the direction and speed of evolution, while the biological/physical system cannot (Mulder and Vand den Berg, 1999; Edelenbos, 2008), because social actors have can anticipate and respond to changes of the coupling systems (Gerrits, 2008). Co-evolution is a key concept of Complexity Theory that concentrates on the dynamics of Complex Adaptive Systems to maintain fitness with environment (Byrne and Callaghan,2014). The basic idea of co-evolution is that the fitness between two or more coupled systems is created and maintained through reciprocal selections (Gerrits, 2011). Specifically, in coupled systems, feedback loops carry information (Gerrits, 2008; e.g. changes of one system) that becomes the selection pressures for the coupling systems. So, the reciprocal selection is "a simultaneous process that consists of continuous feedback loops between systems (Gerrits, 2011)". The systems then make adjustments and responses.

The reciprocal selection and mutual adjustment are circular processes that shape the future state of the systems (Gerrits, 2008). The path from the current state to the future ones presents the directional dimension of co-evolution (Sanderson, 1990), i.e. the types of co-evolution between coupled systems.

This study is about co-evolution of two or multiple policy processes. Policy is a Complex Adaptive System (Gerrits, 2008). The interacted policy processes become environment of each other, thus shaping the evolving trajectory of each other, i.e. co-evolving over time. In the China's case, the policy concepts of CE and EIP emerged almost in the same time period, and they shared common interests in SIPs (Zhang et al., 2010). Meanwhile, they cannot be mutually replaced by each other, because CE has more broad conceptual and practical scopes than EIP (Su et al., 2013). There was space for their mutual influences, and thus co-evolution may occur.

When identifying the types of co-evolution of policy processes, the policy outcomes are taken into consideration. The outcomes can be about the policy goals as identified by policy actors or can be attributed by scholars according to the research topics (Hill and Hupe, 2002). In this study, we examine 1) the durable policy development of CE/EIP and 2) the diffusion of EIPs/CEIPs. Odum (1971) classified three types of co-evolution, consisting of interference, parasitism, or symbiosis. The types can change over time (Gerrits, 2008). It means that a sequential blend of interference, parasitism and symbiosis can be observed in empirical studies (e.g. Ruhl, 1999).

> ***Interference***: In an interferential relation, the interactions of systems mutually restrain the development of each other. As for the co-evolution of policy processes, it means that the coupled policy processes mutually impede or even undermine the achievement of positive policy outcomes. In this case study, interference can be identified when the policies of CE and EIP mutually eroded their durable development, or mutually impeded the diffusions of CEIPs and EIPs.
>
> ***Parasitism***: In the cases that the development of one system is at the cost of the others, the type of co-evolution is parasitism. As for the co-evolution of policy processes, it means that the achievement of positive outcomes of one policy leads to negative policy outcomes of the others. In

this case study, if the durable policy development of CE (EIP) became an anti-force for the development of EIP (CE), or if the wide diffusion of CEIPs (EIPs) impeded the diffusion of EIPs (CEIPs), the co-evolution can be identified as parasitism.

Symbiosis: When all the coupled systems benefit from their interactions and reach more favorable states, it is symbiosis. As for the co-evolution of policy processes, it means that the coupled policy processes mutually reinforce their achievement of positive policy outcomes. In this case study, symbiosis can be identified when interactions of CE and EIP policies mutually reinforce their durable policy development or wide diffusions of CEIPs and EIPs.

5.2.2 Untangling Co-evolution of Policies through Policy Assemblage

In the studies of co-evolution, a question to be coped with first is whether co-evolution occurs or not, i.e. co-evolution or merely co-existence. The identification of co-evolution needs to examine the adaptive changes of systems, i.e. coupled policy processes in this case. Conceptualizing policy as an evolving policy assemblage can accommodate the adaptive changes in detail, and further respect the adaptive changes of the entire policy. In Chapters 3 and 4, policy assemblage, as the association of heterogeneous policy components, has been introduced and defined. In the situation when two or multiple policy processes co-evolve, taking the co-evolution of CE and EIP policies as an example, the policy components around the policy concepts of CE and EIP start to link and delink, and become parts of a large policy assemblage of SIP. This is essentially a bottom-up process of building up a larger assemblage (DeLanda, 2006). From a longitudinal perspective, mapping the evolving policy assemblage can indicate the adaptive changes of policy components and their linkages that result from mutual influences of the coupled policy processes. The adaptability of the policy components can then manifest the adaptability of the policy in creating fitness with the environment and with each other (Fellenz, 2000).

5.2.3 Impacts of Co-evolution on Policy Outcomes

As mentioned above, we are interested in the impacts of co-evolution of policy processes on the policy outcomes. The outcomes include two types. The first is the outcomes of each policy program, including the durable policy development

and the policy diffusion in industrial parks. As mentioned above, the policy outcomes of each policy have been taken into accounted in identifying the types of co-evolution. The second type of outcome is the overall impacts of the co-evolution of policy processes, i.e. the overall development of SIPs in China. We separate the two types of policy outcomes, because the two types are not necessarily related in a positive way. The detrimental relations (e.g. interference or parasitism) do not necessarily exert negative influence on the overall development of SIPs. For instance, the parasitical relation may undermine the development of one policy; however, this may cause more efficient allocation of governmental funds for SIPs, thus accelerating the development of SIPs. The second type of policy outcomes can provide a comprehensive picture for the development of SIPs and more importantly for the assessment on the effects of policy facilitation of SIPs in China. We examine the number and diversity of diffusion. The number refers to the involved industrial parks in a certain time period. And the diversity means the extent to which the policy concept of SIP is diffused in diverse industrial parks, including spatial locations and levels of administration of industrial parks.

5.3METHODS

As argued above, the co-evolution or co-existence of the policies of CE and EIP can be identified by examining the evolving policy assemblage. Chapters 3 and 4 have described the basic analytical steps. Building on our previous studies, I followed these basic analytical steps with slight adjustments. In the previous studies, the sequences of policy events of CE and EIP have already been reconstructed, respectively, covering sequential orders of events, descriptions of events, and types of policy events. The policy event table of SIP was established by integrating the events tables of CE and EIP. If certain events were included in both event tables, one of them was deleted. Eventually, the event table of SIP contained 95 events, chronologically arranged, constructing a decade-long sequence of SIP policy development in China. In addition, in order to map the policy outcomes of the diffusion of SIPs, we further collected data of industrial parks that were involved in CE and EIP policy programs, including the number of industrial parks, the programs the industrial parks involved in and when they involved in, and spatial location and the level of administration of each industrial park.

As argued in the foregoing section, the type of co-evolution can change over time. To show the sequential blends of these types, the policy processes were delineated into successive phases through identifying the breakpoints (Barley, 1986). Because the breakpoints can reflect major changes of policy decisions and actions in facilitating CE or EIP (see Chapters 3 and 4), it can be expected that the discontinuities may reflect changes of the types of co-evolution. I took all these breakpoints identified in Chapters 3 and 4 into consideration and delineated the entire policy process into five successive phases.

In Chapters 3 and 4, the ideas, objects, practices, actors, and policy labels of each event have been coded. Here I conducted a focused coding through grouping similar codes into one code, and then all the codes were given at the same level of abstraction and arranged in the same format. In this way, each event was deconstructed into the heterogeneous policy components. All the components in one phase were imported into the program of Gephi as a policy assemblage. The analysis of policy assemblage combined qualitative interpretation and quantitative assessment via the approach of Social Network Analysis. We selected ten components with the greatest Eigenvector Centrality of policy assemblage of each phase as the centre of the assemblage. Within the central assemblage, I further drew small clusters, through examining the linkages with the normalized weights higher than 0.20. The higher weights mean that these components frequently co-occurred in the same policy events. Through identifying the small clusters, I strived to examine the stable/adaptable components and linkages.

5.4 RESULTS

5.4.1 Policy Assemblage and Types of Co-evolution

According to the methods as described above, the co-evolving trajectory of the policies of CE and EIP was delineated into five phases (Fig. 5.1). I describe the breakpoints and analyze the policy assemblage of each phase, and then identify co-existence or types of co-evolution (Table 5.1).

Phase 1 (06/2000-12/2003)

The concepts of CE and EIP were translated into nationwide policy programs in China in the same time period. Both the concepts were picked up by State

Environmental Protection Agency (SEPA[11]). This was the starting points of the policy processes of CE and EIP. SEPA initiated the National Demonstration EIP Program (at industrial park level) and National Demonstration Program of Circular Economy Zone (at regional level, such as cities and provinces). The policy assemblage of phase 1 presented one central cluster that covered main policy components of both CE and EIP. The main policy components connected to SEPA, who became the single bridging and shared central actor (Fig. 5.2). The different operational system boundaries of CE and EIP created the possibility that, rather than one being selected, both of them were simultaneously translated into nationwide policy programs by the single policy actor. The different system boundaries also meant different target groups (i.e. industrial parks of EIP, and regions of CE). Therefore, orchestrated by the shared central policy actor, there was no apparent overlapping of conceptual and practical scopes between the two programs. They did not mutually shape each other, and the policies of CE and EIP merely co-existed in the initial phase.

Phase 2 (01/2004-06/2005)

The breakpoint between phases 1 and 2 was the emergence of another proactive policy actor who greatly reshaped the structure of policy assemblage (Fig.5.2). From phase 1 to 2, the one central cluster of the policy assemblage was separated into two clusters of CE (CE cluster) and EIP (EIP cluster). Both the clusters were frequently linked to the common idea of restructuring industrial parks. It reflected that the CE policy started to include the target of industrial parks. Their common interests in industrial parks created the possibility of competition in enrolling industrial parks and also in attracting resources. Moreover, in the CE cluster, the policy actor of National Development and Reform Commission (NDRC), which was supported by the powerful actor State Council, started to associate frequently with CE through the practices of learning and organizing discussions and seminars (Fig.5.2). To a large extent, it replaced the previous important role of SEPA in coordinating CE, and accordingly, the National Demonstration Program of Circular Economy Zone was almost dissolved. Generally, phase 2 was a process of 1) the separation of the policies of CE and EIP, which undermined the previous leading role of SEPA in coordinating

[11] SEPA was reorganized into Ministry of Environmental Protection in 2008. To be consistent, the abbreviation of SEPA is adopted in the entire chapter.

CE, and 2) the overlapping of the interests of the two policy concepts on SIPs, which may cause competitions in the near future. As a result, the tensions between SEPA and NDRC emerged. The tension, however, did not exert clear influence on the policy development of each other. So the policies of CE and EIP continuously co-existed in phase 2.

Phase 3(07/2005-03/2007)

The breakpoint between phase 2 and 3 was the publication of the programmatic document of *Several O*pi*nions of Speeding up the Development of CE in China* by State Council, in which the importance of cooperation was emphasized. From phase 2 to 3, the policy assemblage maintained the two-cluster structure (Fig.5.3). Both the clusters grew substantially with the attachment of many new policy components, such as regional actors in the EIP cluster, and many ideas and diverse ministerial level actors in the CE cluster. In the CE cluster, the actors of Ministry of Science and Technology (MOST), Ministry of Finance (MOF), Ministry of Commence (MOC), and National Bureau of Statistics were in more important positions (Fig.5.3). Furthermore, SEPA started to serve as the bridging actor between the two policies. In addition, the connections between the clusters of CE and EIP were also enhanced in sharing common ideas (e.g. recycle, transformation of economic development mode).

Generally, the evolving policy assemblage reflected that the interconnections between the policies of CE and EIP increased, and both entered into a path of co-evolution. SEPA started to serve as the bridging policy actor due to the strategy of cooperation between SEPA and NDRC in facilitating the policy development of CE. The knowledge of SEPA about EIPs, which were accumulated in the previous two phases, was helpful for CE policy making and implementation at the industrial park level. The assemblage also showed that in the situation of co-evolution, both CE and EIP policies developed rapidly, as reflected by the substantial attachment of many new policy components. More importantly, CE started to be implemented in industrial parks, and the number of both CEIPs and EIPs increased (Fig. 5.5). Therefore, the type of co-evolution can be identified as symbiosis, because the co-evolution mutually reinforced the policy development of each other.

Phase 4 (04/2007-08/2008)

The breakpoint between phase 3 and 4 was the establishment of the coalition of SEPA, MOC and MOST. From phase 3 to 4, the interconnections between the clusters of CE and EIP were enhanced significantly (Fig. 5.3). MOC and MOST, associated with NDRC in phase 3, became frequently linked with SEPA. And the actors of SEPA, MOC, and MOST became the bridging actors between the two policies. Another clear feature of the adaptive changes of the policy assemblage was the emphasized emerging idea of energy conservation and emission reduction, which was a salient national policy theme at that time. It was simultaneously embraced as an important policy component by both policies (Fig. 5.3).

For the most part, the increasing interconnections between the policies of CE and EIP reflected that the two policies were still locked into a path of co-evolution. The increasing number of bridging policy actors resulted from the establishment of the cooperative network among SEPA, MOC and MOST. The cooperation was partly influenced by the cooperation implementation in the CE policy in the previous phase. The cooperation in the EIP policy, as analyzed in our previous studies, adapted the EIP policy with the fragmented coordination systems of diverse industrial parks in China, thus reinforcing the durable EIP policy development (see chapter 3). An increasing number of policy actors also benefited the synchronization of embracing new policy ideas of the two policies, which fashioned both CE and EIP and thus sustained them as significant policy concepts over time. Moreover, there were an increasing number of CEIPs and EIPs newly involved in (Fig. 5.5), although the number of EIPs was relatively low, due to the substantial changes of the EIP policy (e.g. policy actors and procedures). Generally, the co-evolution in this phase reinforced the policy development of each other, and it presented a continuously symbiotic relation.

Phase 5(08/2008-12/2011)

The breakpoint between phase 4 and 5 was the CE legislation in August 2008. The legislation reflected that CE was entering the stage of institutionalization in China (Zhu, 2009). Figure 5.4 shows that from phase 4 to 5, the interconnections between the policies of CE and EIP, which were gradually built up in phases 3 and 4, diminished to a great extent. SEPA, MOC and MOST lost their roles as bridging actors between the two policies, because NDRC started to cooperate frequently with MOF to allocate and regularize a lot of subsidies for the goal of

wide diffusions of CE practices. Fig. 5.4 also presented that the idea of low carbon economy, which was also a salient policy theme at that time, was newly attached to the EIP cluster as an important idea, while synchronization was not observed in the CE policy[12].

Table 5.1 Co-existence and Co-evolution between the policies of CE and EIP

Phase	Co-evolution/ Co-existence	Description
1	Co-existence	Different conceptual and practical scopes: CE at regional level and EIP at industrial park level.
2	Co-existence but emergence of tensions	The policy concept of CE and EIP started to show overlapping interests in SIPs, as a result, tensions were emerging between the two key policy actors. However, the tensions did not lead to evident interactions between the two policies.
3	Co-evolution: symbiosis	- increasing interconnections between the two policies; - SEPA became the bridging actor between the two policies through establishing cooperative network with NDRC; - Both CE and EIP started to be implemented in industrial parks, and many new industrial parks involved in.
4	Co-evolution: continuous symbiosis	- increasing interconnections between the two policies; - SEPA, MOC, and MOST became the bridging actors between the two policies, as a result of cooperation between SEPA, MOC, and MOST in the implementation of EIP. The cooperation was impacted by the CE implementation in the previous phase. This cooperation adapted EIP policy with Chinese contexts; -The number of both CEIPs and EIPs continuously increase; - Synchronization of embracing new policy ideas.
5	Probably damping out of co-evolution	- reduction of interconnections between the two policies; - no synchronization of new ideas was observed; - the number of both CEIPs and EIPs continuously and vastly increase; - The types of involved industrial parks were divergent in the two policy programs.

Phase 5 was characterized by the reduction of interconnections of the two policies. It indicated that the co-evolution was seemingly damping out in this phase. In this situation, however, a large number of CEIPs and EIPs were involved in (Fig. 5.5). This was related with the gradual stabilization of the policies and goals of wide diffusion, as well as the strategy of differentiation. This will be analyzed by taking diffusion patterns of industrial parks into consideration in the next section.

[12] As a side note, NDRC initiated another policy program about low carbon in industrial parks in 2013. The program was independent from CE programs. It was not considered in this study, because the research boundary was the co-evolution of the policies of CE and EIP.

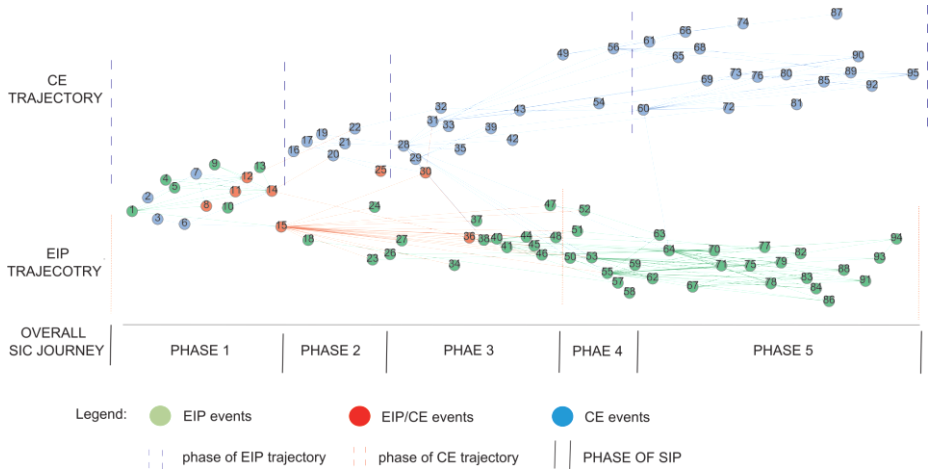

Fig. 5.1 Event Sequence and Phases of Policy Process of SIP

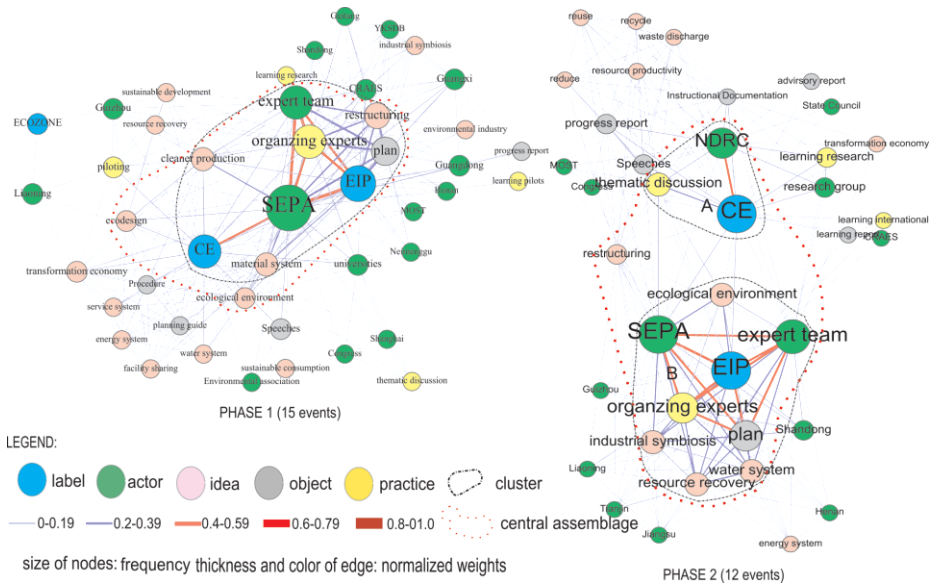

Fig. 5.2 Policy Assemblage in phase 1 and 2

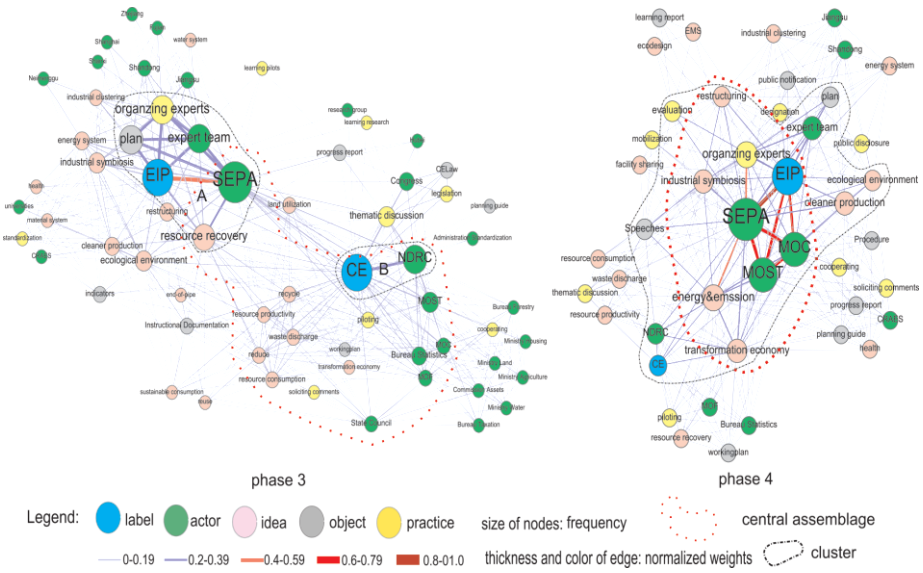

Fig. 5.3 Policy Assemblage in phase 3 and 4

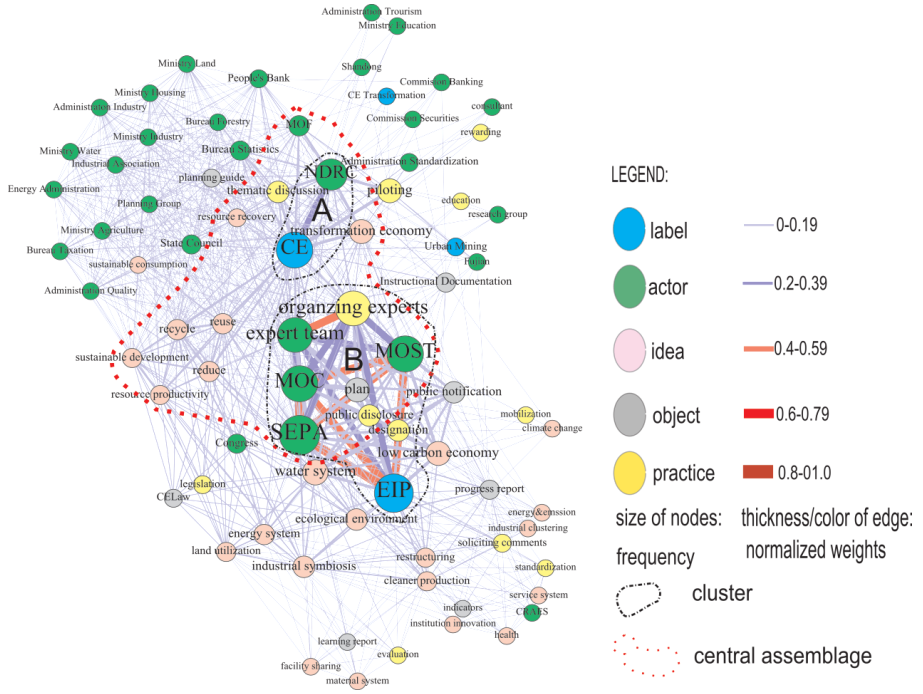

Fig. 5.4 Policy Assemblage of Phase 5

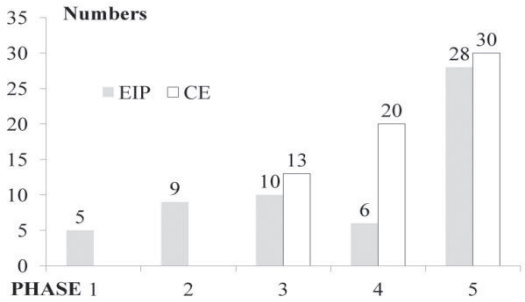

Fig.5.5 the Newly Involved EIPs and CEIPs

5.4.2 Overall Diffusion of SIPs

In the foregoing section, when indentifying the types of co-evolution, the number of diffusions of SIPs was considered (Fig.5.5). The results presented the continuous involvement of new EIPs and CEIPs. To provide a more comprehensive picture of the outcomes of the diffusion of SIPs, we further examine the diversity of those industrial parks. The diversity of diffusion is indicated by the spatial distribution and levels of administration of SIPs.

With regard to the spatial distribution, I adopt the delineation of three super-regional systems of China (eastern, central, and western China) to reflect the spatial distribution pattern of SIPs. The geographic delineation can also briefly display regional economic performance. Mostly, from the east to the centre to the west, there is a decreasing trend of economic performance. Figure 5.6 depicts the spatial distribution patterns of CEIPs and EIPs. It shows that in all the five phases, a large percentage of EIPs were located in eastern China. And the number of EIPs showed a decreasing trend from the east to the centre to the west, although the numbers of EIPs in central China increased in phase 5 compared with that in previous four phases. In contrast, CEIPs were distributed relatively evenly, with a slightly increasing trend toward western China. In general, the spatial distribution of EIPs seems to show the increasing tendency toward economically advanced regions, while that of CEIPs was relatively balanced with the slightly increasing tendency toward economically developing regions. So the co-existence of CEIPs and EIPs brought about a wide range of spatial distribution of SIPs.

With regard to the administrative levels, according to the hierarchy of the administrative bodies of industrial parks in the government system, the

industrial parks can be classified as national level and provincial level[13]. Usually, the higher administrative level, the better quality of industrial parks (e.g. better infrastructure for environmental protection, better economic performance). For EIPs, both national and provincial level industrial parks were involved in all phases except phase 1. There was a clearly increasing tendency of the number of national level industrial parks in phases 4 and 5 (Fig. 5.7). In contrast, CEIPs showed a decline of provincial level industrial parks. So the co-existence of CE and EIP policies greatly enhanced the diffusion of SIP in the diverse types of industrial parks. Both the spatial distribution and administration of industrial parks were characterized by a tendency of divergent targeting industrial parks. The divergence was more apparent in the last phase.

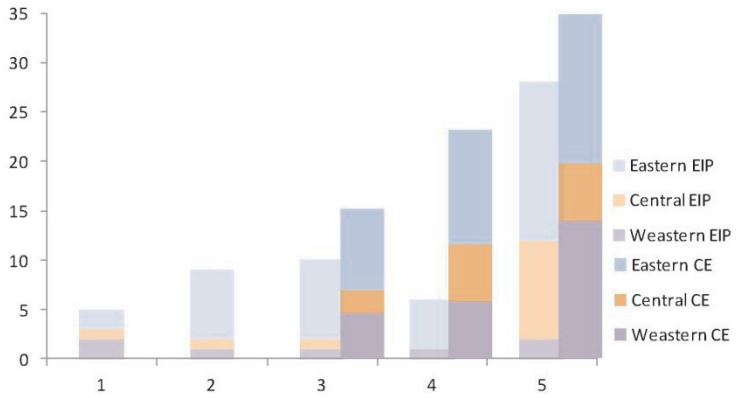

Fig.5.6 Spatial distribution of newly involved industrial parks

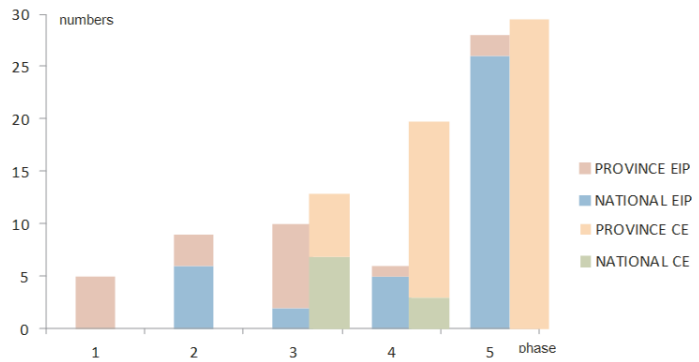

Fig. 5.7 Administration of newly involved industrial parks

[13] The provincial level also included municipal level industrial parks.

5.5 ANALYSIS

In this section, we analyze how the co-evolution (Table 5.1) was shaped in the way as is identified in this case, and the impact of the co-evolution on the overall development of SIPs. In the analysis, we also link with the results of Chapter 3 and Chapter 4.

The results show that the policies of CE and EIP co-existed in phase 1, because of different conceptual and practical scopes. When the two policies started to embrace overlapping interests in SIPs, tensions were emerging, although they did not mutually influence each other. The reason why the CE and EIP policies entered into a path of co-evolution was that they shared overlapping interests in SIPs but that they cannot be mutually replaced by each other, for example, CE presented broader conceptual and practical scopes than EIP. From phase 3 on, the co-evolution presented a symbiotic relation, which was attributed to the following three dynamics. 1) The intervention of external powerful policy actor. When tensions were emerging, the State Council supported the policy actions of NDRC and also emphasized the importance of the cooperation between governmental agencies (including NDRC and SEPA) in order to facilitate the development of CE and EIP. 2) The compromise of one key policy actor. In the situation when DNRC got support from the most powerful policy actor, SEPA reinterpreted its role in facilitating the development of CE and then accepted the leading role of NDRC. As a result, the cooperation between NDRC and SEPA was established. 3) The strategy of cooperation mutually reinforced the two policies when they were in the early period of development. When they entered into the path of co-evolution in phases 3 and 4, both of them were in their early period of development. In this period, the main policy dynamics were intentional learning by doing and creating the adaptability of policies with their environments and also with each other. So the experience of SEPA about EIPs, accumulated in the previous phase, can benefit the policy making and implementation of CE at the level of industrial park. In addition, the industrial parks that have been enrolled in the EIP program had relatively better conditions (e.g. infrastructure of environmental protection, and economic performance), and these industrial parks became good candidates for CEIPs, serving as demonstrating examples to mobilize relevant stakeholders. Therefore, the cooperation greatly reinforced the policy development of CE. Meanwhile, a large amount of subsidy of CE

program can accelerate the development of EIPs that were also involved in the CE program. The implementation of CE through cooperation also inspired the changes of the EIP policy implementation, and this improved the adaptability of the EIP policy with the fragmented coordinating systems of diverse industrial parks in China. Generally, the symbiotic relation of the two policies that shared overlapping interests in SIPs resulted from the strategy of cooperation, and the cooperation was formed from the intervention of most powerful external policy actor and the compromise of one key policy actor.

