



# Dynamic capability matters: Uncovering its fundamental role in decision making of environmental innovation



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## ABSTRACT

This study aims to explore organizations' intrinsic drivers of voluntarily adopting environmental innovations that are in early stage of diffusion. In particular, it investigates the vital role of dynamic capabilities in the decision-making process of adoption. Adopting a process-oriented model, this study focuses on the initiation (instead of implementation) process of innovation adoption and examines how dynamic capabilities can result in intention of adopting environmental innovation voluntarily. The findings show that dynamic capabilities have positive effects on organizational intention of adoption not only directly, but also indirectly through facilitating managers to interpret environmental innovations as an opportunity, rather than a threat. Furthermore, this partial mediating role of managerial interpretation between dynamic capabilities and environmental innovation adoption varies depending on organizational social position. Compared to central firms, peripheral firms tend to be more responsive to managerial interpretation. The chain from dynamic capabilities, to interpretation of environmental innovation as an opportunity, and finally to the intention of adoption is stronger for peripheral firms than for central ones.

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## 1. Introduction

With the emergence of environmental problems and broader social awareness of environmental issues, environmental regulations have become increasingly stricter. In order to offset the production costs incurred, firms are increasingly engaged in environmental innovation, which may help them to conform to environmental regulations without sacrificing competitiveness. Environmental innovation refers to “any product, process, organizational, social or institutional innovation that is able to reduce environmental impact of economic activity and resource use” (Borghesi et al., 2015, p. 669). It is much more than creating eco-friendly products and technologies; more broadly and critically, it is about making organizational management routines and production process greener (Antonlioli et al., 2013; Berrone et al., 2013; De Marchi, 2012). Environmental innovation is multidimensional

and complex, which can cause a more profound institutional change. Its primary goal is to protect environment; however, the results are often intangible, lagging, uncertain, and unpredictable, especially when it is in the early stage of development and diffusion.

The existing literature has predominately focused on the role of extrinsic factors that force firms to adopt environmental innovations, such as governmental regulations, social legitimacy and stakeholder pressure (Darnall et al., 2010; Hoogendoorn et al., 2015; Lee et al., 2016; Li et al., 2016; Popp and Newell, 2012). In order to gain legitimacy, it is necessary that firms engage in environmental innovation to comply with regulations (Ashford and Hall, 2011), keep pace with technological environment at the industry level (Pondeville et al., 2013; Singh et al., 2015), respond to societal expectations and behave in accordance with norms prevalent in the institutional field (Bossle et al., 2016). Nevertheless, these extrinsic factors fail to explain what makes firms adopt an environmental innovation when it is in the early stage of diffusion and has yet been adopted widely. Social legitimacy is effective and related regulations might be introduced only when an innovation is accepted wildly (Massini et al., 2005; Popp et al., 2011). In that sense, extrinsic factors might not be the only drivers of innovation

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adoption, and perhaps not the most fundamental ones, at least in the early stage of innovation diffusion. In fact, when an innovation emerges, all firms are embedded in the same external environment, face the same opportunity and therefore are regulated by the same extrinsic factors. However, some firms choose to adopt the innovation while others reject it. Mere extrinsic factors cannot explain this phenomenon. Instead, researchers should take factors from within into consideration. Therefore, in this study, we aim to fill this gap by examining intrinsic factors that may influence firms' environmental innovation adoption.

One intrinsic driver of environmental innovation adoption that we examine in this study is firms' dynamic capabilities. Given the unpredictability inherent in the outcomes of environmental innovation, simply accumulating "static" resources (e.g., a stock of technological assets and professionals, relative to corporate abilities to make timely responsiveness and effective redeployment of various resources) is insufficient to ensure the success of environmental innovation in the ever-changing environment (Teece et al., 1997; Teece, 2007). What is more important is to have difficult-to-imitate dynamic capabilities that can integrate, learn and reconfigure internal and external resources and knowledge to create and deploy environmental innovation in a rapidly changing competitive environment (Wilhelm et al., 2015). So far, little research has examined the fundamental role of dynamic capabilities in the adoption of environmental innovation.

Organizational innovation adoption does not happen overnight, but rather through a process (Birkinshaw et al., 2007, 2008; Rogers, 2003) that can be divided into two sub-processes. First, initiation, which is a process of "information gathering, conceptualization, and planning for the adoption of an innovation, leading up to the decision to adopt" (Rogers, 2003, p. 420). Second, implementation, which includes "all of the events, actions, and decisions involved in putting the innovation into use" (Rogers, 2003, p. 421). In this study, we advocate such a process-oriented model of innovation adoption, but only focus on the initiation process, as no action would be taken without the decision of adoption. Specifically, we explore how dynamic capabilities shape the decision-making process that lead to the decision of environmental innovation adoption.

