



Environmental innovation and its impact on economic and environmental performance: Evidence from Korean-owned firms in China



Xingle Long^{a,*}, Yaqiong Chen^a, Jianguo Du^{a,*}, Keunyeob Oh^b, Insoo Han^b

^a School of Management, Jiangsu University, Zhenjiang 212013, PR China

^b College of Economics and Management, Chungnam National University, Daejeon 305764, Republic of Korea

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ABSTRACT

This paper analyses the impact of environmental innovation on the economic and environmental performance of Korean-owned firms in China. We establish a theoretical model and propose eight hypotheses, which combine TPB (Theory of Planned Behavior) with theories of global environmental management and environmental innovation. We analyse the determinants of environmental innovation intention. We also analyse the effects of environmental innovation behavior on economic performance and environmental performance in different provinces and of different corporate ownership. We find that environmental innovation behavior has a greater effect on environmental performance than economic performance. Innovation in production processes, in particular, positively affects environmental performance for Korean-owned firms in Jiangsu. We also find that wholly Korean-owned firms (WKOEs) are more receptive to environmental innovation than Sino-Korean joint ventures. It is important to enhance environmental innovation within Korean-owned firms in China. Environmental innovation should concentrate on improving production processes in Jiangsu.

1. Introduction

With the development of industrialisation, global warming has become more severe. We face a conflict between economic development and environmental damage on a scale not previously envisaged (Chen, 2015). Urbanisation and associated investments in infrastructure – including railways and airports – have led to increased use of cement, iron, steel and glass. These energy-intensive industries contribute to growing carbon emissions. Thus, it is imperative to reduce energy consumption by these industries to promote green transformation. The key to green economic transformation is innovation, which increases efficiency (Wu, 2012).

Most Chinese firms have low environmental innovation capacity, as they are dependent more on “end-of-pipe” reductions (Chen, 2015). They are not in a position to solve the problem of environmental pollution. The aim of environmental innovation is to avoid or reduce the damage to the environment through new or improved crafts, technologies, systems and products (Kemp et al., 2002). Environmental innovation can solve the problem of environmental pollution at the source.

Most FDI (Foreign Direct Investment) firms lie in a core position in the global value chain. Their environmental behavior influences the environmental innovation decisions of other firms in the production

chain. For this reason, it is important to analyse the behavior of FDI firms engaging in environmental innovation. Innovation by FDI firms may result in the adoption of advanced production and pollution-abatement technologies by local firms through horizontal and vertical technology spillovers. Furthermore, such behavior may serve as an example for local firms, thus encouraging the development of improved environmental technology and reductions in local environmental pollution. China is the largest FDI destination of Korean firms, attracting some multinational corporations (such as Samsung and Hyundai) and a number of small and medium enterprises (SMEs).

If the home country has stringent environmental regulation, polluting firms will pay environmental compliance fees, which will increase the production costs of these firms. China's environmental regulation is relatively relaxed. Many foreign firms, including Korean firms, are therefore tempted to relocate from their home country to China. We call this the “pollution haven hypothesis”. For example, LG Chemical has invested in Nanjing, Jiangsu Province, and SK Group has invested in the chemical processing of coal in Zaozhuang, Shandong Province. These heavy industries seriously pollute the natural environment and may harm local citizens' health. It is therefore important to investigate the effects of environmental innovation on the economic and environmental performance of Korean-owned firms in China.

The research questions are as follows. What are the antecedent

* Corresponding authors.

E-mail addresses: longxingle@163.com (X. Long), djg@ujs.edu.cn (J. Du).

determinants of environmental innovation intention? What is the relationship between environmental innovation intention and behavior? How does environmental innovation behavior affect economic and environmental performance? How does different environmental innovation behavior impact economic and environmental performance? How does environmental innovation behavior influence economic and environmental performance of different provinces and ownerships?

To address the above research questions, this paper concentrates on the effects of environmental innovation on the economic and environmental performance of Korean-owned firms in China. The research motivations are as follows. First, we extend the TPB framework by combining TPB with theories of global environmental management and environmental innovation. Second, we explore the determinants of environmental innovation intention among Korean-owned firms in China. We then analyse the different effects of environmental innovation behavior on environmental and economic performance. Finally, we explore the role of environmental innovation behavior in environmental and economic performance across different provinces and for different forms of corporate ownership.

The structures of this paper are as follows. We present related literature reviews and hypotheses in Section 2. Methodology is presented in Section 3. We discussed the different roles of environmental innovation behavior on environmental and economic performance across different provinces and ownerships in Section 4. We propose conclusions and policy implications in Section 5.