However, in phase 5, the symbiotic relation disappeared greatly and the co-evolution was seemingly damping out. This result was related with two types of dynamics. First, as argued above, the international learning by doing and adaptation were the main policy dynamics in phases 3 and 4. So, along with the piloting and the accumulation of experience, the primary adaptability of policy with the contexts and with each other was created. In phase 5, the main dynamics became administration and stabilization (e.g. the enforcement of CE Promotion Law) and wide diffusion in industrial parks (Fig. 5.5). Therefore, when both the policies had created primary fitness with the policy contexts and with each other, and then they became quite stable, the co-evolution may gradually damp out. It can be expected that co-evolution may probably occur again, when one of the policies and the contexts change substantially. Second, the diffusion patterns of EIPs and CEIPs presented the divergence in the types of industrial parks, especially in the later phases of the policy process. The diffusion patterns manifested the governmental intentional selection patterns of industrial parks, and the divergence reflected the gradual differentiation of the targeting industrial parks. We further examined the evolving policy assemblage and found that the divergence was also observed in the aspect of defining ideas of SIP. Specifically, as indicated in the policy assemblage in the foregoing section, the main idea that was closely associated with the concept of EIP was *Resource Recovery.* It was mainly about waste, referring to the process of collecting, sorting, processing and transforming waste into raw inputs to create new products. Whereas, the main idea of CE was *Transforming Economic Development Mode*, underlined by the defining idea of *Resource Productivity*, which was mainly about efficiency. Therefore, the co-evolving process of CE and EIP, featured by increasing interconnections, was accompanied with the dynamics of gradual differentiation. The differentiation in this study was that

the policy actors that shared common interests in SIPs strived to differentiate from each other in the aspects of policy goals, means and target groups. When the symbiotic relation dissolved in phase 5, the differentiation became more evident. Therefore, if the symbiotic relation promoted the mutual development of CE and EIP, the differentiation enabled their mutual survivals over time. The strategy of differentiation greatly reinforced the diffusion of SIPs in wide locations and diverse types of industrial parks.

5.6 CONCLUSIONS

The complexity generated by the co-evolution of policies is a challenge for revealing the dynamics of policy facilitation of SIPs. The long-term development of SIP policies in China is an illustrative case, characterized by some periods when there was no co-evolution between the policy processes of EIP and CE, and by some periods when co-evolution took place. This study elucidates the types of co-evolution, and the effects of co-evolution on the overall diffusion of SIPs in China.

The results show that the relation between the policies of CE and EIP merely co-existed in the first two phases, during which the tensions between the key policy actors occurred for the reason that the two policies started to share common interests in SIPs. The most powerful policy actor started to deal with the tensions, resulting in the symbiotic relation between the two policies, which was indicated by the mutual reinforcement of durable policy development and the wide and continuous diffusion of SIPs. However, the dynamics of differentiation was also equally important. As for the differentiation in our case, the policy actors that shared common interests in SIPs strived to differentiate from each other in the aspects of defining ideas of SIP (e.g. waste or efficiency) and target groups (e.g. divergent types of industrial parks). The differentiation reduced the competition and enabled their mutual survival. Therefore, the increasing interactions between policy processes did not necessarily exclude the dynamics of differentiation, and they together led to the diffusion of SIPs in the diverse types of industrial parks. As a side note, the result of diffusion also implied that SIP is eligible for different types of industrial parks, with either relatively advanced or underdeveloped economic performances. A gradual damping out of co-evolution probably occurred in the last phase. If co-evolution was taken as an external factor for the development of each policy program,

internal dynamics dominated in the last phase. After the process of piloting, learning, and interactions, policies created primary fitness with their contexts and with each other. So, the main policy objectives of scaling up and wide diffusion can be achieved when the policy stability was created.

Ongoing attention needs to be paid to the types of co-evolution that may occur in the coming years and the dynamics for the (re)beginning of the co-evolution. The co-evolution of policy processes that share different or even controversial policy goals is also important and needs further elaboration. For instance, the policy of coping with economic crisis probably can undermine the development of SIP policy.

CHAPTER 6

POLICY DURABILITY OF SUSTAINABLE INDUSTRIAL PARKS IN SOUTH HOLLAND, THE NETHERLANDS

At the time of printing the thesis, a part of this chapter was considered to publish as an article with a title of *Rise and Falls of Sustainable Industrial park Policies in South Holland, the Netherlands* (co-authors will be Boons, F.A.A. and Spekkink, W.A.H.). To complete the case study for a systemic comparison in Chapter 7, new texts about policy translation patterns have been added and minor modifications of the text have been made.

Abstract: Durable policy implementation is an important condition for effective governmental facilitation of Sustainable Industrial Parks (SIP). We argue that the various types of policy durability reflect different qualities of the policy process in terms of configuring policy stability and adaptability, and they bring about different policy outcomes of the development of SIPs. This study aims to identify how and to which extent policy durability is achieved and its effects on the diffusion of SIPs, based on the case of the one-decade development of SIP policies in the province of South Holland, the Netherlands. The results show that the policy process underwent five phases before its final erosion, and policy durability manifested high adaptability in the entire policy process. In the earlier two phases, the adaptability was desirable for creating fitness with the stable new context, because policy actors had high uncertainties about the novel policy issue of SIP. In the later three phases, the adaptability was the key property in the volatile policy contexts. It, however, was created at the high cost of policy stability, thus failing to bring about effective policy outcomes of diffusion. The study reflects that it is challenging to find the appropriate balance between the need for adaptability and that for stability in attempt to bring about positive outcomes of diffusion of SIPs, especially when policy contexts change substantially.

6.1 INTRODUCTION

The importance of governmental facilitation of SIPs has been widely recognized (Mirata, 2004; Chertow, 2007; Jiao & Boons, 2014), and one temporal dimension of the governmental facilitation is policy durability. However, the issue of policy durability and its effects on the development of SIPs have been mostly neglected in existing studies.

In previous chapters, we argue that the generation of policy durability requires ongoing management on the needs of policy stability and policy adaptability and the tensions between the two. So, policy durability is not equal to a stable and fixed implementation of policy, but is based on the combination of both stable and adaptable policy components, thus showing different types. To elaborate the different types, we investigate the policy assemblage that emerges and evolves with the unfolding sequence of policy events (Chapter 3, 4, and 5). The types of policy durability manifest different qualities of the policy and thus they are expected to exert different influences on the development of SIPs. These effects can change from symbolic involvement of a limited number of industrial parks to long term and fundamental materialization of SIP ideas in industrial parks in large scales. The focus of this study is the dynamic relations between types of policy durability and policy outcomes of the development of SIP. To this end, we do not intend to identify the best type of policy durability, because the emergence of a certain type and its effects on the development of SIPs are contingent on policy contexts. For instance, when policy contexts substantially change, it is important to re-establish fitness with contexts. Thus, the types of policy durability that embrace more adaptable components is expected to bring about effective outcomes.

The province of South Holland is a prime case. First, SIP emerged as a policy concept in South Holland in 1999, when SIP had become a buzzword in the Dutch national governmental policies since 1997 (Pellenbarg 2002; Heeres et al., 2004). As a response to the national orientation of SIP, the province of South Holland initiated the program of Sustainable and Economic Use of Space (in Dutch: *Duurzaam Economisch Ruimtegebruik*: DECOR was used an abbreviation) with a focus on SIP. The national SIP program was terminated and the concept of SIP was largely dissolved at the national level after 2004. Remarkably, within this inactive national policy context, SIP has had sustained as a policy concept

for one decade in South Holland and was finally eliminated in the provincial policy after 2013. So the one decade long persistence of SIP policies, followed by its dissolution, offers an interesting case for empirical studies of the effects of policy durability, particularly different types of policy durability, on the diffusion of SIPs. Main research questions are:

1) How and to what extent was policy durability achieved in the province of South Holland in the Netherlands with respect to stimulating SIP?

2) What were the impacts of policy durability on the diffusion of SIPs, and in what policy context?

Section 6.2 specifies the theoretical relations between types of policy durability and the development of SIPs. In section 6.3 we present our methods, and section 6.4 offers an overview of SIP policies in the Netherlands and South Holland. Section 6.5 presents results, and in section 6.6, we analyze and discuss the results. We conclude the study in Section 6.7.

6.2 THEORETICAL FRAMEWORK

6.2.1 Stability and Adaptability for Durable Policies

In the previous chapters, we have argued that policy durability means that the essence of policy is stable and persistent, while adaptabilities to dynamic contexts are achieved. It points out that a durable policy embraces the characteristics of stability and adaptability simultaneously (Durlak and Dupre, 2008; National Research Council, 2010).

Policy stability means the extent to which a policy is stable over time (Scartascini et al., 2008). The stable key policy components, such as a central and long term policy goal, can be adopted to denote the durability of policy. For instance, the termination of the entire policy or important parts of the policy is often used to indicate policy erosion (Patashnik, 2003). Stability of policy is required because it is observed that stable and predictable policy resource allocation and budgeting have positive relations with policy outcomes (Liang and Fiorino, 2013; O'Toole and Meier, 2003). Stability also manifests focused, concerted, and long-term governmental commitments for target groups, such as firms and industrial parks (Liang and Fiorino, 2013). The long-term commitments are crucial to persuade and interest industries to make

continuous investment of energy, resource and time (Glazer and Rothenberg, 2001). This is because industries consider their previous experience, credibility, and stability of future policy before making decisions, and when they are uncertain about the continuity of governmental supports, they are more likely to stop investment and drop off (Ardanaz et al., 2010; Scartascini et al., 2008; Glazer and Rothenberg, 2001). The continuous involvement by industries is critical for the development of SIP that is vulnerable to the dropout or changes of the involved firms (Chopra and Khanna, 2014), especially when the industrial symbiotic network is relatively small (Lehtoranta et al., 2011). Stability is certainly an important characteristic of durable policy; total stability can also lead to inert policy. When policy contexts change substantially, inertial policy can become dysfunctional and even erode. Thus, adaptability is also needed.

Adaptability is a concept embracing the interactions between systems and environment, and it explicitly or implicitly implies system thinking (Fellenz, 2000). Policy adaptability refers to the extent to which policy is properly adjusted or changed to adapt to the uncertainties, surprises, and changes of environment (Gilsing, 2007; Scartascini et al., 2008). Adaptability is often taken as a positive and advantageous property for a system (Fellenz, 2000), e.g. organization or policy. So adaptability is widely adopted in prescriptions of polices (e.g. Glachant, 2001). Adaptability is an important characteristic of durable policy so that timely responses can be made to correct previous policy failure, to fit changing social context, or to alleviate external interruptions (Gilsing, 2007; Provan and Kenis, 2007; Ardanaz et al. 2010). Adaptability in this case can lead to more effective resource allocation and responsiveness to requests from firms, and attention from political actors and social media (Patashnik, 2003). SIP is a novel policy concept in the aspect of reconciling environmental and economic goals of industrial parks which are conventionally coordinated by different governmental bodies (Jiao and Boons, 2015), and in the aspect of solving environmental issues of industrial parks from the angle of cooperation among firms (Chertow, 2007). These novelties require significant adaptation when the SIP policy is firstly translated in new policy contexts. Mostly, adaptability implies reflective reconsiderations of policy outcomes and contexts, and it seems desirable for SIP as a long-term development trajectory. However, total adaptability, such as frequent variations of rules, procedures, and substances of policy, can increase the uncertainties for objects affected by the

policy (Liang and Fiorino, 2013), lead to extra investment of industries, and even destroy the identity and continuity of the policy (Weick, 1979). This highlights a key question of achieving adaptability at a low cost of stability (Glachant, 2001).

Both stability and adaptability are key characteristics for a durable policy. This echoes the various degrees of modifications and adjustments of policy over time (Berry et al., 2010; Durlak and Dupre, 2008; Kay, 2006). Stability and adaptability embrace perplexing and even paradoxical relation (Durlak and Dupre, 2008; Weick, 1979). Two types of dynamics of coping with the paradox of being stable and adaptable at the same time have been contended in organizational studies (Weick, 1979). The first is sustaining stability and adaptability simultaneously in different parts of the system. For instance, some components of a policy can play the role of adaptation, and some components maintain stable to achieve coherence and continuity of policy (DeLanda, 2006). The second is choosing stability or adaptability sequentially. For instance, in contexts with substantial changes, adaptability becomes more important than stability; while when the fitness is created in relatively stable context, adaptability becomes secondary. The two types of dynamics manifest that durable policy configures various policy components playing the stable or adaptable role, and the configuration can present diverse types, e.g. reduced stability. Therefore, a typology of policy durability is developed.

6.2.2 A Typology of Policy Durability

Four types of policy durability have been described in previous chapters, and here we elaborate them further. As argued in the previous chapters, we study policy as a translation process, and investigate the policy assemblage that evolves throughout the translation process. As deliberated in Chapter 3, the translation patterns are the typical ways of the emerging and evolving of policy assemblage, i.e. the coming into being of the various shapes of policy assemblage and types of policy durability (Fig. 6.1).

The identity of the policy assemblage can be gradually established, sustained, strengthened, transformed or eroded over time (DeLanda, 2006). A stable identity (e.g. SIP policy) is an emergent characteristic of dynamic (dis)assembling of policy components (DeLanda, 2006), and it is adopted to denote policy durability. Mapping the evolving policy assemblage over time

provides the means to examine the different types of policy durability. As a starting point for our typology of policy durability, we make a basic distinction between the degree of stability of policy labels on the one hand and the degree of stability of other policy components on the other hand. This allows us to distinguish between changes in (or inertia of) the way that a policy is branded, and changes in (or inertia of) the configuration of involved actors, the ideas developed and the objects and practices that materialize the ideas (Table 6.2). For example, if a policy is rebranded (new labels are attached) but the actors, ideas, objects and practices and their linkages remain largely the same, policy may be like 'old wine in new bottles' (cf. Rittberger and Richardson 2003). For instance, in order attract politicians and target groups, policy actors may reframe the policy (Patashnik, 2003). Conversely, if policy labels remain stable but the other components of the policy change, the policy may be described as 'new wine in old bottles.' Learning by doing or timely policy adjustment to fit the changed context can bring about this type (Gilsing, 2007; Provan and Kenis, 2007; Ardanaz et al. 2010). In the extreme case that all the key policy components are relatively stable, we may say that the core of the policy assemblage has solidified. And in another extreme case that most policy components are unstable, we may say that the policy assemblage is fluid. The four types embrace various degrees of stability of policy assemblage. From type A to D, the stability of policy assemblage reduces (Table 6.1).

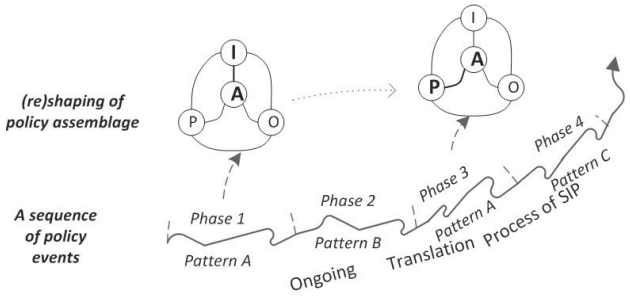

Fig. 6.1 Translation Patterns and Policy Assemblage

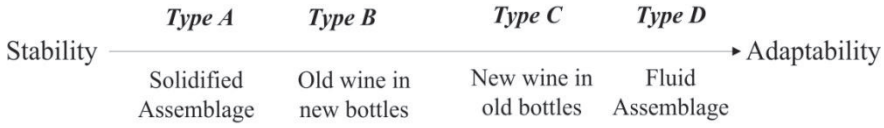

Fig. 6.2 Continuum from stability to adaptability: types of policy durability

Table 6.1 A Typology of Policy Durability

		Other policy components stable	
		Stable	**Unstable**
Policy labels	**stable**	**Type A:** Solidified policy assemblage	**Type C:** New wine in old bottles
	unstable	**Type B:** Old wine in new bottles	**Type D:** Fluid policy assemblage

As analyzed above, the fluidity of policy assemblage, such as type C or type D, often results from the policy efforts on adapting to the changes of contexts or political priorities, so the adaptability of types C and D is relatively higher than the ones with stable assemblage. If stability and adaptability are thought of as two extremes in a continuum, Figure 6.2 shows the locations of each type of policy durability moving from the left to the right with decreased stability and increasing adaptability.

6.2.3 Link Policy Durability with the Outcomes of Diffusion

The diverse types of policy durability embark different qualities of the long term policy process. We argue that these different types of policy durability can bring about different policy outcomes of the development of SIPs. This is also one of the reasons why distinguishing these types. With regard to the development of SIPs in this study, we are interested in the diffusion of the policy concept of SIP in industrial parks (Table 6.2). Positive outcomes are signified by wide and continuous diffusion of SIP ideas in industrial parks[14].

Policy process unfolds in specific contexts. The policy context is a set of processes and structures of politics, economy, and society. The policy context can shape, stimulate or undermine governmental priorities, and it provides explanatory meanings to the effectiveness of policy (Collins et al., 1999). For instance, economic recession may cause policy attention moving from SIP to economic development and job creation. Moreover, the context with great need for the synergy between environmental protection and economic development can enable more attention on SIPs. Furthermore, policy actors manage the

[14] The outcomes we are interested in may differ from the defined policy goals. For instance, instead of wide diffusion, learning and accumulating SIP knowledge can be a main goal in some policy programs (Matland, 1995). In addition, the outcomes in this study are mainly about the number of industrial parks that were involved in the national programs, while the extent to which ideas of SIPs are materialized in industrial parks are not considered in this study.

tension between stability and adaptability, as argued above, to establish or reestablish fitness with the contexts. The fitness is a state that exists at some level at a given point/period of time (Wright and Snell, 1997). It has been widely argued that when fitness between policy and contexts are established, the performance of policy is stronger (Nissen, 2014; Gilsing, 2007), and when the misfit occurs, the policy outcome is negatively affected (Nissen, 2014). We firstly distinguish stable and unstable policy contexts. The contexts cover the aspects of economic performance (e.g. recession or crisis of economy), political processes (e.g. election and changes of coalition of political parties), other issues of industrial park (e.g. infrastructures), and national policy theme (e.g. changes from SIP to creating space for economy). Building on the argument about the role of stability and adaptability and the elaboration of types of policy durability in the foregoing section, we expect: *In volatile policy contexts, the types of policy durability that embrace more adaptability are more likely to bring about effective outcomes of diffusion. And from type D to type A, the policy effects on the diffusion of SIPs reduce. And in relatively stable policy contexts, the types of policy durability that embrace more stability are more likely to bring about effective policy outcomes, and from type A to type D, the policy effects on the diffusion of SIPs reduce.*

Table 6.2 Policy Outcomes of Diffusion

Indicators	**Description**
Numbers/ Ratio1	The Numbers refer to industrial parks that link to the policy label of SIP in each phase. To place the numbers in the regional context, we evaluate Ratio1 that is the ratio of the numbers of SIPs to the total numbers of industrial parks in the regional area.
Continuity /Ratio2	Continuity means the extent to which certain industrial parks get continuous governmental supports (e.g. subsidy, technology, knowledge, etc.) for SIP related practices, especially in the transitional period between phases. Ratio2 means the ratio of the numbers of industrial parks that got previous governmental support to the total numbers of involved industrial parks in a certain phase.
Types	Types relate to the roles performed by industrial parks when they are selected by policy actors. Industrial parks can perform material roles, i.e. materialize SIP ideas into physical objects; and expressive roles, i.e. as a symbol of SIP or as discursive anchors to mobilize stakeholders (Jiao and Boons, 2015). When industrial parks are selected as pilots or demonstrating examples aiming to accumulate knowledge or to mobilize stakeholders, the roles are identified as expressive. While when industrial parks are selected to meet the explicit policy objectives or large scale materialization, the roles can be identified as material.

For a longitudinal policy development process, a key question is continuously creating fitness with contexts over time in order to bring about effective policy outcomes. The continuous fitness can be referred to as Dynamic Fit. In organizational studies, dynamic fit describes longitudinal adjustments of organizational structure to reduce misfits that are produced by changes of endogenous or exogenous factors, thus reestablishing fit with the context (Nissen, 2009). The notion of dynamic fit considers a temporal dimension, and emphasizes the importance of examining the dynamic relations between sequential blends of types of policy durability, contexts, and policy outcome trends.

6.3 METHODOLOGY

This case study followed the generic analytical steps of Event Sequence Analysis and policy assemblage as described in Chapters 3 and 4. Here we briefly describe these steps.

Data Collection. The main data sources are policy documents and interviews. We firstly conducted an unstructured interview with a general question of the development of SIP policies in South Holland; we then got a list of names of policy programs and subsidies, which were taken as search strings for document collection in the electronic archives of the Province of South Holland and Google. We also took sustainable industrial parks/industrial parks & South Holland as search strings (in Dutch: Duurzame Bedrijventerreinen/ Bedrijventerreinen & Zuid-Holland). Eventually, 32 documents were collected. After scanning the documents, a coarse-grained timeline was developed. According to this, we did eight semi-structured interviews with guiding questions about the role of interviewees, how they involved in, the interpretations of SIP, and coordination issue. All the interviews were recorded and transcribed. We further collected a list of names of the projects subsidized by the provincial policy programs, and examined 1) the number of industrial parks/projects subsidized in each policy program, and 2) the number of industrial parks that got continuous governmental subsidy, and 3) the intention of policy actors in selecting industrial parks (pilots, demonstration, or materialization in large scale).

Event Table and Phases. Following the steps of Event Sequence Analysis, we recorded 107 incidents and eventually got a table of 81 events. We colligated the

temporally close and same type of events as one building block (Appendix Table A6.1). Through identifying the breakpoints, the entire policy process was preliminarily delineated into five temporal blocks. We then checked the percentage of the occurrence of building blocks in the empirical translation process by matching theoretical patterns in order to identify the patterns of the temporal blocks.

Mapping Policy Assemblage. Similar to the previous case studies, we coded (descriptive coding and then focused coding) the policy components associated with each event, taking Label, Actor, Idea, Object and Practice as separated coding tracks. After coding, the codes of all the events in each phase were imported into Gephi as the policy assemblage. The size of nodes represents frequencies, the colour of nodes shows their coding tracks, and the width and colour of edges presents their weights. When analyzing the policy assemblage, we drew a central cluster of important policy components with Eigenvector Centrality higher than 0.80 to show main characteristics of policy assemblage. In addition, we analyzed whether there were evident features of the policy components that were located outside the cluster. The identification of types of policy durability was based mainly on the evolving shape of the central cluster of assemblage and evident features of peripheral assemblage. This is because the components outside the central cluster were often quite fluid, which cannot reveal the main characteristics of policy assemblage.

As the main data sources for the decade-long policy development were policy documents, the results may probably be biased to change, because governmental documents often focused on revised or new policy decisions. Thus we interpreted cautiously and carefully in the analysis. To validate the results, we did interviews to get background information. We sent the event table to the civil servant and also invited the civil servant to a workshop when we presented the results. This was because the civil servant involved in the first SIP program and many of the following programs.

6.4 THE PROGRESSES OF SIP POLICIES IN THE NETHERLANDS AND SOUTH HOLLAND

6.4.1 Dutch National Policies of SIP

In the Netherlands, substantial attention was paid to the deterioration of industrial parks in the 1990s, because of the lacking maintenance of industrial parks, shortage of spaces, and environmental deterioration. To cope with these issues, two streams of policies emerged at the Dutch national level. One stream was creating space for economic activities through (re)development of industrial parks, and the other was developed around the idea of decoupling economic growth from environmental deterioration. The introduction of SIP occurred as a part of the second stream (Pellenbarg, 2002). In June 1997, a policy paper entitled *Environment and Economy: towards a Sustainable Economy* was published. It sketched 16 pioneering ideas, and one of the pioneering ideas was SIP (Eilering & Vermeulen 2004). The concept of SIP was further elaborated in a handbook, in which an SIP was defined as "a type of cooperation between firms, and between firms and governments, aiming at the improvement of the economic performance of firms, the reduction of environmental pressures, and the efficient use of space" (Ministry of Economic Affairs, 1998: 9, translated from Dutch). The handbook states that the development of SIPs can be approached from two angles: 1) Sustainable Production Processes referred to the efficient usage of material and energy flows, such as the exchange of energy, material, and water, collective collection and disposal of waste, and facility sharing, and 2) Sustainable Site Arrangement referred to the intensive use of space (e.g. buildings, infrastructure and utilities). To stimulate SIPs, the Ministry of Economic Affairs started a subsidy program of SIP in 1999. The SIP program lasted for four years, and about 252 projects were subsidized. The program was not the actual implementation of specific sustainability projects, but it strived to disseminate the ideas of SIP and stimulate collaboration (Boons & Spekkink, 2012). With the termination of this program in 2004, the financial support from the national government for SIP projects was terminated. At the national level, the first policy stream was concentrated on then. Although the attention for SIPs was largely dissolved at the national level, the concept of SIP was sustained for a longer period in the province of South Holland.

6.4.2 SIP policies in South Holland

In 1999, the provincial Department of Economic Affairs (Economic Department for short) of South Holland initiated the program DECOR with a focus on SIPs. At

that time, the Department of Environmental Protection (Environmental Department for short) was drafting the Provincial Environmental Plan with the idea of facilitating SIP. Thus, Economic Department invited Environmental Department to work jointly on DECOR. DECOR was implemented in three tracks. The first track was accumulating and disseminating SIP knowledge (e.g. selecting industrial parks as pilots, organizing symposium, and publishing handbook, and organizing education courses). The second was establishing a *Regional Knowledge Platform* based on the idea that the region[15] was the proper scale for SIP, especially for industrial clustering and industrial symbiosis. The third track centered on financial incentives. The Industrial Park Development Fund and Planning Grants were developed to subsidize projects, research and feasibility studies. DECOR was terminated in 2003, because of new policy decisions after the provincial election.

After DECOR, the Economic Department and Environmental Department initiated their own programs. The Economic Department initiated the Multiannual Program of Industrial Park in 2004 with the objectives of innovation of industrial parks and (re)development of industrial parks to create space for economy (SFE). In the program, the Economic Department argued to replace SIP by the concept of Quality of Industrial Parks (QIP). QIP concentrated on the images of industrial parks with high quality of infrastructures and better products. In 2006, Multiannual Program was terminated, and Action Program of Space for Economy (2007-2011) with similar objectives was initiated as a following program. Although the attention on SIP of the Economic Department changed, the Environmental Department was persistent in facilitating SIP. In 2005, the Environmental Department shifted the theme of an existing program of *Sustainable Entrepreneurship* from the angle of single enterprises to SIP, and it searched projects as positive examples and provided financial supports and educational courses. In 2006, the Environmental Department initiated the program of *Sustainable Working Landscape* with one subtheme of SIP. Sustainable Working Landscape was proposed as an alternative perspective for the (re)development of high quality industrial parks through highlighting the integration of industrial parks with the surrounding environment. In 2007, the Environmental Department and Economic Department together developed a set

[15] The province of South Holland consists of four regions:Rijnmond, South, West and East.

of indicators as operationalization of the concepts of QIP and SIP. This set of indicators was named as Target Image and was taken as the criteria for the application of provincial industrial park funds. In 2009, several civil servants working on SIP in the Environmental Department were relocated to the Economic Department. Since then, the Economic Department became the major coordinator and initiated the Restructuring Program of Industrial Parks with the aim of redeveloping industrial parks. The Restructuring program was terminated in 2013, and then the policy theme in the province changed from industrial parks to sustainable energy.

6.5 RESULTS

6.5.1 Translation Patterns and Evolving Policy Assemblage

The policy translation process of SIP in South Holland lasted for about 15 years. Following the analytical steps as described in section 6.3, the overall translation process is delineated into five phases. We describe the translation patterns and then map the policy assemblage of each phase.

Phase 1: 1998.11-2000.01

Translation pattern. Phase 1 began when the Provincial Council of South Holland decided to facilitate SIPs. Phase 1 shows the features of the pattern of '*single agency – experimental implementation'* (Fig. 6.3). The Provincial Council assigned Economic Department to initiate an implementation program of DECOR. The Economic Department became the single policy actor and it selected several industrial parks as pilots. Phase 1 was basically a process of experimenting with the ideas of SIP through pilots. This phase came to an end after one year. The Provincial Council evaluated the progress of the single agency approach and considered it 'too slow'. The Economic Department then realized the need for joint actions between governmental departments, especially the cooperation with the Environmental Department.

Policy Assemblage. In phase 1, a small assemblage emerged around the policy labels of SIP and DECOR (Fig. 6.4) with a generic idea of SIP, i.e. *People, Planet, and Profit* (PPP). The Economic Department was the most central actor and connected project managers and Provincial Council. These policy components together formed the central cluster of the assemblage. In the peripheral assemblage, several tangible ideas of SIP (e.g. energy, water) emerged and each

of them was taken as the major idea of each selected pilot.

