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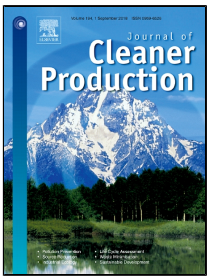

Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective

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Green entrepreneurial orientation for enhancing firm performance: A dynamic capability perspective

Abstract

Despite much attention has been focused on the importance of green entrepreneurial orientation, its impacts on environmental and financial performance remains unclear. Drawing on dynamic capability theory, we hypothesized that green entrepreneurial orientation has positive influences on two types of firm performance. The relationship between green entrepreneurial orientation and firm performance is moderated by green technology dynamism and knowledge transfer and integration. We tested the research hypotheses using data from 264 Chinese firms. The results indicate that green entrepreneurial orientation has positive influences on both environmental and financial performance. In addition, green technology dynamism only negatively moderates the relationship between green entrepreneurial orientation and environmental performance, while knowledge transfer and integration positively moderates the relationships between green entrepreneurial orientation and environmental and financial performance. This study enhances our understanding on green entrepreneurial orientation, described as a dynamic capability, can exploit new ideas and encourage innovativeness, show a propensity to catch potential opportunities, and take risks in transforming the social economy into the social-ecological economy. This study provides suggestions for firms to achieve competitive advantages under conditions of uncertainty and for effective knowledge transfer and integration.

Keywords: green entrepreneurial orientation; dynamic capability; firm performance; moderating effect

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1 Introduction

As environmental issues are becoming increasingly significant threats to economic growth, firms regard human health and living conditions as integral parts of core business activities (Leonidou et al., 2017; Liu et al., 2016). Government and scholars are also paying more attention towards environmental degradation and focus on the solution of environmental issues (Boons et al., 2013). In particular, recent research has suggested that green entrepreneurial orientation (GEO) plays crucial roles in achieving better financial performance as well as minimizing environmental impacts (Parry, 2012; Schaefer et al., 2015).

In this study, GEO refers to a predisposition to pursue potential opportunities that produce both economic and ecological benefits through the introduction of eco-friendly products and services (Dean and McMullen, 2007; Gibbs and O'Neill, 2014). Although the core motivation for green entrepreneurship as well as the benefits of green entrepreneurship (e.g., economic, environmental, and social value) have been addressed in previous research (Gast et al., 2017; Kirkwood and Walton, 2014; Thompson et al., 2011), how GEO influences environmental and financial performance remains unclear.

Our understanding of the conditions under which GEO influences environmental and financial performance is far from comprehensive. While some studies propose a negative relationship between a tangible-external greening strategy in the form of offering green products and services and firm performance (e.g., Shrivastava and Tamvada, 2017), others demonstrate a positive impact of green entrepreneurship on

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financial and environmental performance (e.g., Hockerts and Wüstenhagen, 2010; Gibbs and O'Neill, 2012). Some even indicate that the encouragement of entrepreneurship is not appropriately associated with financial benefits (Nikolaou et al., 2011; Parrish, 2010) and firm growth (Leoncinis et al., 2017). Considering the inconsistent findings for the performance outcomes of GEO, we focus on an important factor of the external environment which is rarely taken into consideration.

This study explains the relationships between GEO and two types of firm performance from the dynamic capability perspective. The firm-level capabilities are fallen into two separable dimensions: ordinary capabilities and dynamic capabilities (Teece, 2014a). Whereas ordinary capabilities involve the operational performance of business functions that are related to task activities, dynamic capabilities are about sensing, seizing, and transforming. Dynamic capability theory (DCT) describes that dynamic capabilities are higher-order capabilities to select, develop, and coordinate ordinary capabilities (Teece et al., 1997). Following Teece's (2016) ideas, dynamic capabilities are about learning and supporting experimentation, recombining resources to grow in new products, and transforming the existing system. GEO is undergirded by three sets of organizational processes: green innovativeness, proactiveness, and openness to risk and vulnerability. Thus, GEO appears to be associated with the notions of dynamic capabilities (York and Venkataraman, 2010).

Firms adopting GEO may contribute to superior environmental performance by several mechanisms. First, GEO addresses environmental issues by creating green products and services (Chen and Chang, 2013). Second, the reduction of hazardous

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emission or toxic materials improves safety and health at work (Xie et al., 2016). Third, focusing on consumer safety and health increases social welfare (Chuang and Yang, 2014). Similarly, GEO enables a firm to enhance financial performance by three channels. First, green product and process innovations address energy or resource costs (Chuang and Yang, 2014). Second, being an active posture in the pursuit of green opportunities may achieve first-mover advantage (Pacheco et al., 2010). Third, a willingness to invest large amounts of resources to projects that report unusual gains or losses (Woldesenbet et al., 2012). Taken together, GEO may improve environmental and financial performance.

The relationship between GEO and firm performance may be distinct under different environmental conditions (Jiang et al., 2016; Saeed et al., 2014; Shirokova et al., 2016). By managing knowledge effectively, firms can effectively implement their entrepreneurial orientation (Bojica et al., 2012; Patel et al., 2015). This study focuses on the impacts of knowledge management capabilities on the relationship between GEO and firm performance. Changes in a dynamic environment may facilitate knowledge creation, search, and diffusion, and knowledge exchanges are identified as improved indicators of knowledge creation capabilities (Denford, 2013; Sirmon et al., 2007). In this study, a rapidly changing technological environment is considered as green technology dynamism (GTD), and a process of acquiring, recognizing, absorbing, and transferring internal knowledge into new organizational activities is referred to as knowledge transfer and integration (KTI) (Nieves and Haller, 2014; Real et al., 2014; Sheng et al., 2011). Drawing upon DCT, firms adopting a strong

GEO will achieve competitive advantages by enhancing their eco-knowledge absorption capabilities (Pérez-Luño et al., 2011). Similarly, firms adopting GEO will achieve competitive advantages by leveraging internal knowledge of the firm to create new knowledge and offer a base for innovation (Clercq et al., 2015; Zhao et al., 2011). Therefore, this study proposes that GTD and KTI may moderate the relationship between GEO and two types of performance.

This study is conducted in the context of China for three compelling reasons. First, the 19th National Congress of China has laid out several new prospects and goals, such as the development of the 'green economy', addressing environmental issues, the protection of ecosystems, and a new generation of environmental regulation (Xi, 2017). GEO contributes to building a 'Beautiful China' and affects long-run growth (Zhao et al., 2011; Zhang et al., 2016). Second, the daily averages of PM 2.5 concentration in northern China has exceeded the World Health Organization's guideline by almost 56 times, pointing to nearly 500,000 pre-mature deaths per year (Chen et al., 2013). Moreover, the poor quality of groundwater and surface water in China leads to nearly 60,000 deaths every year (Qiu, 2011). Despite the growing public concerns for environmental issues, how firms in China reduce environmental degradation through entrepreneurial action remains unclear (Li, 2014; Zhu et al., 2012). Economic reform and uneven regional development in China provide a relatively strong test of differences across West culture and an interesting context for this study. Finally, since the late 1970s, the transfer of the obsolete industries from foreign firms has promoted China's economic growth. However, it leads to mass of

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pollution transfer and diffusion. In recent years, the Chinese government has instituted a series of laws and regulations to address environmental issues. For foreign firms operating in or wishing to enter into China, they should evaluate potential environmental risks beforehand and raise their awareness of environmental issues.

