

# Opportunity-based entrepreneurship and environmental quality of sustainable development: A resource and institutional perspective

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## ABSTRACT

This study combines the resource-based view (RBV) and institutional context to examine the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development, as well as the moderating role of institutional context (regulative, normative and cognitive factors), using Global Entrepreneurship Monitor database (GEM) and World Development Indicator (WDI) data. The results of this study show that opportunity-based entrepreneurship has a positive relationship with environmental quality of sustainable development. An analysis of moderating effects demonstrates that regulative, normative and cognitive factors have positive moderating effects on the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development. An important implication is the need to focus on sustainable development, especially environmental quality, and to promote opportunity-based entrepreneurship to solve environmental issues. This paper contributes to the literature on entrepreneurship and sustainable development by establishing a relationship model between entrepreneurship (especially opportunity-based entrepreneurship) and environmental quality. This research also opens the “black box” mechanism from a resource perspective. Last, this paper emphasizes the institutional contingency approach by empirically testing the role of institutional factors.

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## 1. Introduction

Entrepreneurship has been widely recognized as an engine of economic growth (Stel et al., 2005). Multiple studies have also explored various types of entrepreneurship in different countries (Bergmann and Sternberg, 2007). These countries can be classified as factor-driven countries, efficiency-driven countries and innovation-driven countries (Wong et al., 2005). Recently, the governments of many countries have also paid more attention to the issue of environmental degradation. Many treat entrepreneurship as a solution to environmental issues (Jiang et al., 2018). For entrepreneurs, focus on economic growth is not enough (Dean and McMullen, 2007), they should also plan for their long-term survival (Caliendo et al., 2019). In that regard, they should also focus on the issue of sustainable development (Ikedinachi and Ogamba, 2018), which in turn, requires them to pay more attention

to the issue of environmental protection (Shuai et al., 2018).

Meanwhile, scholars attempt to link entrepreneurship and the natural environment (Tilley and Young, 2006) and seek to understand how entrepreneurial action can help preserve nature (Schaper, 2010). However, it is unfortunate that most previously published studies tend to focus only on economic growth, with only a few focus on environmental quality (Nakamura, 2019). A considerably smaller number use empirical methods to test the relationship between entrepreneurship and the environmental quality of sustainable development. Nevertheless, recent studies on entrepreneurship are more inclined to focus on green entrepreneurship (Grinevich et al., 2017) or sustainable entrepreneurship (Muñoz and Cohen, 2018). This paper discusses the impact of entrepreneurial behavior on sustainable development, focus on opportunity-based entrepreneurship, which may be more reasonable and be of greater significant and practical value. It is quite meaningful to discuss the relationship between entrepreneurship and sustainable development, it also contributes to clean, environmental protection, to make a cleaner earth for us.

There are many theoretical gaps in the existing studies on entrepreneurship and the environmental quality of sustainable

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development. First, although researches on corporate social responsibility and green entrepreneurship or sustainable development call for a focus on the sustainable development of entrepreneurship (Block and Wagner, 2010), most existing entrepreneurial studies still focus on economic growth (Acs et al., 2018). As a result, other aspects of sustainable development cannot be confirmed by empirical evidence. Second, some studies are beginning to focus on the relationship between entrepreneurship and sustainable development (Hall et al., 2010). However, these studies often use entrepreneurial rate to understand entrepreneurship (Block et al., 2015). Clearly, they lack the understanding of entrepreneurship. In fact, the most famous entrepreneurship database, Global Entrepreneurship Monitor (GEM), is a good reference for all entrepreneurship types, which includes almost all countries around the world and is operated by Babson College (USA) and the London Business School (UK). GEM emphasizes one type of entrepreneurship called opportunity-based entrepreneurship. According to GEM, opportunity-based entrepreneurship includes those who are attracted to entrepreneurship by opportunity and because they desire independence or because they wish to increase their income; basically, the entrepreneurial process begins with the discovery of opportunities (Shane and Venkataraman, 2000). Opportunity-based entrepreneurship has been widely discussed in other studies (Dhahri and Omri, 2018) but not investigated in depth to understand the relationship between entrepreneurship and sustainable development, even though the resource-based view (RBV) does recognize its importance and its applicability to the field of sustainable entrepreneurship (Spence, 2011). Third, prior research has focused on institutional factors related to institutional environment as an independent variable of entrepreneurship from an institutional economics perspective (Aparicio et al., 2016). In fact, institutional environment is a contextual factor, as it changes the cognition and behavior of entrepreneurs (Crump et al., 2018). This factor helps us discover the moderating variables in our study from an institutional context. In summary, this paper raises the following theoretical questions: How does entrepreneurship (opportunity-based entrepreneurship) affect environmental quality, and what are the institutional contextual factors of this relationship?

Therefore, this study aims to examine the relationship between entrepreneurship (opportunity-based entrepreneurship) and the environmental quality of sustainable development using Global Entrepreneurship Monitor database (GEM) and World Development Indicator (WDI) data. The study looks at the role of the contextual environment and introduces moderating variables according to GEM nation data, including regulative, normative and cognitive factors, in an institutional context. This study has meaningful implications for opportunity-based entrepreneurship and sustainable development. This paper proceeds as follows. First, we define entrepreneurship (opportunity-based entrepreneurship), the resource-based view (RBV) and the institutional context in the literature review. Second, we attempt to establish a model of opportunity-based entrepreneurship and the environmental quality of sustainable development. Third, we introduce moderating variables in the institutional context, including regulative, normative and cognitive factors. Fourth, we explain the research methodology and then present and discuss the results of our empirical tests. Last, we conclude and outline future research.

## 2. Literature review

### 2.1. Opportunity-based entrepreneurship

Opportunity-based entrepreneurship is a business creation that emerges when there is an entrepreneurial opportunity (Brown

et al., 2010). Opportunity-based entrepreneurs are those who initiate venture activity because of the attractiveness of the business idea and its personal implications (Rui et al., 2014). Opportunity-based entrepreneurs will carry out their own ideas by seeking entrepreneurial opportunities (Dimitratos et al., 2016).