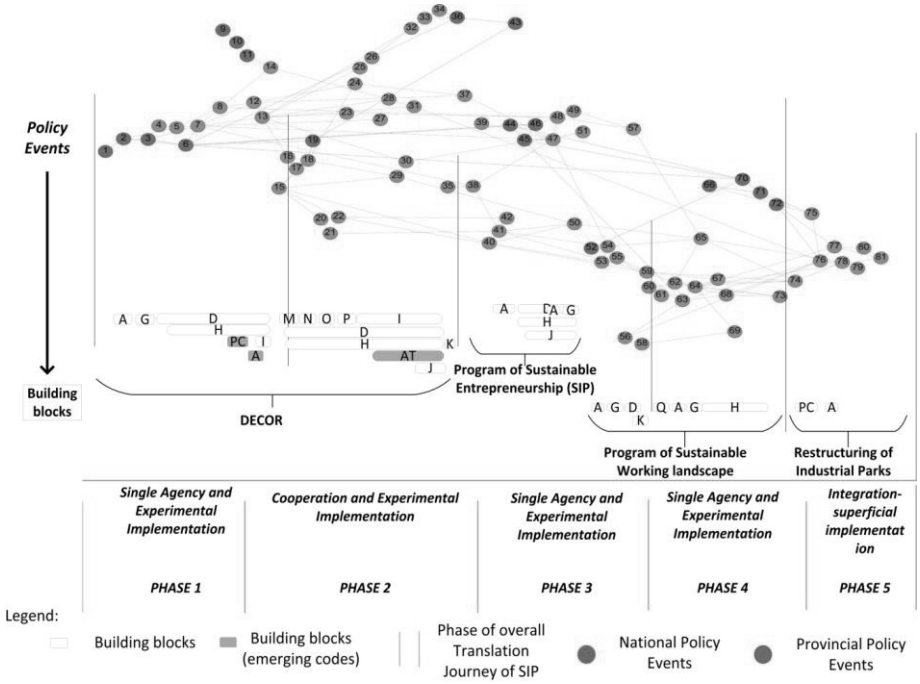

Fig. 6.3 Translation Patterns and Phases

Phase 2: 2000.02-2003.08

Translation Pattern. The breakpoint between phase 1 and 2 was the change of policy decision in implementing DECOR from the approach of single agency to cooperation. Phase 2 lasted about 3 years. A key question at the beginning of phase 2 was 'how to speed up the implementation of DECOR'. The Economic Department strived to build a cooperative network with the Environmental Department in order to solve this. At that time, the Environmental Department was drafting the Environmental Plan with a topic of SIP, and it was in great need of financial resources for programming. The Economic Department persuaded the Environmental Department to join in, by providing financial resource for SIP programming through DECOR. Because the preliminarily defined policy goals and roles of actors were vague, the two Departments quickly formed a temporal coalition. Still, the Economic Department was the focal actor. Rather than developing explicit policy objectives and means, the coalition engaged in learning (e.g. subsiding for research and feasibility studies), orientation (e.g. guidelines), piloting (e.g. several industrial parks as pilots), mobilization (e.g.

SIP workshops) and education (e.g. SIP education classes). Another distinct feature was appropriation. The coalition tentatively explored and strived to build the relations between SIP and existing policy instruments, themes, ideas, and resources (e.g. environmental licenses, corporate social responsibility, and national funds). Generally, phase 2 was dominated by tentative attitudes and key dynamics of learning by doing, and it matches with the pattern of '*cooperation – experimental implementation'* (Fig. 6.3).

Policy Assemblage. In phase 2, around the same policy labels of SIP and DECOR as phase 1, the policy assemblage grew substantially. The most evident change was the strong association between the Economic Department and Environmental Department as the core of assemblage. In addition, many ideas emerged and those about the novel aspects of SIP were emphasized, i.e. shifting perspective from individual firm to the cooperation among firms to achieve the synergy between environment and economy, such as cooperation, co-siting, and industrial ecology (Fig. 6.4).

Phase 3: 2003.09-2006.04

Translation Pattern. The breakpoint between phase 2 and 3 was the termination of DECOR. After the termination, the translation process evolved into two separated trajectories. This separation was indicated by the termination of cooperation between the two departments and the initiation of their own programs. The Economic Department initiated the program that facilitated the development of QIP [16] and the Environmental Department initiated the programs about SIP. In the translation trajectory of SIP, a pattern of *single agency-experimental implementation* was presented (Fig. 6.2). The Environmental Department acted as the single coordinator and initiated the program of Sustainable Entrepreneurship with one subtheme of SIP. The implementation showed experimental features, including 1) appropriation by tentatively linking SIP with the concept of Sustainable Entrepreneurship, 2) searching projects as pilots to accumulate empirical knowledge, and 3) mobilizing and educating stakeholders. Following this program, the

[16] The translation process of QIP began with the Multiannual Program of Industrial Park. The Economic Department set explicit quantitative objectives of (re)development industrial park in order to create space for economic activities. And it assigned the objectives to four regions, and further provided subsidies. Based on a positive evaluation of the outcome, the Action Program of Industrial Park, as a following program of Multiannual Program, was implemented in similar ways.

Environmental Department also decided to initiate the program of Sustainable Working Landscape with a subtheme of SIP.

Policy Assemblage. In phase 3, many new policy labels emerged (Fig. 6.4). Among them, SIP, the labels of Sustainable Entrepreneurship and Sustainable Working Landscape were frequently linked to the Environmental Department, and QIP, Space for Economy, and Innovation of Industrial Park were associated more often with the Economic Department. In addition, the linkage between the two departments was greatly weakened. Along with the separation, the previously emphasized ideas about the novel aspect of SIP (e.g. cooperation, co-siting) disappeared, while the ones about (re)development of industrial parks and QIP were highlighted. Mostly, the label of SIP was still of great importance in phase 3; however, the defining idea of SIP (e.g. industrial symbiosis) was lost and the ways how policy actors associated the label of SIP changed greatly.

Phase 4: 2006.05-2009.11

Translation Pattern. The breakpoint between phase 3 and 4 was the change from the separation to joint actions of the two departments. It began from the decision of the Provincial Council about integrating the environmental funds and economic funds of industrial clusters, which was related to both the QIP program and SIP program. To that end, the two Departments developed a set of indicators jointly to improve the image of industrial parks, which was referred to as Target Image. The two programs were still kept as independent programs, except that the Target Image was adopted in the two programs. So, the previously separated two translation trajectories started to link to a certain extent by the object of Target Image. Regarding the translation trajectory of SIP, apart from taking the Target Image as guides for projects, the program was implemented in a rather similar manner as the program of Sustainable Entrepreneurship, presenting a pattern of *single agency- experimental implementatation.*

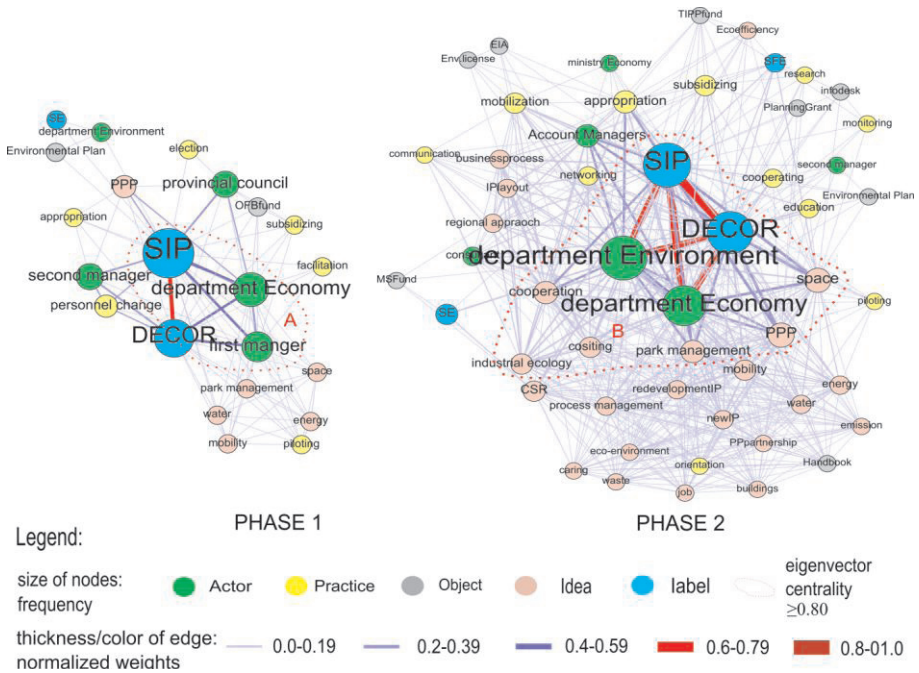

Fig. 6.4 Policy Assemblage in Phase 1 and 2

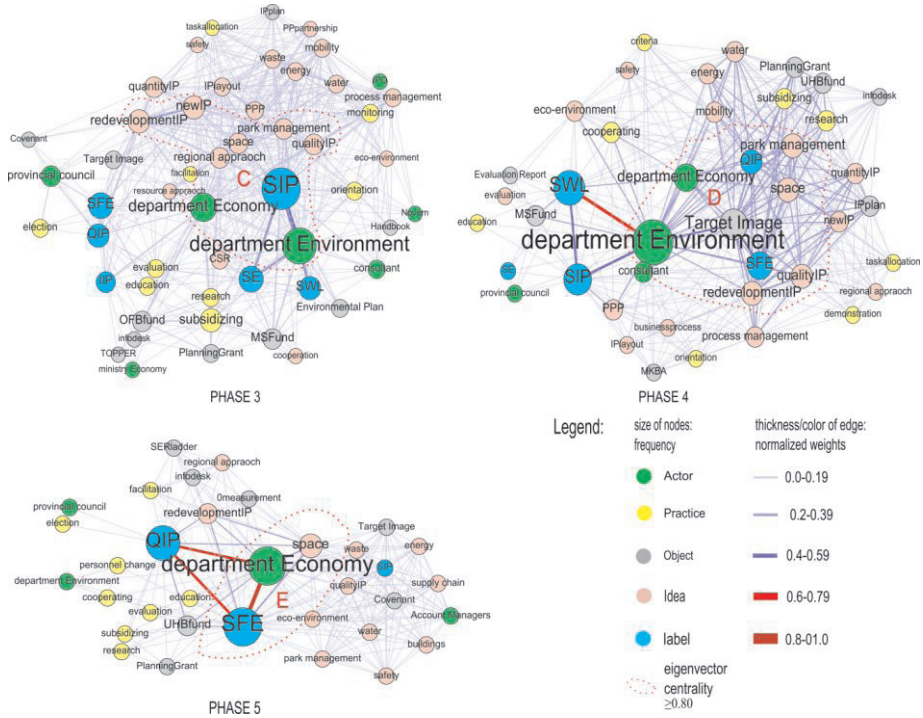

Fig. 6.5 Policy Assemblage in phase 3, 4 and 5

Policy Assemblage. The policy assemblage in phase 4 showed a similar feature as in phase 3, with sustained diverse policy labels and their specific linkages with the two departments (Fig.6.5). However, the central position of SIP label and relevant ideas gradually made ways for the ideas of SEF and QIP, and the object of Target Image occupied the central position mostly, and was closely linked to both Economic Department and Environmental Departments.

Phase 5: 2009.12-2013.04

Translation Pattern. Phase 5 did not match any of theoretical patterns. It began with the Provincial Council's decision of integrating environmental and economic goals of industrial parks. It was done by relocating several civil servants from the Environmental Department to the Economic Department which became the major coordinator. Then the covenant of *Sustainable Development and Dynamic Doing* was signed between the Economic Department and municipalities, in which the concept of SIP was included. However, its implementation program -*Restructuring Program of Industrial Park*- concentrated on QIP and failed to incorporate the ideas of SIP. So the policy concept of SIP existed in a quite superficial way. We referred to this emerging empirical pattern as "*integration -superficial implementation*" (Fig. 6.3). After the termination of this program in 2013, SIP was almost eliminated in the provincial policy.

Policy Assemblage. The policy assemblage presented one-core, constituting Economic Department and the ideas of redevelopment to create spaces around the labels of SEF (Fig. 6.5). Whereas, the ideas about SIP (e.g. energy, water, park management) were clustered in the peripheral assemblage. The attachment of these ideas about SIP was attributed to the object of covenant with agreement for SIP and Target Image, however, these ideas failed to be incorporated into the implementation program. Mostly, SIP became a generic policy symbol.

6.5.2 Types of Policy Durability

The policy concept of SIP in South Holland was interpreted in a rather broad sense, building on a generic notion of Sustainable Development. Around the label of SIP, many diverse policy labels were attached and some of them then get lost along the way. Meanwhile, the policy assemblage showed significant reshaping frequently. A clear feature was that the idea of industrial symbiosis

(e.g. co-siting, cooperation of industries), highlighted in the beginning, lost quickly over time. Other relevant ideas of SIP (e.g. energy or water) were sustained but gradually made ways for the ideas of quantity and quality of (re)development of industrial parks, reflecting gradual erosion of SIP policy. In addition, the evolving assemblage was featured by constant changes of relations between the Economic Department and the Environmental Department. Considering the entire policy translation process, policy durability configured unstable labels and fluid assemblage. It is type D embracing a quite low degree of stability. We further zoomed in on short temporal frames to examine whether durability was achieved at a higher degree of stability. Table 6.3 presents the main (changing) dynamics of assembling, and corresponding types of durability. It shows that Type C has been achieved in the time frames from phase 1 to 2, as well as from phase 3 to 4. In addition, type C and D shifted frequently back and forth in about 15 years, manifesting significant instability of a durable policy of SIP.

Table 6.3 Types of Policy Durability

Across Phases	dynamics in assembling	Durability
1→ 2	Around the same policy labels, the Economic Department that was in a very periphery position started to tightly associate with Environmental Department, and they together became the core of assemblage. In the periphery, abundant ideas attached, and the overall assemblage grew insensitively.	**C**
2→3	The tight association between the Economic Department and Environment Department broke. And many new labels and diverse ideas started to associate around the two departments, respectively.	**D**
3→4	The assemblage maintained a similar structure as phase 3. They differed in the following aspects. 1) The object of Target Image became stressed as the core of assemblage. 2) SIP was still sustained as a policy label, but the importance of the label of SIP and relevant ideas gradually made ways for the emerging controversial policy labels and ideas.	**C**
4→5	The controversial policy labels and ideas against SIP became the centre of assemblage, which tightly allied with the Economic Department. The label of SIP and relevant ideas located in the peripheral position of the assemblage.	**D**

6.5.3 Diffusion of SIPs

The results of diffusion of SIPs are summarized in Table 6.4. To compare with the controversial ideas that are against SIP, the diffusion results of QIP/SEF are also included. In all the five phases, the total number of SIPs and the continuity were low. These limited industrial parks mostly played an expressive and symbolic role. In the next section, we will further discuss the relations between

types of policy durability, policy contexts, and the diffusion of SIPs in each phase.

Table 6.4 Diffusion of SIP and SFE/QIP

	Phase	1	2	3	4	5
SIP	Number /ratio1[17]	9/1.53%	9/1.53	9/1.53%	18/3.06%	0/0
	Continuity /ratio2		9/100%	0/0	2/11.1%	0/0
	Type	Expressive	Expressive	Expressive	Expressive	--
SFE/ QIP	Number /ratio	--	--	46/7.84%	91/15.50%	64/10.90%
	Continuity/ ratio	--	--	2(from SIP)/ 4.35%	10/10.99%	33/51.56%
	Type	--	--	Material	Material	Material

6.6 ANALYSIS AND DISCUSSION

The study aims to reveal the impacts of the types of policy durability on policy outcomes of the diffusion of SIPs, building on the argument that the diverse types of policy durability reflect different qualities of the policy process in the configurations of policy stability and adaptability. We discuss from this angle by taking policy contexts as described below into consideration.

6.6.1 Phases 1 and 2 in relatively stable policy context

In phase 1 and 2, the Dutch national government emphasized the need for synergy between environment and economy, and the Ministry of Economic Affairs initiated *Stimulation Program of Sustainable Industrial Park* (1999-2004). As a response to the national policy orientation, the Provincial Council in South Holland showed great interest in the topics of sustainability and industrial parks. The interest in SIP also originated from the situations that 1) a large number of industrial parks became obsolete and lost their attractions to industries; 2) the ideas of sustainability spread in the Netherlands, and there was strong public opinions about environmental protection of industrial parks in South Holland; and 3) the highly environment-impacted industries (e.g. chemical industry) should be clustered to reduce their environmental impacts. So the policy contexts in phase 1 and 2 in general enabled provincial policy actions on SIP. Embedded in the relatively stable contexts, the translation process presented the successive patterns of 'single agency-experimentation' and 'cooperation-

[17]In calculating the Ratio 1, the total number of industrial parks in 2006 is adopted in all the five phases, as we can only assess this data.

experimentation'. This was because when the concept of SIP was introduced for the first time, both policy actors and practitioners were uncertain about it, and they kept relatively open policy goals and adopted tentative manners of implementation and intentional learning by doing. Accordingly, a fluid policy assemblage (e.g. the number of key policy actors and their relations were reshaped to fit the essence of the concept of SIP) around persistent policy labels emerged, presenting the type C of policy durability. Here adaptability was the dominant feature of the durable policy. The adaptability was generated by creating the fitness between the essences of SIP and the new contexts. As a result, only a limited number of industrial parks were selected as pilots to fulfill symbolic and expressive role to mobilize stakeholders (Table 6.4).

From what has been analyzed above, the results do not agree with the proposition as developed in Section 6.2. In the relatively stable policy contexts, type C of policy durability, rather than type A or B as expected, emerged and it did not bring about effective outcomes of diffusion. This is comprehensible, because type C of policy durability manifested high adaptability, and it was desirable to adapt to new contexts when SIP was introduced for the first time. In this situation, the wide diffusion of SIP was not the main policy objectives.

6.6.2 Phases 3, 4 and 5 in unstable policy context

In phase 3 and 4, the policy context changed substantially. The SIP policy at the national level dissolved, and unsatisfactory economic performance and high unemployment emerged in South Holland. In this context, there were tensions between the two main policy actors and further the separation of the two, because of their controversial ideas concerning SIP. Specifically, the Economic Department argued that SIP was difficult to be accepted by industries and did not fit the context at that time, and it proposed to replace SIP by the concept of QIP. QIP targeted to improve the economic performance of industrial parks through better products and better facilities of industrial parks. The idea of QIP seems to fit more the provincial contexts with unsatisfactory economic performance. Therefore, QIP attracted the newly formed Provincial Council, and a large percentage of provincial funds were subsidized to industries that implemented the idea of QIP (Table 6.4). The increasing support on QIP manifested an endogenous change that exerted influences on the policy development of SIPs. The endogenous change, however, resulted from the

intensions and actions to adapt to the changes of contexts, and thus the adaptation here became a strong undermining force against the development of SIP policy.

In this situation, the key to safeguard SIP as a significant policy concept over time was adapting to both the changes of contexts and the endogenous undermining forces. In this volatile situation, the Environmental Department still intended to continue the policy actions about SIP. The translation process of SIP presented a pattern of "single agency-experimental implementation". The Environmental Department tentatively took SIP as a subtheme of other heated policy programs, i.e. Sustainable Entrepreneurship and Sustainable Working Landscape, both of which were coordinated by the Environmental Department. After the tentative linkages were established, it then recursively engaged in piloting and demonstrating the potential linkages. As a result, policy durability embraced a sequential blend of type D and type C, and high adaptability was the most important property here. The tentative incorporation of SIP ideas into other heated policy programs fashioned SIP as an appealing policy label (Czarniawska and Sevón, 1996; Derthick and Quirk, 1985), thus successfully sustaining SIP as a policy theme in the volatile environment. However, the types of policy durability indicated high instability of SIP policy. The substantial instability exposed industries constantly to new policy environments, which hindered the (continuous) involvement of industries (Glazer and Rothenberg, 2001; Ardanaz et al., 2010). As shown in Table 6.4, the number of diffusion of SIP was rather limited and the continuity was low, and these selected industrial parks mainly performed the expressive role.

In phase 5, the policy contexts became more turbulent. Europe underwent consecutive financial crisis, economic crisis, and fiscal crisis from 2008 to 2011 (Kickert, 2012). The Netherlands and South Holland involved in it and were significantly affected. In this situation, the Dutch national policies oriented toward redevelopment of industrial parks. The worsening of economic performances and national policy actions toward redevelopment of industrial parks created volatile contexts for the provincial actions on SIP. As a response, the Provincial Council integrated the environmental and economic goals/funds of industrial parks in order to be more effective in allocating and utilizing the limited amount of provincial funds for industrial parks. However, the integration

did not sustain, but led to gradual erosion of the SIP policy. This was probably attributed to the way how integration was done. As revealed in the policy assemblage of phase 5, the Economic Department became the single central actor in relation to industrial parks, and safeguarded its advocated ideas about QIP. Meanwhile, along with the detachment of the Environmental Department, the persistent commitment on SIP also dissolved, and the previous SIP policy programs were gradually eroded and SIP was eventually eliminated in the provincial policy.

From what has been analyzed above, the results do not agree with the proposition as developed in Section 6.2. In the later three phases, the policy contexts underwent critical changes, and a sequential blend of type D and type C was presented, which agrees with the proposition. However, the sequential blend of type D and C of policy durability indicated a severe lack of stability of the SIP policy. This extremely unbalanced configuration of stability and adaptability failed to bring about effective outcomes of diffusion, which disagrees with the proposition.

6.7 CONCLUSIONS

In making and implementing SIP policies, wide and continuous diffusion of SIPs is often expected by policy actors. The positive policy outcome is closely related with the durability of policy. The study focuses on how and to what extent policy durability was achieved in the province of South Holland and also on the policy effects on the diffusion of SIPs. The results show that the policy process of SIP underwent five phases before its final dissolution. In the earlier two phases with relatively stable policy contexts, type C of policy durability were presented and did not bring about effective diffusion. However, it cannot be regarded as policy failure, because type C was desirable here for adapting and creating fitness with new contexts when policy actors and practitioners were uncertain about the novel policy concept of SIP. In this situation, the policy outcome of wide diffusion became secondary. In the later three phases, policy contexts changed substantially and two adaptive results are observed. First, there was the shift of the attention of one cooperative policy actor from SIP to the improvement of qualities of industrial parks. This shift aimed to enhance the economic performance of industrial parks, which fitted more policy contexts at that time. However, the adaptation to a great extent became the anti-force against SIP.

Second, the adaptation, done by "externally" fashioning SIP (i.e. tentatively incorporating SIP into other heated policy themes), successfully prevented SIP from undermining. Therefore, adaptability was the dominant feature of the durable policy. However, it was established at the high cost of policy stability. The great lack of stability of the durable policy did not bring about effective outcomes of diffusion. In the last phase, associated with the detachment of the Environmental Department, the persistent commitment on SIP dissolved, and SIP was almost totally dissolved in the provincial policies. It reflects that the long term and persistent role of policy champion is of crucial importance for policy durability.

This case implies that although adaptability is a positive property for a durable policy, the effective diffusion of SIPs cannot be achieved when policy stability lacks greatly. The result again indicates the importance of distinguishing different types of policy durability in order to gain insightful understanding about effective policy facilitation of SIP. The study reveals that it is a thorny issue to find the right balance between the need for stability and that for adaptability in a longitudinal policy development trajectory, especially in the later phases of a process and in the policy contexts with substantial changes. However, this issue needs to be addressed well to sustain SIP as a significant policy theme, and more importantly, to bring about fruition of the development of SIPs.

CHAPTER 7

COMPARISON

7.1 INTRODUCTION

In the previous chapters, the issue of policy durability has been analyzed and empirically investigated. Three building blocks are central: types of policy durability (including the policy stability and adaptability), policy translation patterns (including co-evolution of translation processes), and diffusion of SICs. Two types of relations between these building blocks have been studied. The first is how the translation patterns generate the types of policy durability and the second is how the different types of policy durability affect the diffusion of SICs. China (chapters 3, 4, 5) and South Holland (chapter 6) are the two empirical cases. It should be noted that the theory of this study is not introduced in one chapter, but is gradually built up by introducing new concepts or conceptual relations across chapters. Therefore, not all the conceptual elements and relations have been addressed in each empirical case. For instance, some conceptual elements that are introduced in Chapter 6 are not addressed systemically in previous chapters, and thus I strive firstly to synthesize all the aspects of the empirical studies that are followed by a systemic comparative study. The elaboration of the similarities and differences of the two cases can improve our understanding of each case and be also essential for reaching the conclusion toward a more general understanding of policy durability in Chapter 8. The main research questions are:

T*o what extent do the similarities and differences of the translation patterns lead to the types of policy durability in China and South Holland? Moreover, what are the effects of the types of policy durability on the diffusion of SICs?*

7.2 COMPARISON OF BUILDING BLOCKS

In this section, the similarities and differences of each building block in the theoretical framework are compared. Before the comparison, I introduce the policy contexts in China and South Holland, covering the aspects of economic process, political process, and international (national) policy environment, and other issues of industrial clusters.

South Holland. In the 1990s, sustainable development started to be stressed in the Dutch national policy. The national government published a Policy Note "Environment and Economy – toward a Sustainable Economy". The Note

highlighted the synergy between environmental protection and economic development, and sketched 16 pioneering ideas, one of which was SIC. The Ministry of Economic Affairs initiated the Stimulation Program of SIC in 1999. In the province of South Holland, the newly formed Provincial Council showed great interests in the topics of sustainability and industrial clusters. So the policy context in the initial and early phases was relatively stable, during which SIC was introduced and implemented as an important provincial policy. The national Stimulation Program of SIC was terminated in 2003. Then the national policy focused on the creation of high quality spaces for economic activities and claimed that the improvement of (re)development was more broadly applicable than only for the sustainable themes of industrial parks. In South Holland, DECOR was also terminated in 2003. At that time, the provincial economy did not perform well and there was increasing unemployment. After provincial election, the newly formed Provincial Council shifted attentions to the creation of space to enhance economic activities. In 2008, Europe underwent consecutive financial crisis, economic crisis, and fiscal crisis (Kickert, 2012). The Netherlands and the province of South Holland were involved in and were severely affected. To enhance the economic development, the policies of both national government and South Holland highlighted redevelopment of industrial clusters. So from 2003 on, the national policy orientations and the worsening economic performances in the Netherlands and South Holland created volatile policy contexts. However, SIC was sustained as a policy theme in this context.

China. In the late 1990s, the Chinese government realized that the environmental regulations and command-and-control instruments that were adopted in the early 1970s did not effectively solve the environmental pollution. Then the national government started to explore diverse and novel policy themes (e.g. ecological zone) and various instruments, such as voluntarism, market based instruments, public involvement, to increase governmental capacity for environmental protection (Shi and Zhang, 2006). The industrial cluster was taken as an important field for such explorative attempts, because it was the engines for regional economic development on one hand, and for the origins of serious environmental pressures on the other. So in the initial and early phases, the policy context was stable, in which SIC was introduced to solve environmental pollution. In the early 2000s, China underwent rapid industrialization, urbanization, as well as fast economic development. These

rapid processes required abundant resource and energy, and produced large amounts of wastes. There were serious conflicts between economic development and environmental protection. Meanwhile, China was facing international pressures on CO_2 reduction and energy conservation. These conflicts and pressures are still urgent problems. The relatively stable political process and political regime with communist party as the leading party persistently stress the importance of reducing the conflicts. The Chinese context in general is quite stable, and more importantly, it presents urgent calls for the synergy between environment and economy that have nourished the continuous development of the SIC policy.

7.2.1 Types of Policy Durability

The four types of policy durability -A B, C, D- embody various extents (i.e. levels) to which the stability of policy assemblage are achieved, with reduced stability from Type A to Type D. The types reflect the qualities of durable policy in configuring the policy stability and adaptability, both of which are important characteristics. Therefore, the sequential blend of types of policy durability manifests evolving qualities of policy durability. Table 7.1 summarizes the types of policy durability and their sequences of the two cases.

In both cases, Type C, which embraced more adaptability, emerged when the policy concepts of SIC were newly introduced in the local contexts. However, a significant difference was the types that followed Type C. In China, they were type A and type B. The two types shared characteristics of stabilization of the center of assemblage, around either the sustained stable policy labels (type A) or new emerging labels (type B). Both types embraced more stability. The evolving path from type C to type A/B presented the changing dynamics from active assembling of heterogeneous policy components of diverse sources to gradual patterning and solidifying of the key policy components of the assemblage.

In South Holland, the type D of policy durability followed type C. Type D signified dynamic reshaping of the key components of the policy assemblage around new policy labels, and it was conducive to more adaptability. Furthermore, type C and type D shifted back and forth for about 15 years, featuring the dynamics of (de)linking two central policy actors, and the gradual

movement of one actor from the center to the periphery of the assemblage, accompanied with the emergence and dissolution of diverse policy labels and gradual loss of SIC. So the sequential blends of the two types of policy durability indicated quite high fluidity of SIP policy in South Holland.

Table7.1 Types of Policy Durability (SH: South Holland; CN: China)

CASE	Type	SEQ	Dynamics in Assembling
SH	C/D	C→ D→ C→ D	- Persistent label of SIC, accompanied with emergence of many diverse policy labels on the way, and some of these labels dissolved over time. - The assemblage shifted from one central actor to tightly associated two central actors, during which SIC was highlighted and the ideas about industrial symbiosis occupied central position in the assemblage. Then the two actors were still in the central position, but their tight linkages dissolved. Moreover, different policy components started to assemble around each actor. Eventually, one actor moved from the central to peripheral position of the assemblage. Along with the shift, the idea of industrial symbiosis got lost and other relevant ideas about SIC gradually made ways for quality of industrial clusters.
CN	C/A/ B	EIP: C→ A; CE: C→ B;	- Persistent policy labels of CE and EIP, and proliferation of several labels around CE in the late stage. - The policy assemblage underwent a process of changes from one-cluster center (the Environmental Agency as the core) to a two-cluster structure around CE (the Economic Agency) and EIP (the Environmental Agency), respectively. The general two-cluster structure of the overall assemblage was rather stable, although there were emerging and dissolving linkages between the two clusters. - Each cluster of the assemblage reshaped over time. The two clusters shared the common features of a shift from one central actor to centralized association between multiple actors. Moreover, the structure of the centralized association became stable. Meanwhile, the loose collection of ideas of SIC were gradually funneled and stabilized into solidified center of the assemblage.

