Received : 22 Aug 24 | Revised: 10 Sep 24 | Accepted: 07 Oct 24
DOI: 10.62460/IJEASS/2024.013

RESEARCH ARTICLE

Interdisciplinary Journal of Emerging and Social Sciences

Sustainable Development Goals 7 and 13 of China, Would the Patent-Trademark Strategy Help?

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Abstract

Sustainable development has been the major focus of every nation. This study investigates the adoption of the Patent-Trademark strategy in achieving sustainable development goals on clean energy use and climate change mitigation, SDG 7 and 13 in China. Autoregressive Distributed Lag Model (ARDL) approach to Cointegration, Multiple Linear Regression (MLR), and Granger Causality were employed to this effect. Three models were developed: the benchmark model, the second model, which examined the impact of the trademarks, and the third model, which is the PTR (Patent-Trademark) strategy, which examined the interaction term between patents and trademarks. Results revealed that the PTR strategy addresses clean energy use and climate change mitigation. The Granger Causality test also showed a uni-directional relationship from trademark to CO_2 emissions, CO_2 emissions to patent and trademark to patent. A feedback effect was found between trademarks and patents. Findings suggest that in achieving China's Sustainable Development Goals (SDG 7 and 13) while filing for patents, the government should support private and public sectors with the Green Climate Fund (GCF) to register for trademarks.

KEYWORDS
Patent, Trademark, Economic Growth, Sustainable Development Goals

1 | INTRODUCTION

China's environmental pollution is a barrier to achieving sustainable development goals in relation to clean energy use and climate change mitigation (SDG 7 and 13) respectively (Luo et al., 2018). Clean energy use inevitably promotes a green economy, hence helping in addressing climate change issues. The nation's heavy reliance on coal-fired power plants for electricity generation has led to emissions of various dangerous gases, most significantly greenhouse gases that have proved harmful to human health. Due to rapid economic growth, China has since the year 2009 emerged as the world's largest CO_2 emitter with about 25% of total world emissions (Qin et al., 2017). Attaining a growth rate of about 10% annually in the past decade and consuming huge amounts of fossil fuel contributed negatively to environmental pollution (Chen et al., 2017). A high degree of industrialization and infrastructural development accompanied by increased energy consumption has led this economy to suffer pollution problems because generating and transmitting non-renewable energy is detrimental to climate change.

Largely, industries in China rely on non-renewable energies but improve their processes and products through disruptive innovation in an attempt to achieve sustainable development. China has, in the past three decades, consistently made efforts to decouple economic growth from air pollution and carbon intensity. The ultimate aim is to attain ecological civilization and sustainable development (Lu et al., 2020). For this reason, Disruptive Low Carbon Innovation (DLCI) raised a decade ago has successively been adopted by China (Tyfield, 2018)The policy is geared towards replacing existing technologies at a lower cost and at a faster pace globally. This implies that different sectors of China's economy have been applying disruptive innovation, leading to patenting to solve climate change issues. Despite these efforts, the country remains the highest emitter of CO_2 emissions. In order to achieve SDG goals (7 and 13), there is a need to find alternatives to patenting.

The Blue Ocean strategy is a competitive and modern marketing strategy that yields growth and profit to organizations adopting it (Alghamdi, 2016). This strategy introduces completely novel ways of doing

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things instead of developing existing ones. It is, therefore, both a call-to-action and guide-to-action, and its call-to-action properties have been taken up by governments, businesses, and individuals (Sheehan Norman & Vaidyanathan, 2009). The strategy thus provides uncontested market space for beginners until the time others join to compete. Creators of blue oceans do not set competition as their yardstick, but rather follow a different strategic logic that yields value innovation (Kim & Mauborgne, 2004). A blue ocean results when a company/firm/industry achieves value innovation that fashions value concurrently for both the company/firm/industry and the buyer (Bourletidis, 2014). Industries might have improved on existing technologies in an effort to battle climate change, which might have proved futile. Pioneering climate change mitigation technologies and introducing new organizational strategies without building on existing ones creates blue oceans. Inventors then enjoy the blue oceans they have created through such technological innovations and unique strategy development, which goes a long way to help achieve the sustainable development goals (SDG 7 and 13).