According to the two divisions of entrepreneurship type in the GEM database, we find that as opposed to necessity-based entrepreneurship, opportunity-based entrepreneurship emphasizes the autonomy of entrepreneurship (Rui et al., 2014). Opportunity-based entrepreneurship requires entrepreneurs to actively discover entrepreneurial opportunities, cultivate their own entrepreneurial capabilities, and achieve entrepreneurial value (Arenius and Clercq, 2005). Therefore, on the one hand, opportunity-based entrepreneurs are more inclined to focus on the environmental protection field given the large number of entrepreneurial opportunities (Clark and Ramachandran, 2019). On the other hand, opportunity-based entrepreneurs also pay more attention to the benign interaction with the government in the actual entrepreneurial process and obtain government support through environmental protection (Entezari, 2015). However, the existing literature on opportunity-based entrepreneurship often links opportunity-based entrepreneurship with economic growth while ignoring the influence of opportunity-based entrepreneurship on environmental protection.

### 2.2. Resource-based view (RBV) in entrepreneurship studies

The resource-based view (RBV) is one of the most influential perspectives in organizational sciences and entrepreneurship studies (Barney et al., 2001; Li, 2019). Google Scholar's citation counts show that Barney (1991) and Wernerfelt (1984)'s seminal RBV articles continue to attract increasing interest. The RBV has usually focused on explaining how and why established firms adopt some type of strategy (Kellermanns et al., 2016). The RBV implies that resources are valuable, rare, inimitable and nonsubstitutable; these resources are defined as "all assets, capabilities, organizational processes, firm dimensions, information, knowledge, etc., controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991). Similarly, the resource-based view in an entrepreneurial context has attracted many scholars. Brush (1997) studied small business owners' relative favorability ratings of resource types. The concept of resources in an entrepreneurial context emphasizes entrepreneurial opportunities and capabilities.

The RBV also provides a perspective for the study of entrepreneurship and environmental degradation. As environmental economics shows that environmental degradation results from the failure of markets, some scholars promote entrepreneurship as a means of resolving market failure problems (Coase, 1974) and, more specifically, environmental issues (Cohen and Winn, 2007). Entrepreneurial action can resolve environmental challenges via entrepreneurial resource utilization. Entrepreneurs use resources to reduce transaction costs (Dean and McMullen, 2002), disseminate information and motivate government action to overcome the failure of markets (Eckhardt and Shane, 2003). From an RBV perspective, Eckhardt and Shane (2003) distinguished two important themes in the literature, such as exogenous shocks and asymmetries, which reflect these market changes, such as knowledge. In other words, market failure may result in environmental degradation and provide entrepreneurial opportunities, and entrepreneurs seeking these opportunities could create new ventures (Ball and Kittler, 2019). Thus market failure emphasizes two important elements: entrepreneurial opportunity and entrepreneurial capability.

### 2.3. Institutional context

Institutional theory has played an important role in entrepreneurial studies in the last several decades, especially in the new institutional theory (Battilana et al., 2009) and institutional entrepreneurship (Rosalinde et al., 2013). This theory provides scholars with a new perspective from which to discuss entrepreneurship. New institutional theory focuses on the hidden forces which shape entrepreneurial actions. Institutional constraints include the regulative, normative and cognitive factors proposed by Scott (1995). Regulative factors focus on policy setting, supervision and reward. Normative factors include values and norms. Values refer to the concepts or needs which actors prefer and the various criteria used to compare and evaluate existing structures or behaviors. The cognitive factors emphasize the importance of culture (Scott, 1995).

Institutional context is indispensable to the study of entrepreneurship. Entrepreneurs are clearly influenced by the institutional conditions that surround them, which will impact opportunity discoveries and entrepreneurial action. Scholars have confirmed that entrepreneurship can be encouraged by governmental support, tax structure and culture (O'Neill et al., 2009). Jennings and Zandbergen (1995) argued that institutional theory could help us understand how the institutional environment influences entrepreneurial choices and actions and how the meaning of sustainability is diffused through different organizations. Sustainable entrepreneurship in the energy industry provides evidence that entrepreneurship is indeed closely linked to regulative cognitive and normative institutions. Russo (2003) analyzed the macroeconomic conditions influencing renewable energy projects, while Meek et al. (2010) offered further evidence of the importance of a normative institutional environment for entrepreneurs, wherein social norms can impact policy efficacy.

### 2.4. Relationship between entrepreneurship and sustainable development

Furthermore, the literature focusing on environmental protection confirms that entrepreneurship is the path to sustainable development (York and Venkataraman, 2010). Existing studies show that entrepreneurs will promote environmental welfare (Dean and McMullen, 2002), while Cohen and Winn (2007) argued that human activities impact the ecosystem. However, both studies fail to show the empirical relationship between opportunity-based entrepreneurship and environmental sustainability. Shepherd and Patzelt (2011) suggested that entrepreneurship can protect the ecosystem and thus improve environmental quality. This study provides us with a theory gap to explore the empirical relationship between entrepreneurship and environmental degradation from the RBV and to discuss the question of how opportunity-based entrepreneurs promote environmental protection.

In addition, scholars also attempt to connect entrepreneurship and environmental quality from a social perspective (Moon, 2018). Lebron and Brannon, 2018 used social-identity theory to establish a theory model linking entrepreneurial motivation and green entrepreneurship. Gasbarro et al. (2018) took an institutional perspective to investigate how sustainable entrepreneurs address regulative, normative and cultural-cognitive factors and then discuss institutional change.

Thus, entrepreneurship can contribute to the environmental quality of sustainable development, and RBV and the institutional perspective provide opportunities for us to explain the relationship between entrepreneurship and sustainable development. We focus on opportunity-based entrepreneurship and environmental quality, propose a theoretical model, and test it using GEM and WDI data.

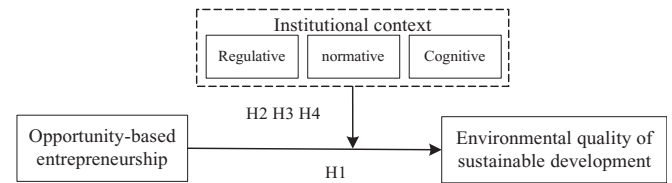


Fig. 1. The framework for hypothesis.

## 3. Hypotheses

As shown in Fig. 1, the baseline proposition for our hypothesis focuses on the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development; the moderating effect of institutional context includes regulative, normative and cognitive factors. We will analyze the effect of opportunity-based entrepreneurship on the environmental quality of sustainable development and examine how regulative, normative and cognitive factors in an institutional context influence this relationship.