7.2.2 Translation Patterns

Table 7.2 summarizes the translation patterns and their sequences of the cases of China and South Holland. The patterns of “single agency-experimental implementation” and “cooperation-experimental implementation” were

presented in the early phases of both cases. The two patterns shared common features of tentative attitudes of policy actors and social experimentations (e.g. piloting, intentional learning, R&D, mobilization and education). Furthermore, it can be seen that the translation process shifted from the former pattern to the latter in both cases. The main change associated with this shift was the changes of primary policy translator(s) from a single focal agency to the cooperation of multiple policy actors.

The translation processes with similar starting points in the two cases evolved in different trajectories. In China, administrative features were gradually infused into the pattern of "cooperation-experimental implementation" in both the CE and EIP policies, referred to as the pattern of "cooperation implementation with a mixture of experimental and administrative features". The increasing administrative features were indicated by the enforcement of law, standardizations of procedures and substances, and stricter subsidy applications. In South Holland, the cooperation was broken and the Environmental Agency became the single focal policy actor. So the shared pattern of "*cooperation- experimental implementation"* was followed by the pattern of "*single agency-experimental implementation".* This pattern lasted for seven years. The experimental implementation was characterized by tentative incorporations of SIC into other salient policy themes of the periods (i.e. sustainable landscape and sustainable entrepreneurship) and the exploration of the potential linkages between SIC and these salient policy themes. Mostly, the translation process in the entire period in South Holland is featured by experimentation, and the primary policy actor(s) changed greatly. With the eventual dropout of the Environmental Agency, SIC policy dissolved in the province.

Co-evolution of policy translation processes of SICs was presented in both cases. However, the dynamics through which the policy processes were locked into the path of co-evolution were different. In China, the policies of CE and EIP co-evolved and both of them aimed to facilitate the development of SIC. After a short period of tension when they started to share the common interest in SIC for the first time, they entered a path of co-evolution with symbiotic relations that mutually reinforced the development of each other. The establishment of symbiotic relation was accompanied with a strategy of differentiation in the

aspects of target groups, conceptual scopes, and defining ideas. The differentiation has greatly reduced their possible competitions. In the end, although the interactions between the policies of CE and EIP policies reduced, both of them succeed to diffuse in a large number of industrial parks (see Chapter 5). While in South Holland, after four-year policy implementation of SIC, controversial policy ideas emerged. The Economic Agency proposed the concept of Quality of Industrial Parks (QIP) to replace SIC and argued that the QIP means better products and better facilities of industrial clusters that could boost economic performance of industrial clusters and fitted more with policy contexts. Then QIP and SIP entered into a path of co-evolution. The SIC policy was constantly interrupted by the policy process of QIP, and the development of QIP was at the cost of SIC policy. Their interactions eventually undermined the development of SIC, so their relation can be identified as parasitism.

Table 7.2 Translation Patterns

Patterns	CHINA	SOUTH HOLLAND
Pattern (Matched)	Single agency-experimental implementation; Cooperation-experimental implementation;	Single agency-experimental implementation; Cooperation-experimental implementation;
Pattern (Emerging)	Cooperation implementation with a mixture of experimental and administrative features; Critical change and punctuation;	Integration-superficial Implementation
Sequence	- CE: Single agency-experimentation→ Critical change and punctuation→ cooperation- experimental implementation→ cooperation implementation and mixing of experimental and administrative features; - EIP: Single agency-experimental implementation→ cooperation implementation and a mixture of experimental and administrative features;	- Single agency and experimentation→ cooperation -experimental implementation→ single agency - experimentation:(the interactions between SIC and other policy streams changed in this period) → Integration-superficial Implementation
Co-evolution translation processes	Co-existence(tensions)→ symbiosis: co-evolution of CE and EIP policies, and both policies aimed to facilitate SICs	Parasitism: co-evolution of the policies of SIC and QIP, and the development of QIP policy gradually undermined SIC policy.

7.2.3 Diffusion of SICs

The diffusion of SICs reflects the effects of policy on transiting industrial clusters toward SICs. We investigated the three aspects of diffusion: ratios/numbers, continuity, and types of diffusion (see Chapter 1 for detailed descriptions). Here we do not intend to have a clear-cut judgment about the most effective types of policy durability, because the two cases are not identical (e.g. different levels of governmental system) and there are significant differences of the contexts. The main goal is to evaluate the extent to which the different types of policy durability bring about different outcomes of diffusion, and in what contexts.

Number/Ratio. To place the number of diffusion in local contexts, we assess the ratio of the number of SICs in each phase to the total number of industrial clusters in the area18. Figure 7.1 shows a steady increase in the number of SICs in China, and fluctuations in South Holland. Specifically, the fluctuation means the number of SICs was stable in the beginning three phases, and after a slow growing in phase 4 the number decreased sharply in phase 5. The clear difference of the two cases was the reverse trends shown in phase 5, i.e. a leap in China and no active involvement of SIC in South Holland. Figure 7.1 also shows that the ratio was relatively higher in South Holland than in China in phase 1 and 2. From phase 3 on, the ratio in China becomes higher. It should be noted that in assessing the ratio we only considered the number of industrial clusters that have linked to the policy concept of SIC, without examining the degree of implementation of SIC ideas in these industrial clusters19. For a brief overview of the implementation in industrial parks, we can observe the different strategies adopted in the implementation of SIC policies in the two cases. In China, with explicit environmental and economic objectives, the industrial clusters were enrolled to systemically transit toward SICs. A large number of industrial clusters were national level industrial clusters, which were large in size and in number of companies. For instance, the size of Tianjing Economic and Development Area (TEDA) is about 4600 hectares and has more than 300 companies. To meet the defined environmental and economic objectives, a large

[18] In South Holland, because we can only assess the total number of industrial clusters in 2006, the number (587) was adopted in all the five phases. Similarly, the total number of industrial clusters in China of 2006 was 1568 (Shi et al., 2012), which was also adopted in the overall five phases.

[19] The investigation of materialization of SIC ideas in industrial clusters is proposed as a future research agenda in Chapter 8.

number of projects in one industrial cluster were designed and facilitated as a pack. This manner can be referred to as "industrial cluster-based strategy". Differently, in South Holland, one or two projects were subsidized in each involved industrial cluster to demonstrate potential ways in implementing SIC ideas. For instance, in the program of DECOR, nine industrial clusters were selected as pilots, and each concentrated on one or two particular themes of SIC, such as energy, or park management. We name this approach as "project-based strategy". It seems that the "industrial cluster-based strategy" can implement the SIC ideas more deeply.

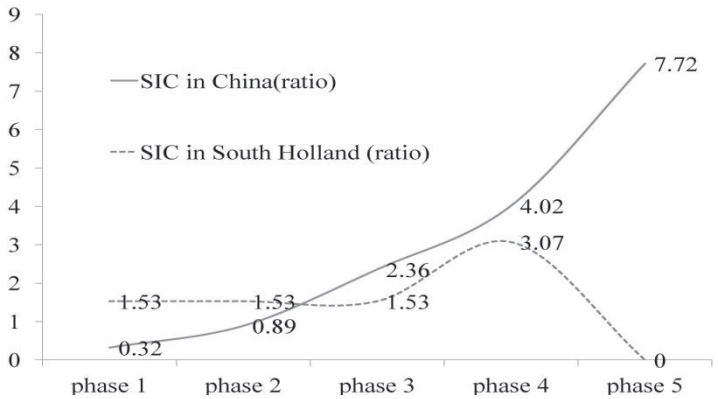

Fig.7.1 The ratio of total numbers of SIC to total numbers of industrial clusters

Continuity. The continuity of governmental supports for the industrial clusters that have been involved in previous programs of SIC was relatively higher in China than in South Holland. In China, with "industrial cluster-based strategy", most of the involved industrial clusters got continuous governmental support (e.g. reputation, subsidy) until and even after meeting the defined environmental and economic objectives. More importantly, it has been emphasized that the previously involved industrial clusters had the priority in getting the governmental supports in the new programs. In South Holland, the intention of "project-based strategy" was linking SIC concept and limited resources (e.g. funds) with as many diverse industrial clusters as possible. The intention of wide diffusion of SICs was at the cost of low continuity (see Chapter 6).

Types of Diffusion. A common feature of the two cases is the symbolic role of industrial clusters in the early phases, reflected by limited number of industrial

clusters as pilots or show-cases to accumulate experience and to mobilize stakeholders. The symbolic role of industrial clusters was maintained in South Holland in the whole period, and the material role of industrial clusters emerged in the late phases in China (see chapter 4 and chapter 5).

Overall the SIC policy concept was diffused continuously and steadily in China, and the outcome seems to be more effective than in South Holland where a termination of governmental support for SIC eventually occurred.

7.3 COMPARISON OF SEQUENCES

An evident feature of the two cases, as showed above, is their similar beginnings but different endings (Table 7.3). In this section, we strive to link the comparative results of the three building blocks and consider their temporal orders in the policy process in order to reveal the causes and effects of the similar beginnings, and more importantly, the different endings.

7.3.1 Similar Beginnings

The similar beginnings were manifested in all the key building blocks. In the initial and early phases of both cases, the policy context was relatively stable, and more importantly, the concept of sustainability became fashionable, and the ideas of synergy between environmental protection and economic development started to draw political and public attentions. In this context, the concept of SIC was translated in the national and provincial policies for the first time. Attributed to the fact that there were a lot of unknowns about the novel concept of SIC, the approach of intentional learning by doing was adopted by policy actors, so the translation patterns presented the tentative attitudes and experimental approaches, accompanied with the shifts from single agency implementation to cooperation between governmental agencies. Regarding to the shift, the two cases presented common dynamics. First, the shared reason was that the focal policy actor started to realize the importance of joint actions between multiple governmental agencies in order to facilitate the development of SIC. Because SIC is related with the issues of environmental protection, economic development and infrastructures of industrial clusters, those policy actors included three types: Economic Agency, Environment Agency, and Administrative Bodies of Industrial parks. Second, many diverse policy actors intended to link to the concept of SIC after it became a fashionable policy theme

pioneered by the focal actor. Case-specific manners of the cooperation were also observed, i.e. different ways that policy actor pass through the OPP (see Chapter 3). In a gentle manner, the multiple policy actors strived to create a win-win situation, so the focal policy actor interested (e.g. negotiate and persuade) other active policy actors to be enrolled (e.g. DECOR in South Holland) or the other active policy actors interested (e.g. negotiate or persuade) the focal policy actor for the cooperation (e.g. EIP program). In this gentle manner, the central role of the focal actor was sustained and the continuity of policy actions was relatively high. In a critical manner, the new policy actor replaced the central role of the previous focal actor, accompanied with new interpretations and discontinuities of previous policy actions (e.g. CE in China).

Brought about by the translation processes featured by the experimentation with the shift from single agency approach to cooperation, the policy assemblage presented active assembling of policy components from diverse sources and also shifts of the number and types of central policy actors, and thus type C of policy durability emerged. Type C was the attractive starting points of both cases. It was desirable for adapting the novel concept of SIC in the new policy contexts, but it failed to bring about effective policy outcome of diffusion. Because the high fluidity of policies created uncertain policy environment for practitioners and the novel concept required many changes of practitioners, only a limited number of industrial clusters were selected to perform the symbolic role. In addition, the results of continuity of diffusion seem to show that it is related with the extent to which the focal policy actors were changed in type C of policy durability. As analyzed above, the two manners (i.e. gentle and critical) of the establishment of cooperation are observed. With the gentle manner, the focal actor sustained its central position and it safeguarded the continuous support for these involved industrial clusters (e.g. EIP program and DECOR program), so the continuity of diffusion was relatively high. In the case of critical manner, the focal actor changed and the new focal actor was more likely to select new pilots to meet the revised policy goals (e.g. CE program), so the continuity was relatively low. Generally, the type C of policy durability in the early phases failed to bring about effective outcomes of diffusion in both cases. However, the ineffective outcomes of diffusion cannot be regarded as policy failure, because the adaptation was the first priority for policy actor in the beginning of policy process to develop a fitted policy with the new contexts.

7.3.2 Different Endings

To understand the dynamics of effective policy facilitation of SICs, what matters most were the different endings of the two cases. Following the similar beginnings, the policy durability of the two cases presented different or even contrasting evolving paths: 1) continuously fluid and dynamic assembling and even relabeling, i.e. toward the ones that embraced more policy adaptability (type D) in South Holland, and 2) from fluid and dynamic assembling to gradual stabilization of the core of the assemblage, i.e. toward the ones that embraced more policy stability with limited adaptability (type A/B) in China. We will elaborate the causes and effects of the different endings.

Causes of the different endings

The different endings of the evolving paths of policy durability of the two cases were attributed to the specific translation patterns embedded in quite diverse policy contexts (Table 7.3).

In China, the evolving path of policy durability toward more policy stability with some room of adaptation was brought about by the pattern of "cooperation implementation with a mixture of experimental and administrative features" embedded in the stable policy context. This pattern emerged in the process of gradual infusion of administrative features into the "cooperation-experimental implementation". Thus, it combined certain features of the patterns of "cooperation–experimental implementation" and "cooperation-administrative implementation". Specifically, it sustained some degree of experimental features, such as piloting and demonstration, and meanwhile, the administrative features increased, formalizing and regularizing the implementation. Within these administrative approaches, standardization (of procedures, contents, and indicators) was popular in China. On one hand, the standardization brought about patterned and stable relations between policy components, and created the possibility of abstracting and comparing the diverse and complex practices of the locals (Fenwick, 2010). On the other hand, the standards maintained room for practitioners to adapt to the policy contents with diverse local contexts (Fenwick, 2010). So, along with the unfolding translation pattern, the policy assemblage presented a solidified and patterned center with some room for adaptability, and thus the type A (EIP policy)/B (CE policy) emerged. The emergence of type B and type A seems to be related with the conceptual scope of

the policy concept. The CE case shows that instability of policy labels resulted from the proliferations of policy labels around CE. It means the new policy labels derived from the central label of CE, because CE was a comprehensive concept with multiple traits (i.e. the implementation at the levels of firm, industrial clusters, and society), and the proliferation of labels was attributed to the specifications of the broad scopes of CE into target programs. As EIP was a single-trait concept, type A of policy durability emerged.

Table 7.3 Similar Beginnings and Different Endings

Building Blocks	Cases	Similar beginnings	Different endings
Context	CN	Stable	Stable
	SH		volatile
Translation patterns	CN	Single agency-experimental implementation →cooperation-experimental implementation	Cooperation implementation with a mixture of experimental and administrative features
	SH		Single agency –experimental implementation
Types of policy durability	CN	Type C	Type A/ Type B
	SH		Type D/Type C
Diffusion of SICs	CN	- limited numbers - symbolic roles -low/high continuity	-wide diffusion -high continuity - more material roles
	SH		- limited numbers - low continuity - more symbolic roles

In South Holland, type C and type D of policy durability shifted back and forth, and the key policy components and policy labels presented high fluidity. The corresponding translation pattern observed was "*single agency-experimental implementation*". This pattern presented when the policy contexts became unstable and when the internal controversies emerged in the implementation of SIC policy. From 2003 on, the policy contexts in South Holland became unstable with unpleasant economic performance and then economic crisis that impacted political priorities. The national and provincial governments changed the political priority from sustainable development to promotion of economic

development. As an adaptation to this change, the Economic Department replaced the concept of SIC by QIP that were argued to enhance the economic development of industrial parks. Thus, in the volatile contexts and internal controversies, the Environmental Department became the single coordinator of SIC policy and adopted experimental approaches to prevent SIC policy from dissolving, such as fashioning the concept of SIC, as analyzed above. The translation pattern resulted in great fluidity of the policy assemblage, and type D/type C emerged, dedicating to adapt SIC policy in the volatile contexts.

Effects of the different endings

The contrasting evolving paths of the policy durability of the two cases led to different policy outcomes of diffusion of SICs. The comparison showed that SIC policy continuously and steadily diffused in industrial parks in China. The result seems to be more effective than in South Holland where the governmental support for SIC eventually terminated. I thereby explain the relationships between types of policy durability and the diffusion of SICs.

The main difference of policy durability of the two cases was the extent to which the fluid assemblage was stabilized in the later phases. We observed gradual patterning and stabilization in the China's case, and continuous fluidity and dynamic assembling and relabeling in the case of South Holland. The difference reflects that stability was an important characteristic for the wide and continuous diffusion of SICs. Stability manifests a long term and concerted governmental commitments for target groups (Liang and Fiorino, 2013). Because industries consider their previous experience, credibility, and stability of future policy before making decisions, the long-term governmental commitments is crucial to persuade industries to make continuous investment of energy, resource and time (Glazer and Rothenberg, 2001). Furthermore, the continuous involvement of industries is critical for the development of SIP that is vulnerable to the dropout of the involved firms (Chopra and Khanna, 2014).Whereas, the stability lacked in the case of South Holland. The type C and type D of policy durability dedicated to adapt SIC with the volatile policy contexts, which successfully sustained SIC as a policy theme; however, the fluid assemblage (e.g. changes of procedures and substances) created highly uncertain policy environment for practitioners, impeding their (continuous) investment. Adaptability was needed to sustain SIC as a policy theme in the

volatile context; however, it was created at a high cost of stability that partly accounted for the ineffective policy outcomes of diffusion. The adaptation through fashioning the policy concept of SIC is also observed in the China's case, but it was done differently. The implications of fashioning of the two cases will be discussed in the next section.

7.4 CONCLUSIONS AND DISCUSSIONS

7.4.1 Conclusion on the similar beginnings but different endings

The comparison of the two cases shows that type C of policy durability was an attractive starting point. Here adaptability was the dominant feature of the policy. Type C was desirable when the policy concept of SIC was newly introduced in the stable local contexts. The type C was brought about by the translation patterns that embodied experimental features and reshaping of policy actors from single agency to cooperation, which was essentially a process of adapting SIC policy with the new contexts. The adaptation was the priority of policy actors in the earlier phases of policy process, and the wide diffusion of SICs became secondary.

The type C of policy durability, however, evolved toward a direction with more fluidity (i.e. type D) in South Holland, and toward a direction with more stability accompanied with some degree of adaptability (i.e. type A or B) in China. The different endings resulted from the subsequent translation patterns shaped by specific policy contexts. In China, the infusion of administrative features into the pattern of "cooperation-experimental implementation" unfolded in stable policy contexts led to the type A/B of policy durability, and both types of policy durability brought about positive outcomes of diffusion of SICs. In South Holland, with the critical changes of policy contexts, the policy translation process presented the pattern of "single agency – experimental implementation" that strived to adapt SIC with the changes of the contexts. The pattern has sustained SIC as a significant policy theme in the volatile policy contexts, and the durable policy presented high adaptability, but the adaptability was achieved at the high cost of policy stability. Because of the severe lack of stability, the durable policy of SIC failed to bring about the effective outcome of the diffusion of SICs.

The results of diffusion do not mean Type A/B is inherently better than Type C/D, or the policy actors in China were doing better than in South Holland. It

should be understood well because of the great differences of policy contexts of the two cases. The comparison suggests that the judgment of the effects of policy durability should take into consideration of 1) the political priority at hand in various policy contexts, and 2) the sequential orders of the diverse types of policy durability.

Ad 1) about the first point, the policy contexts can shape the political priority that further exerts influences on governmental actions on SIP policies. In the different contexts, the priority interpreted by policy actors can change from intentional learning, to policy sustainment from undermining, and to effective diffusion. The achievements in the former two priorities, which often correspond to type C and type D of policy durability, manifest the policy success in adapting to the volatile contexts. Although SIC is not widely diffused, the policy outcome cannot be taken as policy failure.

Ad 2) about the second point, the sequential orders of the different types of policy durability are also important. The solidification of key policy components of the policy assemblage does not occur immediately (i.e. type A or B), but builds on the adaptability that is created in the previous dynamic assembling of policy components from diverse sources (i.e. type C or D). Therefore, type C or type D in the earlier phases is indispensable for the positive effects of type A or B on the diffusion of SIC in the later phases.

7.4.2 Lessons from the strategies/approaches adopted in cases

Cooperative approach or single agency approach. The cooperation and single agency implementation were the two main approaches in the implementation of SIC policy in both China and South Holland. Furthermore, the shift from the single agency to cooperation was observed in both cases in the early phases of the translation process. However, the cooperation was sustained in China for an extended period but dissolved in South Holland, because of controversial ideas among the cooperative actors. The different policy outcomes as analyzed above seem to show that the single agency approach is eligible for introducing and translating SIC into the new context, while the cooperation between governmental agencies is desirable for effective outcomes of diffusion. SIC pursues synergies between environment (Planet), economy (Profit), and society (People), so the SIC policy touches multiple issues that are coordinated by

different governmental bodies. The cooperation of these multiple governmental bodies can link SIC policy to broader context and the complex reality of the multiple stakeholders in industrial clusters (Dijkema and Basson, 2009), thus increasing its fitness with local contexts. In addition, cooperative network generally embodies more flexibility than single agency approach (Provan and Kenis, 2007), as these diverse policy actors can access and bring in information from different sources when the contexts change. Although the cooperation fits well with the essence of SIC and the complex nature of industrial clusters, policy actors need to carefully detect how the cooperative network need to be established, because it is uneasy. In both cases, the cooperation of Economic Agency and Environmental Agency was established but maintained only for a short period of time (i.e. about 3-4 years). This was because 1) the two agencies conventionally coordinate different aspects of the industrial clusters (i.e. environmental aspect and economic aspect), and 2) more importantly, these aspects are often interpreted as conflicting and cannot be achieved simultaneously (McManus, 1996), although the ideas of sustainable development and synergy between environment and economy have been spread widely.

Experimental approach or administrative approach. The two cases suggest that the adoption of experimental approaches is crucial in the early phases of the policy translation process of SIC or in the policy contexts with substantial changes. The social experimentation holds tentative attitudes (Heclo, 1986) and adopts strategies like piloting, show-cases, intentional learning, and appropriation. Through these strategies, policy makers can discover contingencies before making explicit and far-reaching policy decisions (Heclo, 1986), can reflectively consider the changed policy contexts, and can make timely adjustment and adapt with new contexts (Metze and Zuydam, 2013). As a result, the policy making and implementation become intertwined co-evolving process. The experimental approach is important for increasing policy adaptability. Nevertheless, the administrative approach is crucial for effective diffusions of SICs. The underlying ideas of administration is that the relatively linear implementation of ideas into reality is an efficient policy implementation, and the policy ideas are translated into targets, plans, rules, and standards with limited discretion for practitioners (Matland, 1995). The administrative approach can bring about policy stability that is an important feature for

effective policy outcomes. However, due to the complexity and diversities of local SIC practices, it is unlikely to create an overall stable policy that fits well with all the diversities. Standardization can be an optimal strategy, as standards has room for local adaptive practices, and also can abstract the diverse local practices into stable and compare components, such as indicators (Fenwick, 2010).

Fashioning SIC policies: internalization or externalization. The efforts of fashioning (Czarniawska & Sevón, 1996) the policy concept of SIC are observed in both cases. The fashioning refers to the policy actions of linking the policy concept of SIC with newly emerged salient policy ideas in order to attract attentions of politicians, media, or practitioners. In both cases, the fashioning has successfully linked SIC with broader contexts and sustained SIC policy for extended time periods. However, the fashioning was conducted in different ways in the two cases, leading to different policy outputs and outcomes. In China, in the later phases, the policy actors linked SIC with the salient policy themes (e.g. Low Carbon Economy) and the linkage was established by incorporating the ideas of these salient policy themes into the SIC policy, such as stimulating industrial clusters to produce the products with low carbon footprints. So the fashioning was achieved through "internalizing" other salient policy ideas into the SIP policy. In contrast, the linkage was built up by incorporating SIC as a subtopic of other salient policy themes, such as Sustainable Working Landscape in South Holland. The fashioning was achieved through "externalizing" SIC policy ideas into other salient policies. Comparing the results of diffusion of SICs in the two cases, we suggest the fashioning that internalizes is probably desirable for effective diffusions, because it can increase adaptability (i.e. link SIC with broader policy contexts, attract attentions, and interest more diverse industrial clusters) without leading to substantial changes of the policy. In contrast, the fashioning that externalizes is a result of adapting to the volatile contexts in order to prevent SIC from undermining. Although it creates high adaptability, it produces substantial changes of policy components around SIC and thus it is created at the high cost of policy stability. The substantial changes create significantly unstable policy environment for practitioners, impeding the diffusion of SICs (Ardanaz et al., 2010; Glazer and Rothenberg, 2001).

CHAPTER 8

CONCLUSIONS AND REFLECTIONS

8.1 INTRODUCTION

The thesis began with the observations that policies of Sustainable Industrial Clusters (SIC) are flourishing around the world and the discussions about the role policy plays and should play in facilitating SIC effectively. The notion of policy in this study refers to a course of decisions and actions of governmental actors to provide intentional guidance to solve collective issues. Policy durability is an important quality of policy process. It refers to the ability to maintain a degree of stability, coherence and integrity of policies over time, where the contexts can and often change and generate pressure on policies. The process begins when public authorities or organizations pick up a certain concept (like SIC), and translate it into a course of policy decisions, programs and actions, which can solve a collective issue, like environmental pollution of industrial clusters. Durable policy is argued as an important factor for the success of most public policies (Patashnik, 2003) and is of particular importance for the success of policies of SICs, because these are long-term processes (Boons et al., 2014;Voβ et al., 2009). It is intriguing to see that the concept of policy durability is unnoticed in the SIC literature. This thesis aims to fill this knowledge gap. The central research question is:

How does policy become durable to facilitate the development of SIC effectively?

The answers and conclusions about this question are presented in Section 8.2. In drawing the conclusions, we keep in mind that they are based on two cases. However, the case studies contribute to the understanding of the phenomena of policy durability, policy translation, diffusion of SICs, and their relations for two reasons. First, since the two cases share similar starting points but present different endings, all the four types of policy durability have been empirically observed. This allows us to conduct a complete analysis of the relationships between key concepts. Second, as they are longitudinal and in-depth case studies, the results can lead to a certain level of generalization, which means that the "arguments that can 'travel' in some form beyond a specific time and space (Pierson, 2004, p6)". Following the conclusions, reflections on theories, future research, and policy practices are added in Section 8.3. The thesis ends with reflections on interdisciplinary studies as a translation process in Section 8.4.

8.2 REVISITING POLICY DURABILITY

To answer the central research question, the study reveals the dynamics of the coming into being of various types of policy durability and their effects on the diffusion of SICs. Three core-conclusions with regard to this question are drawn, based on three key concepts (types of policy durability, policy translation patterns, and diffusion of SICs) and two critical relations ("translation patterns⇨ types of policy durability", and "types of policy durability ⇨ diffusion of SICs") (Fig. 8.1).

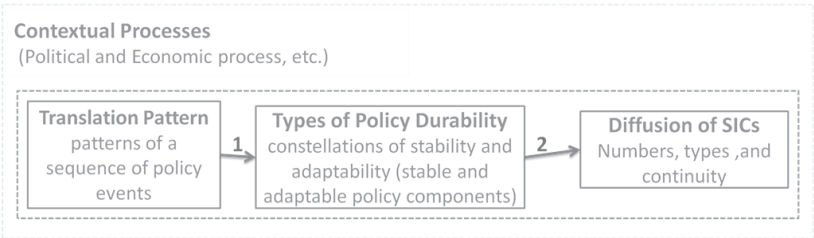

Fig. 8.1 Key concepts and relations

Conclusion I

Type C of policy durability that embraces more adaptability is an attractive starting point, whereas the evolving path of policy durability over time manifests increasing perplexing relations between stability and adaptability.

Policy durability incorporates perplexing relations between policy stability and adaptability. Policy endures and meanwhile adapts over time (Kay, 2006). Stability and adaptability are the two characteristics for a durable policy, i.e. a durable policy configures both stable and adaptable policy components. Stability (e.g. stable and long term policy goal) is required because stable and predictable policy resource allocation and budget have positive relations with policy outcomes (Liang and Fiorino, 2013; O'Toole and Meier, 2003), and is also crucial to persuade industries to make continuous investment (Glazer and Rothenberg, 2001). Stability, however, is not the whole story for a durable policy, but goes hand in hand with adaptability. Adaptability is often taken as a positive and advantageous property for a policy to have. Adaptability means that timely responses are made to correct previous policy failure, to fit changing context, or to alleviate external interruptions (Gilsing, 2007; Provan and Kenis, 2007;

Ardanaz et al. 2010). The changes that result from the efforts of adaptation do not mean policy erosion or failure, but they can serve as the power of policy. However, policy durability incorporates perplexing and even paradoxical relations between policy stability and adaptability (Durlak and Dupre, 2008; Weick, 1979), because of trade-offs and tensions between stability and adaptability.

A typology of policy durability. One dynamic of coping with the perplexing relation between stability and adaptability is that stability and adaptability are simultaneously accommodated and sustained. It means that some policy components are maintained stable to achieve coherence and continuity of policy, and some components are adaptable to fit the changes of policy contexts. The various configurations of stable and adaptable policy components present different types of policy durability. These different types are tangible by mapping the policy assemblage that emerges and evolves with the unfolding policy process and by tracing the stability of the policy assemblage. Four types of policy durability, i.e. A, B, C, D, are obtained by distinguishing the changes in (or inertia of) the way that a policy is branded (i.e. (in) stability of policy labels) from the changes in (or inertia of) the center of the assemblage (i.e. central actors, ideas, practices, and objects). The summary of the four types observed in this study are presented in Table 8.1.