Numerous studies have been conducted on innovation and CO_2 emissions in China from diverse perspectives using different methodologies and with varying findings (Tyfield, 2018; Wilson et al., 2018). Mostly, these scholars proved that innovation has been of relevance in the climate mitigation battle of China and other economies, yet climate change remains an outstanding issue especially in China. This is an indication that the disruptive innovation strategy in addressing climate change has not been as effective as it should. There comes the question, what other strategy can help address climate change problems in China? In an attempt to contribute to knowledge, this study pioneers the blue-ocean-emission mitigation nexus in addressing climate change-related and clean energy use in China. Would it be beneficial should this strategy be applied to clean energy use, hence CO_2 emissions mitigation in China?

The remaining sections of this study are as follows: section 2 covers related relevant literature, section 3 presents research data and methods, section four presents results and discusses the findings, and section 5 draws a conclusion to the study, offering policies based on findings.

2.0 LITERATURE REVIEW

2.1 Disruptive Innovation Concept

Disruptive innovation refers to a new product, idea, process, or business model that introduces significant change or disruption in the market and to some extent the industry serving the market (Mahto et al., 2020). Disruptive innovation theory has played a vital role in igniting debate within academia on the difficulties of reigning firms to respond to continuous technological changes (Vecchiato, 2017). A firm's ability to join forces and innovate for sustainability while remaining competitive is seen as a specific organizational competence (van Kleef & Roome, 2007).

Much has been covered on innovation and CO_2 emissions in China. (Zhang et al., 2017) adopted the SGMM method in investigating the dynamic impact of environmental innovation on carbon emissions lessening of China's 30 provinces at varied phases of development and discovered that environmental innovation significantly decreases CO_2 emissions in China. Also, they found out that firms' independent innovation capability is necessary for promoting a reduction in CO_2 emissions. (Dong et al., 2014) found in their research on the effects of eco-innovation typology on its performance: Empirical evidence from Chinese enterprises that while economic growth is unlikely to harm the environment, environmental innovations, and rigorous rules can hurt industrial productivity and competitiveness. (Su & Moaniba, 2017b) proved that a country's tendency to innovate and patent a climate-change technology is subjective to the levels of CO_2 emissions and other greenhouse gas emissions. (Tyfield, 2018) analyzed disruptive low-carbon innovation in the light of three key shifts in perspective in China and found that technological innovation is identified as 'disruptive.' He established significant disruptive innovation that led to a low-carbon transition. (Martiskainen & Kivimaa, 2018) studied the topic "Creating innovative zero-carbon homes in the United Kingdom — Intermediaries and champions in building projects," which is a form of disruptive innovation. They found that at different stages of project development, platforms and actors standing in as innovation mediators advance zero-carbon buildings. Also, some of these intermediaries take advocating roles, while other actors champion projects whenever intermediation is absent.

The inference drawn from these studies is that disruptive innovations have been beneficial to sustainable development in relation to climate change mitigation and clean energy use, SDGs 7 and 13. However, as the needed results of these two goals have not been fully achieved, it is necessary to introduce and examine other strategies in an effort to address these goals.

2.2 Blue Ocean Strategy Concept

Blue ocean strategy encompasses the creation of strong growth and high profits for companies that discover new market positions where there are neither direct competitors nor accredited competition rules (Rebón et al., 2015). A blue ocean is created when a company attains value innovation that builds value instantaneously for both the buyer and the company (Bourletidis, 2014). Organizations that take on the blue ocean strategy consider growth and sustainability out of the orthodox confines and frontiers of the existing industry (Kamal & Dionne-Odom, 2016). The key idea behind the Blue Ocean perspective is value innovation, which means being innovative in one's production processes and procedures. (Lindič et al., 2012)). Simply put, a good blue ocean strategy is one that is not easy to imitate (Chang, 2010). While complacency has taken the hedge of firms, struggling in the “red ocean” instead of the blue ocean” (Lindič et al., 2012) suggests that companies must change their established business models to tread the path of the blue ocean. This could require destroying models that have granted them success over time in the industry and discarding once-valuable assets.