### 3.1. Opportunity-based entrepreneurship and environmental quality

The literature on entrepreneurship distinguishes different types of entrepreneurship, such as productive (Baumol and Strom, 2007) and unproductive entrepreneurship (Audretsch and Keilbach, 2008), entrepreneurship with and without growth aspirations (Baumol, 1996), and formal and informal entrepreneurship (Minniti, 2008). In the last decade, researchers have focused on the classification distinguishing opportunity-based entrepreneurship from necessity-based entrepreneurship (Autio and Acs, 2010). The famous GEM entrepreneurship database also adopts entrepreneurship classifications. Opportunity-based entrepreneurship is a type of activity that encompasses high-growth expectation entrepreneurial activities, with is associated with good business opportunities (Dau and Cuerdo-Cazurra, 2014). Necessity-based entrepreneurship includes self-employment, given the lack of better job opportunities (Angulo-Guerrero et al., 2017). Based on GEM data, an empirical study by Reynolds et al. (2005) summarized four main differences: (1) the expectations of job creation, (2) projections for out-of-country export expectations, (3) intention to replicate existing business activities vs. the creation of new ventures, and (4) market share. Moreover, opportunity-based entrepreneurship had a greater positive effect on economic growth. We focus on opportunity-based entrepreneurship, rather than necessity-based entrepreneurship, because opportunity-based entrepreneurship is generally thought of as business creation when there is an entrepreneurial opportunity.

Sustainable development differs from economic development because sustainable development not only includes economic development (Bromley et al., 1991) but also integrates environmental development (Khan, 2010). Improving environmental quality requires changing traditional production modes, implementing clean production and civilized consumption to improve economic activities, saving resources and reducing waste (Smulders and Maria, 2012). Therefore, focusing on environmental protection will also promote a country's systematic development. Indeed, entrepreneurship is related to environmental goals (Parrish, 2010).

In addition, many researchers have shown that opportunity-based entrepreneurship contributes to environmental quality. For example, Tiba and Omri (2017) examined the contribution of entrepreneurship to environmental improvement to show that the

entrepreneurship impact on environmental quality varies according to a country's income, which means that in high-income countries, the impact is low. York and Venkataraman (2010) highlighted the role of entrepreneurship in environmental protection and considered entrepreneurship to be a solution to environmental degradation. Furthermore, Shepherd and Patzelt (2011) suggested the positive impact of entrepreneurship on environmental quality. These researchers argued that entrepreneurship could protect the ecosystem, reduce environmental deforestation, improve agricultural practices, increase environmental quality and enhance freshwater supplies and biodiversity. Thus, it is clear that entrepreneurship influences environmental quality.

Focusing on opportunity-based entrepreneurship and the resource-based view (RBV) perspective, we propose two mechanisms to explain the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development, entrepreneurial opportunity and entrepreneurial capability (Shu et al., 2018), which has attracted considerable attention in entrepreneurship studies (Sleptsov and Anand, 2010). The first mechanism is entrepreneurial opportunity which, when linked to environmental protection, will provide entrepreneurs with a chance to effect environmental productions, green service, and certain environmental conditions. Since opportunity-based entrepreneurs discover these opportunities and make use of them, they will begin their entrepreneurship by contributing to the environmental quality of sustainable development by means of environmental value creation. Hanohov and Baldacchino (2017) emphasized the role of entrepreneurial opportunities in sustainable development and the discovery of opportunities based on prior knowledge, which means that the cognition of sustainable development may influence them in their opportunities to make discoveries and then result in sustainable development (Hanohov and Baldacchino, 2017). Cohen and Winn (2007) showed the importance of entrepreneurial opportunities in influencing the environment. Based on the analysis of four types market imperfections, including inefficient firms, externalities, flawed pricing mechanisms and information asymmetries, they showed that these market imperfections provide opportunities to introduce innovative technologies and business models. These opportunities establish the foundations of sustainable entrepreneurship, not only allowing founders to obtain entrepreneurial rents but also leading to improved local and global social and environmental conditions. The findings indicated that opportunity-based entrepreneurship had the potential to slow down the Earth's degradation but even progressively enhanced its ecosystems (Cohen and Winn, 2007). Opportunity recognition is important in entrepreneurship research, as entrepreneurship always begins with a potential business idea and eventually develops into a new product, service, or process (Shane and Venkataraman, 2000). Entrepreneurial opportunities stem not only from economies but also from social and ecological systems because entrepreneurs are embedded in the social environment (Muñoz and Cohen, 2018). The second mechanism is entrepreneurial capability. Entrepreneurial capability means the capability to turn opportunities into practice, including how to start new venture and run a new business (Bingham et al., 2010). Entrepreneurial capability helps entrepreneurs who intend to be real entrepreneurs. Shepherd and Patzelt (2011) proposed that entrepreneurs have the entrepreneurial capability to strike a balance between the competitive goals created by economic and environmental value, which are often contradictory (Youssef et al., 2018); thus, they concluded that entrepreneurship could reduce environmental pollution, especially in agricultural practices. In other words, entrepreneurship is significantly related to environmental development (Block and Wagner, 2010). Furthermore, entrepreneurial capability also includes entrepreneurs being able

to forge a solid relationship with the social environment, especially the government, during the entrepreneurship process. Therefore, entrepreneurs with better entrepreneurial capabilities will obtain more government support, thereby enjoy a competitive advantage. On this basis, they will pay more attention to social outcomes, such as the environmental protection of sustainable development that the government cares about (Newman et al., 2017). In short, the strong entrepreneurial capability of opportunity-based entrepreneurship promotes entrepreneurs be involved in environmental protection, thereby improve the quality of the environment.

Over all, we argue that entrepreneurship, especially opportunity-based entrepreneurship, is crucial to environmental quality. The prior literature also proves that entrepreneurship does indeed contribute to the environmental quality of sustainable development. When focusing on opportunity-based entrepreneurship, we can find it can influence the environmental quality of sustainable development through two mechanisms: entrepreneurial opportunity and entrepreneurial capability. Thus, we formulate the following hypothesis H1:

**Hypothesis 1.** (H1). Opportunity-based entrepreneurship has a significantly positive effect on environmental quality.

### 3.2. Moderating effect of institutional context

#### 3.2.1. Regulative factor

Regulative factors emphasize institutional constraints and regulatory behaviors and focus on policy setting, supervision, and reward. Regulation includes establishing rules and supervising others to follow them. The role of regulation is not only repression and restraint but also encouraging actors to create actively. Therefore, in simple terms, regulative factors emphasize governmental actions regarding opportunity-based entrepreneurship, such as governmental financing and support (Scott, 1995).