This study addresses two crucial questions. First, taking the dynamic capability perspective, we examine the effect of GEO on environmental and financial performance. Second, we assess the moderate effect of GTD and KTI upon the relationship between GEO and two types of firm performance. Our findings show that a firm-level strategic orientation (i.e., GEO) plays the role of a dynamic capability by efficiently and effectively initiating green activities, becoming proactive in capturing new opportunities, and taking risks in transforming the system. This study will provide an effective way for managers to achieve competitive advantages under complex conditions.

2 Theory Foundation and Hypotheses

From the dynamic capability perspective, this study demonstrates that GEO associates with two types of firm performance, and these relationships depend on the levels of GTD and KTI. Figure 1 presents the research framework of this study.

[INSERT FIGURE 1 ABOUT HERE]

2.1 Green entrepreneurship

The first precedent of green entrepreneurship can be traced back to 1960 when the consequences of environmental degradation and industrialization spurred establishment of regulations for environment protection in developed countries

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(Thompson et al., 2011). Several researchers have devoted their work to the subject of green entrepreneurship (Berle, 1991) and its derived terms. Common terms involve ecopreneurship, eco-entrepreneurship (Schaper, 2002), environmental entrepreneurship, and enviropreneurship (Keogh and Polonsky, 1998). Table 1 compares the differences and similarities for each of these definitions as well as considers four perspectives on the definitions of green entrepreneurship.

Inspiring by the definitions by Dean and McMullen (2007) and Schaltegger (2016a) as well as by the thoughts of Li et al. (2010), this study employs the following definition of green entrepreneurship: a predisposition to pursue potential opportunities that produce both economic and ecological benefits through initiating green activities. In this study, green entrepreneurship reflects green innovativeness, market proactiveness, and risk-taking regarding the way a firm operates.

[INSERT TABLE 1 ABOUT HERE]

Empirical research regarding green entrepreneurship can be categorized into three main aspects. First, this study reviews the existing literature on intrinsic motivations required for green entrepreneurship. These can be summarized in some aspects, such as emotional embeddedness, market, and social orientation (Biniari, 2012). Second, it can be recognized that external environment may affect green entrepreneurship including institutional context, social norms, and regulations (Meek et al., 2010; Silajdžić et al., 2015). Finally, a literature analysis is carried out to evaluate the performance consequences of green entrepreneurship. It can be noticed that green entrepreneurial activity could simultaneously foster economic and ecological benefits

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for society, such as the exploitation and creation of market opportunities and the prevention of environmental degradation (Lenox and York, 2011). Table 2 provides an overview of empirical research regarding green entrepreneurship.

[INSERT TABLE 2 ABOUT HERE]

The importance of green entrepreneurship has been discussed in specific country contexts or particular industries. For example, Sine and Lee (2009) examined how social movement organizations trigger to green entrepreneurship in the U.S. wind energy sector. De Bruin and Lewis (2016) focused on the waste recycling and minimization sector in New Zealand, and illustrated several factors promoting or hindering green entrepreneurship. Silajdžić et al. (2015) conducted case studies on green entrepreneurs in the green business sector in Bosnia and Herzegovina.

2.2 GEO and environmental performance

GEO contributes to environmental sustainability and social welfare through several mechanisms. First, entrepreneurial action may reduce environmental degradation and capture economic value by enhancing the efficiency of markets as well as alleviating market failure. Following Teece's (2012) terminology, what it is to be entrepreneurial aligns closely with what it is to have a dynamic capability. Dynamic capability is valuable for identifying, exploring, and assessing potential opportunities in environmentally relevant market failures. Since some market failures may result in environmental degradation, it implies opportunities for entrepreneurial action. For example, monopoly is considered to be the market failure because firms possessing monopoly power often lead to inefficiency in the economic system. The electrical

utility industry is criticized for being less inclined to widely adopt eco-friendly technologies, causing the underutilization of wind power (Dean and McMullen, 2007). To eliminate this market failure, GEO may help capture the potential market by adopting new technologies and methods of production. As a result, GEO allows for enhancing the efficiency of energy and making better use of natural resources (York et al., 2016). Specifically, Toyota introduces hybrid technology or the DM drugstore chain in Germany to realize higher sustainability standards in its product range than other competitors (Schaltegger et al., 2016b). Furthermore, the utilization of new technologies in the telecommunications industry, such as microwave towers and cell phones, improves resource-effectiveness and reduces reliance on resource-intensive technologies, such as copper transmission lines (Dean and McMullen, 2007). Hence, the utilization of new green technology can conserve natural resources and prevent pollution.

Second, the damage to the health and safety of employees at work can be reduced through decreasing consumption of toxic materials and cutting harmful emissions (Chuang and Yang, 2014). Teece (2014b) argues that dynamic capabilities focus on building, renewing, and reconfiguring internal and external resources. This tendency encourages seizing the opportunities and needs to capture values. According to Teece's argument, GEO facilitates an emerging generation of new product processes (Woldesenbet et al., 2012). Specifically, if a firm develops a strong GEO, then an approach to reduce pollution at production is likely to be emphasized on a new generation of manufacturing processes. As a result, toxic and harmful emissions

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generated throughout production can be reduced. Furthermore, a firm possesses GEO will increase the efficiency of resource conversion. Green technologies utilized in the production processes may decrease the consumption of water, electricity, coal, or oil (Triguero et al., 2013). Thus, GEO facilitates meeting the requirements of the standard for occupational health and safety management like ISO 14000.

Third, GEO addresses transforming the structure to respond to rapidly changing environments (Teece, 2016). This suggests that GEO not only enables firms to comply with environmental regulations, but also addresses the environmental concerns of public. When adopting GEO, the firm will possess a motivation to produce solar energy products rather than fossil energy products. As the cleanest domestic energy resource available, the utilization of solar energy may migrate the risk for the health and safety of people (Dangelico and Pujari, 2010). Furthermore, the utilization of recyclable or reusable cups rather than waste glass bottles or mirrors may increase social welfare. Starbucks has recently laid out a new goal to only use recyclable and compostable cups with a three-year ambition. That is a new approach to attract new customers, and lead entrepreneurs with technical and other expert resources to develop a global solution. Based on these contentions we hypothesize:

H1a: GEO has a positive influence on environmental performance.

2.3 GEO and financial performance

GEO contributes to greater financial performance through three mechanisms, which are associated with three characteristics of entrepreneurial orientation including innovativeness, proactiveness, and risk-taking (Covin and Lumpkin, 2011). First,

innovativeness describes a tendency to exploit new ideas, engage in experimentation, and support creative processes. Drawing from DCT, firms adopting GEO are enabled to recombine resources to launch new products or processes (Teece, 2016). Specifically, new clean technologies are developed to make better use of resources as well as to reduce water and fossil fuels consumption (Xie et al., 2016). In addition, composite and recycling materials are generally used across the production or the delivery process (Graham and McAdam, 2016). Moreover, designers may consider whether the product is easy to reuse, recycle, and recovery before starting a manufacturing activity (Hatcher et al., 2013). On the other hand, many firms adopting GEO are facilitated by institutional and social norms. The introduction of eco-friendly product and process may not only comply with regulations, but avoid penalties by the government (Demirel et al., 2017). Taken together, GEO can help firms improve process efficiency, minimize waste, and reduce costs through exploitation of new ideas.