Sequential blends of types of policy durability. The other dynamic of coping with the perplexing relation between stability and adaptability is to embrace more stability or more adaptability sequentially. It means that in contexts with substantial changes, adaptability becomes important, and the types of policy durability that embrace more adaptability are thus favourable. Whereas, when the fitness has been created in relatively stable contexts, the policy durability that embraces more stability is favourable in order to achieve effective outcomes of diffusion (as will be concluded in the following section). The sequential blend of types of policy durability reflects the evolving quality of durable policy in dynamically fitting the contexts and the progress of industrial parks. The study reveals three sequential blends of types of policy durability (Fig. 8.3). It shows that type C presents in the initial and early phases in all the three paths of the two cases. However, it then evolves in different or even contrasting directions: 1) from the type embracing more adaptability (in relatively stable contexts) to the

ones with more stability (i.e. type A/B in relatively stable contexts) in China, and 2) with continuous high adaptability (i.e. type C in relatively stable contexts and then type D in volatile contexts) in South Holland. The contrasting directions of the sequential blends of different types of policy durability manifest increasing tensions between the need for adaptability in order to re-establish fitness with changes of contexts, and that for stability in order to achieve effective diffusions (as will be concluded below).

Table 8.1 Four Types of Policy Durability

TYPE	DESCRIPTION
A solidified assemblage	All the main policy components are solidified. It has some room for minor additions of new ideas or practices. This type of policy durability is observed in the later phases of policy process. It presents when policy actors have created a primary fit of policy goals and means with the relatively stable contexts and the reality of industrial parks.
B old wine in new bottles	New policy labels are introduced, but the main actors, ideas, objects and practices involved remain largely the same. Theoretically, this type may emerge as a result of fashioning or mainstreaming the concept to attract political attentions. The study shows that it presents in the later phases of policy process and when policy actors have created a primary fit of policy goals and means with the relatively stable contexts and the reality of industrial parks. These new labels result from specifications of different aspects/levels of implementation of the concept, because the policy concept has multiple traits, such as circular economy.
C new wine in old bottles	Policy labels remain stable, but the other main components of the policy change. This type often emerges in the initial and early phases of policy process, because of a lack of knowledge. It can also occur when policy contexts changes substantially. This type reflects timely and reflective policy adjustments to fit the new/changing policy contexts and the progress of industrial parks.
D fluid assemblage	In the extreme case that all policy components are unstable, we may say that the policy assemblage is fluid. This type indicates high fluidity of policy. It can occur when policy context are volatile and strong undermining forces present. In this situation, the durability of policy can be achieved by incorporating the policy concept with other salient policy themes.

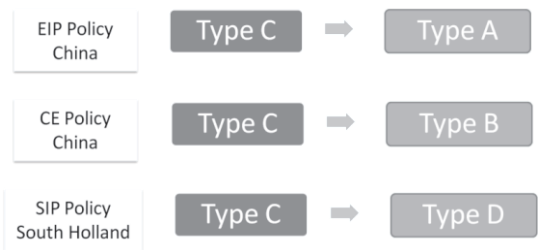

Fig. 8.3 Sequential blends of types of policy durability

Conclusion II

For the effective diffusion of SICs, it is desirable that the policy durability evolves from the types embracing more adaptability to those with more stability in stable policy contexts. However, in policy contexts with substantial changes, it is crucial for the policy durability to sustain adaptability at the low cost of stability.

Policy durability is an important but underestimated condition for the effective policy facilitation of SIC. Our interest in policy durability is aroused by the observation that some policy efforts to realize SICs survive only for a short time period and then dissolve. This leads to the discontinuity of governmental supports, which can impede the continuous involvement of industries and even undermine what has already been achieved. Policy durability is an important but underestimated condition for the effective policy facilitation of SIC (see Chapter 3 and 4). As the various types of policy durability manifest different qualities of policy in the configurations of stability and adaptability, they can exert different influences on the development of SICs, which is operationalized as the diffusion of SICs in this study. These influences are contingent on policy contexts, because policies unfold in specific contexts and the contexts provide explanatory meanings for the effectiveness of policy (Collins et al., 1999).

Relationships between the types of durability and the diffusion of SICs. The comparison of the two cases in Chapter 7 shows that, the continuous diffusion of SICs was achieved in a number of industrial parks when the policy durability showed the types A (CE policy) and B (EIP policy) in the later phases of the policy process (Table 8.2). The result suggests that, in relatively stable policy contexts, the types of policy durability that embrace more stability are more likely to bring about effective policy outcomes. Table 8.2 also shows that type C of policy durability is unlikely to bring about positive outcomes of diffusion in (un)stable policy contexts, and type D fails to bring about the effective diffusion when policy contexts change substantially. The result suggests that, when policy contexts are unstable or new, due to the need of adapting to the changing/new contexts, the types of policy durability with more adaptability, such as type C or type D, are likely to present. However, these types are unlikely to bring about positive outcomes of diffusion, because they are characterized by high fluidity which is difficult to interest industries to make (continuous) investment of time,

energy, and resource. This disagrees with the proposition in Chapter 6. The empirical results suggest that a high degree of stability of policy is an important condition for positive outcomes of the diffusion of SICs.

Table 8.2 Type of Policy Durability and Diffusion of SICs

TYPE	Diffusion of SICs	Contexts
A solidified assemblage	- wide diffusion - high continuity - more material roles	Stable
B old wine in new bottles	- wide diffusion - relatively high continuity - more material roles	Stable
C new wine in old bottles	- limited diffusion - low/high continuity - more symbolic roles	Stable/Unstable
D fluid assemblage	- limited diffusion - low continuity - more symbolic roles	Volatile

The results do not mean that the types A and B of policy durability are inherently better than types C and D. And the ineffectual diffusions of SICs of type C or D of policy durability do not necessarily mean policy failure. The policy outcomes should be evaluated by embedding in the specific policy contexts. In some circumstances, the wide diffusions of SICs are relatively secondary compared with the adaptation to new or changing contexts for policy survival. For instance, type D emerges when the policy contexts are volatile in South Holland, and the priority at hand is safeguarding SIC against undermining forces.

A longitudinal perspective of the relationships between the types of durability and the diffusion of SICs. The impacts of the types of policy durability on the diffusion of SICs should be further placed in the context of time. It is about the dynamic relations between the sequential blend of types of policy durability and the trend of diffusion outcomes as time passes. As concluded in the foregoing section, Type C of policy durability is an attractive starting point, although the outcomes of diffusion are often quite weak. This is because when policy actors are unfamiliar with the innovative policy concept (e.g. SIC), the priority and main goals of policy actors are to translate it to a new context. From a longitudinal perspective, in order to achieve effective diffusion, the key question is whether policy actors are able to generate type A or B of policy durability over time. To put in another way, it is about whether a policy with initial fitness will

be gradually stabilized or erodes over time. This is the main contrast between the cases of China and South Holland. The paths from type C to type A/ B occurred in the Chinese case with relatively stable policy contexts, generating effective outcomes of diffusion. However, in South Holland, the durability evolved from type C toward type D, which resulted from the adaptation to the huge economic crisis and subsequent changes of political priority (Chapter 6). The high adaptability was achieved at the high cost of stability. The severe lack of stability impeded the (continuous) investment of industries on SIC.

Conclusion III

The desirable starting point of type C of policy durability can be brought about by the transition of translation patterns from 'single agency-experimental implementation' to 'cooperation-experimental implementation'. The contrasting evolving paths of policy durability over time result from the infusion of administrative approaches when contexts are relatively stable, and from the continuous experimentation in contexts with substantial changes.

Policy translation patterns. Policy translation process is defined in Chapter 3 as *a sequence of policy events in which certain policy concepts are picked up by policy actors, translated into policy decisions, and eventually materialized into (linguistic and material) objects and practices that are performed by actors.* The translation perspective highlights the reinterpretation and reconstruction of the policy concepts in the new or changing contexts (Czarniawska & Sévon, 1996). To gain insight into complex policy process, six translation patterns are elaborated in Chapter 3: *single agency-experimental implementation, single agency-administrative implementation, cooperation-experimental implementation, cooperation-administrative implementation, boundary implementation, and symbolic implementation*. Each translation pattern shows a typical sequence of policy events through which the policy concept is translated into local practices. A longitudinal policy translation process can consist of successive translation patterns, thus constituting successive phases of the policy process.

Relationships between the translation patterns and the types of durability. Policy durability is an ongoing effect of active policy translation process (Chapter 3). As defined in Chapter 4, the translation patterns are typical ways in which policy

assemblages emerge and are maintained. Specifically, each translation pattern corresponds to specific dynamics of assembling policy components, thus bringing about the specific type of policy durability. Table 8.3 presents the summary of the relations between the translation patterns and the types of policy durability, which are observed in this study. It shows that type C of policy durability is likely to be generated by the translation patterns of 'single agency/cooperation-experimental implementation', and that type D is brought about by the translation pattern of 'single agency -experimental implementation'. It suggests that the patterns dominated by experimental approaches are more likely to bring about the types of policy durability that embrace more adaptability, such as types C and D. Furthermore, brought about by similar translation patterns, the emergence of type C or type D seems to be related with specific policy contexts. When policy contexts are relatively stable (e.g. in the early phases in both cases), type C is more likely to emerge, and when the policy contexts change substantially, both type C and type D of policy durability can emerge (e.g. the South Holland case). This is because the sustainment of SIC policy can be achieved through incorporating it into other salient policy themes, which bring in new policy labels.

Table 8.3 also shows that both types A and B are brought about by the emerging pattern of "cooperation- a mixture of experimental and administrative features" embedded in stable policy contexts. The infusion of administrative feature seems to be are indispensable for the occurrences of type A and B of policy durability. The emergence of type A or B is probably related to the conceptual scope of the policy concept: multi-trait (type B) and single-trait (type A). When it is single-trait (e.g. EIP), type A of policy durability is more likely to emerge; whereas, when it is a multi-trait policy concept (e.g. CE), type B can emerge, because many policy labels may proliferate over time. This conclusion is building on the empirical observation that the changes of policy labels are not necessarily attributed to the fashioning or rebranding of policy as proposed in the theory, but can be a result of the proliferation of programs about the multiple traits, such as the multiple implementation levels (firm, industrial parks, regions and society) of CE policies.

Table 8.3 Translation Patterns and Types of Policy Durability

Translation Patterns	Policy Durability	Context
Single agency –experimental implementation;	C/D	Stable/Volatile
cooperation-experimental implementation;	C	Stable
Cooperation implementation – mixture of experimental and administrative features (emerging pattern)	A/B	Stable

A longitudinal perspective of the relationships between the types of policy durability and the translation patterns. The coming into being of policy durability implies a longitudinal perspective of the dynamic relationships between successive translation patterns and the sequential blends of types of policy durability. In both cases, type C of policy durability is the shared beginning, and it corresponds to the translation process that is featured by the transition from the pattern of 'single agency–experimental implementation' to 'cooperation–experimental implementation'. There are two common dynamics with regard to this transition. 1) The beginning pattern of 'single agency –experimental implementation' is helpful to introduce the concept SIC into new contexts. However, the single focal policy actor gradually realizes the needs of the cooperation between governmental agencies, because SIC policy is related with environmental, economic, and coordinating issues (infrastructures) of industrial parks. 2) Many diverse policy actors intend to link to the policy concept of SIC when it becomes salient and fashionable after a period of experimentation.

As concluded above, the contrasting evolving paths of the types of policy durability in the two cases suggest that, after the existence of type C for a period, the tensions between the needs of stability and adaptability become more evident over time. These contrasting paths are brought about by the different subsequent translation patterns that are shaped by different policy contexts. In relatively stable policy contexts, along with the accumulation of knowledge, the infusion of administrative features into the patterns of 'cooperation-experimentation' bring about relatively stable and patterned center of the policy assemblage, and thus type A or B of policy durability emerges, and further lead to effective diffusion of SICs, such as in the case of China. In the situation of substantial changes of policy contexts (e.g. the case of

South Holland), the translation patterns with continuous experimentation (e.g. piloting, appropriation, research, mobilization, and education) are adopted, during which diverse policy components are fluidly (dis)assembling, and thus the types of policy durability that embrace more adaptability (e.g. type C or type D) emerge, and then fail to bring about effective diffusion of SICs.

Co-evolution of policy translation processes. Intertwinement and interaction of policy translation processes, which increase the complexity, occur quite often in policy studies. Because policy is a Complex Adaptive System, the interactive policy processes are locked into a co-evolving path. They become the environment of each other, respond and adapt to the changes of each other (Gerrits, 2008). Both the cases show that the policy translation processes enter a path of co-evolution if they 1) share common interests in SIC or 2) hold controversial interests in SIC. In the former situation, such as the policies of CE and EIP in China as investigated in Chapter 5, the co-evolution occurs after the intervention of a powerful policy actor and when both the policy translation processes of CE and EIP present the pattern of 'cooperation-experimental implementation'. This is because this pattern is relatively flexible and open to its environment, creating the possibility of shaping each other. The two policy translation processes presents the symbiotic relation, and they mutually reinforce the durable development of policies and further the diffusions of CEIPs and EIPs. The mutual reinforcement goes hand in hand with the strategy of differentiation. The differentiation is gradually achieved in the aspects of conceptual and practical scopes, the defining ideas of SIC, and the target groups. It is a strategy adopted to reduce the possibility of competition. If the symbiotic relation mutually reinforces each other, the differentiation contributes to the mutual survival of policies, and more importantly, it enables the diffusion of SICs in diverse types (e.g. different locations and different administrative types) of industrial parks.

In the situation that the co-evolving policy processes hold controversial ideas about SIC, parasitical relation is likely to emerge and it is shaped by policy contexts. It means that the development of one policy idea undermines the other, and that the surviving idea (i.e. SIC or the controversial idea) depends on their adaptability and fitness with the contexts. For instance, the policy concepts of Quality of Industrial Park (QIP) and SIC in South Holland are in such a relation,

and two types of dynamics of adaptation are elaborated in Chapter 6. The first is that the emergence of QIP resulted from the adaptation to the economic crisis and shifts of political priorities. The second is that the sustainment of SIC policy was achieved by fashioning SIC through externalization which was a result of adapting to the volatile policy contexts. Because the policy idea of QIP fit better the contexts with economic crisis. It, together with the economic crisis, constituted the volatile contexts against the SIC policy. Eventually, its constant interruption undermined the development of SIC policy.

8.3 REFLECTIONS

8.3.1Theoretical Contribution

Revealing the complexity and dynamisms of policy process. The systemic literature review in Chapter 2 shows that the concept of policy is defined loosely and the system boundary is unclear in the SIC literature. Furthermore, these studies fail to zoom in on the policy dynamics and neglect the ability and struggles of policy actors to safeguard SIC policy against anti-forces. So the dynamics of policy facilitation of SICs were still unclear. Chapter 3 shows that the complexity and process dynamics of policy have been invoked in policy studies; however, a large body of literature of policy implementation and policy durability is variable-based. This study aims to contribute to the process dynamics of policy. To this end, we reconstruct the event sequence of policy translation and examine the patterns of the sequence. In this way, we are able to identify the recursive character of policy formation, implementation, and evaluation. We also show how policy concepts could 'travel' and be transferred. The translation can also evolve along two or more paths, which can intertwine, interact with and mutually shape each other. All the decisions and programs form the empirical path of translating ideas into reality. More importantly, the examination of patterns makes it possible to compare and generalize the messy policy processes and to present sequential orders of processes. The process perspective needs to be supported by appropriate process approaches. We apply the Event Sequence Analysis to reconstruct the sequences of events and make sense of process data through identifying the emerging process patterns (Boons et al., 2014). In addition, many studies have shown that policy endures and meanwhile changes over time, which constitutes the complexity of public policy process. For instance, many scholars argue that it is difficult to identify the

durability of policy, because policy undergoes various degrees of reshaping over time. Existing studies have not systemically investigated both stability and changes of policy. The thesis presents and elaborates the idea of policy assemblage, i.e. the dynamic (dis)assembling of heterogeneous policy components. This allows nuanced observations of the differentiated stability of policy components and the different role played by the various policy components (e.g. stability or adaptability) of a policy system. The evolving assemblage can be analyzed through combining qualitative interpretations with the approach of Social Network Analysis.

Policy durability as an important quality of policy process. Policy durability, as argued in the first chapter, is an important factor for the success of SIC policy and of most public policies. However, it is not addressed well in existing studies. This thesis concentrates on policy durability and develops a typology of policy durability to manifest different qualities of long-term policy processes in terms of the configuration of stability and adaptability. This is because the achievement of effective policy outcomes most often asks for an adaptive approach, changing elements of the policy but not losing the core ambitions. The thesis elaborates the coming into being of various types of policy durability, and evaluates their impacts on the development of SICs. Essentially, this study is about the management of the perplex relations and even tensions between the needs for stability and adaptability in order to sustain SIC as a significant policy theme over time, and more importantly, to achieve positive outcomes of the diffusion of SICs. The role of policy stability and adaptability has been recognized in policy studies. The two are often intuitively understood notions and prescribed as positive characteristics of policies. However, the questions of what their inherent tensions exactly are have not been sorted out. This thesis deliberates policy durability as the configuration of the characteristics of stability and adaptability, and elaborates two dynamics of accommodating and sustaining stability and adaptability 1) simultaneously (i.e. types of policy durability) and 2) sequentially (i.e. sequential blend of types of policy durability). As summarized above, the idea of policy assemblage makes the observation of these dynamics tangible. The focus on the tensions reflects the struggles and efforts of policy makers. This improves our understanding of process dynamics and policy durability in general and the dynamics of policy facilitation of SICs in particular.

8.3.2 Policy Recommendations

Based on our findings, some policy recommendations for promoting the development of SICs can be presented.

Centralized cooperation can be effective for the development of SIC. SIC embraces the issues of environment, economy, and infrastructure and management of industrial parks. These issues are often coordinated by different government agencies, so the cooperative implementation fits better the conceptual attribute of SIC. In addition, the cooperation usually embodies more flexibility than the hierarchies of single agency implementation (Kapucu and Van Wart,2006). Heterogeneous actors in the cooperative network can bring new policy ideas from diverse sources into EIP policy, and it creates the possibility of quickly responding to the changes of contexts or seizing opportunities (Provan and Kenis, 2007). However, a key question to be addressed in the cooperation is that the involvement of multiple policy actors increases the complexity (Provan and Kenis, 2007). Our case studies show that a policy champion with persistent and long-term commitments can maintain coherence in a policy, and safeguard it from undermining over time. Therefore, a policy champion seems to be crucial for a durable policy. To accommodate the multiplicity of policy actors and the persistent role of the policy champion, and to reduce the complexity, a centralized structure of the cooperation can be optimal. It means that one of the policy actors serves as the focal actor who coordinates the entire cooperative network. Furthermore, when many policy actors are involved in, the centralized cooperation associated with "selection" can be effective. This type of cooperation is observed in the CE policy in China (see Chapter 4). During the implementation of CE policy, NDRC was the focal policy actor and many other ministerial level policy actors involved in. To reduce the extreme complexity, NDRC selectively cooperated with the diverse policy actors according to the purpose at hand. For instance, it cooperated with National Bureau of Statistics to develop the CE indicators, and worked jointly with Ministry of Education to select CE Educational Bases. So, to a great extent, DNRC served as a 'boundary" actor that is linked with the diverse policy actors, and all the actors together are intended to achieve the overall policy goals of CE development. This centralized and selective cooperation can be adopted when complexity increases because of the involvement of too many policy actors.

As concluded in the foregoing section, the gradual stabilization of key policy components over time is important for effective outcomes of diffusion. Standardization (of procedures, substances, and indicators) is one of such strategies. It can stabilize the key policy components but cannot lead to the rigidity of policy, because standards sustain room for practitioners to adapt the policy ideas with local contexts. Meanwhile, it is argued that adaptability is needed for durable policy. Fashioning is a frequently adopted strategy, which is observed in both cases. The fashioning requires policy actors to reflectively consider and respond to the changes in the contexts. Two ways of fashioning are elaborated in Chapter 7: externalization and internalization. To reduce the cost for policy stability, it is desirable that the fashioning is done by internalizing other salient policy ideas into the SIC policy. However, if the "internalizing" fashioning fails to draw attention or solve the problems, externalizing SIC ideas into other salient policy themes can also be a strategy to safeguard SIC against undermining. However, fashioning in this way is unlikely to bring about positive outcomes of diffusion of SICs. As a side note, when the policy concept of SIC is fashioning, policy actors need to avoid overburdening the concept. For instance, in DECOR program in South Holland, SIC was interpreted as a comprehensive sustainable development strategy of industrial parks (see Chapter 6). The ideas of job creation, minority group employment, and even children caring were included in the SIC policy. SIC was interpreted as a "dream" by some policy actors who argued that SIC did not fit the contexts at that time. Furthermore, the overburdened policy concept requires significant changes of governmental agencies and industries, which can impede the implementation process. The broad ideas can also probably hollow out the concept of SIC, so SIC eventually becomes a symbol of industrial parks.

8.3.3 Future Research Agenda

Comparative Studies. As pointed out in section 8.1, one of the limitations of this study is that our conclusion is merely built on two detailed longitudinal case studies. A limited number of cases reduce the possibility of generalization. Comparative studies of a variety of cases, especially cases embedded in divergent policy contexts, can further strengthen our understanding of policy durability, i.e. the strategies and approaches adopted by policy makers in managing the tensions between stability and adaptability, and their effects on

the development of SICs. Because the longitudinal case studies require abundant time, resource, and energy of scholars, the cooperation between scholars from different countries is required. The cooperation can reduce the "loss in the translation" of the policy documents written in different languages.

Qualities of the development of SICs. The policy outcome of the development of SICs in this study is operationalized as the diffusion of SICs. The diffusion mainly reflects the quantities of the development of SICs rather than the qualities. The quality means the extent to which the policy ideas of SIC are implemented in industrial parks. The SIC practices in industrial parks can change from superficial adoption of labels to fundamental changes of material and energy flows, and to substantial reduction of environment pressures. The examination of the qualities of diffusion can add to our conclusions about the effects of types of policy durability on the development of SICs. Another step that also needs to be made is assessing the outcome trends of actual environmental and economic performances of SICs. The trends can be linked to the policy dynamics, thus enriching our understanding about the process dynamics of policy facilitation of SIC.

Grounding policy around the complexity of SIC. In Chapters 1 and 2, it is argued that policy is recognized as one of the important factors affecting the development of SICs; however, a focused study of policy from the angle of policy dynamics is lacking. We take this as the starting point in this study, and obtain insight into the strategies, struggles and efforts of policy actors in facilitating the development of SIC. As a follow-up study, policy needs to be grounded around the complexity of SIC, i.e. the interactions of the factors driving SIC.

8.4 INTERDISCIPLINARY RESEARCH AS AN TRANSLATION PROCESS

While writing the PhD thesis from the perspective of translation, I gradually realize that the interdisciplinary study *per s*e is a translation process. Baumann (2009) distinguished collaborative interdisciplinary studies from integrative interdisciplinary studies. The former means that researchers work jointly in a multidisciplinary project, and the latter refers to that, in one study, researchers "harbor and synthesize the different types of knowledge, as well as choose between different academic norms and conventions (Baumann, 2009, 51)". My experience in doing the PhD thesis is the integrative interdisciplinary study. I

present the coming into being of this research topic, and then provide insight into the three phases of the translation process in conducting an integrative interdisciplinary study.

With an education background of Geography and Environmental Sciences, I intended to write a PhD thesis about the relations between policy and SIC, and I was exposed in the flux of interdisciplinary environment in the Department of Public Administration in 2011. After the seminar on my first day in the Department, I was very frustrated, because I did not catch most of the discussions. I came to realize that the studies done by the scholars in Public Administration were quite different from my interpretations. For instance, the first version of my research proposal was about policy facilitation of SICs, focusing on the differences and similarities of the policy instruments adopted in China and the Netherlands. In that proposal, I treated policy almost equally as policy instruments, which occurred often in studies of policies of SIC by environmental scholars and engineers. I had a discussion with one of my supervisors, and he recommended the keyword of "policy learning". After searching and article reading of policy learning, I got a list of all kinds of definitions of learning in the end, such as social learning, political learning, government learning, and policy-oriented learning. I got lost in these definitions, and the most frustrating part was that I could not find any linkage between "policy learning" and my proposal. So my intention or my supervisor's intension to assemble the two did not succeed at that time. It, however, did not mean "learning" was "improper" or "wrong". It was just I failed making the connections, because of my scarce knowledge about policy dynamics and public administration at that time. Indeed, after five years' study in Public Administration and empirical studies of policy processes, I find that "policy learning" is really a good concept, as learning is observed as an important dynamics in the development of SIC policy. If I had continuously dug deeper into the concept of policy learning from that time on, the PhD thesis would be probably rather different from the one I have now.

Because of the failed assembling of policy learning and my proposal, I started to search other possible ways of assembling. A colleague recommended to me a book of *Translating Organizational Change* edited by Czarniawska and Sevón (1996). I was fascinated by the concept of Translation, because it is linked with

my observation of diverse SIC policies (e.g. my ideas about different policy instruments in China and the Netherlands). I strived to incorporate it into the proposal, and I got the freedom from my supervisors to work on it further. Then the concept of policy translation became a central topic of my thesis. I began to know more about translation theories, Actor-Network theory, policy sciences, and industrial ecology, and strived to find the connecting points between them and then to assemble them as an integrated whole.

I found that policy dynamics is a broad topic and I cannot pinpoint the right angle to narrow it down, partly because my purpose was to contribute to both policy sciences and environmental sciences. In 2013, I participated in the ISIE Conference in South Korea. When a professor introduced the SIC policy programs of South Korea, I realized the importance of keeping policy "alive" for the development of SICs. I read several articles about policy durability, and then the thesis was narrowed into policy durability of SIC. The fragmented understanding of these diverse theories from different disciplines started to be integrated as a whole.

The question why a certain theory is not selected is often asked. For an interdisciplinary study, especially for a researcher like me as an "outsider" of Public Administration at the beginning of my PhD journey, the selection can be seen as a "moment" choice when you are sparked by possible connections between these different theories from different disciplines. This "moment" decision depends on the knowledge of researchers about these disciplines. It is actually a proper assembling in the proper time, rather than a "rational decision" of selecting the "right" theory after acquainting all the necessary knowledge. Generally, ***the integrative interdisciplinary study can be seen as a process of translation. It consists of three phases: 1) understanding the different types of "knowledge" and interpreting what scholars from different disciplines say; and 2) integrating and assembling these different languages and "knowledge" as an integrated piece of work; and 3) presenting the work through different languages, based on the researcher's understanding about the potential interests of the audiences.*** I elaborate the three steps below.

First, different disciplines use different concepts and languages, and also have different academic identities, norms, and different types of knowledge (Baumann, 2009; Boons and Howard-Grenville, 2009). These differences can be

considered as the boundaries that block the integrative interdisciplinary studies. For instance, engineers and environmental scientists play a dominating role in the field of industrial ecology, whose interests are often in modeling and designing the energy and material flows, and one of the final products of these studies can be recommendations of "beautiful" policy instruments. Such types of studies and recommendations are often referred to as "roles of Industrial Ecologist" (a term I got to known in a seminar of ISIE conference). Remarkably, there is increasing interests in the social dimension of industrial ecology. Social scientists study the social mechanisms and social contexts that shape the material and energy flows, and critically reflect what is happening (Boons and Howard-Grenville, 2009). The mechanism of policy intervention and facilitation is one aspect of the social dimension. Social scientists strive to unpack the complexity of policy process by building on theories, and aiming for developing theories. There are different and diverse types of knowledge about "policy" and "industrial ecology". The communication and connection between these disciplines can enrich the understanding of industrial ecology, and also can add different types of policies and cases into the database of policy. Therefore, a clear message is that an interdisciplinary study firstly requires researchers to understand the diverse knowledge and languages, and to interpret and understand what the scholars from different disciplines say and mean.

Second, after the acquaintance of the primary interpretations of the different types of knowledge, the most challenging phase is finding the connecting points and bringing and assembling the knowledge from diverse sources into an integrated whole. The key of the assembling here is "internal consistency" (Baumann, 2009). It relies on researchers' experiences, understandings, and sensitivities about the diverse knowledge. The assembling needs researchers to recognize both the weaknesses and strengths of each type of knowledge. For instance, uncovering the complexity of public policy can contribute to the under-studied dynamics of policy facilitation of SICs, and more policy implications can be derived from the angle of policy actors. Another example is that Actor-Network Theory, which encourages researchers to start from a clean slate and trace the messy process, can contribute to the understanding of the complexity of public policy, and its object-oriented ontology, which treats both human and nonhuman actors equally, is well suited to study the coupled human-natural system.

Third, after assembling the different types of knowledge into an integrated piece of work, the next step is presenting and conveying the integrative work to the audience from different disciplines. This is also difficult, because the studies and researchers can be labeled as "outsiders" for all these different disciplines. As argued above, these diverse disciplines use different languages and have different criteria in judging the quality of work (Baumann, 2009), so researchers need to interpret the interests of the audience and translate the research into their languages in order to be understood and accepted by the researchers from these different disciplines.

The translation process is precarious (Law, 1992). The three phases are not isolated, but iterative. It always takes several rounds before researchers can understand well what the researchers from different disciplines say and feed the interests of different types of audience properly. In the final analysis, crossing the boundaries of different disciplines can greatly enrich our knowledge about the development of SICs.

More importantly, interdisciplinary studies are fun to do!

REFERENCES

Adamides E and Mouzakitis Y (2009) Industrial ecosystems as technological niches. Journal of Cleaner Production 17(17): 172-180.

Allenby BR (1999) Industrial Ecology: Policy Framework and Implementation. Upper Saddle River, HJ:Prentice-Hall.

Andriotis K and Vaughan DR (2009) The pattern-matching approach and its application in tourism development. Current Issues in Tourism 12(4): 315-336.

Anh PT, Dieu TTM and Mol APJ,et al. (2011) Towards eco-agro industrial clusters in aquatic production: the case of shrimp processing industry in Vietnam. Journal of Cleaner Production 19: 2107-2118.