The analytical tool called the four actions framework outlined by (Kim & Mauborgne, 2005) are the questions organizations should ask themselves if they seek to change the odds. Eliminating CO_2 emissions demands that these questions be asked by all industries; which factors are being taken for granted by industries, however, causing climate change, should be abolished? Which factors should be abridged, well underneath industry standards? Which factors should be elevated well above industry standards? and which factors should be generated that industries have at no time offered? Answers to these questions would go a long way to address issues of SDG 7 and 13 as well as yield more profit to these sectors. New opportunities would be discovered, which could earn a trademark for the concerned sector. Comparatively, trademarks are easier to obtain than patents and it equally protect innovation (Mensah et al., 2019). Trademarks fulfill two complementary roles which are the identification of a product or service from its source and a differentiation role, distinguishing one product or service from that of others in a given market (Castaldi, 2018). For this reason, this study proxies the Blue Ocean strategy with trademark application. Applying a blue ocean strategy to real business cases and in management is deemed a good approach (Lohtander et al., 2017).

Empirically, it has been established by (Al Nsour, 2016) the competitive advantage of commercial banks in Saudi, stems from implementing the Blue Ocean strategy. (Chang, 2010) examined the “Bandit cellphones: A blue ocean strategy,” they revealed that the Bandit cellphones company introduced a new business model that changed the rules of the game in the foreign-owned mobile phone company that had dominated the Chinese market. The strategy was low cost accompanied by high value-added features of their cell phones. Thus, the blue ocean strategy created by Bandit cellphones pushed them through successfully on the market. Chang pointed out that the analysis based on this cellphone company marks a good example in the field of strategy and innovation management. This is to say, in the field of innovation management, it is necessary and best to adopt the Blue Ocean strategy.

(Bourletidis, 2014) studied “The Strategic Model of Innovation Clusters: Implementation of Blue Ocean Strategy in a Typical Greek Region”. He is of the view that innovation should elevate and create worth for the market, while simultaneously sinking or eradicating features or services that are less appreciated by the existing or upcoming market. He examined how to apply the ‘blue ocean’ concept in a typical Greek region, implement cluster development and new business models, and ascertain reliable directions for innovation policy development. China’s quest to achieve SDG 7 and 13 goals could adopt such a blue ocean cluster strategy.

The environmental management literature has not yet considered the blue ocean strategy in the climate change mitigation battle. Therefore, studies of this nature are very important since they open different ways of fighting environmental pollution not only in China but globally.

2.3 Urbanization, Economic Growth and CO_2 Emissions

Urbanization in China has converted to one of the engines of its economic growth (Song et al., 2018). However economic growth is unachieved without harm to the environment and energy consumption leads to CO_2 emissions (Mensah et al., 2019). Urbanization creates challenges as increased demand and consumption of energy staggers behind increased CO_2 emission levels (Wang et al., 2014). China's commercial energy consumption contributions from the urban areas make up 84% of total energy use (Dhakal, 2009). This has however stirred up research on the relationship between urbanization and emissions in China (Solarin & Lean, 2016; Zhang et al., 2014). They established that there is a negative impact of urbanization on CO_2 emissions, implying that urbanization pollutes the environment and the reserve is true in the case of (Abdallh & Abugamos, 2017).

Economic growth accelerates urbanization and urbanization enhances economic growth. In as much as urbanization promotes economic growth and also leads to environmental pollution, divorcing these three seems inevitable; however, conscious and cautious effort from stakeholders could go a long way to address this issue without a detrimental effect on the Chinese economy. This necessitates the adoption of strategic, tactical, and operational plans to create a win-win situation.