Second, proactiveness reflects a desire to outperform competitors, thus capitalizing on emerging opportunities (Woldesenbet et al., 2012). According to DCT, proactiveness refers to a proclivity to respond to customer needs by introducing green products, service, or technology first. With the widespread of the issues of environmental awareness, firms are facing growing pressure from customers (Chiou et al., 2011). Proactive firms are likely to respond more quickly than competitors do to the needs of customers. Under the trend of customers' attitude towards green marketing, firms can reap financial benefits of becoming a pioneer in green

innovation practices. Therefore, GEO may enhance capability of customer response speed for green practices, bringing out first-mover advantage.

Third, risk-taking reflects a tendency to adopt an active posture when investing in projects with high levels of uncertainty. Although materializing a green innovation is often associated with complex situations and uncertainties, it may bring in new customers and fresh revenue (Wong, 2012). According to DCT, firms adopting GEO are likely to pursue overly risky strategies when getting trapped in the face of fundamentally changing circumstances (Shirokova et al., 2016). In fact, strong ordinary capabilities may lead a firm into complacency. A trap may be sprung when market turbulence occurs. Dynamic capabilities may address the continued renewal of ordinary capabilities. When confronting demands in a changing environment, firms adopting GEO will enhance their customer response capability. As a result, keeping the system fresh and dynamic can overcome the risk, and achieve superior performance. Accordingly, we propose:

H1b: GEO has a positive influence on financial performance.

2.4 The moderating role of GTD

In this study, GTD is defined as the rate and uncertainty of green technological paradigm change in the external environment (Schilke, 2014). According to DCT, firms need to align their resources and capabilities with the changing market conditions (Wilden and Gudergan, 2015). If firms undergo rapid technological changes, then a motivation to collect knowledge about new technologies will be improved (Zhao et al., 2018). Hence, GTD fosters a capability that acquires

technology, patents, and knowledge externally (Cai et al., 2014). Although the changing technological conditions are associated with uncertainty, eco-knowledge absorption capability may be more crucial when facing GTD than facing stable environments. This is because the knowledge absorption capability can help firms possess specific knowledge that supports eco-friendly business practices, such as R&D, technological leadership, and innovation. If the level of GTD increases, then firms adopting GEO are likely to emphasis on building the capabilities of absorbing new eco-knowledge. As a result, they may take advantage of eco-friendly technologies, and in turn increase firm performance. Conversely, if the level of GTD decreases, firms adopting GEO are less likely to foster their eco-knowledge absorption capabilities. Under such conditions, their performance decreases, mainly because of lack of motivation and eco-knowledge. Pavlou and El Sawy (2011) proposed that environmental turbulence positively moderates the effect of dynamic capabilities on operational new product development capabilities, leading to greater new product development performance.

Since GEO is tagged as risk-taking, firms may perform well in a fast-changing marketplace or even uncertain environments (Boso et al., 2012). Risk-taking reflects a tendency to be proactive in adapting to uncertainty. It asserts that the higher the degree of environmental dynamism is, the stronger the proclivity toward facing uncertainties will be. In others words, the willingness to make investment decision-making may depend greatly on whether the condition is uncertain or not. In volatile environments, firms adopting GEO are likely to gain competitive advantages by

making risky investments in green innovation (Kraus et al., 2012). However, a stable environment provides certainty for continued investment in entrepreneurial activities, yielding less incentive to actively take risks (Gathungu et al., 2014). Taken together, adopting GEO may achieve greater performance under higher levels of GTD than lower levels of GTD. Jiao et al. (2013) suggested that dynamic capabilities improve new venture performance by a rapid response to customers' needs facing changing uncertainties and opportunities in the market. According to the above arguments, we propose the following hypotheses:

H2: GTD positively moderates the relationship between GEO and (a) environmental performance, and (b) financial performance.

2.5 The moderating role of KTI

In this study, KTI refers to the cross-functional transmission of knowledge within the firm as well as the pooling of internal resources and coordination of skills to stimulate innovation (Akgün et al., 2007). Knowledge of market and technology is emphasized as facilitators to competitive advantage. Since knowledge gaps may be generated by entrepreneurial activities, a combination of diverse sources of knowledge is important for generation of new ideas. Thus, the creation of new knowledge is required for filling these gaps. It is suggested that the outcomes of entrepreneurial action primarily depend on knowledge-based resources that the firm possesses (Bojica et al., 2012). If a firm transfers and integrates knowledge successfully, GEO will lead to beneficial effects for firm performance by generation and distribution of new knowledge inside the firm (Jiang et al., 2016). On the

contrary, if there are barriers to transfer and integration of knowledge, the learning capabilities are limited. With a limited understanding of markets and technology, firms cannot continue to gain benefits through their green entrepreneurial activities (Alegre and Chiva, 2013). Following Stam and Elfring's (2008) argument, an increased capacity involved in the appreciation, recombination, and application of knowledge to a highly central firm through its intra-industry ties, can strengthen the link between entrepreneurial orientation and performance.

In order to sustain exploitation of new emerging opportunities, an ability to renew or reconfigure existing knowledge resources is also required for firms (Teece, 2016). Market knowledge involves customer's concerns, demands, and preferences. It is argued that a firm possessing market knowledge can determine the value of new opportunities discovered. At the same time, market knowledge may offer guidance on how to best serve a new market. Hence, nurturing specialized knowledge sets is critical for preserving a competitive advantage. KTI facilitates a widely dispersed of valuable knowledge assets, providing access to new knowledge resources. In such an environment, firms adopting GEO may enhance the ability to evaluate and discover potential green opportunities, leading to first-mover advantages. Conversely, if there are many barriers to transfer and integrate internal knowledge, they show quite limited ability to recognize opportunities in proactive ways. Under such conditions, they may fail to better meet customer needs. As a result, GEO will not achieve competitive advantages. Accordingly, we propose the following hypotheses:

H3: KTI positively moderates the relationship between GEO and (a) environmental

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performance, and (b) financial performance.

3 Methods

3.1 Sampling and Data Collection

This study collected data from five provinces in China including Guangdong, Jiangsu, Shandong, Shaanxi, and Henan. These five provinces represent distinct levels of economic development, geographical location, and ecological state. We first randomly selected 300 firms for each province in the local business directory, approaching a total of 1,500 firms. As depicted in Table 3, the firms are selected across a wide range of industries sectors.

[INSERT TABLE 3 ABOUT HERE]

Managers, CEOs, or presidents in sample firms are identified as informants. In order to obtain permission, emails or telephone calls were used. Questionnaires were sent to these managers and then assigned to their employees. Each questionnaire was accompanied with a description of this survey for better understanding our purposes. To encourage respondents, the general results would be offered to them. Two-week later, follow-up calls were used to remind them and to thank for their participation as well as to answer any difficulties they encountered. When the survey questionnaire was completed, employees directly sent it to us to protect the confidentiality.

A questionnaire was originally designed in English. Then the English version of the questionnaire was translated into Chinese. Three researchers and eight executives were chosen to examine and revise the measurement items. Ten firms were selected randomly and managers from these firms participated in a pilot study. Based on a

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consultation, the questionnaire was modified to improve its clarity.