Ardanaz M, Scartascini C and Tommasi M (2010) Political Institutions, Policy Making, and Economic Policy in Latin America.

Ashton WS (2009) The structure, function, and evolution of a regional industrial ecosystem. Journal of Industrial Ecology 13(2): 228-246.

Aviso KB, Tan RR and Culaba AB,et al. (2010) Bi-level fuzzy optimization approach for water exchange in eco-industrial parks. Process Safety and Environmental Protection(88): 31-40.

Baas L (2011) Planning and Uncovering Industrial Symbiosis: Comparing the Rotterdam and Östergötland Regions. Business Strategy and the Environment 20(428-440).

Bai L, Qiao Q, Yao Y, Guo J and Xie M (2014) Insights on the development progress of National Demonstration eco-industrial parks in China. Journal of Cleaner Production 70: 4-14.

Banner I, Donnelly J and Ryder J (2012) Policy networks and boundary objects: enacting curriculum reform in the absence of consensus. Journal of Curriculum Studies 44(5): 577-598.

Bardach E (1977) The Implementation Game. Cambridge, MA:MIT Press.

Barley S (1986) Technology as an occasion for structuring: evidence from observation of CE scanners and the social order of radiology departments. Administrative Science Quarterly 31(1): 78-108.

Baumann H (2009) Don't fence me in... In: Boons F and Howard-Grenville J (eds.) The Social Embeddedness of Industrial Ecology. UK: Edward Elgar, 48-64.

Behera SK, Kim J and Lee S,et al. (2012) Evolution of 'designed' industrial symbiosis networks in the Ulsan Eco-industrial Park: "research and development into business" as the enabling framework. Journal of Cleaner Production 29-30: 103-112.

Berman P (1978) Designing Implementation to Match Policy Situation: A Contingency Analysis of Programmed and Adaptive Implementation. Santa Monica, CA: RAND Corporation.

Berry C, Burden B and Howell W (2010) After enactment: the lives and deaths of federal programs. American Journal of Political Science Association 54(1): 1-17.

Blackmore S (1999) The Meme Machine. Oxford University Press.

Blatter J and Haverland M (2012) Designing Case Studies: Explanatory Approaches in Small-N Research. Palgrave Macmillan.

Bonacich P (2007) Some unique properties of eigenvector centrality. Social Network. 29: 555-564.

Boons F and Howard-Grenville J (2009) Introducing the social embeddedness of industrial ecology. In: Boons F and Howard-Grenville J (eds.) The Social Embeddedness of Industrial Ecology. UK: Edward Elgar, 3-27.

Boons F and Strannegard L (2000) Organizations coping with their natural environment: a laboratory for institutionalization? International Studies of Management and Organization 30(3): 7-17.

Boons F, Spekkink W and Jiao W (2014) A process perspective on industrial symbiosis: Theory, methodology and application. Journal of Industrial Ecology 18(3): 341-355.

Boons F, Chertow M, Park. JY, Spekkink W and Shi H (in press) Industrial symbiosis dynamics: a comparative framework to move from divergent experiences to joint understanding. Journal of Industrial Ecology.

Boons, F., Spekkink, W. (2012) Levels of institutional capacity and actor expectation about industrial symbiosis: Evidence from the Dutch stimulation program 1999 - 2004. Journal of Industrial Ecology 1(16): 61-69.

Boons, F., Spekkink, W., Mouzakitis, Y. (2011) The Dynamics of Industrial Symbiosis: a Proposal for a Conceptual Framework Based upon a Comprehensive Literature Review. Journal of Cleaner Production 19: 905-911.

Borgatti S, Mehra A, Brass D and Labiance G (2009) Network Analysis in the Social Sciences. Science 323(5916): 892-895.

Bossong R (2008) The action plan on combating terrorism: a flawed instrument of EU security governance. Journal of Common Market Studies 46(1): 27-48.

Bosworth B and Weaver R (2011) Social Security on Auto-Pilot: International Experience with Automatic Stabilizer Mechanisms.

Brent AC, Oelofse S and Godfrey L (2008) Advancing the concepts of industrial ecology in South African institutions. South African Journal of Science 104: 9-12.

Brinkerhoff DW (1996) Process Perspectives on Policy Change: Highlighting Implementation. World Development 24(9): 1395-1401.

Byrne D and Callaghan G (2014) Complexity Theory and the Social Sciences: The State of the Art. London and New York: Routledge: Taylor and Francis Group.

Callon M (1986) Some Elements of a Sociology Translation: Domestication of the Scallops and the Fishermen of St. Brieuc's Bay. In: Law J (ed.) Power, Action and Belief: A New Sociology of Knowledge? London: Routledge & Kegan Paul, 196-229.

Callon M (1980) Struggels and Negotiations to Define What is Problematic and What is Not: The Sociology of Translation. In: Knorr C.K., Korhn, R., and Whitely, R. (ed.) The Social Process of Scientific Investigation. Boston, MA:Reidel, 197-219.

Callon M (1991) Techno-economic networks and irreversibility. In: Law J (ed.) A Sociology of Monsters. Routledge, 132-161.

Chertow M and and Park JY (2015) Scholarship and practice in industrial symbiosis: 1989-2014. In: Clift R and Druckman A (eds.) Taking Stock of Industrial Ecology. Springer, 87-116.

Chertow M and Lombardi DR (2005) Quantifying Economic and Environmental Benefits of Co-Located Firms. Environmental Science & Technology 39(17): 6535-6541.

Chertow MR (2007) 'Uncovering' Industrial Symbiosis. Journal of Industrial Ecology 11(1,11): 11-30.

Chopra S and Khanna V (2014) Understanding resilience in industrial symbiosis networks: insights from network analysis. Journal of Environmental Management 141: 86-94.

Collins C, Green A and Hunter D (1999) Health sector reform and the interpretation of policy context. Health Policy 47: 69-83.

Cooke P (2010) Socio-technical transitions and varieties of capitalism: green regional innovation and distinctive. Journal of the Knowledge Economy 1: 239-267.

Costa, I., Ferrão, P. (2010) A Case Study of Industrial Symbiosis Development Using a Middle-out Approach. Journal of Cleaner Production 18: 984-992.

Costa, I., Massard, G., Agarwal, A. (2010) Waste Management Policies for Industrial Symbiosis Development: Case Studies in European Countries. Journal of Cleaner Production 18: 815-822.

Cox A (2006) The Political Economy of Fisheries Policy Reform: A Review of Key Issues.

Czarniawska, B., Hernes, T. (2005) Actor-Network Theory and Organizing. Liber&Copenhagen Business School Press.

Czarniawska, B., Joerges, B. (1996) Travels of Ideas. In: Czarniawska, B., Sevon, G. (ed.) Translating Organizational Change. Berlin; New York; de Gruyter.

Czarniawska, B., Sevon, G. (1996) Translating Organizational Change. Berlin; New York: de Gruyter.

DeLanda M (2006) A New Philosophy of Society: Assemblage Theory and Social Complexity.

Derthick M and Quirk P (1985) The Politics of Deregulation. Washington, DC: The Brookings Institution.

Deutz P (2009) Producer responsibility in a sustainable development context: ecological modernization or industrial ecology? The Geographical Journal 175(4): 274-285.

Deutz P and Ioppolo G (2015) From theory to practice: enhancing the potential policy impact of industrial ecology. Sustainability 7: 2259-2273.

Deutz, P and Gibbs, D (2008) Industrial Ecology and Regional Development: Eco-industrial Development as Cluster Policy. Regional Studies 42(10): 1313-1328.

Dijkema G and Basson L (2009) Complexity and Industrial Ecology: Foundations for a Transformation: From Analysis to Action. Journal of Industrial Ecology 13,2: 157-164.

Dolowitz D and Marsh D (1996) Who learns what from whom: a review of the policy transfer literature. Political Studies XLIV(44,2): 343-357.

Domenech, T., Davies, M. (2011) The Role of Embeddedness in Industrial Symbiosis Networks: Phases in the Evolution of Industial Symbiosis Networks. Business Strategy and the Environment 20: 281-296.

Durlak JA and Dupre EP (2008) Implementation Matters: a review of research on the influence of implementation on program outcomes and the factors affecting implementation. Am J Community Psychol 41: 327-350.

Easton D (1953) The Political System. New York: Knopf.

Edelenbos J, Gerrits L and Van Gils M (2008) The coevolutionary relation between Dutch mainport policies and the development of the seaport Rotterdam. Emergence: Complexity & Organization 10(2): 49-60.

Ehrenfeld, J., Gertler, N. (1997) Industrial Ecology in Practice: The Evolution of Interdependence at Kalunborg. Journal of Industrial Ecology 1(1): 67-79.

Ehrenfeld JR (2007) Would industrial ecology exist without sustainability in the background? Journal of Cleaner Production 11: 73-84.

Eilering JAM and Vermeulen WJV (2004) Eco-industrial parks: toward industrial symbiosis and utility sharing in practice. Progress in Industrial Ecology 1: 245-270.

Elabras Veiga LB and Magrini A (2009) Eco-industrial Park Development in Rio de Janeiro, Brazil: a Tool for Sustainable Development. Journal of Cleaner Production 17: 653-661.

Elster J (1989) Nuts and Bolts for the Social Sciences. Cambridge: Cambridge University Press.

Fadeeva Z (2004) Translation of Sustainability Ideas in Tourism Networks: Some Roles of Cross-sectoral Networks in Change towards Sustainable Development. Journal of Cleaner Production 13: 175-189.

Fellenz MR (2000) Flexibility in Management Theory: Towards Clarification of an Elusive Concept.

Fenwick T (2010) (un)Doing standards in education with actor-network theory. Journal of Education Policy 25(2): 117-130.

Freeman R (2009) What is 'Translation'? Evidence & Policy 5(4): 429-447.

Geels F (2005) Co-evolutio of technology and society: The transition in water supply and personal hygiene in the Netherlands (1850-1930): a case study in multi-level perspective. Technology in Society 27: 363-397.

Geng Y, Fu J and Sarkis J,et al. (2012) Towards a national circular economy indicator system in China: an evaluation and critical analysis. Journal of Cleaner Production 23: 216-224.

Geng Y, Sarkis J, Ulgiati S and Zhang P (2013) Measuring China's Circular Economy. Science 339: 1526-1527.

Geng Y, Zhang P, Cote R and Fujita T (2008) Assessment of the National Eco-Industrial Park Standard for Promoting Industrial Symbiosis in China. Journal of Industrial Ecology 13, 1: 15-26.

Geng, Y., Doberstein, B. (2008) Developing Circular Economy in China: Challenges and Opportunities for Achieving 'Leapfrog Development'. Journal of Sustainable Development & World Ecology 15(3): 231-239.

Gerrits L (2011) A coevolution revison of decision making processes: an analysis of port extensions in Germany Belgium and the Netherlands. Public Administration Quarterly(35,3): 309-341.

Gerrits L (2008) The Gentle Art of Coevolution: A Complexity Thoery Perspective on Decision Making Over Estuaries in Germany, Belgium and the Netherlands. Optima Grafische Communicatie Rotterdam.

Gerrits L and Marks P (2015) How the complexity sciences can inform public administration: an assessment. Public Administration 93(2): 539-546.

Gibbs D (2003) Trust and networking in inter-firm relations: the case of eco-industrial development. Local Economy 18(3): 222-236.

Gibbs, D., Deutz, P. (2007) Reflections on implementing industrial ecology through eco-industrial park development. Journal of Cleaner Production 15: 1683-1695.

Gibbs, D., Deutz, P. (2005) Implementing Industrial Ecology? Planning for Eco-industrial Parks in the USA. Geoforum 36(36): 452-464.

Gilsing R (2007) Intergovernmental relations and the effectiveness of local governance: the case of Dutch youth policy. International Review of Administrative Sciences 73(1): 45-64.

Giorgi L and Redclift M (2000) European environmental research in the social sciences: research into ecological modernization as a 'boundary object'. European Environment(10): 12-23.

Glachant M (2001) The need for adaptability in EU environmental policy design and implementation. European Environment(11): 239-249.

Glazer A and Rothenberg L (2001) Why Government Succeeds and Why it Fails. Cambridge, MA: Harvard University Press.

Gorur R (2011) Policy as Assemblage. European Educational Research Journal(4,10): 611-622.

Gusfield JR (1982) Deviance in the welfare state. In: Michael Lewis (ed) Reserach in Social Problems and Public Policy. New York: JAI Press.

Hall PA (2003) Aligning ontology and metholdody in comparative historical analysis. In: Mahoney J and Rueschmeyer D (eds) Comparative Historical Analysis in the Social Sciences. Campbridge: Cambridge University Press, 373-406.

Hall TE and O'Toole L.J. (2000) Structures for policy implementation: an analysis of national legislation, 1965-1966 and 1993-1994. Administration & Society 31(6): 667-686.

Haselswerdt J (2014) The lifespan of a tax break: comparing the durability of tax expenditures and spending programs. American Politics Research 42(5): 731-759.

Hashimoto S, Fujita T and Geng Y,et al. (2010) Realizing CO2 emission reduction through industrial symbiosis: A cement production case study for Kawasaki. Resource, Conservation and Recycling 54: 704-710.

Haydu J (1997) Making use of the past: time periods as cases to compare and as sequences of problem solving. American Journal of Sociology 104(2): 339-371.

Heclo HH (1986) Conclusion: Policy Dynamics. In: Rose R and Bowden T (eds) The Dynamics of Public Policy: A Comparative Analysis. Sage Publications, 237-266.

Heclo HH (1972) Policy Analysis. British Journal of Political Science 2(1): 83-108.

Hedström P and Swedberg R (1998) Social Mechanisms: An Analytical Approach to Social Theory. Cambridge: Cambridge University Press.

Heeres, R.R., Vermeulen, W.J.V., Walle, F.B. (2004) Eco-industrial Park Initiatives in the USA and the Netherlands: First Lessons. Journal of Cleaner Production 12: 985-995.

Hill M (2005) The Public Policy Process. Longman.

Hill M and Hupe P (2002) Implementing Public Policy. SAGE publication Ltd.

Howard-Grenville J (2008) The Emergence and Diffusion of Interorganizational EnvironmentalCollaborations: Industrial Symbiosis in the UK.

Howlett M (2009b) Process sequencing policy dynamics: beyond homeostasis and path dependency. Journal of Public Policy(29): 241-262.

Howlett M (2009a) Governance modes, policy regimes and operational plans: A multi-level nested model of policy instrument choice and policy design. Policy Sciences 42(1): 73-89.

Howlett M, Mukherjee I and Woo J (2015) From tools to toolkits in policy design studies: the new design orientation towards policy formulation research. Policy and Politics 43(2): 291-311.

Howlett M and Rayner M (2006) Understanding the historical turn in the policy sciences: a critique of stochastic, narrative, path dependency and process-sequencing models of policy-making over time. Policy Sciences 39(1): 1-18.

Jacobsen NB (2006) Industrial Symbiosis in Kalundborg, Denmark: A quantitative assessment of economic and environmental aspects. Journal of Industrial Ecology 10(1-2): 239-255.

Jacobsen, N. B., Anderberg, S. (2004) Understanding the Evolution of Industrial Symbiotic Networks: The Case of Kalundborg. In: Van de Bergh J and Janssen M (eds) Economics of Industrial Ecology: Materials, Structural Change, and Spatial Scales. The MIT Press, 313-335.

Jenkins W (1978) Policy Analysis. London: Martub Robertson.

Jiao W and Boons F (2015) Policy Durability of Circular Economy in China: A process analysis of policy translation. Resources, Conservation and Recycling.

Jiao W and Boons F (2014) Toward a research agenda for policy intervention and facilitation to enhance industrial symbiosis based on a comprehensive literature review. Journal of Cleaner Production 67: 14-25.

Jiao W, Boons F and Teisman G Policy durability as an active policy translation process: illustration from the National Demonstration Program of Eco-industrial Park in China. Under Review.

Johnson, B., Hagstrom, B. (2005) The Translation Perspective as an Alternative to the Policy Diffusion Paradigm: the Case of the Swedish Methadone Maintenance Treatment. Journal of Social Policy 34: 365-388.

Kapucu N and Van Wart M (2006) The evolving role of the public sector in managing catastrophic disasters: lesions learned. Administration & Society(38): 279-308.

Kay A (2006) The Dynamics of Public Policy: Theory and Evidence. UK: Edward Elgar Publishing Limited.

Kickert W (2012) State response to the fiscal crisis in Britain, Germany and the Netherlands. Public Management Review 14(3): 299-309.

Kim H (2007) Building an Eco-Industrial Park as a Public Project in South Korea: The Stakeholders' Understanding of and Involvement in the Project. Sustainable Development 15(15): 357-369.

Kingdon JW (2010) Agendas, Alternatives, and Public Policies. Longman Classics in Political Science.

Klein, K.J. and Sorra, J.S. (1996) The challenge of Innovation Implementation. The Academy of Management Review 21(4): 1055-1080.

Klijn E and Koppenjan J (2012) Governance network theory: past, present and future. Policy & Politics 40(4): 587-606.

Korhonen, J., Malmborg, F.V., Strachan, P. et al. (2004) Management and policy aspects of industrial ecology: an emerging research agenda. Business Strategy and the Environment 13: 289-305.

Koyama JP (2011) Generating, comparing, manipulating, categorizing: reporting, and sometimes fabricating data to comply with No Child Left Behind mandates, 26: 5, 701-720. Journal of Education Policy 26(5): 701-720.

Langley A (1999) Strategies for theorizing from process data. Academy of Management Review 24(4): 691-710.

Langstrand J (2012) Exploring Organizational Translation: A Case Study of Changes Toward Lean Production. Department of Management and Engineering, Linköping University.

Latour B (2005) Reassembling the Social: An Introduction to Actor-Network Theory. Oxford University Press.

Latour B (1992) Technology is society made durable. In: Law J (ed) A Sociology of Monsters: Essays on Power, Technology and Domination. London: Routledge, 103-131.

Latour B (1986) The power of associations. In: Law J (ed) Power, Action, and Belief. London: Routledge and Kegan Paul.

Law J (2009) Actor Network Theory and Material Semiotics. In: Bryan ST (ed) The New Blackwell Companion to Social Theory. Blackwell Publishing Ltd.

Law J (1992) Notes on the theory of the Actor-Network: Ordering, Strategy, and Heterogeneity. Systems Practice 5(4): 379-393.

Laybourn P and Lombardi R (2012) Industrial symbiosis in European Policy: Overview of Recent Progress. Journal of Industrial Ecology 16(1): 11-12.

Lehtoranta S, Nissinen A, Mattila T and Melanen M (2011) Industrial symbiosis and the policy instruments of sustainable consumption and production. Journal of Cleaner Production 19: 1865-1875.

Lewis DE (2012) Policy durability and Agency Design. In: Jenkins JA and Patashnik E (eds) Living Legislation: Political Development and Contemporary American Politics. Chicago: University of Chicago Press.

Liang J and Fiorino D (2013) The implications of policy stability for renewable energy innovation in the United States, 1974-2009. The Policy Studies Journal 41(1): 97-118.

Liu C, Ma C and Zhang K (2012) Going beyond the sectoral boundary: a key stage in the development of a regional industrial ecosystem. Journal of Cleaner Production 22: 42-49.

Liu L, Zhang B, and Bi J,et al. (2012) The greenhouse gas mitigation of industrial parks in China: A case study of Suzhou Industrial Park. Energy Policy 46: 301-307.

Lo C, YIP P and Cheung K (2000) The regulatory style of environmental governance in China: the case of EIA regulation in Shanghai. Public Administration and Development 20: 305-318.

Lockwood M (2013) The political sustainability of climate policy: the case of UK Climate Change Act. Global Environmental Change 23: 1339-1348.

Marsh, D., Sharman, J.C. (2009) Policy Diffusion and Policy Transfer. Policy Studies 30(3): 269-288.

Marsh D and Rhodes RAW (1992) Policy Networks in British Government. Oxford: Clarendon Press.

Martin S (1996) Eco-Industrial Parks: A Case Study and Analysis of Economic, Environmental, Technical and Regulatory Issues. Prepared for Office of Policy, Planning, and Evaluation. Washington (DC): US EPA.

Massard G, Jacquat O and Zurcher D (2014) International Survey on Eco-Innovation Parks: Learning from Experiences on the Spatial Dimension of Eco-Innovation. Bern: Federal Office for the Environment FOEA and the ERA-NET ECO-INNOVATION.

Mathews JA and Tan H (2011) Progress toward a circular economy in China: the drivers (and inhibitors) of eco-industrial initiative. Journal of Industrial Ecology 15(3): 435-457.

Matland RE (1995) Synthesizing the Implementation Literature: The ambiguity -Conflict Model of Policy Implementation. Journal of Public Administration Research and Theory(5): 145-174.

Mayntz R (2004) Mechanisms in the Analysis of Social Macro-Phenomena. Philosophy of the Social Sciences 34(2): 237-259.

McManus P (1996) Contested Terrains: Politics, Stories and Discourses of Sustianabilty. Environmental Politics(5): 48-73.

Metze TAP and Zuydam SV (2013) Pigs in the city: reflective deliberations on the boundary concept of Agroparks in the Netherlands. Journal of Environmental Policy & Planning DOI: 10.1080/1523908X.2013.819780.

Meyer J and Rowan B (1977) Institutionalized Organzations: Formal Structure as Myth and Ceremony. American Journal of Sociology 83(2): 340-363.

Mirata M (2004) Experiences from Early Stages of a National Industrial Symbiosis Programme in the UK: Determinants and Coordination Challenges. Journal of Cleaner Production 12: 967-983.

Mol A (2010) Actor-network theory: sensitive terms and enduring tensions. Kölner Zeitschrift Für Soziologie Und Sozialpsychologie 50(1): 253-269.

Mukhtarov F (2012) Rethinking the travel of ideas: policy translation in the water sector. Policy & Politics.

Mulder P and Van der Bergh JCM (1999) Evolutionary economic theories of sustainable develoment. Growth and Change 32 (4): 110-134.

Naustdalslid J (2014) Circular Economy in China- the environmental dimension of the harmonious society. International Journal of Sustainable Development & World Ecology 21(4): 303-313.

Nissen ME (2014) Organization design for dynamic fit: a review and projection. Journal of Organization Design 3(2): 30-42.

Nissen ME (2009) Dynamic Fit and Misfit through Organizational Design: Conceptualization via Stabilty and Maneuverability.

Oborn E, Barrett M and Exworthy M (2011) Policy entrepreneurship in the development of public sector strategy: the case of London health reform. Public Administration 89(2): 325-344.

Odum EP (1971) Fundamentals of Ecology. Philadelphia:W.B. Saunders Company.

Ohnishi S, Fujita T and Chen X,et al. (2012) Econometric analysis of the performance of recycling projects in Japanese Eco-Towns. Journal of Cleaner Production 33: 217-225.

O'Toole L.J. (2000) Research on policy implementation: assessment and prospects. Journal of Public Administration Research and Theory 10(2): 263-288.

O'Toole L.J. and Montjoy R (1984) Interorganizational policy implementation: a theoretical perspective. Public Administration Review 44(6): 491-503.

O'Toole LJ and Meier KJ (2003) Plus Ca Change: public management, personnel stability, and organiational performance. Journal of Public Administration Research and Theory(13): 43-64.

Park H and Won. J. (2007) Ulsan Eco-industrail Park: Challenges and Opportunities. Journal of Industrial Ecology(3): 11-13.

Park H, Rene E and Choi S et al. (2008) Strategies for sustainable development of industrial park in Ulsan, South Korea – From spontaneous evolution to systematic expansion of industrial symbiosis. Journal of Environmental Management 87: 1-13.

Parsons W (1995) Public Policy: An Introduction to the Theory and Practice of Policy Analysis. Edward Elgar.

Patashnik E (2008) Reforms at Risk: What Happens After Major Policy Change are Enacted. Princeton University Press.

Patashnik E (2003) After the Public Interest Prevails: The Political Sustainability of Policy Reform. Governance: An International Journal of Policy, Administration, and Institutions 16(2): 203-234.

Pel B (2012) System Innovation as Synchronization: Innovation Attempts in the Dutch Traffic Management Field. PhD, Erasmus University Rotterdam.

Pel, B., Teisman, G.R., Boons, F. (2012) Transition by translation: The Dutch traffic intelligence innovation cascade. In: F.W. Geels, R. Kemp, G. Dudley & G. Lyons (ed) Automobility in Transition? A Socio-Technical Analysis of Sustainable Transport. London: Routledge. Routledge Studies in SustainabilityTransitions, 250-267.

Pellenbarg PH (2002) Sustainable business sites in the Netherlands: a survey of policies and experiences. Journal of Environmental Planning and Management 45(1): 59-84.

Pierson P (2005) The study of policy development. The Journal of Policy History 17(1): 34-51.

Pierson P (2004) Politics in Time: History, Institutions, and Social Analysis. Princeton University Press.

Pressman, J.L., Wildvasky, A. (1984) Implementation: How Great Expectations in Washington are Dashed in Oakland: Berkeley: University of California Press.

Provan KG and Kenis P (2007) Modes of Network Governance: Structure, Management, and Effectiveness. Journal of Public Administration Research and Theory(18): 229-252.

Ram S (1987) A Model of Innovation Resistance. Advances in Consumer Research 14: 208-212.

Ren Y (2007) The circular economy in China. Journal of Material Cycles and Waste Management 9(9): 121-129.

Richardson J (1982) Policy Styles in Western Europe. London: George Allen & Unwin.

Rittberger B and Richardson J (2003) Old wine in new bottles? The commission and use of environmental policy instruments. Public Administration 3: 565-606.

Rose R (1976) Models of Change. In: Rose R, (ed) The Dynamics of Public Policy. SAGE Publications.

Ruhl J (1999) The co-evolution of sustainable development and environmental justice: cooperation, then competition, then conflict. Duke Environmental Law & Policy Forum 9: 160-185.

Ruhnau B (2000) Eigenvector-centrality - a node-centrality? Social Network 22: 357-365.

Ryan N (1995) Unravelling conceptual developments in implementation analysis. Australian Journal of Public Administration 54(1): 65-80.

Sabatier P (2005) From Policy Implementation to Policy Change: A Personal Odyssey. In: Gornitzka Aea (ed) Reform and Change in Higher Education. , 17-34.

Sabatier P (1987) knowledge, policy-oriented learning, and policy change. Knowledge: Creation, Diffusion, Utilization 8: 649-692.

Sabatier P (1986) Top-down and Bottom-up Approaches to Implementation Research: A Critical Analysis and Suggested Synthesis. Journal of Public Policy 6(1): 21-48.

Sabatier P and Jenkins-smith H (1993) Policy Change and Learning: An Advocacy Coalition Approach. Westview Press.

Sabatier PA (2007) Theories of the Policy Process. Boulder, Co: Westview Press.

Saldana J (2013) The Coding Manual for Qualitative Researchers.

Salmi O, Hukkinen J and Heino J,et al. (2011) Governing the interplay between industrial ecosystems and environmental regualtion: heavy industries in the Gulf of Bothnia in Finland and Sweden. Journal of Industrial Ecology 16(1): 119-128.

Scartascini C, Stein E and Tommasi M (2008) Veto Playes, Intertemporal Interactions and Policy Adaptability: How do Political Institutions Work? .

Schofield J (2001) Time for a revival? Public policy implementation: a review of the literature and agenda for furture research. International Journal of Management Reviews 3(3): 245-263.

Seuring S and Műller M (2008) From a literature review to a conceptual framework for sustainable supply chain management. Journal of Cleaner Production 16: 1699-1710.

Shi H and Zhang L (2006) China's environmental governance of rapid industrialisation. Environmental Politics 15(02): 271-292.

Shi H, Tian J and Chen L (2012) China's question for Eco-industrial Parks, Part I: History and Distinctiveness. Journal of Industrial Ecology 16(1): 8-10.

Shi H, Chertow M and Song Y (2010) Developing country experience with eco-industrial parks: a case study of Tianjin Economic-Technological Development Area in China. Journal of Cleaner Production 18: 191-199.

Simpson D (2012) Knowledge resources as a mediator of the relationship between recycling pressures and environmental performance. Journal of Cleaner Production 22: 32-41.

Spekkink W (2014) Building capacity for sustainable regional industrial systems: an event sequence analysis of developments in the Sloe Area and Canal Zone. Journal of Cleaner Production 98: 133-144.

Spekkink W (2013) Institutional capacity building for industrial symbiosis in the Canal Zone of Zeeland in the Netherlands: a process analysis. Journal of Cleaner Production 52: 342-355.

Spekkink W and Boons. F. (in press) The emergence of collaborations. Journal of Public Administration Research and Theory.

Spekkink W and Boons F (2010) A Varieties of Capitalism Approach to EIP Development.

Star SL and Griesemer JR (1989) Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professional in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social Studies of Science 19: 387-420.

Su B, Heshmati A, Geng Y and Yu X (2013) A review of the circular economy in China: moving from rhetoric to implementation. Journal of Cleaner Production 42: 215-227.

Taddeo R, Simboli A and Morgante A (2012) Implementing eco-industrial parks in existing clusters:findings from a historical Italian chemical site. Journal of Cleaner Production 33: 22-29.

Teisman G (2000) Models for research into decision-making processes: on phases, streams and decision-making rounds. Public Administration 4: 937-956.

Theodoulou, S.Z., Kofinis, C. (2004) The art of the game:understanding policy making. In: Anonymous: Thomson Wadsworth, p.191.

Tian J, Liu W, Lai B, Li X and Chen L (2014) Study of the performance of eco-industrial park development in China. Journal of Cleaner Production 64: 486-494.

Treib O, Bahr H and Falkner G (2007) Modes of governance: towards a conceptual clarification. Journal of European Public Policy 14(1): 1-20.