First, regulative factors on financing will increase entrepreneurs' access to financing. Funding availability is important for entrepreneurs, as it helps them meet the cost of technology and operation and also provides opportunities for entrepreneurs to become aware of new products and services (Schick et al., 2002). In environmental quality and green production, financing is difficult to access because it is difficult to accurately price the risk of investment in the market. To harness the innovative potential of entrepreneurs for environmental technologies, regulative factors on financing help entrepreneurs develop relationships with the early-stage investment community and improve the success rate of entrepreneurship (Urbano and Alvarez, 2014). In other words, financing support not only provides increased opportunities for entrepreneurs but also helps them improve their competitiveness.

Second, regulative factors on governmental support provide entrepreneurs with policy protection. The largest challenge for entrepreneurs in terms of environmental quality is going from research to production and distribution. Governmental support ensures the success of this transition. The government introduces green production to the market and illustrates the benefit of purchasing green products (Qiu et al., 2020). Once the public to be aware of the necessary of sustainability, they will support sustainable development and the government can stimulate the development of sustainability (Ivan et al., 2019). Governmental support creates increased opportunities for entrepreneurs in relation to sustainable development.

Furthermore, government participation can improve the legitimacy of entrepreneurship (Krane et al., 2020). Once the government supports entrepreneurial behavior, the enterprise will receive increased support for its development, such as market and venture capital (Williams and Nadi, 2012). Government support is the



foundation for entrepreneurs to begin a business. Without this support, entrepreneurship will face further obstacles. Therefore, the government-led incubator and enterprise entrepreneurship platform have greatly enhanced the entrepreneurial ability of start-ups. Such enterprises are also more likely to succeed than general enterprises.

In summary, regulative factors influence the opportunities and capabilities of entrepreneurs, which in turn will promote entrepreneurship related to environmental quality. Thus, we formulate the following hypothesis H2:

**Hypothesis 2.** (H2). Regulative factors in an institutional context moderate the relationship between opportunity-based entrepreneurship and environmental quality.

### 3.2.2. Normative factor

The normative factor includes values and norms. Values refer to those needs preferred by the actors and the various criteria used to compare and evaluate existing structures or behaviors. The normative factor dictates how things should be completed and the legal way or means of accomplishing them (Nanere et al., 2020). The normative dimension emphasizes the organization's adherence to rules and to general beliefs and values, which is also an important basis for the formation of institutions (Scott, 1995).

First, the normative factor emphasizes how to establish the norm. Social values require guidance from the government and from entrepreneurial enterprises, especially environmental entrepreneurship (Özge, 2013). Environmental entrepreneurship should advocate social attention to the sustainability of entrepreneurial development. While emphasizing economic growth, we must also pay attention to social and environmental values. To this end, governments and enterprises should work diligently toward the guidance of green values. The internal development of the industry and the construction of the external environment not only emphasize entrepreneurial opportunities to discover and create but also the entrepreneurial ability of entrepreneurs (Parris and Mcinnis-Bowers, 2014). When entrepreneurs have the ability to guide the market and gradually establish a reasonable norm, they will create new areas of entrepreneurship and thus gain the considerable value of entrepreneurship, thereby affecting environmental quality.

Second, the normative factor also emphasizes the establishment of common rules. For example, in a mature entrepreneurial field, entrepreneurs must abide by the entrepreneurial and market rules established by existing enterprises to obtain the legitimacy of entrepreneurship and hence entrepreneurial opportunities (Kibler et al., 2014). In an emerging field, entrepreneurs of the first enterprise must guide and improve the establishment of industry norms as the first enterprises (Ana and Mário, 2019). Thus, industry norms will affect the entrepreneurial choices of entrepreneurs. Different industry norms lead entrepreneurs to have different understandings of opportunities and abilities (Klaus and Irina, 2018).

In summary, normative factors influence the opportunities and capabilities of entrepreneurs, which will promote entrepreneurship in terms of environmental quality. Thus, we formulate the following hypothesis H3:

**Hypothesis 3.** (H3). Normative factors in an institutional context moderate the relationship between opportunity-based entrepreneurship and environmental quality.

### 3.2.3. Cognitive factor

The cognitive factor emphasizes the importance of culture. The distinctive feature of the new institutionalists is paying attention to

the role of culture and cognition in the organization. Cognition is the intermediary of the external world's stimuli and the reaction of the individual's body. Cognition is a series of symbolic phenomena concerning the world. This cognition provides a model of thinking, emotion, and action. Cognition in the institutional environment emphasizes the culture and customers' cognition in the market (Scott, 1995).

First, the cognitive factor emphasizes the role of culture. When the culture of a certain region is open and the acceptance of emerging environmental protection products or green entrepreneurship is relatively high, the market support in the region will be significantly improved, thereby affecting entrepreneurial enthusiasm and behavior (Engelen et al., 2015). In addition, cultural similarities are also conducive to reducing information asymmetry, and the culture of convergence can narrow the gap between entrepreneurs and the market. Therefore, entrepreneurs can obtain greater high-quality and reliable market information more smoothly (Klapper and Love, 2011). At the same time, it is also beneficial for entrepreneurs to discover and create new entrepreneurial opportunities. This reduces the cost of entrepreneurship and improves the quality of entrepreneurial ability.

Second, the cognitive factor emphasizes the important role of customers. There is no doubt that the customers' purchasing decisions have a major impact on entrepreneurs, which may result in the application of green productions which, in turn, influences environmental quality (Grégoire et al., 2011). Positive market feedback will encourage entrepreneurs to invest and initiate R&D in environmental production. Furthermore, customers offer incentives to the local market development of environmental quality. The customer's cognitive factor provides opportunities for entrepreneurs and encourages them to turn environment-related technologies into market products, thereby stimulating enthusiasm for entrepreneurship and improving its success rate, which in turn affects environmental quality.

In summary, cognitive factors influence the opportunities and capabilities of entrepreneurs, which in turn will promote entrepreneurship related to environmental quality. Thus, we formulate the following hypothesis H4:

**Hypothesis 4.** (H4). Cognitive factors in an institutional context moderate the relationship between opportunity-based entrepreneurship and environmental quality.