A total of 264 valid questionnaires were received, representing 17.6% return rate. The average tenure of firms in this study is 15.91 years (S.D. = 15.74), while the average number of firm employees is 923.11 (S.D. = 1,558.77). Table 3 presents the industry, size, and ownership structures of the firms. A *t*-test was conducted in terms of size, age, and industry between the respondents and non-respondents. There are no significant differences, suggesting non-response bias is not a problem in this study. Furthermore, *t*-tests were conducted to test differences between early and late respondents. No significant differences are found either. Therefore, timing bias is not significant in this study.

Common method variance (CMV) was checked using three procedures (Podsakoff et al., 2003). The first approach was separating the independent and dependent variables by different scale endpoints. Then, Harman's one-factor test was performed. The first factor accounted for 24.482% of the variance and none stated the majority of the total variance. Third, the results of confirmatory factor analysis (CFA) indicate that the one-factor model (χ^2 = 2139.23, *d.f.* = 230, NNFI = 0.555, CFI = 0.932, SRMR = 0.123, RMSEA = 0.177) is unsatisfactory. Therefore, CMV is not an issue in this study.

3.2 Variables and Measures

All items were measured on seven-point Likert scales, ranging from 1 (strongly disagree) to 7 (strongly agree). The survey questions of constructs and items in this study are listed in Table 4.

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The measurement items of GEO were adapted from Li et al. (2010). Financial performance was measured using seven items based on the research of Li and Zhang (2007). Environmental performance was measured using four items adopted from Zhu et al. (2008). GTD was measured using a four-item scale originally proposed by Sheng et al. (2011). KTI items were adopted from Akgün et al. (2007).

Firm performance is likely to be influenced by firm demographics, industry type, customer orientation, employee satisfaction, and market competition (Feng et al., 2012; Taoketao et al., 2018; Wang et al., 2017; Yee et al., 2010). Thus, firm size and age were controlled and measured by calculating the natural log of the number of employees and the period firm setting up. Industry type was controlled and indicated with a dummy variable (high-technology industry = "0", otherwise = "1").

Additionally, customer orientation was controlled and assessed using a six-item scale from Li et al. (2010). Items include "Our business objectives are driven primarily by customer satisfaction", "Our strategy for competitive advantage is based on our understanding of customers' needs", "We measure customer satisfaction systematically and frequently", "We give close attention to after-sales service", "We often look for measurements to increase customer value or decrease product cost", and "We give close attention to the evaluation of customer on our product".

Employee satisfaction was controlled and measured using six-item taken from Yee et al. (2010), which evaluates "Be absent from work", "Continue our employment in this company", "Contribute extra effort for the sake of this company", "Become a part of this company", "Turn down other jobs with more pay in order to stay with this

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company", and "Take any job to keep working for this company".

Market competition was added in control variables and measured using three-item developed from Yee et al. (2010), which evaluates "High availability of alternative products offered in the market", "High availability of alternative services offered in the market", and "Attractive benefit plans offered in the market".

3.3 Reliability and validity

To explore whether the measure construct is evident in China, an exploratory factor analysis (EFA) was conducted using varimax rotation and a cut-off of an eigenvalue exceeding 1 was used to determine item loadings (Hair et al., 2010). The factor analysis resulted in five factors with eigenvalues above or near 1.0, explaining 76.08% of the total variance. All items had higher loadings on their intended construct and lower loadings on the constructs on other factors, demonstrating the unidimensional characteristic of the construct.

The reliability of constructs was assessed using Cronbach's coefficient alpha. Table 4 illustrates that all five Cronbach's alpha values achieve the acceptable value of 0.70, suggesting adequate reliability (Carmines and Zeller, 1979). Because each item-total correlation surpassed 0.4, no item was eliminated. The scale reliability was further established by calculating composite reliability. All the composite reliability (CR) values were over 0.8, ensuring reliability in this study (Fornell and Larcker, 1981) (see Table 4).

[INSERT TABLE 4 ABOUT HERE]

Convergent and discriminant validity was computed by employing CFA. As shown

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in Table 4, average variance extracted values (AVE) of all constructs are higher than the recommended value of 0.5, demonstrating an adequate convergent validity (Fornell and Larcker, 1981). Fit indices are acceptable: χ^2 = 542.38, *d.f.* = 220, NNFI = 0.921, CFI = 0.932, SRMR = 0.047, RMSEA = 0.075 (Barclay et al., 1995). The results in Table 5 suggest that the square root of AVE of each construct is greater than their correlations with other constructs. Therefore, the discriminant validity can be verified in this study.

[INSERT TABLE 5 ABOUT HERE]

4 Analysis Results

Table 6 presents the results of hierarchical multiple regressions. H1a hypothesized that GEO has a positive influence on environmental performance, and H1b predicted that GEO has a positive influence on financial performance. As depicted in Table 6, GEO has positive influences on both environmental performance (β = 0.194, p<0.05, Model 2) and financial performance (β = 0.351, p<0.001, Model 5). Thus, H1a and H1b are supported.

H2a hypothesized that GTD positively moderates the relationship between GEO and environmental performance. Table 6 illustrates that the coefficient for the interaction of GEO and GTD is significant and negative (β = -0.155, p<0.05, Model 3). Thus, H2a is rejected. H2b predicted that GTD positively moderates the relationship between GEO and financial performance. Table 6 reveals that the coefficient for the interaction of GEO and GTD is not significant (β = -0.096, n.s., Model 6). Hence, H2b cannot receive support.

H3a stated that KTI positively moderates the relationship between GEO and environmental performance. Table 6 indicates that the coefficient for the interaction of GEO and KTI is positive and significant (β = 0.122, p<0.05, Model 3). Thus, H3a is supported. H3b argued that KTI positively moderates the relationship between GEO and financial performance. Table 6 shows that the coefficient for the interaction of GEO and KTI is positive and significant (β = 0.135, p<0.05, Model 6). Hence, it provides support for H3b.

To further facilitate interpretation of this finding, we plotted this interaction effect in Figures 2-4 by following Aiken and West's (1991) suggestions. GEO took the values of one standard deviation below and above the mean. As displayed in Figure 2, the relationship between GEO and environmental performance is significantly positive when the level of GTD is low (β = 0.390, SE = 0.101, t = 3.875, p<0.001), but not when it is high (β = 0.183, SE = 0.094, t = 1.937, n.s.). Our findings cannot support H2a. On the contrary, holding a common level of GTD may alleviate the positive relationship between GEO and environmental performance.

[INSERT FIGURE 2 ABOUT HERE]

As depicted in Figure 3, the relationship between GEO and environmental performance is significantly positive both when the level of KTI is high (β = 0.263, SE = 0.096, t = 2.736, p<0.01) and when it is low (β = 0.212, SE = 0.095, t = 2.227, p<0.05), but to significantly different degrees. Our results further confirm H3a. When holding a managerial level of KTI, a slight increase will be reported in the positive impact of GEO on environmental performance.