2 METERIAL AND METHOD

3.1. Dataset and Variables

The data sets used in this empirical analysis are patent application, carbon dioxide (CO_2) emissions, urbanization, trademark, energy consumption, and Real Gross Domestic Product. This dataset was obtained from the World Bank WDI database for the study period 1990 to 2015. Table 1 shows the definition of the variables. The dependent variable in this study is the CO_2 emission. The independent variables are Real GDP, urbanization, trademark, and patent application. This study proxies trademark as a measure of the Blue Ocean Strategy for the fact this strategy results in innovative products or services distinctively different from existing ones on a market that houses the potential of obtaining a trademark. Disruptive innovations are measured in terms of Patent application, as done in previous studies.

Table 1: Variable definitions

Variable	Expected Signs	Definition	Source
CO_2		Carbon dioxide emission(metric tons per capita)	World Development Indicators
RGDP	+	Economic Growth(GDP constant USD, 2010)	World Development Indicators
URB	+	Urbanization (Urban population total)	World Development Indicators
PAT	-	Patent (Total Patent application)	World Development Indicators
TRD	-	Trademark (Total Trademark application)	World Development Indicators

CO_2 emissions are measured in metric tons per capita; RGDP is the real gross domestic product in constant USD 2010 US$, representing economic growth; URB is urbanization measured as the ratio of urban population to total population. TRD is a trademark in terms of trademark application.

PAT is patent and measured in terms of patent application.

3.2 The Econometric Approach

Examining the relationship between disruptive innovation and the Blue Ocean Strategy in addressing sustainable development goals 7 and 13, multiple linear regression (MLR), the ARDL approach to the co-integration test, and the Granger Causality Approach were employed. The ARDL approach is employed because it has advantages over other methods. (Ali et al., 2017) purport that variables used for a study where the ARDL bound test propounded is to be employed need not be integrated in the same order. Again, the long-run and short-run parameters of a model could be estimated concurrently. Last but not least, the small sample properties of a bound test approach are superior to that of multivariate co-integration (Narayan, 2005). The first model, which serves as a benchmark for this study, is formulated and estimated to determine the marginal effect of disruptive innovation on climate change mitigation (Su & Moaniba, 2017a; Tyfield, 2018). Though other variables were inculcated into the equation, focus remains on the effect of disruptive innovation on CO_2 emissions which has attracted much research already.

The first and our benchmark equation is written as;

$$CO_2 = \alpha_0 + \beta_1 URB_t + \beta_2 RGDP_t + \beta_3 EC_t + \beta_4 PAT_t + U_t \quad (1)$$

where $CO2_t$ is the dependent variable. β_1, $\beta_{2,3}$ and β_4, estimate the coefficients for the regressors. The explanatory variables: URB represents urbanization, RGDP for economic growth, EC represents energy consumption, and PAT for patent application. The subscript $_t$ represents the period of time.

We introduce the second equation by substituting the Blue Ocean strategy (trademark) in place of disruptive innovation (patent application) following (Mensah et al., 2019). This equation is to examine the effect of the blue ocean strategy on CO_2 emissions.

The second equation is therefore given as;

$$CO22 = \alpha 20 + \beta 21 URBt + \beta 22 RGDPt + \beta 23 ECt + \beta 24 TRDt + U2t \quad (2)$$

Here, we introduce the subscript $_2$ into the equations to differentiate the second equation from the benchmark equation and *TRD* depicts the trademark application for China

To examine the mitigating effect of disruptive innovation and blue ocean strategy on SDG 7 and 13, two other models, the third and fourth models, were built. The third equation is an interaction term between disruptive innovation and blue ocean strategy following (Mensah et al., 2015). The third equation is written as;

$$CO23 = \alpha 30 + \beta 31 URBt + \beta 32 RGDPt + \beta 33 ECt + \beta 34 PTRt + U3t \quad (3)$$

Where *PTR* is the variable generated, representing the interaction term between disruptive innovation and blue ocean strategy. The subscript $_3$ here identifies and distinguishes equation 3 from the others.

$$CO24 = \alpha 40 + \beta 41 URBt + \beta 42 RGDPt + \beta 43 ECt + \beta 44 (PATt + TRDt) + U4t \quad (4)$$

The fourth model has subscript $_4$ and also an addition of disruptive innovation and blue ocean strategy.