## 4. Methodology

### 4.1. Sample

The main goal of this study is to investigate the contribution of opportunity-based entrepreneurship on environmental quality. We collected the opportunity-based entrepreneurship and institutional context data from Global Entrepreneurship Monitor (GEM) database, the GDP data from World Development Indicator (WDI), and CO<sub>2</sub> emissions data from Carbon Dioxide Information Analysis Center (CDIAC), cause the CO<sub>2</sub> emissions data from year 2015–2017 is missing in WDI. GEM is the world's foremost study of entrepreneurship, operated by Babson College (USA) and London Business School (UK). The database includes Adult Population Survey (APS) and National Expert Survey (NES). Adult Population Survey (APS) looks at the characteristics, motivations and ambitions of individuals starting businesses, as well as social attitudes towards entrepreneurship. National Expert Survey (NES) looks at the national context in which individuals start businesses. Scholars consider GEM a rich, reliable and valid survey (Autio and Acs, 2010). Recent entrepreneurship and international business researchers have relied on this data (Bjørnskov and Foss, 2013).

GEM data at year 2014 includes 206,000 interviewees and 3,936 experts on entrepreneurship research, involved 73 economies. First, we use the 206,000 individual data to calculate the ratio of opportunity-based entrepreneurship of country, and got the data of 69 countries. Then we combine this data with CO2 emissions and GDP. Finally, we got the data of 67 countries after dropping missing data, which include 13 Asian countries, 27 European countries, 6 African countries, 11 north American countries, 9 south American countries and 1 ocean country. The countries list is as below.

#### 4.2. Measurement

This paper wants to exam the relationship between opportunity-based entrepreneurship and environmental quality of sustainable development. First, we choose opportunity-based entrepreneurship as independent variable, and use the ratio of opportunity-based entrepreneurship to measure opportunity-based entrepreneurship. Alvarez and Busenitz (2007) understood opportunity as a central element of quality entrepreneurship, and the initiatives that derive from it arise as a result of the desire for income, wealth and achievement. There are two models of entrepreneurship in GEM data, includes opportunity-based entrepreneurship and necessity-based entrepreneurship (Amorós et al., 2016). The measurement of the ratio of opportunity-based entrepreneurship includes three steps. First, we get the original data of individuals who are involved in opportunity early-stage entrepreneurial activities or not, “1” behalf opportunity-based entrepreneurship and “0” behalf not opportunity-based entrepreneurship. Second, we calculate the ratio of opportunity-based entrepreneurship of all samples. Finally, we take the ln of ratio into the regression. The data is in year 2014. Secondly, we take environmental quality as dependent variable. Environmental quality measured by per capita CO2 emissions (Dhahri and Omri, 2018). Cause the missing of CO2 emissions of year 2015–2017 in WDI, we got the data from Carbon Dioxide Information Analysis Center (CDIAC). Then we use the ratio of carbon emissions to GDP as a measure of environmental quality. What is more, there is a big gap between samples, so we take the ln of ratio into the regression. Third, we introduce the moderating variables from institutional context. As proposed by institutional theory, institutional context includes three aspects: regulative, normative and cognitive factors (Scott, 1995). We obtained the data from the Global Entrepreneurship Monitor (GEM) and the National Expert Survey (NES). The regulative factor focuses on the constraints and regulating mechanisms of institutions and governments, such as laws, regulations and support (Scott, 1995). We use governmental financing support and government programs to estimate the regulative factor. The normative factor emphasizes the normative rules that prescribe rights and privileges, as well as responsibilities and duties, such as expectations and market acceptance (Gega et al., 2011). We use internal market dynamic, internal market openness and R&D transfer to estimate the normative factor. The internal market acts on behalf of market acceptance, and R&D transfer represents the maturity of industry development. The cognitive factor stresses the shared conceptions that comprise the nature of social reality, and the frames through which meaning is made, such as creating shared identities (Baron, 2010). It emphasizes the culture and taken-for-granted aspects of individuals. We thus use cultural and social cognition and service infrastructure to estimate the cognitive factor. The data is in year 2014 in the GEM database. Besides, we use income of countries and region of countries as control variables. We choose these two control variables based on the research of Omri (2018). He concluded that the income level plays an important role. Otherwise, he also suggested future researches focus more on about contingency factors. We follow his research, choose these

two control variables. The first is income of countries, which includes low-income and high-income countries. Existing studies have proved that the income has contributions on environmental improvement (Omri, 2018). We use “0” behalf low-income countries, use “1” behalf not low-income countries. The second control variable is region of countries. According to the rules of the world continent, we divide all sample countries into Asia, Europe, Africa, North America, South America and Oceania as shown in Table 1.

Table 2 shows the variables description and data source.

## 5. Results

### 5.1. Descriptive statistical analysis

In this study, we conducted a descriptive statistical analysis with all the variables. Table 3 shows the correlation matrix for all the variable in this paper. The relationship among variables are meaningful (See. Table 4).

### 5.2. Result analysis

There is no doubt that the endogenous is existing between opportunity-based entrepreneurship and environmental quality. The ways can be used to eliminate endogenous, by using instrumental variables (IV), many scholars use the t+1 of dependent variable as IV. In this study, we use the t+1 of dependent variable to eliminate endogenous. So the independent variable is in year 2014, but the dependent variable is in year 2015.

The dependent variable in Table 5 model (1)–(4) is environmental quality, model (1) contains independent variable (ln per capita CO2 emissions), model (2)–(4) encompass moderator variables, independent variable and interaction items of independent variable and moderator variables (entrepreneurship\* regulative factor, entrepreneurship\* normative factor, entrepreneurship\* cognitive factor).

Table 5 illustrates the result testing Hypothesis 1, 2, 3, 4.

Hypothesis 1 predicts that entrepreneurship (opportunity-based entrepreneurship) has a significant effect on environmental quality. The result in model (1) shows that entrepreneurship (opportunity-based entrepreneurship) has a negative impact on per capita CO2 emissions (dependent variable), which means that it has a positive impact on environmental quality ( $r = -0.281$ ,  $P < 0.1$ ) because the greater the per capita CO2 emissions are, the worse the environmental quality is. H1 is thus confirmed.

Hypothesis 2 states that regulative factor moderates the relationship between entrepreneurship and environmental quality. According to Table 5 model (2), the effect of entrepreneurship and regulative factor on environmental quality is significant ( $r = 0.948$ ,  $P < 0.05$ ), H2 is supported.