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[INSERT FIGURE 3 ABOUT HERE]

The plot in Figure 4 illustrates that the relationship between GEO and financial performance is significantly positive both when the level of KTI is high (β = 0.497, SE = 0.093, t = 5.337, p<0.001) and when it is low (β = 0.303, SE = 0.092, t = 3.288, p<0.01), but to significantly different degrees. These findings further support H3b. When holding a managerial level of KTI, a slight increase will be reported in the positive impact of GEO on financial performance.

[INSERT FIGURE 4 ABOUT HERE]

5 Discussion and Implications

5.1 Discussions

This study aims to address two important research questions: Does adopting GEO help a firm achieve better environmental and financial performance? Do the effects of GEO on firm performance vary? Drawing on DCT, we hypothesized that GEO has positive influences on environmental and financial performance. Furthermore, we proposed that whether GEO can achieve better performance depends on the levels of GTD and KTI.

Our findings reveal a positive link between GEO and environmental performance, which supports previous work of Menguc and Ozanne (2005). An entrepreneurship addressing natural environmental issues is positively related to profit and market share. In addition, the findings demonstrate a positive link between GEO and financial performance, which is consistent with a discussion from Dean and McMullen (2007). Environmental entrepreneurship can contribute to the reduction of environmental

degradation as well as the enhancement of economic value.

This highlights the important role of dynamic capabilities in the entrepreneurial action. In this study, GEO is characterized by green innovativeness, proactiveness, and openness to risks. First, capitalizing on dynamic capabilities, GEO alters existing substantive capabilities (i.e., the ability to launch new products or processes). For example, the enhancement of eco-design of practice can reduce hazardous emission or toxic materials. The application of new advanced process technologies can minimize environmental impacts and address the health and safety of people (Feng et al., 2016). Second, adopting a strong GEO allows firms to create, discover, and exploit new opportunities and to capture value from doing so. In order to meet the growing demand by customers for eco-friendly products and services, GEO is required to take the dynamic capability role in seizing opportunities. Building a strong dynamic capability enables firms to recognize an opportunity to capture additional market share. Third, adopting GEO reflects risk-taking. Dynamic capabilities with aim of transforming internal structure and business models are also exposed to risk. When traditional patterns are applied in the new tasks, firms who rely on an inherent selectivity of capabilities may bring forth a structural risk. The more dynamic the environment is, the higher the risk will be. Thus, it is crucial to monitor organizational capabilities and its evolvement in order to compensate its inherent risk.

However, the moderating effect of GTD on the relationship between GEO and environmental performance, and the moderating effect of GTD on the relationship between GEO and financial performance are not supported. Further inspection of two

simple regression lines (see Figure 2) illustrates that the positive relationship between GEO and environmental performance becomes weaker when the level of GTD increases. Our findings about the moderating role of GTD on the relationship between GEO and environmental performance are consistent with Huang et al. (2014). In their work, an orientation to exploratory innovations does not significantly increase new venture performance in a dynamic environment. Relevant to our results, Wiklund and Shepherd (2005) argued that entrepreneurial orientation under stable environment may improve firm performance by better capitalizing on abundant opportunities and focusing on efficient exploitation.

The explanations for these interesting findings can be speculated from three aspects. First, as GTD increases, costs of absorption may outweigh the benefits of highly novel knowledge and technologies. Entrepreneurial ventures are likely to be committed to long-held business models contributing revenues and profits in a short tenure. Although adopting GEO necessitates an environmental ethic of responsibility, firms tend to initiate green activities with the aim of increasing the marginal or incremental rates of return (Bendell, 2017). At high levels of GTD, knowledge components become more diverse than a stable environment. However, the firm is greatly constrained by costs of absorption when processing novel knowledge and technologies into usable innovations. Thus, some degree of GTD can be detrimental for the consequences of an entrepreneurial orientation.

Second, customers with a high tendency to purchase eco-friendly products are strongly influenced by social recognition, rather than functional value, such as price,

durability, quality, or advanced technology (Biswas and Roy, 2015). If consumers exhibit greater social responsibility, sustainable consumption behavior will be promoted. Consumers' green purchase behavior is also likely to be influenced by peer opinion. If individuals show a willingness to pay premium for eco-friendly products, they are expected to make a positive impression on peer groups. Therefore, regardless of environment, firms' financial performance will increase with the effective implementation of GEO.

Third, consumers are likely to know little about what is involved in entrepreneurial action. Although the benefits of utilizing eco-friendly products and services have been focused on, customers may exhibit price sensitivity for green purchase. This often leaves an attitude-behavior gap between consumer environmental awareness and their actually consumption behavior. If the general level of public environmental knowledge increases, customers will be more likely to adopt green products or services and acquire innovation benefits. Thus, the changing environment induces an ineffective marketing communication between the firm and customers, and in turn diminishes the benefits of GEO.

The findings suggest that KTI positively moderates the relationship between GEO and environmental and financial performance. Further inspection of four simple regression lines (see Figures 3 and 4) illustrates that the positive relationships between GEO and two types of firm performance become stronger when the level of KTI increases. This finding supports the work of Patel et al. (2015). He addressed that knowledge transformation and recombination with existing resources and

competencies could positively moderate the relationship between entrepreneurial orientation and sales growth. Taken a view of dynamic capability, firms adopting GEO are encouraged towards organizational learning when fostering new knowledge creation activities. Under a wide range of market knowledge base, firms adopting GEO are likely to capture potential opportunities, and thus the advantage can be achieved. The results indicate that firms need to encourage KTI in order to gain economic profits and minimize environmental impacts through entrepreneurial action.

This study makes several research contributions. First, this study takes a perspective of dynamic capabilities, identifying a firm's strategic orientation (i.e., GEO) as a major dynamic capability. In so doing, this study demonstrates that GEO and dynamic capabilities are subtly intertwined through three specific processes and routines (i.e., a desire to initiate green innovations, a proactiveness to capture potential opportunities, an open attitude to take risks in transforming the social economy). Second, although the importance of green entrepreneurship has been recognized, how GEO influences environmental and financial performance remains unclear. In addition, whether the performance effect of entrepreneurial strategies depends upon relevant environmental conditions needs to be investigated. This study reveals that GEO has positive impacts on environmental and financial performance. Confronting GTD can erode any benefit from GEO, leading to a weaker environmental performance than facing a stable environment. An effective knowledge transfer in a firm facilitates and supports the pursuit of greater performance through entrepreneurial action. Taken together, it demonstrates that GTD and KTI play critical

roles in the development and implementation of entrepreneurial strategies. Third, the majority of studies on GEO have been conducted in advanced economies. However, issues related to GEO adoption, and performance perceptions from these adoptions become even more critical in China. In the present study, we contribute to the literature by adding fresh evidence on the benefits involved in implementing GEO in emerging economies.

5.2 Managerial implications

Our findings offer the following implications for practitioners. First, firms can utilize GEO as their dynamic capabilities to exploit the potential opportunities in the market. Dynamic capabilities will support entrepreneurial activities and provide self-awareness, such as new technological discoveries. In addition, managers should reconfigure internal resources and recombine them in new ways. They need to fill the knowledge gap required in the entrepreneurial activities. Market knowledge proves to be a crucial source of customer needs and preferences. Thus, intra-firm knowledge transfer processes can provide guidance on how to better meet customer demands. Developing dynamic capabilities is useful to respond quickly to customer demands and achieve long-term competitive advantages.