Finally, we built a model based on the ARDL co-integration test as another approach to scrutinize the both the short and long-run relationships between disruptive innovation, blue ocean strategy and CO_2 emissions.

ARDL is computed in equation as follows:

$$\Delta CO_{2_t} = \beta_0 + \sum_{i=1}^{k} \xi_1 \Delta CO_{2_{t-i}} \sum_{i=1}^{k} \xi_2 \Delta RGDP_{t-i} + \sum_{i=1}^{k} \xi_3 \Delta\, URB_{t-i} + \sum_{i=1}^{k} \xi_4 \Delta TRD_{t-i} + \sum_{i=1}^{k} \xi_5 \Delta PAT_{t-i} + \lambda_1 CO_{2_{t-i}} + \lambda_2 RGDP_{t-i} + \lambda_3 URB_{t-i} + \lambda_4 TRD_{t-i} + \lambda_5 PAT_{t-i} + \cdots + U_t \quad (5)$$

where CO_2 depicts the dependent variable. Here, the constant terms in front of the variables β (Zahn et al., 2019) is replace with λ (lambda) and ξ (Xi) to different the changing stage of the variables. The variables with the ∆ **(**delta) symbols estimates the short-run relationship whilst that with the λ (lambda) estimates the long-run relationship. Subscript $_5$ is an indication of a fifth equation.

3 RESULTS AND DISCUSSION

4.1 Unit Root Test

In avoidance of spurious regression results, the stationarity of the variables were investigated using Augmented Dickey-Fuller (ADF) and Philips Perron (PP) tests and results given in Table 2. From the results, all other variables, except trademark were found to be non-stationery at level. However, trademark turns stationery at 1st difference.

Table 2: Unit root test

	Level		1st Difference	
Variable	ADF	PP	ADF	PP
CO_2	-0.19(0.93)	0.44(0.98)	-2.66(0.09)	-2.70(0.08)
GDP	-0.19(0.93)	-0.93(0.76)	-4.28(0.00)	-4.29(0.00)
URB	-1.43(0.55)	-2.62(0.10)	1.92(0.03)	1.48(0.04)
TRD	-3.523(0.02)	-4.31(0.00)	-3.65(0.00)	-2.97(0.03)
PAT	0.70(0.98)	0.53(0.98)	-3.32(0.03)	-3.31(0.03)
EC	-0.94(0.75)	0.69(0.98)	-4.04(0.01)	-2.64(0.09)

4.2 Co-integration Test

ARDL Bounds test was adopted to test for co-integration among the variables and results reported in Table 4. Per the model selected and the F-statics value, variables are seen to be co-integrated. This means a long-run estimation method can be applied to our models.

Table 4: Results of the ARDL Bounds Test

Model	F-statistics	Model	Decision
CO_2 (dependent variable)	31.44	(2,1,0,0,1,1)	Co-integrated
Diagnostic Test Adj. R^2=0.92 F-statistic=514.20 Prob (F-statistic)=0.00			

Critical Values for the ARDL Bound Test

	Pesaran		Narayan	
Critical Values	Low Bound 1(0)	High Bound 1(1)	Low Bound I(0)	High Bound I(1)
10%***	1.85 2.11	2.85 3.15	2.19 2.59	3.25 3.77
5%**	2.62	3.77	3.54	4.93
1% *				

4.3 Multiple Linear Regression Results

The first three models were estimated based on multiple linear regression. The benchmark model that examined the effect of disruptive innovation on climate change mitigation is Model 1; Model 2 estimated the impact of the blue ocean strategy on climate change mitigation, and the third model also estimated the interaction term of both strategies on climate change mitigation. Results are displayed in Table 5. The benchmark model revealed that disruptive innovation, although insignificant, has a positive effect on climate change mitigation in China, looking at the coefficient value. This explains why disruptive innovation has not fully solved climate change problems in China. This finding is evident that in the phase of disruptive innovation, China continues to be the highest emitter of CO_2 emissions, and could be attributed to a lack of technological transfer (Mensah et al., 2018) or the inability of these technologies to address climate change issues properly. Economic growth proliferates emissions by 37% which supports (Bekhet et al., 2017). Energy consumption escalates emissions by 106%.