As the same, H3 and H4 are also be supported, the normative factor moderates the relationship between entrepreneurship and environmental quality ( $r = 1.097$ ,  $P < 0.1$ ), the cognitive factor moderates the relationship between entrepreneurship and environmental quality ( $r = 1.140$ ,  $P < 0.05$ ).

Furthermore, we also find the effect of two control variables (income and region). Region is especially significant as a control variable, which proves that it is meaningful of control variables.

## 6. Robust test

To get a robust result, we use the data of year 2016 and 2017 to do robust test. We choose the data of two lags (2016) and three lags (2017) as the dependent variables of the robust test, for the following reasons: First, the impact of opportunity entrepreneurship on environmental quality itself has a lag effect, that is,

**Table 1**  
Countries list.

Region	Countries
Asia	China, Vietnam, Philippines, Qatar, Singapore, Thailand, Malaysia, Kazakhstan, Japan, Iran, Indonesia, India, Georgia
Europe	Austria, Belgium, BOSNIA & HZ, Croatia, Denmark, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden Switzerland, United Kingdom, Norway, Netherlands, Luxembourg, Lithuania, Italy, Ireland, Hungary, Greece, Germany, France, Finland, Estonia
Africa	Angola, Botswana, Burkina-faso, Cameroon, South Africa, Uganda
North America	Barbados, Belize, Canada, Costa Rica, El Salvador, Trinidad and Tobago, United State, Panama, Mexico, Jamaica, Guatemala
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Uruguay, Suriname, Peru
Oceania	Australia

**Table 2**  
Variables description and data source.

Variable	Variable name	Description	Sources
Independent variable	opportunity-based entrepreneurship	Ln (The ratio of opportunity-based entrepreneurship)	Global Entrepreneurship Monitor (GEM)-APS
Dependent variable	environmental quality	Ln (CO <sub>2</sub> emissions/GDP)	World Development Indicator (WDI) and Carbon Dioxide Information Analysis Center (CDIAC)
Moderating variable	Regulative factor	Governmental financing support and government programs	Global Entrepreneurship Monitor (GEM)-NES
	Normative factor	Internal market dynamic, internal market openness and R&D transfer	
	Cognitive factor	Cultural and social cognition, service infrastructure	
Control variable	Income	Income level of countries	Global Entrepreneurship Monitor economic reports
	Region	Region of countries	Global Entrepreneurship Monitor economic reports

opportunity entrepreneurship may show up in the second or even the third year. So we choose lagged data in robust test. Second, the impact of opportunity entrepreneurship on environmental quality may also be reflected after one year. Therefore, the lag period (2016) and the third period data (2017) is appropriate. Methodologically, the choice of lagged data can also solve the endogenous problem of the model (Fingleton and Palombi, 2016; Fan et al., 2017; Klomp, 2019), and is widely used.

We take the environmental quality in year 2016 and 2017 (as  $t+2$  and  $t+3$ ) as dependent variable. The result is shown in Table 6 and Table 7. As shown, opportunity-based entrepreneurship has significant effect on environmental quality ( $r = -0.264$  and  $r = -0.272$ ,  $p < 0.1$ ), the regulative factor's moderating effect is

significant ( $r = 0.957$ ,  $p < 0.05$  and  $r = 0.992$ ,  $p < 0.1$ ), the normative factor's moderating effect is significant ( $r = 1.088$ ,  $p < 0.1$  and  $r = 1.092$ ,  $p < 0.1$ ), the cognitive factor' moderating effect is significant ( $r = 1.158$ ,  $p < 0.05$  and  $r = 1.135$ ,  $p < 0.05$ ).

So the result is robust. We can conclude that opportunity-based entrepreneurship has significant effect on environmental quality, and institutional context (regulative factor, normative factor and cognitive factor) plays the moderating effect on this relationship.

## 7. Discussion

Opportunity-based entrepreneurship makes important sense on the environmental quality of sustainable development. This

**Table 3**  
Result of descriptive statistical analysis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)ln(per capita CO <sub>2</sub> emissions)2015	1.0000						
(2)ln(ratio of opportunity-based entrepreneurship)	-0.2225*	1.0000					
(3)regulative factor	-0.3832***	0.4077***	1.0000				
(4)normative factor	-0.1709	0.4140***	0.6561	1.0000			
(5)cognitive factor	-0.1140	0.0918	0.5431***	0.4744***	1.0000		
(6)income	-0.1638	0.3133***	0.1443	0.0870	0.0326	1.0000	
(7)region	-0.0976	-0.2962**	-0.3592***	-0.5188***	-0.1711	0.1034	1.0000

\* correlation is significant at 0.1,\*\*correlation is significant at 0.05, \*\*\*correlation is significant at 0.01, N = 67.

**Table 4**  
The Descriptive of samples.

Variable	Obs(N)	Mean	Std. Dev
(1)ln(per capita CO <sub>2</sub> emissions)2015	67	-21.81435	0.7503834
(2)ln(ratio of opportunity-based entrepreneurship)	67	2.195635	0.6679219
(3)regulative factor	67	2.611866	0.3601955
(4)normative factor	67	2.654229	0.2735203
(5)cognitive factor	67	3.28597	0.3431309
(6)income	67	1.835821	0.3732338
(7)region	67	1.686567	1.394893

**Table 5**  
Result of environmental quality 2015 as dependent variable.

	Dependent variable: ln(per capita CO <sub>2</sub> emissions)2015			
	model(1)	model(2)	model(3)	model(4)
Income	−0.138 (−0.53)	0.009 (0.04)	−0.127 (−0.50)	−0.166 (−0.65)
Region	−0.088 (−1.27)	−0.183*** (−2.76)	−0.136* (−1.78)	−0.135* (−1.93)
ln(ratio of opportunity-based entrepreneurship)	−0.281* (−1.84)	2.184** (2.16)	2.679 (1.66)	3.336** (2.14)
regulative factor		1.313 (1.33)		
normative factor			1.862 (1.30)	
cognitive factor				2.452** (2.05)
entrepreneurship* regulative factor		0.948** (2.31)		
entrepreneurship* normative factor			1.097* (1.79)	
entrepreneurship* cognitive factor				1.140** (2.33)
_cons	−20.796*** (−41.51)	−24.219*** (−9.84)	−25.703*** (−6.84)	−28.414*** (−7.55)
r <sup>2</sup>	0.083	0.288	0.160	0.171
F	1.896	4.931	2.326	2.514

\* correlation is significant at 0.1, \*\*correlation is significant at 0.05, \*\*\*correlation is significant at 0.01, N = 67.

research builds on previous theoretical studies of sustainable development. Our findings contribute to the entrepreneurial literature by providing an empirical approach, one that also leads to policy and managerial implications and provides some future research directions. The results are as follows.