Second, managers should consider a stable environment including a slow technology movement. Since some of excessive technologies for an industry might not always benefit technology users, managers are required to curb these damaging effects. It is impossible to predict what effects technology changes may have. These effects on the performance outcomes of adopting a strategy are primarily consistent

with uncertainty. Hence, managers should address uncertainty and set up a contingency plan for future issues. Technology knowledge will be more competent in determining the value of new technological changes before taking entrepreneurial action. Managers are provided with reference materials available in training to think about knowledge building.

Third, managers should encourage employees to discuss and analyze errors and failures among cross-functional teams in the firm. In the context of organizational learning, employees are motivated to exchange new ideas, programs, and activities. This learning type will help transfer tacit knowledge from peers and enhance knowledge capital in the firm. In order to develop appropriate knowledge combinations, managers should carefully make use of instruments, such as documents, databases, and routines. Under a large knowledge base, entrepreneurial action can be efficiently and effectively translated into superior firm performance.

6 Conclusion and Limitations

Adopting GEO provides a critical approach for firms to gain a competitive advantage and enhance their performance. Drawing on a perspective of dynamic capabilities, this study indicates that GEO has positive influences on both environmental and financial performance. This study advances our understanding of GEO. It identifies the role of GEO as the dynamic capability in exploiting new ideas and encouraging innovativeness, catching potential opportunities, and taking risks in transforming the social economy into the social-ecological economy. Furthermore, the introduction of GTD and KTI stems from the same dimension, but two opposite

forces. GTD is considered as a constraint to knowledge management capabilities, while KTI is accepted as a facilitator to strengthen knowledge management capabilities. The findings suggest that GTD negatively moderates the relationship between GEO and environmental performance. KTI positively moderates the relationship between GEO and environmental and financial performance. Adopting a stable environment facilitates greater environmental benefits from GEO than a context of technology turbulence. A process of intra-firm knowledge transfer and internal knowledge integration can help firms adopting GEO enhance two types of performance effectively and efficiently.

There are several limitations need to be mentioned in future studies. First, GEO was assessed by a single informant and using self-reported data in each firm. Some critics believe that a potential bias may be generated. Although several remedial measures were taken and CMV is not an issue in this study, it may still exist. Further studies might evaluate the degree of GEO by connecting multiple answers of employees with managers.

Second, the study only examined the moderating roles of GTD and KTI in the GEO - firm performance link. To provide an extension, further research may consider the potential moderating effects of several other factors, such as management commitment, systems thinking, and open and experimental. This would generate valuable insights into the mechanism of linking GEO with firm performance under different situations.

Third, the sample firms were collected in the specific context of China. However,

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our study may be limited by its context. The experience of firms in other emerging or transitional economies may produce different effects and boundaries. Therefore, future research attempts to draw conclusions in diverse environments, such as Brazil, Russia, and India.

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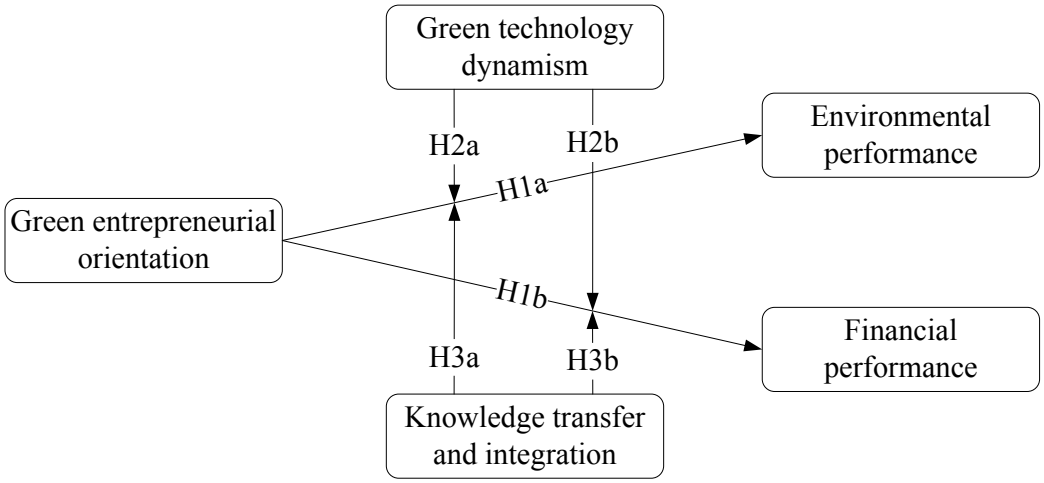

Figure 1 Conceptual model

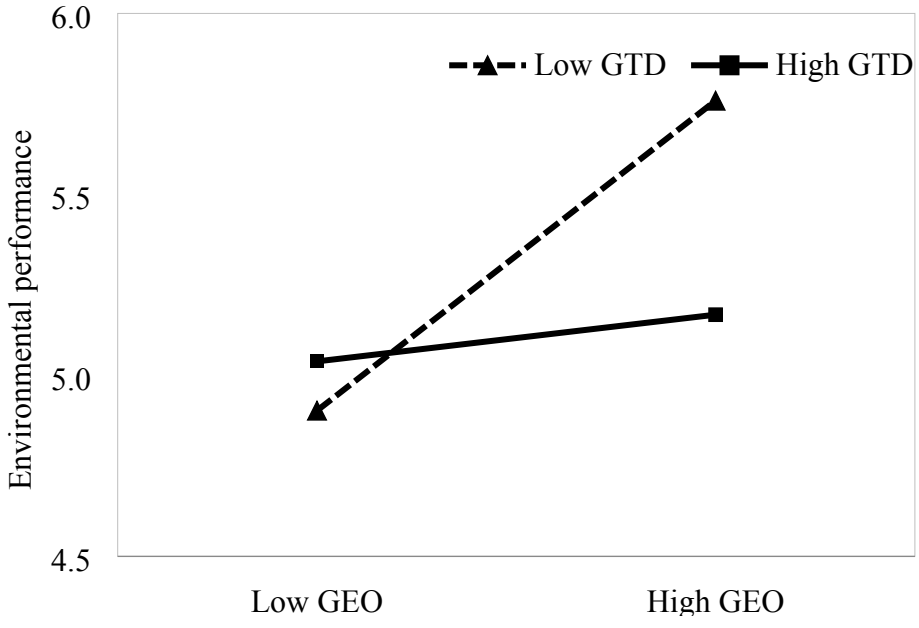

Figure 2 Simple slopes for the interaction effect of GEO and GTD on environmental performance