United States National Research Council (2010) Policy Durability and Adaptability. In: United States National Research Council (ed) Limiting the Magnitude of Future Climate Change. Washington: The National Academies Press, 215-223.

Van Beers D, Bossilkov A and Lund C (2009) Development of large scale reuses of inorganic by-products in Australia: The case study of Kwinana, Western Australia. Resource, Conservation and Recycling 53: 365-378.

Van Beers D, Corder G and Bossilkov A,et al. (2007) Industrial symbiosis in the Australian Minerals Industry. Journal of Industrial Ecology 11(1): 55-72.

Van Berkel R, Fujita T and Hashimoto S et al. (2009) Industrial and urban symbiosis in Japan: Analysis of the Eco-Town program 1997-2006. Journal of Environmental Management 90: 1544-1556.

Van Berkel, R., Fujita, T., Hashimoto, S. et al. (2009) Quantitative Assessment of Urban and Industrial Symbiosis in Kawasaki. Environmental Science & Technology 43: 1728-1281.

Vayda AP (1983) Progressive Contextualization: Methods for research in Human Ecology. Human Ecology 11(3): 265-281.

Venturini T (2010) Diving in magma: how to explore controversies with actor-network theory. Public Understand. Sci. 19(3): 258-273.

Voß J, Smith A and Grin J (2009) Designing long-term policy:rethinking transition management. Policy Sciences 42: 275-302.

Wang Q, Deutz P and Gibbs D (2012) UK's Waste Policy Framwork for ISD: Lessons for China?

Weick KE (1979) The Social Psychologyof Organizing. New York:McGraw-Hill.

Weir M and Ansell CK (2009) Collaboration is not enough_virtuous cycles of reform in Transportation Policy. Urban Affairs Review 44(4): 455-489.

White, I., Richards, J. (2007) Planning Policy and Flood Risk: The translation of national guidance into local plans. Planning Practice and Research 22(4): 513-534.

White RM (1994) In: Allenby BR and Richards DJ (eds) The Greening of Industrial Ecosystems. National Academy Press.

Wright PM and Snell SA (1997) Toward a Unifying Framework for Exploring Fit and Flexibility in Strategic Human Resource Management. .

Xue B, Chen X, Geng Y, Guo X, Lu C, Zhang Z et al. (2010) Survey of officials' awareness on circular economy development in China: based on municipal and county level. Resources, Conservation & Recycling 54: 1296-1302.

Yu C (2014) Eco-Transformation of Industrial Parks in China. Next Generation Infrastructures Foundation.

Zhang, L., Yuan, Z., Bi, J. et al. (2010) Eco-industrial Parks: National Pilot Practices in China. Journal of Cleaner Production 18: 504-509.

Zhu D (2009) Circular Economy 2.0: From Environmental Management to Green Development (in Chinese). Tongji University Press.

Zhu Q, Lowe EA and Wei, Y, et al. (2007) Industrial symbiosis in China: a case study of the Guitang Group. Journal of Industrial Ecology 11(1): 31-42.

SUMMARY IN ENGLISH

1. Research aims and relevance

Industrial symbiosis seeks to decrease ecological impact of firms within a regional industrial system through exchanges of by-products and waste, and utility sharing. Industrial parks that seek to develop symbiotic linkages are referred to as Sustainable Industrial Clusters (SICs) in this study. Policy makers and scholars have recognized the need to establish policies for the development of SICs. However, the implementation of policies for SIC is still an under-researched part of policy processes. To improve understanding of the dynamics of long-term and non-linear policy implementation, this study elaborates the issue of policy durability. Policy durability refers to the established degrees of stability, coherence, and integrity of policy as time passes, and also the ability to adapt to changing conditions. It reflects continuous governmental efforts to solve public issues.

Our focus on policy durability is based on the observation that SIC policies need to be sustained for many years, but in practice they are sometimes introduced and implemented for a short time and then dissolved, which can lead to discontinuities of local SIC practices, and further undermine what has been already achieved. Policy durability is an important quality of public policy in general and of SIC policy in particular. The thesis elaborates this underestimated condition for the development of SICs. The research question is:

How does policy become durable in search for effective facilitation of the development of SICs?

To answer the question, two relationships need to be addressed: 1) the process-dynamics contributing to durable policies, and 2) the effects of durable policies on the development of SICs. Through a review of literature relevant to these two relationships, two main limitations are identified. First, policy undergoes various degrees of modifications and adjustments over time. Scholars hold contradictory opinions on whether it is a quality or erosion when a policy changes? Second, a large body of literature on policy durability and policy implementation takes policy as a "configuration of variables" that is dis-embedded from the context of time and space. Process-dynamics are

neglected; however, for in-depth understanding of policy making and implementation of SICs, they are crucial.

2. Theoretical framework

To answer the research question and address the two limitations identified above, ***policy is conceptualized as a translation process***. Translation is a key concept from Actor-Network Theory. The translation perspective highlights the nonlinearity, iteration, changes, and complexity in the process of the "movement" of entities, such as innovations, concepts or policies. ***Policy translation is defined as a sequence of policy events, during which policy ideas are born and eventually objectified and materialized into linguistic and material objects.***

With the unfolding sequence of policy translation, a policy assemblage, consisting of heterogeneous policy components (ideas, objects, practices, and policy actors), emerges and evolves. The idea of translation concentrates on how some relations in the assemblage become bolstered, strengthened, or eventually dissolve over time; in other words, it brings into a focus on the coming into being and eventual dissolution of a more or less durable policy assemblage. The key building blocks of the theoretical framework are follows.

Types of Policy durability: According to various degrees of stability of the policy assemblage, four types of policy durability, i.e. A, B, C, D, are deduced. From type A to type D, the stability of the policy assemblage reduces. A long-term policy process can present a sequential blend of different types of policy durability.

Translation Patterns: Translation patterns are typical sequences of policy events in which policy assemblages emerge and are maintained. We argue that policy durability is an ongoing effect of an active policy translation process. Each translation pattern corresponds to specific assembling of policy components, bringing about types of policy durability. Revealing the relationship between translation patterns and types of policy durability is one of the focal areas of this study.

Policy Outcomes of Diffusion of SICs: the intended policy outcome in the case of SIC is the diffusion of SIC policy concept in industrial parks. The outcomes can

be indicated by the number of industrial parks that adopt the concept of SIC, the variety of types of industrial parks, and the continuity of getting governmental supports (e.g. subsidy or technology) of the previously involved industrial parks. Revealing the relationship between types of policy durability and diffusion of SICs is another focal area of this study.

3. Research design and method

The study includes two cases: (1) national SIC policies in China and (2) the provincial policies to stimulate SIC in South Holland, the Netherlands. Both the two are longitudinal case studies (i.e. from the initiation of first SIC policy program to the most recent development). The Chinese case consists of two main sequences, namely Circular Economy policy and Eco-industrial Park policy.

The thesis consists of 2 published articles (chapters 2 and 4) and 6 unpublished chapters (chapters 1, 3, 5, 6,7and 8). Chapter 1 introduces the research topic, research question, relevance of the study, and a brief overview of the theoretical framework. Chapter 2 is a comprehensive literature review of the studies of policy in the literature of SIC. The chapter concludes with a research agenda toward the dynamics of policy facilitation of SICs. We then elaborate the concept of policy durability and its relationships with translation patterns and SICs diffusion results from Chapters 3 to 6. They are illustrated by the case studies of Eco-industrial Park policy in China (Chapter 3), Circular Economy policy in China (Chapter 4), the Co-evolution of Eco-industrial Park policy and Circular Economy policy in China (Chapter 5), and the SIC policy in South Holland (Chapter 6). The four chapters (Chapters 3-6) are the core of this study, across which the theory is gradually built up. Chapter 7 synthesizes the results of the previous chapters and compares the two cases. By comparison, this chapter aims to reveal the causes and effects of the similar beginnings but different endings of the two cases. Chapter 8 presents answers to the research question, and ends with policy recommendations, and future research agenda.

The study applies Event Sequence Analysis, focusing on the reconstruction of sequences of policy events and the identification of process patterns that emerge. This approach enhances our understanding of policy making and implementation and the generation of policy durability in a more dynamic way. The analytical steps include process identification (i.e. identifying the types of

policy events), data collection, sequence construction (i.e. policy events), and pattern identification. In the final step, the strategy of "temporal bracketing" is adopted, through which the process data are parsed into successive adjacent phases. The underlying idea is that there is continuity of the process within each phase and discontinuity between phases. Moreover, we make the analytical step from process to network, i.e. from sequence of events of translation to policy assemblage. The policy components associated with each event, including IDEA, OBJECT, PRACTICE, ACTOR and LABEL, were coded. The coding results were imported into the software program Gephi to visualize policy assemblages. In the analysis, we combine qualitative interpretations and quantitative approaches of Social Network Analysis to analyze these evolving assemblages.

4. Conclusions and future research agenda

The conclusion is threefold. The first conclusion is about the various types of policy durability, manifesting different qualities of the policy processes in terms of the configurations of policy stability and adaptability, both of which are important characteristics for a durable policy. Stability is required for persuading industries to make (continuous) investment, and adaptability is needed to make timely responses to fit changing context, to correct previous policy failure, or to alleviate external interruptions. However, there are tensions between them. **One dynamic of coping with the tensions between stability and adaptability for a durable policy is accommodating them simultaneously.** It means that some policy components are stable and some are adaptable. The stability or adaptability of these components can manifest the configuration of stability or adaptability of the entire policy. In this regard, types A and B of policy durability embrace more stability, and types C and D are associated with more adaptability. Both the cases show that **type C was the starting point.** It is also a desirable starting point, because when policy actors are unfamiliar with the innovative policy concept (e.g. SIC), the priority at hand is to adapt the innovative policy concept within the new context. However, the major differences of the two cases are the subsequent types of policy durability as time passes. This difference indicates **another dynamic of coping with the tensions between stability and adaptability, that is, accommodating them sequentially.** When the policy context was relatively stable in China, the sequential blend of policy durability evolved from high adaptability (i.e. type C)

toward more stability (i.e. type A or B). This was essentially a path of strengthening the tentative beginning. When the policy contexts changed substantially in South Holland, the durable policy presented high adaptability (i.e. types C and D of policy durability), as a result of the adaptation to the economic crisis and changes of political priority.

The second conclusion is about process dynamics of policy (i.e. translation patterns) and their contributions to the different types of policy durability. Six ideal-typical translation patterns are elaborated in Chapters 3 and 4. They are '*single agency-experimental implementation', 'single agency-administrative implementation', 'cooperation-experimental implementation', 'cooperation-administrative implementation', 'boundary implementation', and 'symbolic implementation'*. The transition of patterns over time parses the entire translation process into phases. The identification of the (successive) patterns that emerge in the translation process reflects the recursive characteristics (e.g. policy making, implementation, evaluation) of the policy process. With regard to the dynamic relationship between translation patterns and types of policy durability, both the cases show that **the common starting point of type C of policy durability of SIC was brought about by translation patterns of 'single agency-experimental implementation' or 'cooperation-experimental implementation', or the transition from the former to the latter.** The contrasting directions of the sequential blends of types of policy durability resulted from **the infusion of administrative features into experimental implementation in relatively stable policy contexts and from continuous experimental implementation in contexts with substantial changes, respectively.** Specifically, in relatively stable policy contexts in China, along with the accumulation of knowledge, the infusion of administrative approaches into the patterns of 'cooperation-experimental implementation' brought about type A or B of policy durability. It suggests that the administrative features of the translation process are indispensable for the occurrence of types A and B of policy durability. In the context with substantial changes in South Holland, the translation patterns with continuous experimentation was adopted, and type C or D of policy durability emerged. It suggests that the experimental features of the translation process are important for the occurrence of types C and D of policy durability.

The third conclusion is about the dynamic relationships between types of policy durability and the diffusion of SICs. The comparison of the two cases shows that the continuous diffusion of SICs was achieved in China when the policy durability showed the types A and B in the later phases of the policy process. This suggests that, in relatively stable policy contexts, the types of policy durability that embrace more stability are more likely to bring about effective policy outcomes. In contrast, the types C and D of policy durability constantly failed to bring about the effective diffusion for the entire time period in South Holland, where the policy context changed substantially. The results show that the types of policy durability that embrace more adaptability are unlikely to bring about effective diffusion. From a longitudinal perspective, the path from type C to type A/ B proved to work in the Chinese case with relatively stable policy contexts, generating effective outcomes of diffusion. Generally, **for the effective diffusion, the key question is whether policy actors are able to generate type A or B of policy durability over time when policy context is stable.** The result also implies that, **in policy contexts with substantial changes it is crucial for policy durability to sustain adaptability without substantially sacrificing stability**.

The readers should note that the three main conclusions presented here have limited generalizability, because they are based on two case studies. However, we can draw theoretical and practical lessons from them that can be validated in further research. Building on this study, future research can be developed in the following three tracks. 1) Comparative studies of various cases that embed in different policy contexts can strengthen the generalization of policy durability. 2) The quality of diffusion should be taken as an important aspect of the policy outcomes. The quality refers to the extent to which the policy ideas of SIC are implemented in industrial parks (e.g. superficial adoption of labels, or fundamental changes of material and energy flows). And, 3) the investigation of the interactions of diverse factors that drive the development of SICs (e.g. the interactions between governmental actors and other factors) is important to improve the understanding of policy facilitation of SICs.

SUMMARY IN DUTCH

1. Doelstellingen en relevantie van het onderzoek

Industriële symbiose gaat over pogingen van bedrijven in regionale industriële systemen om hun ecologische impact te verminderen, door middel van uitwisseling van bijproducten en afval, en het delen van nutsvoorzieningen. Industriële clusters waar deze symbiotische uitwisselingen worden geïmplementeerd worden in dit onderzoek aangeduid als Duurzame Industriële Clusters (DICs). Het belang van beleid voor de ontwikkeling van DICs wordt door zowel beleidsmakers als onderzoekers erkend, maar de implementatie van dergelijk beleid is een nog weinig onderzocht onderdeel van het beleidsproces. Het doel van dit onderzoek is om ons begrip van de dynamiek van lange termijn en nonlineair beleidsimplementatieprocessen te verbeteren, met een specifieke focus op beleidsbestendigheid. Beleidsbestendigheid verwijst naar de mate van stabiliteit, coherentie en integriteit van beleid door de tijd heen, alsook het vermogen van beleid om zich aan te passen aan veranderende omstandigheden. Het is een uiting van herhaaldelijke ingrepen van de overheid om publieke problemen op te lossen.

De focus op beleidsbestendigheid is gekozen op basis van de observatie dat beleid voor DIC voor vele jaren in stand moet worden gehouden, maar in de praktijk vaak kort na implementatie verdwijnt, waardoor er discontinuïteit is in lokale DIC toepassingen, en waardoor reeds behaalde resultaten worden ondermijnd. Beleidsbestendigheid is een belangrijke kwaliteit van beleid in het algemeen, en van beleid voor DICs in het bijzonder. Dit proefschrift werkt deze vaak onderschatte voorwaarde voor de ontwikkeling van DICs verder uit, aan de hand van de volgende onderzoeksvraag:

Hoe wordt beleid bestendig in de zoektocht naar effectieve facilitering van de ontwikkeling van DICs?

Om deze vraag te beantwoorden, moet er helderheid worden geschept over twee relaties: 1) de procesdynamiek die bijdraagt aan bestendig beleid, en 2) de effecten van bestendig beleid op de ontwikkeling van DICs. Door middel van een studie van literatuur over deze twee relaties zijn er twee belangrijke beperkingen geïdentificeerd. De eerste beperking is dat beleid altijd in meer of

mindere mate aan veranderingen en aanpassingen onderhevig is. Onderzoekers hebben tegenstrijdige meningen over de mate waarin dit een probleem, of juist een positief verschijnsel is. Een tweede beperking is dat een belangrijke aandeel van de literatuur over beleidsbestendigheid en beleidsimplementatie beleid beschouwt als een "configuratie van variabelen" die is losgezongen van haar ruimtelijke en temporele context. Procesdynamiek wordt genegeerd, terwijl deze cruciaal is voor een diepgaand begrip van de ontwikkeling en implementatie van beleid voor DICs.

2. Theoretisch raamwerk

Om de onderzoeksvraag te beantwoorden, en de twee bovengenoemde beperkingen te overwinnen, wordt in dit onderzoek ***beleid geconceptualiseerd als een translatieproces***. Translatie is een centraal concept van Actor Network Theory. Het translatieperspectief wijst op de nonlineariteit, iterativiteit, veranderlijkheid en complexiteit van het proces van 'beweging' van entiteiten, zoals innovaties, concepten en beleid. ***Beleidstranslatie wordt gedefinieerd als een sequentie van beleidsgebeurtenissen, waarin beleidsideeën worden geboren, en uiteindelijk worden geobjectiveerd en gematerialiseerd in linguïstieke en materiële objecten.***

Waar een beleidstranslatie zich ontvouwt, ontstaat en ontwikkelt zich een beleidsassemblage van ideeën, objecten, praktijken, en beleidsactoren. Elke translatie kent een unieke combinatie van deze vier verschillendsoortige elementen. Het idee achter translatie is dat verbindingen in de assemblage worden bestendigd en versterkt, maar ook weer kunnen oplossen. In andere woorden, het brengt het ontstaan en de uiteindelijke verdwijning van een min of meer bestendige beleidsassemblage aan het licht. De centrale bouwstenen van het theoretisch raamwerk zijn als volgt:

Typen van beleidsbestendigheid: Om de mate van stabiliteit van beleidsassemblages te duiden, worden vier typen van beleidsbestendigheid onderscheiden: A, B, C en D. Bij type A is de stabiliteit van beleid het hoogst, bij type D het laagst. In een langdurig beleidsproces kunnen de types van beleidsbestendigheid elkaar opvolgen.

Translatiepatronen: Translatiepatronen zijn typische sequenties van beleidsgebeurtenissen waardoor beleidsassemblages zich ontwikkelen en in

stand blijven. Beleidsbestendigheid wordt in dit onderzoek gezien als een resultaat dat alleen in stand blijft door voortdurende beleidstranslatie. Elk translatiepatroon hangt samen met een specifieke assemblage van beleidscomponenten, waarmee tevens verschillende soorten van beleidsbestendigheid tot stand komen. De relatie tussen translatiepatronen en soorten beleidsbestendigheid is een focus van dit onderzoek.

Beleidsuitkomsten en de verspreiding van DICs: In de context van beleid voor DICs, is de gewenste beleidsuitkomst de verspreiding van het DIC beleidsconcept in industriële clusters. Indicatoren voor deze uitkomst zijn het aantal clusters dat het concept adopteert, de diversiteit van deze clusters, en de continuïteit in het verkrijgen van overheidssteun (bijvoorbeeld in de vorm van subsidies of technologie) door reeds betrokken clusters. De relatie tussen typen beleidsbestendigheid en diffusie van DICs is eveneens focus van dit onderzoek.

3. Onderzoeksdesign en methoden

In dit onderzoek zijn twee casussen bestudeerd: (1) nationaal DIC beleid in China en (2) provinciaal DIC beleid in Zuid-Holland, Nederland. In beide gevallen gaat het om longitudinale casusstudies, met als focus de periode van in gang zetten van het eerste DIC beleidsprogramma tot de recente ontwikkeling. De China casus is opgebouwd uit twee grote sequenties: het beleid voor Circulaire Economie en het beleid voor Eco-Industriële Parken.

Het proefschrift bestaat uit 2 gepubliceerde artikelen (hoofdstukken 2 en 4) en 6 niet-gepubliceerde hoofdstukken (hoofdstukken 1, 3, 5, 6, 7 en 8). In hoofdstuk 1 worden het onderzoeksonderwerp, de onderzoeksvraag, de relevantie van het onderzoek en een overzicht van het theoretisch raamwerk uiteengezet. Hoofdstuk 2 bevat een uitgebreide studie naar beleid in de literatuur over DICs. Het hoofdstuk wordt afgesloten met een onderzoekagenda voor de studie naar de dynamiek van beleidsfacilitering van DICs. Het concept beleidsbestendigheid en de relaties met translatiepatronen en de diffusie van DICs worden in hoofdstuk 3, 4, 5, en 6 uitgewerkt. Er worden voorbeelden gegeven uit de casusstudies van het beleid voor Eco-Industriële Parken in China (hoofdstuk 3), het beleid voor Circulaire Economie in China (hoofdstuk 4), de co-evolutie van deze twee beleidsprogramma's (hoofdstuk 5), en het DIC beleid in Zuid-Holland (hoofdstuk 6). Deze hoofdstukken vormen de kern van deze

studie, waarin de theoretische bijdrage van dit proefschrift geleidelijk wordt opgebouwd. Hoofdstuk 7 geeft een synthese van de voorgaande hoofdstukken en een vergelijking van de twee casussen. Uit de vergelijking wordt verklaard hoe het kan dat de casussen een vergelijkbaar startpunt hebben, maar verschillende eindpunten. In hoofdstuk 8 wordt de onderzoeksvraag beantwoord, gevolgd door beleidsaanbevelingen en een nieuwe onderzoekagenda.

In het onderzoek wordt gebruik gemaakt van Event Sequence Analysis, die het mogelijk maakt beleidsgebeurtenissen te reconstrueren en zich opbouwende patronen te identificeren in de sequenties. Deze benadering versterkt ons begrip van dynamiek in beleidsontwikkeling, -implementatie, en –bestendigheid. De analytische stappen zijn het identificeren van het proces (het identificeren van types van gebeurtenissen), dataverzameling, reconstructie van de sequenties (beleidsgebeurtenissen), en het identificeren van patronen. In de laatste stap wordt de strategie van "temporal bracketing" gebruikt, waarbij de procesdata worden ontleed in opeenvolgende fasen. De onderliggende idee is dat er continuïteit is binnen elke fase van het proces, en discontinuïteit tussen fasen. Daarnaast maken we de analytische stap van proces naar netwerk, dat wil zeggen, van sequenties van translatiegebeurtenissen naar beleidsassemblages. De beleidscomponenten die we associëren met gebeurtenissen, gelabeld als IDEE, OBJECT, PRAKTIJK, ACTOR en LABEL, worden gecodeerd. De resultaten van het coderingsproces worden geïmporteerd in het softwarepakket Gephi om beleidsassemblages te visualiseren. Om de evolutie van de beleidsassemblages te bestuderen, combineren we kwalitatieve interpretaties en kwantitatieve benaderingen van Sociale Netwerkanalyse.

4. Conclusies en onderzoekagenda voor de toekomst

Het onderzoek leidt tot drie conclusies. De eerste gaat over de waargenomen soorten beleidsbestendigheid, die uiting geven aan kwaliteiten van beleidsprocessen in termen van stabiliteit en adaptatie van beleid, beide belangrijke kenmerken van bestendig beleid. Stabiliteit is nodig om het bedrijfsleven ervan te overtuigen investeringen te (blijven) doen. Adaptatie is nodig om tijdige te reageren op een veranderende omgeving, om zo driegend beleidsfalen te corrigeren en om gevolgen van externe schokken op te vangen. Er bestaan echter spanningen tussen deze twee kwaliteiten. **Een kunst van**

omgang met de spanningen tussen stabiliteit en adaptatie voor een bestendig beleid is om gelijktijdig in beide te voorzien. Dit betekent dat sommige beleidscomponenten stabiel zijn, terwijl anderen adaptief zijn. De stabiliteit of adaptatie van beleidscomponenten kan de configuratie van stabiliteit of adaptatie van het gehele beleid verzorgen. Types A en B van bestendigheid zorgen voor stabiliteit, terwijl types C en D juist sterker zijn in adaptatie. In beide casussen zien we dat **type C het startpunt was.** Dit is ook een gewenst startpunt, omdat de prioriteit ligt bij het aanpassen van innovatieve beleidsconcepten (bijv. DIC) aan een nieuwe context, wanneer beleidsactoren nog onbekend zijn met de concepten. Ondanks dit overeenkomstige startpunt in beide casussen, zien we grote verschillen tussen de casussen als het gaat om de types van beleidsbestendigheid die we na het startpunt waarnemen. Deze verschillen wijzen op **een andere dynamiek van omgang met de spanningen tussen stabiliteit en adaptiviteit, namelijk door ze in het beleidsproces af te wisselen.** Wanneer de beleidscontext relatief stabiel was in China, werd een adaptieve vorm van beleidsbestendigheid (bijv. type C) gevolgd door een vorm met meer stabiliteit (type A of B). In essentie was dit een pad waarin een voorzichtig begin wordt gemaakt dat in verloop van tijd sterker wordt verankerd. Wanneer de beleidscontext sterk veranderlijk was in Zuid-Holland, werd bestendig beleid gekenmerkt door hoge adaptiviteit (types C en D), als gevolg van aanpassingen aan de economische crisis en veranderingen in politieke prioriteiten.

De tweede conclusie gaat over de procesdynamiek van beleid (translatiepatronen) en hun bijdrages aan typen van beleidsbestendigheid. Zes ideaaltypische patronen worden uitgewerkt in hoofdstukken 3 en 4. Deze typen zijn '*unilaterale experimentele implementatie', 'unilaterale administratieve implementatie' 'coöperatieve experimentele implementatie', 'coöperatieve administratieve implementatie', 'grensimplementatie', en 'symbolische implementatie'.* De transitie van patronen door de tijd heen leidt tot een verdeling van het proces in fases. De identificatie van de (opeenvolgende) patronen die in het translatieproces ontstaan geeft uiting aan de recursieve eigenschappen van het beleidsproces (bijv. beleidsontwikkeling, -implementatie, en -evaluatie). Ten aanzien van de dynamische relatie tussen translatiepatronen en types van beleidsbestendigheid laten de casussen zien dat **het gezamenlijke startpunt van type C van beleidsbestendigheid van DIC tot stand werd**

gebracht door translatiepatronen van het soort 'unilaterale experimentele implementatie', 'coöperatieve experimentele implementatie', of de transitie van de eerste maar de laatste. De contrasterende richtingen in daaropvolgende sequenties, waarin periodes van stabiliteit en adaptiviteit elkaar afwisselen, zijn het resultaat van, respectievelijk, **de inprenting van administratieve eigenschappen in de experimentele implementatie in relatief stabiele beleidscontexten, en continue experimentele implementatie in sterk veranderende beleidscontexten.** Meer specifiek zien we dat in relatief stabiele beleidscontexten in de Chinese casus, de cumulatie van kennis en de inprenting van administratieve benaderingen in patronen van 'coöperatieve experimentele' leiden tot type A of B van beleidsbestendigheid. Dit suggereert dat administratieve eigenschappen van het translatieproces noodzakelijk zijn voor types A en B van beleidsbestendigheid. In een sterk veranderende context in Zuid-Holland, worden translatiepatronen met continue experimenten gehanteerd, en dit leidde tot types D en C van beleidsbestendigheid. Dit suggereert dat de experimentele kenmerken van het translatieproces belangrijk zijn voor types C en D van beleidsbestendigheid.

De derde conclusie gaat over de relatie tussen beleidsbestendigheid en diffusie van DICs. De vergelijking van de twee casussen laat zien dat de continue diffusie van DICs in China wordt bereikt wanneer beleidsbestendigheid van types A en B optraden in latere fasen van het beleidsproces. Dit suggereert dat, in relatief stabiele beleidscontexten, de types van beleidsbestendigheid die gepaard gaan met meer stabiliteit meer kans hebben om tot effectieve beleidsuitkomsten te leiden. Types C en D, daarentegen, leidde niet tot een effectieve diffusie van DICs voor de gehele periode in de casus Zuid-Holland, waar de beleidscontext door de tijd heen sterk veranderde. Deze resultaten wijzen erop dat de typen van beleidsbestendigheid die gepaard gaan met meer adaptiviteit minder kans hebben om te leiden tot effectieve diffusie van DICs. In het algemeen geldt dat, **voor de effectieve diffusie van DICs, de belangrijkste vraag is welke beleidsactoren in staat zijn om type A of B van beleidsbestendigheid te genereren in een stabiele beleidscontext.** Het resultaat impliceert ook dat **in sterk veranderlijke beleidscontexten het voor beleidsbestendigheid cruciaal is om adaptiviteit te waarborgen zonder stabiliteit daar volledig voor op te offeren.**

De lezer wordt erop gewezen dat de drie belangrijkste conclusies beperkte generaliseerbaarheid hebben, omdat ze zijn gebaseerd op resultaten van twee casussen. Desondanks kunnen we theoretische en praktische lessen uit de conclusies trekken, die kunnen worden gevalideerd in toekomstig onderzoek. Voortbouwend op dit onderzoek kunnen we drie sporen voor toekomstig onderzoek formuleren. 1) Vergelijkende studies van uiteenlopende casussen die zijn ingebed in verschillende beleidscontexten kunnen leiden tot meer generieke uitspraken over beleidsbestendigheid. 2) De kwaliteit van de diffusie kan als een belangrijk aspect van beleidsuitkomsten worden genomen. Hier verwijst kwaliteit naar de mate waarin beleidsideeën van DIC worden geïmplementeerd in industriële clusters (bijv. oppervlakkig gebruik van beleidslabels, of fundamentele veranderingen in materiaal- en energiestromen). 3) Onderzoek naar interacties tussen diverse factoren die ten grondslag liggen aan de ontwikkeling van DICs (bijv. de interacties tussen overheidsactoren en andere factoren) is belangrijk om ons begrip van beleidsfacilitering van DICs te vergroten.