First, H1 is significant, which proves the positive relationship between entrepreneurship and environmental quality. The result is robust according to a robustness test using 2016 and 2017 data. This is the same as in prior literature, which also proposed the same positive relationship (Korber and Mcnaughton, 2017). This result provides the foundation for further analysis and a bridge linking prior studies. We illustrate the resource-based theory of environmental quality of sustainable development. H1 shows that opportunity-based entrepreneurship contributes to the environmental quality of sustainable development. As noted in H1, the RBV encourages opportunity-based entrepreneurs to seek and create new valuable, rare and difficult-to-imitate resources (Kellermanns

et al., 2016). This finding implies that opportunity-based entrepreneurs focus more on entrepreneurial opportunity and capability in building their competitive advantage. Furthermore, this result forces the entrepreneurs to pay more attention to the environmental quality of sustainable development, such as sustainable entrepreneurial opportunities or ties with the government regarding environmental management.

Second, both institutional factors include regulative, normative, and cognitive factors and have a positive moderating effect on the relationship between opportunity-based entrepreneurship and environmental quality (H2, H3, H4). This finding means that the institutional context will promote the influence of opportunity-based entrepreneurship. The result also proves the effectiveness of institutional theory in entrepreneurial research (Jing et al., 2016; Goel and Karri, 2020). The major emphasis on these factors indicates that opportunity-based entrepreneurs try to identify new opportunities and improve their entrepreneurial capabilities to

**Table 6**  
Result of environmental quality 2016 as dependent variable.

	Dependent variable: ln(per capita CO <sub>2</sub> emissions)2016			
	model(1)	model(2)	model(3)	model(4)
Income	−0.160 (−0.61)	−0.013 (−0.05)	−0.149 (−0.58)	−0.189 (−0.74)
Region	−0.078 (−1.12)	−0.172*** (−2.58)	−0.126 (−1.65)	−0.125* (−1.78)
ln(ratio of opportunity-based entrepreneurship)	−0.264* (−1.73)	2.220** (2.18)	2.674 (1.64)	3.409** (2.18)
regulative factor		1.340 (1.34)		
normative factor			1.838 (1.27)	
cognitive factor				2.507** (2.09)
entrepreneurship* regulative factor		0.957** (2.32)		
entrepreneurship* normative factor			1.088* (1.77)	
entrepreneurship* cognitive factor				1.158** (2.36)
_cons	−20.818*** (−41.35)	−24.305*** (−9.80)	−25.664*** (−6.79)	−28.608*** (−7.56)
r <sup>2</sup>	0.076	0.280	0.153	0.165
F	1.737	4.737	2.209	2.416

\* correlation is significant at 0.1, \*\*correlation is significant at 0.05, \*\*\*correlation is significant at 0.01, N = 67.



**Table 7**  
Result of environmental quality 2017 as dependent variable.

	Dependent variable: ln(per capita CO <sub>2</sub> emissions)2017			
	model(1)	model(2)	model(3)	model(4)
Income	−0.165 (−0.62)	−0.015 (−0.06)	−0.152 (−0.59)	−0.192 (−0.75)
Region	−0.084 (−1.20)	−0.180*** (−2.68)	−0.135* (−1.76)	−0.131* (−1.85)
ln(ratio of opportunity-based entrepreneurship)	−0.272* (−1.77)	2.298** (2.24)	2.678 (1.64)	3.327** (2.11)
regulative factor		1.417 (1.41)		
normative factor			1.806 (1.25)	
cognitive factor				2.436** (2.02)
entrepreneurship* regulative factor		0.992* (2.39)		
entrepreneurship* normative factor			1.092* (1.77)	
entrepreneurship* cognitive factor				1.135** (2.29)
_cons	−20.794*** (−41.05)	−24.469*** (−9.84)	−25.561*** (−6.74)	−28.361*** (−7.44)
r <sup>2</sup>	0.081	0.287	0.161	0.167
F	1.850	4.911	2.342	2.444

\* correlation is significant at 0.1, \*\*correlation is significant at 0.05, \*\*\*correlation is significant at 0.01, N = 67.

build competitive advantages. The moderating institutional context provides us with further opportunities to discuss the institutional role. Opportunity-based entrepreneurs also make decisions from the market's perspective, but we submit that they should pay more attention to the social perspective, such as regulative, normative, and cognitive factors. Indeed, properly embedding in the social environment will not diminish enterprises' profitability but will enhance their competitive advantages. The institutional perspective holds that social factors provide enterprises with competitive advantages which other resources find difficult to provide. These competitive advantages are more difficult to imitate, such as political connections. Therefore, the moderating role of the institutional context provides a new perspective from which to explain the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development. The RBV clarifies the internal interpretation mechanism more clearly and provides solutions as to how to create an institutional environment beneficial to opportunity-based entrepreneurship and environmental quality.

Although this paper establishes and validates the relationship between opportunity-based entrepreneurship and environmental quality, this research requires critical reflection. First, one must ask whether the contribution of opportunity-based entrepreneurship to environmental quality is "too much worse." The conclusions of this paper verify the linear significant relationship between the two at the early stage of the venture, but in the time dimension, one must determine if the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development is an inverted U-shape. That is, after a certain point, the effect of opportunity-based entrepreneurship on environmental quality begins to weaken, and there is even a negative correlation between the two. At this point, opportunity-based entrepreneurs focus on achieving sustainable entrepreneurial opportunities and making political connections. When opportunities and political connections become the most important elements of sustainable entrepreneurship, enterprises tend to over concentrate opportunities and political connections, which may lead to resource redundancy or "rent-seeking" of existing ones. Second, can opportunity-based entrepreneurship be further divided? Although this paper has focused on and divided the opportunity

from the previous "entrepreneurship," the concept of opportunity-based entrepreneurship may be further divided. The literature on opportunity-based entrepreneurship (Zahra, 2010) shows that it also includes different types, such as opportunity creation and opportunity discovery (Goss and Sadler-Smith, 2017). Based on the preliminary establishment of the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development, we can discuss different types of opportunity-based entrepreneurship in relation to different environmental qualities of sustainable development in the future. Last, this paper verifies the role of institutional factors, but how to create an institutional environment suitable for opportunity-based entrepreneurship is still a topic to be further explored. The institutional environment can positively moderate opportunity-based entrepreneurship and environmental quality, but which institutional factor can make opportunity-based entrepreneurship pay more attention to environmental quality is a theoretical problem that must be explored and that is also significant for practical actions. In addition, although this paper establishes the relationship between opportunity-based entrepreneurship and environmental quality, and uses RBV to try to open the "black box" mechanism, it is difficult to empirically test the differences between entrepreneurial opportunities and entrepreneurial capabilities as data dilemma. This is also worth further discussion in the future.