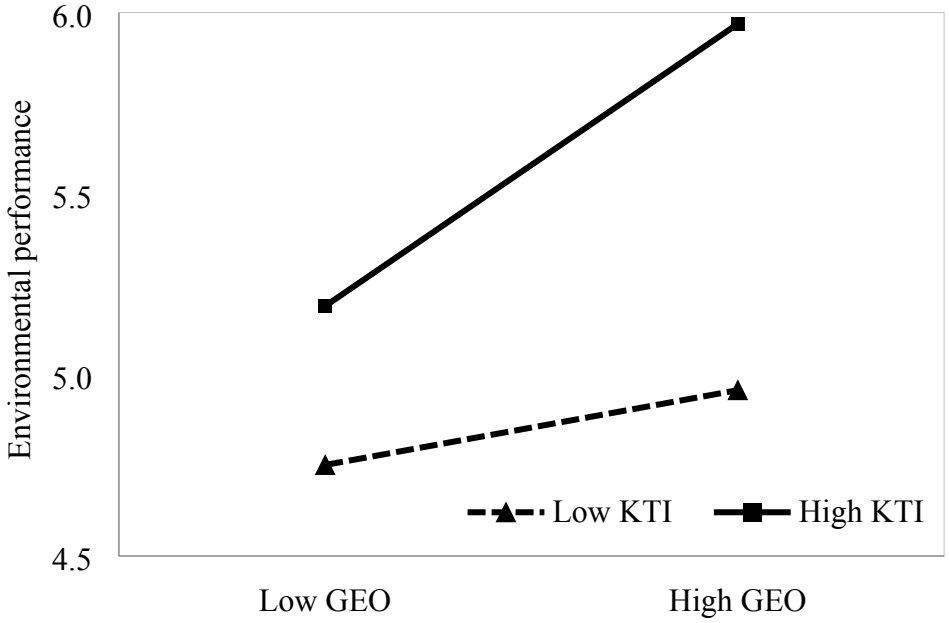

Figure 3 Simple slopes for the interaction effect of GEO and KTI on environmental performance

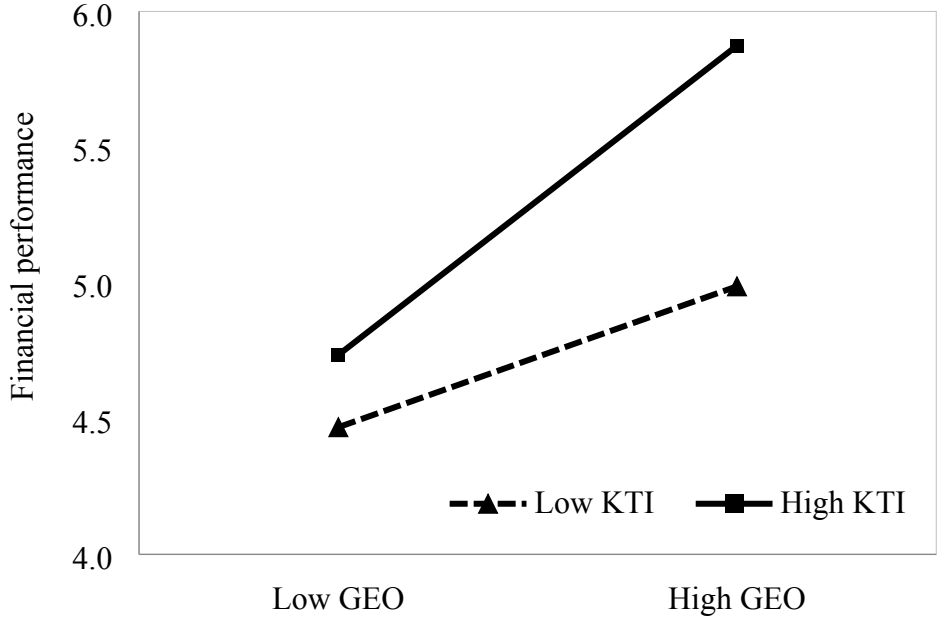

Figure 4 Simple slopes for the interaction effect of GEO and KTI on financial performance

Table 1 Summary of terms, definitions, and perspectives on green entrepreneurship

References	Term	Definition	Perspective
Lober (1998)	Environmental entrepreneurship	The creation of new products, services, or organizations responding to environmental market opportunities	Distinctive organizational characteristics, environmental purpose
Keogh and Polonsky (1998)	Environmental entrepreneurship	Innovation, the identification of opportunities, and the exploration of universal perspectives, global views and the inter-relationships	
Pastakia (1998)	Ecopreneurship	Popularization of eco-friendly ideas and innovations through either market or non-market routes	
Isaak (2002)	Ecopreneurship	Creating green-green businesses aimed at radically transforming the economic sector and operating system	
Dean and McMullen (2007)	Environmental entrepreneurship	Discovering, evaluating, and exploiting economic opportunities through ameliorating environmentally relevant market failures	
Kotchen (2009)	Eco-entrepreneurship	Starting new businesses to earn a profit and provide environmental benefits	
Schaltegger (2016a)	Ecopreneurship	Innovative, market-oriented and personality-driven form of value creation through environmental innovations and products since starting up a business	
Anderson and Leal (1997)	Enviro-Capitalists	Quality improvement in the environment using business tools, involving preserving open space, developing wildlife habitat, and saving endangered species	Environmental outcomes
Hendrickson and Tuttle (1997)	Environmental entrepreneurship	An entrepreneurial activity with environmental benefits	Entrepreneurial behavior, the net effect of commercial activity on the natural environment, set of aspirations and values
Linnanen (2002)	Ecopreneurship	Improving the quality of the environment and life, and meanwhile conducting commercial activities and earning profits	
Walley and Taylor (2002)	Ecopreneurship	Green-green businesses with an environmental orientation, and meanwhile maximizing profit	
Schaper (2005)	Ecopreneurship	Intentionally undertake business ventures involved high risks, with a positive effect on the natural	

		environment	
Gibbs (2009)	Ecopreneurship	A combination of environmental awareness with business activities	
Holt (2011)	Ecopreneurship	Profit-generating businesses with environmental considerations in the business's culture, product or service	
Hartmann and Stafford (1998)	Environmental entrepreneurship	The formulation and implementation of corporate activities integrating economic, environmental, and social objectives	Environmental, social and economic objects
Stafford et al. (2000)	Enviropreneurship	Entrepreneurial innovations and technological approaches to address environmental and sustainability problems	
Russo (2003)	Ecopreneurship	Sustainable entrepreneurship	
Dixon and Clifford (2007)	Ecopreneurship	A combination of environmental, social and economic objects through entrepreneurial action	
Allen and Malin (2008)	Ecopreneurship	An unique and enthusiastic vision and/or feelings of obligation for societal change and norms building	
Meek et al. (2010)	Environmental entrepreneurship	Addressing social norms to entrepreneurial action towards environmental benefits	
Paulraj (2011)	Enviropreneurship	Entrepreneurial orientation that accommodates the needs of the environment, society and economy	
Partzsch and Ziegler (2011)	Enviropreneurship	Tackling environmental and social problems through entrepreneurial activities	
Kirkwood and Walton (2014)	Ecopreneurship	New businesses foundation according to the principle of sustainability	