Table 5: Results for (Multiple Linear Regression)

	MODEL 1	MODEL 2	MODEL 3
Constant	-0.14(1.46)	0.23(0.97)	-1.35(2.12)
URB	-1.16(0.69)	-1.19(0.76)	-0.86(1.40)
RGDP	0.37(0.191)*	0.39(0.18)**	0.27(0.23)
EC	1.06(0.14)***	0.98(0.18)***	0.91(0.15)***
PAT	-0.02(0.04)		
TRD		-0.02(0.07)	
PTRD			-0.01(0.01)
R-squared	0.99	0.99	0.99

***, **, * denotes 1%, 5%, and 10% respectively.

The second model, which focused on the impact of the Blue Ocean strategy and CO2 emissions, proves a similar pattern as that of the model disruptive innovation. Blue Ocean's strategy is seen to curb emissions but not yet to the point of high effectiveness. From the negative coefficient sign, it can be seen that the impact of this strategy on the climate change battle is promising. The blue ocean strategy could be helpful in addressing emissions problems in China from the negative yet insignificant coefficient value displayed. Again, economic growth and energy consumption both pose detrimental impacts to sustainable development in China, evident in the coefficient values of 39% and 98%, respectively.

The PTR strategy proposed by (Thoma, 2015) is the blend of both disruptive innovation and blue ocean strategy and has the tendency to curb emissions as seen in the negative coefficient value. The third model factor in both strategies and results seemed satisfactory in that an abatement in emissions is experienced by the implementation of both. It implies that combining these two could go a long was to solve pollution problems in China. This affirms the assertion of (Thomä & Bizer, 2013; Zhou et al., 2016) that firms apply for trademarks and patents to complement each other. Economic growth poses a threat to climate change in China in that it contributes 91% of emissions generated.

4.4 Granger Causality Test

The VECM Granger Causality test between the variables of the study is reported in Table 6. The VECM model is preferred to the VAR in situations where long-run relationship is established (Boamah et al., 2017).

Table 6: VECM Granger Causality Test (Short-Run/Long-Run Causality)

	Short-run						Long-run
	ΔCO_2	$\Delta RGDP$	ΔEC	ΔURB	ΔTRD	ΔPAT	ECT
ΔCO_2	-	0.03(0.98)	0.48(0.79)	6.49(0.04)**	6.49(0.04)**	4.69(0.09)*	0.08[0.84] (0.93)
$\Delta RGDP$	0.29(0.86)		0.06(0.97)	10.78(0.00)***	10.78(0.00)***	11.27(0.00)***	-0.19[0.82] (0.43)
ΔEC	1.66(0.44)	0.86(0.65)	-	3.86(0.15)	3.86(0.15)	4.34(0.11)	-0.22[0.51](0.67)
ΔURB	0.39(0.82)	6.14(0.05)**	0.73(0.70)	-	0.97(0.62)	18.80(0.00)***	-0.00[0.03] (0.97)
ΔTRD	0.80(0.67)	5.24(0.07)*	1.53(0.46)	1.41(0.49)	-	7.92(0.02)**	-0.46[0.80] (0.58)
ΔPAT	0.79(0.67)	1.18(0.55)	0.79(0.67)	6.87(0.03)**	3.63(0.16)	-	-2.68[1.46] (0.09)*

****, **, * denotes 1%, 5%, and 10% respectively.*

Results revealed a uni-directional relationship between blue ocean strategy and CO_2 emissions, urbanization and CO2 emissions, disruptive innovation and CO2 emissions, and disruptive innovation, and economic growth. This is in contrast with the findings of (Wang et al., 2014) who found a bi-directional relationship between urbanization and CO_2 emissions. A bidirectional relationship was found between urbanization and economic growth, blue ocean strategy and economic growth, and then disruptive innovation and urbanization. It was also established that the Blue Ocean strategy granger causes disruptive innovation, and a feedback effect was found between the Blue Ocean strategy and disruptive innovation.