We explore the effect of dynamic capabilities by addressing two research questions. First, what is the process that dynamic capabilities lead to organization's decision of adopting environmental innovation voluntarily without any regulatory requirement? Specifically, we will examine the direct effect of dynamic capabilities, as well as their indirect effect through managerial interpretation of environmental innovation. Second, what is the boundary condition of this adoption mechanism driven by firms' dynamic capabilities? We will examine whether the proposed mechanism can apply to all organizations. The rest of the article is organized as follows. In Section 2, we present the research context of the study, Chinese Emission Trading Scheme (ETS) and discuss why voluntary intention of participating in ETS can be regarded as an environmental innovation. In Section 3, we develop four hypotheses and a structural model of the relationships between dynamic capabilities and intention of adopting environmental innovation. Section 4 presents how we collected data and measured the variables. We report our statistical methods and the results in Section 5. Finally, in Section 6, we discuss the findings and their theoretical and practical implications. We also discuss the limitations of this study and suggest directions for further research.

## 2. Research setting

Environmental innovation is a multidimensional concept. As such, what can be conceived as environmental innovation remains

ambiguous. Much literature, based on a result-oriented method, has used tangible environmental technological innovation (i.e., patents) to represent environmental innovation (Berrone et al., 2013; Oltra and Saint Jean, 2009; Wagner, 2007). We believe that environmental innovation is far more than merely technological innovation. It is any innovative means (often strategic) that firms use to produce products and services, which can reduce the impact on environment, and to become environmentally innovative (Bossle et al., 2016). It can be considered as a paradigm shift, which fundamentally challenges firms to adapt their corporate culture, strategies, routines, and organizational structure to keep functioning efficiently. From this point of view, we regard firms' voluntary participation in Chinese national Emission Trading Scheme (ETS) as a form of engaging in environmental innovation in this study.

ETS is a cap and trade system for carbon dioxide emissions. It aims to reduce the carbon emission by creating a carbon market where firms can buy and sell emission permits. Each firm that participates in the ETS is assigned a cap, which refers to a yearly permitted amount of emissions, depending on various factors such as the industry it belongs to, its production rates, technology in use, and the industrial structure of the city it is located in and so on. If a firm exceeds the assigned cap, it would be subject to monetary and/or administrative penalties. Alternatively, it can also purchase emission permits from other firms in a carbon market to evade penalties. On the contrary, if a firm's emission is below the cap, it can either save the permits for future use or sell them in a carbon market. In this way, ETS can help reduce the carbon emission by increasing the firms' costs of making pollution. Hence, saving carbon emission permits can bring firms with additional resources for their production. Consequently, whether and how to reduce carbon emission to keep it below the cap becomes an important strategic decision for firms.

At the end of 2011, China launched pilot ETS in seven cities (i.e., Beijing, Shanghai, Shenzhen, Guangzhou, Tianjin, Chongqing, Hubei). The seven pilot ETSs involve about 2250 industrial firms that generate about 1.2 billion tons carbon permits every year, making them the second largest carbon market after the European ETS (Qi and Chen, 2015). In these pilot ETS regions, it is required that firms exceeding a threshold of yearly carbon emission participate in ETS, whereas others can choose to participate voluntarily.

ETS is a typical market instrument that has been developed in a bottom-up path in developed economies (Stavins, 2003). In those countries, the diffusion of ETS is driven by business firms. On the contrary, in China, a transition economy, it is a completely new concept and is imposed by the central government on business firms. This top-down approach makes it very challenging to implement ETS successfully among Chinese firms that have little experience with it. In the seven pilot regions, many firms were forced into a pilot ETS and have been struggling since then, whereas few other firms, if any, chose to participate in ETS voluntarily.

Chinese central government has declared that the national ETS will be launched in 2017 (Economist, 2017). It means that ETS will have profound influence on Chinese firms' production and management (Zhou et al., 2016). Given its newness and challenges involved in ETS, a firm's voluntary participation in the national ETS can manifest its enormous commitment to an overhaul of the firm's operating and managing system. It means that the firm is willing to take the initiative to assume environmental responsibility and to restrain its carbon emissions through not only technological and productive innovation, but rather a more complex change of corporate strategy, organizational culture and business philosophy in order to adapt to ETS (Borghesi et al., 2015). This is consistent with our concept of environmental innovation. Therefore, this research aims to explain firms' intention to adopt voluntarily the national ETS in China once it is launched.

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