Table 2 An overview of empirical research regarding green entrepreneurship

Authors (year)	Major findings	Theoretical perspectives	Sub-category
Hechavarria et al. (2012)	Female entrepreneurs are more likely than male entrepreneurs to emphasize social or environmental value creation.	Gender role theory	Intrinsic motivations required for green entrepreneurship
Colombelli and Quatraro (2017)	(1) The amount of knowledge locally available, and (2) technological variety yields are positively associated with the creation of green innovative start-ups.	Knowledge spillovers theory of entrepreneurship	
Giudici et al. (2017)	The creation of clean-tech startups in a geographical area positively relates to (1) local availability of scientific and technological knowledge, and (2) local environmental awareness.	Knowledge spillover theory of entrepreneurship	
Leonidou et al. (2017)	The deployment of organizational capabilities committed to environmental protection will lead to the adoption of a green business strategy by the small firm	Resource-based view (RBV) theory	
Sine and Lee (2009)	Social movement organizations can enhance entrepreneurial opportunity in the presence of greater environmental group membership.	Social movement theory	External environment, such as institutional context, social norms, and regulations
Meek et al. (2010)	Social norms have a positive impact on the founding rate of environmentally responsible new ventures.	Entrepreneurship, sociology, and institutional theory	
Hörisch et al. (2017)	(1) Environmental orientation is frequently used as a source for legitimizing entrepreneurial activities. (2) High levels of educated entrepreneurs have lower degrees of environmental orientation. (3) Environmental entrepreneurship requires different measures of political support.	New institutional theory	
Menguc and Ozanne (2005)	Natural environmental orientation (1) comprises three components entrepreneurship, corporate social responsibility (CSR), and commitment to the natural environment, (2) enhances profit after tax and market	Natural resource-based theory	Economic and ecological benefits

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	share.	
Dean and McMullen (2007)	Environmental entrepreneurs enhance ecological sustainability by ameliorating environmentally relevant market failures	Sustainable entrepreneurship theory
York and Venkataraman (2010)	Environmental entrepreneurship is (1) effective in for-profit, new ventures, and (2) associated with uncertain and intractable the environmental problem.	Entrepreneurship theory
Meyskens and Carsrud (2013)	Partnership diversity in nascent green-technology ventures is positively related to venture development.	Resource based view
Mrkajic et al. (2017)	Born-to-be-green is a reliable signal for investors when entrepreneurs perform activities based on green technologies/products and position their business in a green sector.	Signaling theory
Shrivastava and Tamvada (2017)	For entrepreneurial firms, both external and internal green strategies have a positive impact on firm performance.	Natural-resource-based view

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Table 3 Profile of sampled firms

Industries	Frequency	Percentage (%)
Food and beverage	7	2.6
Textile and apparel	6	2.3
Chemical and related products	14	5.3
Pharmaceutical and medical	6	2.3
Rubber and plastics	5	1.9
Non-metallic mineral products	16	6.1
Smelting and pressing	11	4.2
Metal products	19	7.2
Machinery and engineering	21	7.9
Transport equipment	10	3.8
Electrical machinery and equipment	25	9.5
Communication and computers related equipment	32	12.1
Instruments and related products	18	6.8
Industrial services	65	24.6
Others	9	3.4
Number of employees	Frequency	Percentage (%)
Less than 50	83	31.4
50-99	37	14.0
100-299	45	17.1
300-999	42	15.9
1000-1999	17	6.4
2000-4999	15	5.7
5000 or more	25	9.5
Ownership structures	Frequency	Percentage (%)
State-owned and collective firms	74	28.0
Private firms	137	51.9
Foreign-invested firms	53	20.1

Table 4 CFA results

Construct	Item	Factor loading	CITC	AVE	Cronbach's alpha	Composite reliability
Green entrepreneurial orientation	GEO1: In general, our firm favors a strong emphasis on green practices, such as R&D, technological leadership, and innovation	0.65	0.52	0.525	0.796	0.843
	GEO2: When facing uncertainty, we typically adopt a proactive posture in order to catch potential green opportunities	0.82	0.67			
	GEO3: In dealing with competitors, we typically initiate green actions that competitors respond to	0.84	0.70			
	GEO4: Our firm favors a tendency to be a leader, and always introduce green products, service, or technology first	0.73	0.64			
	GEO5: In dealing with competitors, we typically adopt a competitive 'undo-the-competitors' posture	0.54	0.42			
Financial performance	FP1: Sales growth	0.90	0.85	0.790	0.955	0.963
	FP2: Profit growth	0.93	0.88			
	FP3: Return on assets	0.90	0.85			
	FP4: Return on investment	0.91	0.87			
	FP5: Market share growth	0.85	0.81			
	FP6: Overall efficiency of operations	0.87	0.83			
	FP7: Return on sales	0.86	0.81			
Environmental performance	EP1: Reduced pollution	0.92	0.85	0.847	0.943	0.958
	EP2: Reduced energy and materials consumption	0.95	0.89			
	EP3: Reduced consumption for hazardous/harmful/toxic materials	0.93	0.88			
	EP4: Reduced frequency for environmental accidents	0.88	0.84			
Green technology dynamism	GTD1: The green technology in our industry is changing rapidly	0.82	0.74	0.609	0.828	0.856
	GTD2: It is very difficult to forecast the green technology development direction in our industry	0.51	0.45			
	GTD3: Most green technological innovations in our industry are radical	0.93	0.79			

	changes on existing techniques					
	GTD4: The green technological changes in our industry can bring many opportunities for firms	0.80	0.65			
	KTI1: Errors and failures are always discussed and analyzed in this firm, on all levels	0.83	0.70			
Knowledge transfer and integration	KTI2: Employees have the chance to talk among themselves about new ideas, programs, and activities that might be used to the firm	0.86	0.74	0.679	0.838	0.864
	KTI3: Our firm has instruments (manuals, databases, files, organizational routines, etc.) that allow what has been learned in past situations to remain valid, although the employees are no longer the same	0.78	0.67			

Table 5 Mean, standard deviations and correlations of the constructs

Constructs	Mean	S.D.	1	2	3	4	5
1. Green entrepreneurial orientation	5.225	0.980	**0.725**				
2. Financial performance	5.016	1.148	0.551**	**0.889**			
3. Environmental performance	5.217	1.173	0.507**	0.557**	**0.920**		
4. Green technology dynamism	4.571	1.174	0.297**	0.330**	0.189**	**0.781**	
5. Knowledge transfer and integration	5.172	1.092	0.571**	0.527**	0.558**	0.438**	**0.824**

Note: * α=0.05; ** α=0.01; *** α=0.001; Numbers in bold on the diagonal indicate the square root of AVE.

Table 6 Results of regression analyses

	Environmental performance			Financial performance		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control variables						
Size	0.072	0.045	0.039	0.171**	0.111	0.110
Age	-0.016	-0.047	-0.043	-0.143*	-0.148*	-0.139*
Industry	-0.075	-0.041	-0.042	-0.030	0.010	0.007
Market competition	-0.011	-0.045	-0.063	0.064	-0.052	-0.066
Employee satisfaction	0.320***	0.210**	0.210**	0.304***	0.138	0.144*
Customer orientation	0.358***	0.153*	0.167*	0.292***	0.013	0.024
Independent variable						
Green entrepreneurial orientation (GEO)		0.194**	0.210**		0.351***	0.361***
Moderators						
Green technology dynamism (GTD)		-0.127*	-0.097		0.068	0.074
Knowledge transfer and integration (KTI)		0.296***	0.309***		0.233**	0.251**
Interactions						
GEO × GTD			-0.155*			-0.096
GTD × KTI			0.122*			0.135*
R^2	0.338	0.411	0.428	0.304	0.407	0.420
ΔR^2		0.073***	0.017*		0.104***	0.013
F change for ΔR^2		10.557***	3.780*		14.789***	2.773

Note: * α=0.05; ** α=0.01; *** α=0.001