



Low-carbon promises and realities: Lessons from three socio-technical experiments in Shanghai

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ABSTRACT

China's ongoing transition to a modern urban-centered economy is accompanied by ambitions of sustained economic growth as well as promises of environmentally sustainable futures for its cities. In this paper we critically assess how these two ideas are combined and translated into realities on the ground by examining three low-carbon development projects in Shanghai: Anting New Town, Dongtan Eco-City, and Hongqiao CBD's low-carbon transportation hub. By mobilizing insights from the academic field of Sustainability Transitions – specifically on expectations, experimentation and innovation journeys – we show how the original plans derailed and why until now there has been limited success in living up to the promises of sustainability. To realize the promises more fully in future projects we identify three broad lessons for the actors involved: they should nurture a set of parallel pathways, foster a more experimentalist mindset, and learn to embrace uncertainty.

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1. Introduction

The ancient painting *Qingming Shanghetu* has been the exemplar for what desirable urban life in China in looks like. Painted in the early 12th century, it depicts a mix of economic activities and a broad range of lifestyles that together symbolize the vitality, continuity and social and natural harmony of a compact city clearly defined within its city walls. Today, the reality is very different: the pace of urbanization accelerated over the past two decades and this is reflected not only in the physical reality of territorial and material growth but also in the emergence of a new political economy of urban expansion and the rising prominence of an ideology of urbanism. According to Hsing (2010) these three elements combined dominate the logic of China's transformation. This urban transformation is epitomized in many new towns, high-tech industrial parks and advanced transport hubs at the fringes of Shanghai and

other megacities (Den Hartog, 2010, 2017).

The advent of urban modernity has created many new opportunities, but simultaneously new problems have appeared in terms of the environment (Zhao et al., 2006; Economy, 2007). The emergence of 'urban headaches', such as CO₂ emissions, air pollution and environmental degradation have put new policy approaches on the agenda to foster green growth (Chang et al., 2016). One of the key solutions advocated are massive new construction projects endorsed by ambitious labels, such as 'eco-city', 'ecological model town' or 'low-carbon transportation hub'. These projects promise a decreased carbon footprint, a clean environment and a better quality of life in these new urban centers (Wu, 2012; Lu et al., 2017).

This paper investigates the promises and realities in terms of sustainability features in three promising urban development projects around Shanghai. We focus on Shanghai because it is a frontrunner city in China in terms of its ambitions for green urban renewal. We investigate three of the most ambitious and internationally recognized sustainability oriented development projects: Anting New Town, Dongtan Eco-City and Hongqiao CBD's low-carbon and transportation hub. For each case we critically assess how initial visions were translated into outcomes on the ground. We also identify overarching patterns across the cases and

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formulate broad lessons on how such projects can contribute to a more sustainable urban future.

The paper is structured as follows. Section 2 introduces three key concepts (expectations, socio-technical experimentation and innovation journeys) that are useful tools to help assess the promises and realities of sustainable development projects. Section 3 elaborates on our methodological approach and the selection of the three cases. Section 4 describes the dynamics for each of cases. Section 5 synthesizes the findings and identifies overarching patterns and concludes by formulating lessons for practitioners.

2. Theory: expectations, experiments and journeys

This paper is concerned with the transformation toward radically more sustainable future cities, and in particular how urban development projects imbued with environmental promises might contribute to this goal. To conceptualize this contribution we draw on insights from the field of Sustainability Transitions. Scholars from this field investigate major shifts toward sustainable socio-technical systems of production and consumption. The study of socio-technical transitions to sustainability draws on a wide range of literature and lines of thought (such as neo-institutional theory, evolutionary economics and Science and Technology Studies) and a variety of frameworks and approaches (such as the Multi-level Perspective, Strategic Niche Management and Transition Management) to express how promising visions of a sustainable future can become a material reality in experimental development projects and how these can be empowered in order to transform the unsustainable incumbent order (Grin et al., 2010; Markard et al., 2012).

To investigate the promises and realities of green development projects, we mobilize three core concepts from the Sustainability Transitions field. They serve as ‘sensitizing concepts’ for the empirical analysis and structuration of our argument (Blumer, 1954). The concepts are: (1) expectations, (2) socio-technical experimentation and (3) innovation journeys.