APPENDIX

Appendix 1: SUPPLEMENTARY MATERIAL TO CHAPTER 2

Table A2.1 List of Articles in the Four Categories

Category	Articles
Overview of Policy Programs	1. Geng, Y., Fu, J., Sarkis, J.,et al., 2012. Towards a national circular economy indicator system in China: an evaluation and critical analysis. Journal of Cleaner Production, 216-224 2. Behera, S.K., Kim, J., Lee, S.,et al., 2012. Evolution of 'designed' industrial symbiosis networks in the Ulsan Eco-industrial Park: "research and development into business" as the enabling framework. Journal of Cleaner Production, 103-112 3. Van Berkel, R., Fujita, T., Hashimoto, S. et al., 2009. Industrial and urban symbiosis in Japan: Analysis of the Eco-Town program 1997-2006. Journal of Environmental Management, 1544-1556 4. Costa, I., Massard, G., Agarwal, A., 2010. Waste Management Policies for Industrial Symbiosis Development: Case Studies in European Countries. Journal of Cleaner Production, 815-822 5. Zhang, L., Yuan, Z., Bi, J. et al., 2010. Eco-industrial Parks: National Pilot Practices in China. Journal of Cleaner Production, 504-509 6. Laybourn, P., Lombardi, R., 2012. Industrial symbiosis in European Policy: Overview of Recent Progress. Journal of Industrial Ecology. 1, 11-12 7. Geng, Y., Doberstein, B., 2008. Developing Circular Economy in China: Challenges and Opportunities for Achieving 'Leapfrog Development'. Journal of Sustainable Development & World Ecology. 3, 231-239 8. Ren, Y., 2007. The circular economy in China. Journal of Material Cycles and Waste Management, 121-129 9. Mathews, J.A., Tan, H., 2011. Progress toward a circular economy in China: the drivers (and inhibitors) of eco-industrial initiative. Journal of Industrial Ecology. 3, 435-457
Policy as a Mechanism for Stimulating Industrial Symbiosis	10. Mirata, M., 2004. Experiences from Early Stages of a National Industrial Symbiosis Programme in the UK: Determinants and Coordination Challenges. Journal of Cleaner Production, 967-983 11. Ohnishi, S., Fujita, T., Chen, X.,et al., 2012. Econometric analysis of the performance of recycling projects in Japanese Eco-Towns. Journal of Cleaner Production, 217-225 12. Taddeo, R., Simboli, A., Morgante, A., 2012. Implementing eco-industrial parks in existing clusters: findings from a historical Italian chemical site. Journal of Cleaner Production, 22-29 13. Van Beers, D., Corder, G., Bossilkov, A.,et al., 2007. Industrial symbiosis in the Australian Minerals Industry. Journal of Industrial Ecology. 1, 55-72 14. Van Beers, D., Bossilkov, A., Lund, C., 2009. Development of large scale reuses of inorganic by-products in Australia: The case study of Kwinana, Western Australia. Resource, Conservation and Recycling, 365-378 15. Salmi, O., Hukkinen, J., Heino, J.,et al., 2011. Governing the interplay between industrial ecosystems and environmental regulation: heavy industries in the Gulf of Bothnia in Finland and Sweden. Journal of Industrial Ecology. 1, 119-128 16. Gibbs, D., Deutz, P., 2005. Implementing Industrial Ecology? Planning for Eco-industrial Parks in the USA. Geoforum, 452-464 17. Gibbs, D., Deutz, P., 2007. Reflections on implementing industrial ecology through eco-industrial park development. Journal of Cleaner Production, 1683-1695 18. Liu, C., Ma, C., Zhang, K., 2012. Going beyond the sectoral boundary: a key stage in the development of a regional industrial ecosystem. Journal of Cleaner Production, 42-49 19. Shi, H., Chertow, M., Song, Y., 2010. Developing country experience with eco-industrial parks: a case study of Tianjin Economic-Technological Development

	Area in China. Journal of Cleaner Production, 191-199 20. Zhu, Q., Lowe, E.A., Wei, Y,,et al., 2007. Industrial symbiosis in China: a case study of the Guitang Group. Journal of Industrial Ecology. 1, 31-42. 21. Anh, P.T., Dieu, T.T.M., Mol, A.P.J.,et al., 2011. Towards eco-agro industrial clusters in aquatic production: the case of shrimp processing industrial in Vietnam. Journal of Cleaner Production, 2107-2118 22. Brent, A.C., Oelofse, S., Godfrey, L., 2008. Advancing the concepts of industrial ecology in South African institutions. South African Journal of Science, 9-12 23. Chertow, M.R., 2007. 'Uncovering' Industrial Symbiosis. Journal of Industrial Ecology, 11-30 24. Costa, I., Ferrão, P., 2010. A Case Study of Industrial Symbiosis Development Using a Middle-out Approach. Journal of Cleaner Production, 984-992 25. Boons, F., Spekkink, W., 2012. Levels of institutional capacity and actor expectation about industrial symbiosis: Evidence from the Dutch stimulation program 1999 - 2004. Journal of Industrial Ecology, 1-9 26. Deutz, P., 2009. Producer responsibility in a sustainable development context: ecological modernization or industrial ecology?. The Geographical Journal. 4, 274-285 27. Simpson, D., 2012. Knowledge resources as a mediator of the relationship between recycling pressures and environmental performance. Journal of Cleaner Production, 32-41 28. Deutz, P., Gibbs, D., 2008. Industrial Ecology and Regional Development: Eco-industrial Development as Cluster Policy. Regional Studies. 10, 1313-1328
Evaluation of the Impacts of Policy Programs	29. Park, H., Rene, E., Choi, S. et al., 2008. Strategies for sustainable development of industrial park in Ulsan, South Korea – From spontaneous evolution to systematic expansion of industrial symbiosis. Journal of Environmental Management, 1-13 30. Lehtoranta, S., Nissinen, A., Mattila, T. et al., 2011. Industrial symbiosis and the policy instruments of sustainable consumption. Journal of Cleaner Production, 1865-1875 31. Van Berkel, R., Fujita, T., Hashimoto, S. et al., 2009. Quantitative Assessment of Urban and Industrial Symbiosis in Kawasaki. Environmental Science & Technology, 1728-1281
Lessons from Practice: Lesson learnt and Policy Implications	32. Kim, H., 2007. Building an Eco-Industrial Park as a Public Project in South Korea: The Stakeholders' Understanding of and Involvement in the Project. Sustainable Development, 357-369 33. Adamides, E., Mouzakitis, Y., 2009. Industrial ecosystems as technological niches. Journal of Cleaner Production, 172-180 34. Chertow, M., Lombardi, D.R., 2005. Quantifying Economic and Environmental Benefits of Co-Located Firms. Environmental Science & Technology. 17, 6535-6541 35. Liu, L., Zhang, B., Bi, J.,et al., 2012. The greenhouse gas mitigation of industrial parks in China: A case study of Suzhou Industrial Park. Energy Policy, 301-307 36. Aviso, K.B., Tan, R.R., Culaba, A.B.,et al., 2010. Bi-level fuzzy optimization approach for water exchange in eco-industrial parks. Process Safety and Environmental Protection. 88, 31-40 37. Hashimoto, S., Fujita, T., Geng, Y.,et al., 2010. Realizing CO2 emission reduction through industrial symbiosis: A cement production case study for Kawasaki. Resource, Conservation and Recycling, 704-710

Appendix 2: SUPPLEMENTARY MATERIAL TO CHAPTER 3

Table A3.1 CODING SCHEME[20]

Abbre	Building Block	Description
A	single agency as implementer	policy decisions of developing or facilitating policy concept or practice. And One central agency as implementer (assigned by authority or serves as policy pioneer)

[20] The Coding Scheme was also used chapters of 4, 5 and 6.

B	policy decision is translated into implementation program with plans or targets	Policy decision is translated into implementation programs with plans and targets, which are assigned to regional actors.
C	rules, standards, regulations are formulated	1. Policy actors make soft rules to formalize the implementation. The feature of such rules is non-binding, or a mixture of binding and non-binding. 2. Policy actors make hard rules to regulate the implementation. The feature of such rules is legal binding.
D	resource provision	Policy actors provide technology or knowledge or subsidy for the implementation.
E	monitor	Policy actors check whether the policy outcomes are achieved as planned. It is periodically recurring task.
F	sanction, withdraw resource or continue resource	Policy makers punish implementers or practitioners for their failure through withdraw resource or reputation, or through removing from office, or penalty.
G	policy decision is translated into implementation program with tentative attitudes	Policy decision is translated into implementation program. The implementation program adopts tentative attitudes, starting with social experimentation.
H	experimentation	Piloting: The policy concept is tentative implemented in small scale as test or experimentation in order to find whether it is proper or successful enough to do in large scale. Demonstration: The practice of demonstrating, explaining, or showing what to do to implement the policy concept through examples or showcases.
I	intentional learning	learning from R&D; learning from other similar policy actions (e.g. international experience or knowledge exchange); The local empirical practices and information are fed back to policy makers, such as annual progress report, or frequent contact person; Stakeholders comment on the draft policy papers, or program plans, etc. before its formal publication.
J	facilitation	Mobilization: Policy makers organize stakeholders to gather or work together in order to interest stakeholders and disseminate the policy concept. Education: Policy makers educate stakeholders through educational classes. Orientation: The policy actions to orient stakeholders toward desired targets and outcome, such as target development and benchmarking.
K	evaluation	The policy outcomes/performance is evaluated by policy makers or the third party with the purpose of improvement of the policy in the future.
L	adjustment	The policy goals/means are adjusted.
M	decision with inter-organizational joint action	Policy decisions of developing or facilitating certain policy concept are made, and joint actions of multi-actors are considered necessary for the implementation.
N	coalition coordinator	Certain actor is appointed or strives to act as coordinator for multi-actor cooperation.
O	interestment	Coalition coordinator (re)defines policy goals and means, and roles of each actors to from the coalition. And Coalition coordinator persuades and negotiates with other actors to form the coalition (e.g financial support). And Coalition coordinator exercises power and looks for support from external powerful actors to form the coalition.
P	coalition establishment	Policy actors agree and start to work together as a coalition.

Q	development of boundary objects	Multi-actors develop objects that can both inhabit several intersecting social world and can meet their own work requirement.
R	small coalition establishment	A small cluster of actors started to work together.
S	policy decision with referent goal	Policy actors develop salient policy symbols, such as a slogan.
PE	Policy entrepreneurship	Policy entrepreneurs (from outside of the formal positions of government), introduce, translate, and help implement new ideas into public practice.
ELA	Emerging local initiatives	The emerging local activities of CE before the formal publication of governmental policy, which could be a source or stimulation for policy making.
PP	Emerging policy pioneer	Certain actor actively strives to facilitate certain concept.
PA	Powerful outsiders	The powerful actors are involved in to give support, govern, or guard policy making or policy implementation.
MS	Measurement and Statistics	Policy makers develop/utilize indicators or statistics to recognize policy issues, to perform program design, monitor or evaluate policy implementation.
PD	Progress documentation	The governmental actions and local practices are systemic recorded and documented.
PC	Personnel Change	Changes of personnel that relates with the policy program, such as changes of project manager of SIP
AT	Appropriation	the process that policy actors borrow or depend on existing entities (ideas, networks) to produce something new or for own usage. The existing entities are not developed for such purposes. This is distinguished from resource integration or goal integration.

Table A3.2 Events and Building Blocks (BB)

BB	Description	Duration	Event Number	Incidents
G	Policy decision with single agency: SEPA as the single agency became the pioneer to facilitate EIP	2000-6-11	e1	5
H	Piloting: Two industrial parks became EIP pilots	2000-6-11 → 2001-11-29	e2,e3	6,7,8,9,10
K	Practical experience to policy maker: the practical experience and progresses were fed back to SEPA.	2002-3-15	e4	11
H	Piloting: Three industrial parks became EIP pilots	2003-2-1 → 2003-11-18	e5, e6, e7	12,13,14,15,16,17
L	Adjustment: the implementation was adjusted to more structured manner through the publication of management procedure and content guidance.	2003-12-31	e8, e9	19,20
I	Learning: learning through R&D	2003-12-1 → 2006-03-02	e10	18,21,41,45
H	Piloting: 11 industrial parks became EIP pilots	2004-2-26 → 2006-5-18	e11, e12, e13, e14, e15, e16, e17, e18, e19, e20, e21	22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40,41,42,43,44,45,46

I	Learning: learning from other similar experiences	2005-1-1	e22	36
L	Adjustment: the implementation was adjusted to more structured manner and explicit targets through the publication of assessment standards	2006-6-2	e23	48,49.50
H	Piloting: 8 industrial parks became EIP pilots	2006-7-11→ 2007-01-19	e24, e25, e26, e27, e28, e29, e30, e31	51,52,53,54,55,56,57,58,59,60,6162,63,64,65,67
K	Practical experience to policy maker: the practical experience and progresses were feedback to SEPA.	2007-1-7	e32	66
H	Piloting: 2 industrial parks became EIP pilots	2007-3-16 → 2007-05-16	e33,e34	68,69,71,72
P	Coalition establishment: SEPA, MOC, and MOST established the steering group.	2007-4-3	e35	47,70
K	Practical experience to policy maker: the practical experience and progresses were feedback to SEPA.	2007-9-7	e36	73
L	Adjustment: the published provisional documents were revised and standardized.	2007-10-15→ 2007-12-20	e37,e38	74,75,76,80
H	Demonstration: 3 pilot EIPs got the designation of Demonstration EIP.	2008-3-1→ 2008-03-31	e39	77,78,79
J	Mobilization: mobilization through EIP working meeting.	2008-5-20 → 2008-07-07	e40	81,83
H	Piloting: 8 industrial parks became EIP pilots	2008-6-25→ 2009-01-07	e41,e42	82,84,85,86
K	Practical experience to policy maker: the practical experience and progresses were feedback to SEPA.	2009-2-20	e43	87
L	Adjustment: the published assessment standard was adjusted, and upgraded from trial version into formal version	2009-6-23	e44	88,89
H	Demonstration: 2 pilot EIPs got the designation of Demonstration EIP.	2009-4-3 → 2009-06-23	e45,e46	90,93,96,91,94,97
L	Adjustment: low carbon economy was added as policy targets	2009-12-21	e47	92
H	Piloting and demonstration: 21 industrial parks became national EIP pilots and 7 EIP pilots got the designation of national Demonstration EIP	2010-2-1 → 2011-10-10	e48, e50, e51, e53, e56, e57, e58, e49, e52, e54, e55	95,98,99,100,101,102,103,104,105,106,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,122
L	Adjustment: the plans and targets for 2015 were made	2011-11-2 → 2011-12-05	e59	123,124
J	Mobilization: mobilization through EIP working meeting.	2011-12-8	e60	125

Appendix 3: SUPPLEMENTARY MATERIAL TO CHAPTER 4

Table A4.1 Building Blocks (BB) and Patterns

pattern	BB	description
PHASE 1:	A/H	SEPA initiated the national program of Ecological Demonstration Zone

emerging of local CE initiatives		(eco-province, eco-city, and eco-county), which took ecological economics as the main theory. The first stage of the program was implemented from 1995-2000 through selecting pilots.
	A/H	The State Planning Commission made and started to implement China Agenda 21st. Shanghai was one of its16 pilots.
	I	Shanghai Agenda 21st Action Group visited Germany to learn German experience of sustainable development. A professor was involved in this visiting.
	PE	After the visiting, Professor Zhu published several academic articles and news reports about CE in Germany and its implications on Shanghai and China toward sustainability. And furthermore, he was involved in the plan making of China Agenda 21st - Shanghai Action Plan and advocated CE.
	ELA	Several regional governments started to work on CE, such as Shanghai, Guiyang, and Liaoning.
Phase 2: single agency -experimental implementation	A/G/H	The decision of initiation of CE Demonstration Program was made by SEPA, and two regions were approved as pilots.
	J	The decision of facilitating CE was disseminated in several international and domestic forums, conferences, and workshops by SEPA.
	C	SEPA published the provisional document to formalize the management procedure and planning guidance of CE demonstration Zone program.
	I	The National Key R&D program of CE and Industrial Ecology was initiated by MOST and evaluated by SEPA
Phase 3: Critical breakpoint	PP/I	NDRC initiated the research program of China CE Development Strategy.
	PA	NDRC wrote the Countermeasures to the State Council, which got positive support from state council.
	I	NDRC studied the key sectors and key regions in order to facilitate CE, and further organized an expert team to make the draft of Instructional Views on Promoting CE.
	L	SEPA redefined its role for promoting CE development in the CE experience sharing workshop.
	J	The workshops and meetings were organized by NDRC, together with the National People's Congress (Environment and Natural Resources Protection Committee), MOST and SEPA, in order to disseminate CE and mobilize actors.
	I	SEPA organized a learning tour in Japan. In the tour, CRAES and practitioners from pilot EIP and CE Zones were involved in the trip.
Phase 4: cooperation - experimental implementation	M/N	State Council published the programmatic document: Several Opinions of the State Council on Speeding up the Development of CE, which formally decided to promote CE through cooperation of ministries, and NDRC was the major coordinator.
	C	The formal decision of issuing CE promotion law was made, and NDRC was appointed to take the lead. After several seminar discussions, the law was approved and started to have effects.
	L	SEPA published the document with the decisions of SEPA's role of facilitating CE.
	P/H	The first and second batches of CE pilots were initiated in 2005 and 2007 by 6 ministries together, and after 8 years of piloting, and these pilots were evaluated in 2013 by NDRC.
	J	Several meetings, seminars, workshops were organized by NDRC and other actors to mobilize stakeholders.
	M/P	The inter-ministerial joint conference system was established, which was approved by state council.
	MS	NDRC and NBSC made the draft of CE indicators, and after soliciting comments, the indicator system was officially published.
	C-	The decision of CE standardization was made, and several batches of CE standardization pilots were initiated.
	J	NDRC and SEPA together organized the second national CE working meeting to mobilize stakeholders about the initiation of the 2nd batch of CE pilots.

Phase 5: Cooperation implementation - a mixture of experimentation and administration	PD	The first China CE Yearbook (2008) was published, following which a series of yearbooks were published.
	PA	State Council paid particular attention to the CE plan of Gansu Province and Qinghai Province Chaidamu.
	D	CE investing and financing policy was published aiming to attract more public and private capitals into CE.
	M/G/ Hb	The formal decision of initiation the program of urban mining was made, and 7 industrial parks were selected as the first batch pilots.
	MS	The decision of developing CE statistics was made by NDRC and NBSC, for which pilots were initiated and expert team discussions were organized.
	J	The CE planning guidance was published after several thematic discussion meetings organized by NDRC.
	C	China CE Development Plan was drafted, discussed, passed the evaluation, and published for the 2011-2015.
	M/G/ Hb	The decisions of CE Transformation were made, and several batches of pilots were selected.
	J	The decision of CE education base was made, and totally 9 CE education bases were selected and open for visits.
	J	76 firms and industrial parks were selected as advanced CE exemplars to mobilize actors.
	D	The notice on the Management and Regulations of the special funds for CE was issued.
	M/G/ Hb	NDRC made the decision of initiating CE Demonstration City (county) program. Together with the decision, working plan and the guidance of CE city (county) executive plan (on trial), and indicator system of CE Demonstration City (county) was published (on trial).
	M/G/ Hb	The decision of developing low-carbon IP pilots are made by NDRC and Ministry of Industry and Information Technology of China, and the first batch of low carbon IP pilots were selected.

Appendix 4: SUPPLEMENTARY MATERIAL TO CHAPTER 6

Table A6.1 Building Blocks (BB) and Patterns

Program/ PATTERN	BB	DESCRIPTION	EVENT
SIP			
DECOR: single agency -experimental implementation	A	After the provincial election, the new provincial political coalition was established. The new provincial political coalition decided to facilitate SIP in the coming four years, and the Department of Economic Affairs was the major coordination body.	E4/E5
	G	The provincial policy decision of SIP was translated into the provincial program of DECOR with the feature of social experimentation by the Department of EZ.	E7
	D	Provincial policy makers allocated the fund of OFB (industrial park development funds) to support the implementation of DECOR, and The national fund of TIPP was integrated in OFB. To integrate TIPP in OFB, the province had to integrate the goals of saving space into DECOR.	E8/E14
	H	Piloting: 6 industrial park were selected as SIP pilots. In the selected pilot industrial parks, the pilot- provincial network was established. That was, at each pilot, there were two contact people, one from industrial park, and one from province.	E12

	PC	The first project manager of DECOR was fired, and second project manager came: Leo de Klerk, who was very active about SIP.	E13
	A	SIP was decided to be facilitated by the Department of Environmental Protection in the draft of Environmental Plan (2000-2004).	E15
	I	The project manager of DECOR learnt the definition of sustainability from Our Common Future, and thought SIP was the balance of People, Profit, and Planet.	E16
DECOR: Cooperation-experimental implementation	M/O	The project manager of DECOR thought the cooperation among departments was very important in order to achieve people, planet, and profit. So he invited the department of environmental protection to cooperate, and provided abundant funds for the program.	E17
	P	The environmental and economic departments started to work together as a coalition to implement DECOR.	E18
	I	The coalition developed the planning grant to support research, planning, and feasibility studies of DECOR project. And also, the The regional knowledge platform was gradually built up with the aim of exchanging knowledge regarding SIP of regions.	E23/E26
	AT	The coalition started to connect SIP with existing regional governance system through account managers, the spatial planning, environmental license,and park management.	E25/E27/E28/E34
	J	the coation started to organize education classes and symposiums, publish handbook to educate, mobilize, and orient about DECOR and SIP.	E29/E30/E32/E31/E33
	K	The 6 pilots of DECOR were evaluated by the coalition, support by TNO.	E37
sustainable entrepreneurship: single agency -experimental implementation	A	The Sustainable Entrepreneurship was decided to be implemented in the Environmental Plan in South Holland (PDO).	E20
	B	The program of Sustainable Entrepreneurship was initiated and was mainly coordinated by the Department of Environmental Protection.	E21
	D	The Department of Environmental Protection provided the fund of MSF to subsidize the projects regarding Sustainable Entrepreneurship.	E22
	A	The Policy Plan Water and Environment 2000-2004 was decided to be extended to 2006.In this situation, the program of sustainable entrepreneurship (PDO) was decided to be continued. The main theme of PDO was adjusted to SIP and sustainable greenhouses, and implemented by the Department of Environmental Protection.	E40/E41
	D/H	The Department of Environmental Protection provided the subsidy of MSF to support good projects.	E42
	J	The Environmental Department organized four master classes each year to educate stakeholders about sustainable related themes in this administrative period.	E50
Sustainable Working Landscape: single agency -experime	A	The Policy Plan Green, Water and Environment 2006-2010 was published, which decided to facilitate the development of SIP.	E53
	G	The Department of Environmental Protection initiated the program of Sustainable Working Landscape highlighting a novel idea about SIP.	E54

ntal implement ation	D	The program of sustainable working landscape was co-financed by MSF and other provincial budget, mainly OFB.	E55
	PU	After the election in South Holland, the new provincial council was formed. In this coalition, CU/SGP got on board, which claimed the integration of environment and economy.	E56
	K	Evaluation: projects subsidized by MSF during 2003-2006 was evaluated by the Department of Environmental Protection.	E59
	F	It was decided that MSF was decided to be stopped based on the idea of integrating the provincial environmental and economic funds.	E60/E 67
	M	The decision of the integration of environmental and economic funds also caused the necessary of integration the environmental goals into economic goals of industrial parks.	E60/E 67E61
	Q	Department of Economic Affairs and the Department of Environment started to develop Target Image, supported by a consultant firm.	E62
	H	The Department of Economic Affairs actively looking for good projects, most of which were subsidied by UHB. In the program, target image was recommended.	E69
multiannu al program		After the provincial election of South Holland, a new provincial council was formed. decision of taking the results regarding SIP of DECOR a step further was announced in the Coalition Program of Province of South Holland 2003-2007.	E35/ E38
		The Coalition decision was translated into the Multiannual Program of industrial parks 2004-2007.	E47
		The concept of Southern Wing was emerging in the policy agendas. (super-regional perspective - relate with TOPPER)	E39
		The tender of OFB continued for the Multiannual Program of industrial parks 2004-2007. In addition, The Department of Economic Affairs incorporated Topper from national government to the Multiannual Program of industrial parks 2004-2007.	E48/E 39
		The Economic Department organized four master classes each year to educate stakeholders about the available resource and how to apply in this administrative period.	E51
		Evaluation: the Multiannual Program of Industrial Park - step forward was evaluated. The final evaluation report was published.	E57
action/imp lementatio n program		The coalition agreement of "sustainable thinking, dynamic doing" was formed. In this coalition covenant, the target of 750 hectare restructuring and 250 hectare new industrial park were set.	E58
		The Department of Economic Affair initiated the Action Program of Space for Economy 2007-2011: policy framework and instruments. And this program was further elaborated by the Department of Economic Affairs into Implementation Program of Space for Economy 2008-2011.	E63/E 68
		The Department of Economic Affairs allocated the fund of UHB and Planning Grants for the Action Program. For the application of UHB, target image was set as the criteria.	E64
		The Department of Economic Affairs published the Guide of Social Cost-Benefit Analysis of Sustainable Industrial park to orient stakeholders about the restructuring task.	E73

Restructuring Program		4 Civil Servants working on SIP in the Department of Environmental Protection was relocated to the Department of Economic Affairs: This related with the decision of integration of environmental and economic goals regarding industrial parks.	E74
		The Covenant toward Sustainable Industrial Park of South Holland was signed through which municipalities together committed to 820 hectares of restructuring.	E75/74
		The decision in the Covenant toward Sustainable Industrial Park was translated into the Restructuring Program Industrial Park South Holland 2009-2013, coordinated by the Department of Economic Affairs.	E76
		The fund of UHB and planning grants were provided to the Restructuring Program Industrial Park South Holland 2009-2013.	E77
		The Department of Economic Affairs organized four master classes each year to educate stakeholders.	E78
		The instrument of 0-measurement was developing in order to monitor the progress of restructuring industrial parks, but it was stopped after a while, as it caused to much labour and cost.	E79
		The Department of Economic Affairs started to evaluate UHB.	E80/E81

ACKNOWLEDGEMENT

During the PhD research, I could not have achieved so much without the help of my supervisors and colleagues. I would like to express my appreciation and gratitude to the "supporter network" behind me. My first special appreciation is given to the supervisor Geert Teisman. He can always point out exactly what the problems of my work are and then has motivated me to find the best solutions. At the last stage, he has played an important role in guiding me to synthesize all the materials into a coherent piece of work. I also appreciated the way of his supervision, that is, I do get the freedom to do the research that I feel very interested in, and meanwhile, he gives continuous and valuable feedbacks.

My sincere thanks are also given to the supervisor Frank Boons. Without his help, I would not have the chance to experience the great research atmosphere and to do the research in this beautiful country. His encouragements and patience have enabled me to do better in my research and communication, and meanwhile I become an independent researcher gradually under his heuristic supervision. His comments on my work were always sharp, and this pushed me to carve the thesis all long. I also appreciate his patience and help in sorting out my worries on adapting to the Dutch style of research and social life.

Studying in a foreign country is fresh but uneasy. I would like to thank my colleagues, Lasse Gerrits, Joop Koppenjan, Henrikke Baumann, Yi Liu and Wouter Spekkink. I have enjoyed talking with Lasse about the cultures in Asian countries and the Netherlands. He also shared his PhD research experience with me, and this shows the importance of an energetic and creative mind in becoming a good researcher. Joop is very kind, and I felt very welcomed when he showed me Rotterdam and invited me to celebrate Dutch traditional holidays. Henrikke shared a lot with me about how to adapt to the new environment. Her persistence in interdisciplinary studies has inspired me to continue my work on "policies" and "industrial symbiosis", and I enjoy interdisciplinary research now. Yi had lunch talk with me everyday during her one-year visit here, and she taught me to resolving problems in gentle ways. I also would like to thank Wouter. We were the two PhD students here working on industrial symbiosis. He helped me a lot in the research design and methodology of the thesis.

Thanks are also due to my friends and officemates. Yanwei Li and I came here together, and we shared many excitements as well as disappointments about our studies. Ruxi Wang is my close friend and a nice roommate, and we became to know each other when we tried to find partners to go to the gym. Diana Giebels and I had many nice chats about our studies and future careers. Her attitudes on research reminded me that I need to devote more time and energy to the research. I also thank Qiaomei Yang for her great help in preparing all the paperwork and printing the thesis when I was away in China. I would like to thank my two officemates Guido van Os and Lieselot VandenBussche. It was joyous time when we were sharing the office. Guido is the first person who introduced the Dutch culture to me. Lieselot and I discussed many diverse topics, and I also enjoyed very much of the hang out. I also thank Saskia van Broekhoven, Bonno Pel, Mansee Bal, Jingjing Liu, Wei Sun, Qiushi Liang, Sanne Grotenbreg, Chang Yu, Wen Xin, Hongchun Zhang, Da Chi and Qiong Gong for their help. You have enriched my life in Rotterdam. Special thanks are given to Aleida van den Akker. She talked to me a lot about sustainable industrial parks in South Holland and helped me contact interviewees, which made the Dutch case study more tangible.

Finally, I am deeply thankful to my parents and my husband for their unconditional love, supports and sacrifices, always putting my needs ahead of their own.

ABOUT THE AUTHOR

Wenting Jiao studied at School of Earth and Environmental Sciences, Lanzhou University, China from 2004-2008 and obtained the Bachelor Degree in Geography. She continued to conduct her postgraduate study for the Master Degree in Human Geography at the same school from 2008-2011. She developed great interest in interdisciplinary studies about policies and Sustainable Industrial Clusters, when participating in many research projects on regional development of Eco-industrial parks and Circular Economy. Then she got the Joint Scholarship of Erasmus University Rotterdam and China Scholarship Council for the PhD research at Department of Public Administration and Sociology, Erasmus University Rotterdam, the Netherlands from 2011-2016. Her PhD research topic builds on policy facilitation of the development of Sustainable Industrial Clusters. In these years of study and research, she has obtained many awards and scholarships from Lanzhou University, China Scholarship Council, and Ministry of Education of China. She has also published several international peer-reviewed articles such as in Journal of Cleaner Production, Journal of Industrial Ecology, Resources Conservation and Recycling.