On theoretical contributions, this study contributes to the existing literature on opportunity-based entrepreneurship and the environmental quality of sustainable development in several ways. First, we highlighted the role of opportunity-based entrepreneurship on environmental quality. The study advocates researchers to focus on the relationship between entrepreneurship (especially opportunity-based entrepreneurship) and sustainable development. Previous studies on entrepreneurship discuss the relationship between entrepreneurship (especially opportunity-based entrepreneurship) and economic growth (Huggins et al., 2018) but ignore environmental factors (Wennekers et al., 2005). However, we believe that environmental quality is an important part of sustainable development (Lu et al., 2018) and attempt to establish a model of opportunity-based entrepreneurship and the environmental quality of sustainable development in our study. Ultimately, our findings also demonstrate the importance of integrating

environmental elements for sustainable development. Second, we highlight and confirm the role of resource-based view (RBV) in entrepreneurial research. By using resource-based view (RBV), we propose two mechanisms to explain the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development, entrepreneurial opportunity and entrepreneurial capability (Shu et al., 2018), which has attracted considerable attention in entrepreneurship studies (Sleptsov and Anand, 2010). RBV provides a special perspective on the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development. We further validate the applicability of RBV in entrepreneurial research, reach a deeper understanding of entrepreneurial resources, and extend RBV from entrepreneurial research to entrepreneurial sustainable development research. Third, we introduce the institutional theory by empirical evidence. Understanding the role of institutional context brings us closer to the theory of sustainable development. Institutional theory focuses on the external environment of entrepreneurship, emphasizing the impact of external institutions on entrepreneurial behaviors (Tolbert et al., 2011). The role of institutional contexts in entrepreneurship or sustainable entrepreneurship has often been examined using qualitative analysis without empirical evidence. Our study attempts to demonstrate the important role of institutional elements through an empirical analysis of GEM data and a call for follow-up research to focus on the role of institutional theory in entrepreneurship to enrich studies on institutions and entrepreneurship.

On managerial contributions, this paper presents significant strategies and practical suggestions for entrepreneurs and policy-makers. First, we highlight the importance of entrepreneurship, and encourage the government to focus more on opportunity-based entrepreneurship to solve environmental problems. Our findings support the important role of entrepreneurship, especially opportunity-based entrepreneurship on environmental quality. Therefore, the government should actively encourage entrepreneurs to participate in opportunity-based entrepreneurship to start businesses during policy formulation (Munasinghe, 2007) and encourage everyone to take the opportunity to start them. Entrepreneurship (opportunity-based entrepreneurship) can not only effectively solve the labor employment problem but also promote environmental quality. Second, we also highlight the institutional environment which give the stakeholders growing spaces. In the contextual discussion of this paper, we find that institutional factors (regulative, normative, and cognitive factors) have a positive moderating role. Thus, there are many things for the institutional environment to accomplish. How can the government establish regulative rules? How can industry and society build normative rules? How can entrepreneurs change the market's cognition? All these questions are interesting and significant for entrepreneurship, especially opportunity-based entrepreneurship. We should therefore pay more attention to opportunity-based entrepreneurship and the institutional context which could influence it in terms of the environmental quality of sustainable development.

## 8. Conclusions

The objective of our study was to examine how opportunity-based entrepreneurship contributes to sustainable development (environmental quality), as well as testing the moderating impact of institutional context using data from the GEM database. The results showed that entrepreneurship is positively related to environmental quality and that institutional context has a positive moderating effect on opportunity-based entrepreneurship and the environmental quality of sustainable development.

This paper introduces RBV and institutional perspective to

explain the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development. According to the empirical results, RBV and institutional perspective have strong explanatory power. Given the above, this paper discusses other possibilities related to the relationship between opportunity entrepreneurship and the environmental quality of sustainable development and proposes policy recommendations for policy-makers based on the results of empirical research. Overall, this paper is a preliminary exploration of the relationship between entrepreneurship types (opportunity entrepreneurship) and the environmental quality of sustainable development. The results confirm our assumptions and can be discussed in depth based on the categories of opportunity-based entrepreneurship in the future.

## 9. Limitation and future research opportunities

Despite making a number of contributions, this paper also has several limitations. First, the sample data are limited. The data in this paper are country-level data, and the conclusions must be further tested. Future studies could examine the relationship between entrepreneurship and environmental quality using panel data. The second weakness pertains to the framework of this study. The moderating variables proposed in this paper are based on GEM's national-level data. However, future studies should further investigate whether these moderating variables can comprehensively summarize the entrepreneurial situation. As one of the reviewers notes, this paper contributes to the relationship between opportunity-based entrepreneurship and the environmental quality of sustainable development but fails to explore entrepreneurial opportunities and capabilities, which is important. As we were limited by the data in the GEM database, we can discuss this aspect in the future based on other questionnaire data.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## CRedit authorship contribution statement

**Jinjiang He:** Conceptualization, Methodology. **Mohd Nazari:** Writing - review & editing. **Yingqian Zhang:** Data curation, Writing - review & editing. **Ning Cai:** Supervision.

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## Appendix A. Data

The data used in this paper from Global Entrepreneurship Monitor (GEM) database (<https://www.gemconsortium.org/>), World Development Indicator (WDI) (<http://datatopics.worldbank.org/world-development-indicators/>), and Carbon Dioxide Information Analysis Center (CDIAC) ([https://cdiac.ess-dive.lbl.gov/trends/emis/meth\\_reg.html](https://cdiac.ess-dive.lbl.gov/trends/emis/meth_reg.html)).

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