To investigate how actors are bound together in green development projects that harbor a particularly appealing vision of the future, scholars from the field of Sustainability Transitions often mobilize the concept of *expectations*. Expectations can broadly be defined as “statements about the future – uttered or inscribed in texts or materials – that circulate” (Van Lente, 2012: 772). The main idea here is that expectations are not merely descriptive statements that are either true or false, but that they ‘do’ something. Expectations lead to action when they are articulated – spoken, written, drawn or otherwise rendered visually – in a particular context or situation through a particular medium by a particular actor. In other words, they are ‘performative’ in the sense that they help create a new reality by providing heuristic guidance (Rip and Kemp, 1998); by coordinating roles and activities amongst actors (Konrad, 2006); and by legitimizing certain investments (Borup et al., 2006). The articulation of expectations is one of the key processes in facilitating or managing sustainable innovation journeys and to do this successfully the expectations should be robust (shared by multiple actors), specific (if expectations are too general they do not give guidance), high-quality (the content of expectations is substantiated by ongoing hands-on projects) (Schot and Geels, 2008).

Because the notion of expectations is very broad some scholars prefer more specific concepts to highlight how actors can engage with the transformation toward sustainable cities. Some have emphasized the need for setting up so-called Urban Transition Labs to deploy and learn about trajectories of sustainable urban development (Nevens et al., 2013). A key part in this process is the formulation of an explicit ‘transition vision’ (Loorbach, 2007). This is seen as a deliberative activity whereby a group of actors

(‘frontrunners’) formulate an overarching direction for future development together. The idea is that these actors agree on basic principles for longer-term development whilst leaving room for dissent on the details and the shorter term. In this deliberative process of envisioning the different actors involved learn about each other’s perspectives and values, about the complexity of setting up projects to achieve sustainable development, about the uncertainties regarding the future and about the possibilities of cooperation. Sengers (2016), on the other hand, emphasizes that envisioning is not necessarily a formal and deliberative process, but a more implicit process whereby ideas about the future gradually become more substantiated and specific. He argues that urban sustainability transitions are journeys that start out in the minds of individual actors (‘change agents’) as vague conceptual images inspired by far-flung ideals, which are later articulated as ‘urban imaginaries’ – defined as shared understandings of what constitutes a desirable future city. This implies that envisioning urban sustainability transitions are fundamentally about ‘re-imagining places’ (Hodson and Marvin, 2009), and that the actors involved have to some extent similar ideas about what the future ought to look like for a designated urban area and about what actions need to be undertaken to achieve this.

To turn visions into reality actors engage in a process of *socio-technical experimentation*. Ideas that look appealing on paper and sound good in words have to be applied in real-life settings in order to be tested and developed further. In the context of transitions in the urban environment, experiments are seen as important seeds of change that may eventually lead to a profound shift in the material and social organization of the city. The hope is that the learning and demonstration effects of small-scale experiments lead to larger-scale experiments and contribute to the overall momentum of the main principles behind these experiments in eventually replacing established principles of urban development (Sengers et al., 2016).

Scholars from the field of Sustainability Transitions argue that the notion of experiment has a rather distinct meaning, unlike the way the term is used in the natural sciences and more akin the term pilot project (Weber et al., 1999; Vergragt and Brown, 2007; Van den Bosch and Rotmans, 2008; Berkhout et al., 2010). We could say that experimentation in the natural sciences takes place under strictly controlled laboratory conditions as a way to find hard objective truths about the reality out there, but that experimentation for sustainability takes place in a real-world environment without strict laboratory conditions whereby a variety of societal actors commit to the messy engage with the introduction of alternative socio-technical systems in order to purposively reshape material realities in a desirable direction. In this sense it might be more accurate to talk about a ‘socio-technical experiment’, which can be defined as: “an inclusive, practice-based and challenge-led initiative, which is designed to promote system innovation through social learning under conditions of uncertainty and ambiguity” (Sengers et al., 2016: 9).

It should be noted that there are six key concepts in this definition and that these can be interpreted in a normative way, in the sense that they prescribe how an experiment would contribute more meaningfully to a sustainable innovation journey. First, an experiment should be inclusive. In order to mobilize the necessary resources and legitimacy projects have to be firmly supported by a number of directly and indirectly involved parties (a deep coalition). A recurring observation in the literature is that the involvement of more active participation or more diversity in the coalition of supporting actors and the perspectives they bring to the table increases the potential for success and to meaningfully learn from the experiment (a broad coalition) (Schot and Geels, 2008). Second, an experiment should be practice-based. It should not be treated as

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