2. Materials and hypotheses

Multinational corporations (MNCs) have a mixed environmental impact on local economies. When MNCs pollute the natural environment in their home country, they are required to pay high environmental compliance costs. In order to keep production costs down, MNCs are tempted to relocate from countries with stringent environmental regulation to countries with more relaxed environmental regulation. We call this the “pollution haven hypothesis”. On the other hand, MNCs tend to implement environmental policies or performance standards that surpass the requirements of local government regulation; we call this the “self-regulate” hypothesis (Christmann and Taylor, 2001; Christmann, 2004).

Stringent environmental regulation can stimulate firm's environmental innovation through enhancing production equipment and processes, which can improve the productivity and increase profits (Porter and Linde, 1995). Brunnermeier and Cohen (2003) indicated that pollution abatement expenditure can positively affect environmental patents, however, the impact is weak. The maturity of environmental management systems positively influence environmental process innovations (Rennings et al., 2006). Environmental innovation positively affect financial performance (Judge and Douglas, 1998). Environmental innovation can positively impact environmental performance (Fronzel et al., 2010; Li, 2014).

We establish an extended TPB model by combining TPB, theories of global environmental management and environmental innovation (see Fig. 1). The framework incorporates eight variables as follows: attitude towards environmental behavior, subjective environment norm, perceived environment behavioral control, global environmental management, environmental innovation intention, environmental innovation behavior, environmental performance and economic performance. We implement 7-point Likert scale according to Zhang et al. (2014). We also propose 8 different hypotheses according to theoretical model.

2.1. Theory of planned behavior

Ajzen, (1985, 1991) proposed theory of planned behavior (TPB), which incorporates attitude towards the behavior, subjective norm, perceived behavioral control, intention, and behavior. TPB has been

used in many fields (Chen and Tung, 2014; Zhang et al., 2014; Wang et al., 2016). Zhang et al. (2014) investigated the determinants of employee' electricity saving through TPB, they found that perceived behavioral control positively affects employees' intention to save electricity.

Attitude toward the behavior is the multiplicative combination of behavioral beliefs and outcome evaluations, which might be positive or negative. If one person has a favorable attitude toward environmental innovation, he or she has more possibility to intent environmental innovation (Ajzen, 1991). Chen and Tung (2010) revealed that attitude toward behavior had significant effect on consumers' intentions on recycling. Intention is defined as that a person intends to perform the behavior, he or she should succeed in doing so, when he or she has the required opportunities and resources (Ajzen, 1991). According to TPB, we propose Hypothesis 1 as follows.

Hypothesis 1: Attitude toward environment behavior might positively affect environmental innovation intention.

Subjective norm is the combination of the strength of each normative belief and motivation to comply with different social referent (Ajzen, 2012). Chen and Tung (2014) analyzed consumers' intention to visit green hotel through extended TPB which incorporates environmental concern and perceived moral obligation, they found that subjective norm positively impacts consumers' intention to visit green hotels. Chen and Tung (2010) introduced moral norms and consequences of recycling into TPB, they found that subjective norm positively affect consumers' recycling intentions. Wang et al. (2016) found that subjective norm significantly affect consumers' environmental concern on their intention to adopt hybrid electric vehicles. According to above literatures, we propose Hypothesis 2 as follows.

Hypothesis 2: Subjective environment norm might positively impact environmental innovation intention.

Perceived behavioral control is termed as “the extent to which people believe that they are capable of, or have control over, performing a given behavior” (Ajzen, 2012). If people believe that they have more capacity to save electricity, they are more likely to persevere and, therefore, to achieve success (Ajzen, 2012; Zhang et al., 2014). Wang et al. (2016) revealed that perceived behavioral control had significant positive effect on consumers' intention to purchase hybrid electric vehicles. When firms have higher capacity of environmental innovation, they are much easier to solve obstacles they would face. Therefore, stronger perceived behavioral control can promote environmental innovation intention. We are expecting that perceived environment behavioral control positively affects intention of environmental innovation. As sated above, we propose Hypothesis 3.

Hypothesis 3: Perceived environment behavioral control might positively influence environmental innovation intention.

2.2. Global environment management and environmental innovation intention

MNCs can self-regulate their environmental behavior through standardizing their environmental policies globally (Christmann, 2004), which can reduce environmental pollution of host country. The global environmental policy or management mainly incorporate three classifications: setting stricter minimum global environmental performance standards, standardizing operational environmental policies, and global standardization of environmental communication (Christmann, 2004). Because MNCs often have relatively higher environmental innovation technology, we propose Hypothesis 4 as follows.

Hypothesis 4: Global environmental management will positively impact environmental innovation intention.

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