ECT shows the speed of adjustment of the independent variables with the dependent variables. It explains the catch-up speed of the independent to the dependent. In the long run, all the regressors have no relationship with the dependent variable.

4.5 Auto-regressive Distributed Lag Model (ARDL)

The ARDL approach to co-integration was adopted to examine both the short and long-run effect of disruptive innovation and blue ocean strategy in attaining SDGs 7 and 13. Findings reported in Table 7 show that disruptive innovation in the short and long run lessens CO_2 emissions by 27% and 12% respectively, which ratifies (Hodson et al., 2018). ARDL approach to co-integration's results from our benchmark model indicates a negative short and long-run relationship between disruptive innovation and CO_2 emissions. Clearly, being disruptively innovative alone could gradually lead to improvement in CO_2 emissions levels in China but patent applied, consequently granted are usually a few hence limited accessibility (Mensah et al., 2018).

Blue Ocean strategy also curbs emissions by 67% in the short run. In the long run, it is estimated that the blue ocean strategy would help battle CO_2 emissions by 24%. However, the blue ocean strategy from the ARDL approach abates emissions much better than disruptive innovation in the short run and is also estimated to curb emissions better in the long run from the coefficient values. This is a signal of a stronger effect of the blue ocean concept on the achievement of sustainable development goals (SDG 7 and 13) of China. Combining these two strategies can be very helpful as (Thoma, 2015) revealed that using both trademarks and patents institutes a signal for investors, competitors, and commercial partners that the primary pivotal invention is extremely valuable from a commercial point of view.

Table 7: Results of the Short and Long-run Estimates of the ARDL Model 3 (Dependent Variable: CO_2)

Model(2, 1, 0, 0, 1) Short-run estimates	Coefficient	T-statistic	P-value
Δ CO_2 (-1)	1.06	4.05	0.00***
ΔEC	0.33	0.31	0.31
ΔRGDP	1.20	1.75	0.06*
ΔPAT	-0.27	-3.55	0.00***
ΔTRD	-0.67	3.14	0.01***
ΔURB	-16.20	-2.90	0.01***
Coint Eq(-1)	-2.31	-4.98	0.00***
Long-run estimates			
CONSTANT	-2.77	-2.65	0.02**
EC	0.56	3.03	0.01***
RGDP	0.05	0.59	0.56
PAT	-0.12	-5.04	0.00***
TRD	-0.24	-3.60	0.00***
URB	1.68	3.01	0.01***
ARDL Model (2, 1, 0, 0, 1)			
R^2	0.82		
Adj. R^2	0.67		
F-stats	2.47		0.06*
Normality test			
Jarque-Bera	0.49		0.78
Hetero test	1.04		0.47

***,**,* denotes 1%, 5% and 10% significance level, respectively

All three models showed that energy consumption negatively affects CO2 emissions in China with coefficient values of 106%, 98%, and 91%, respectively. However, the detrimental impact of economic growth on CO_2 emissions is confirmed in the first two models with corresponding coefficient values of 37% and 39%. Energy consumption and economic growth pose a threat to the environment in China. This is possible due to the energy mix used in China. It has been confirmed that economic growth cannot be achieved without energy consumption (Dauda et al., 2019). Notwithstanding, energy use leads to environmental quality deterioration. That is to say, any attempt to reduce CO_2 emissions by lessening energy consumption can affect a country's level of competitiveness, inducing a decline in economic growth, (Charfeddine et al., 2018).

Urbanization in China is seen to worsen CO_2 emissions by 16.20% in the short run, confirming (Osathanunkul et al., 2018; Raggad, 2018). An estimated increase of 168% in CO_2 emissions would result from urbanization, consistent with (Zhou & Liu, 2016). In the short run, energy use and economic growth are a threat to environmental quality but insignificant. In the long run, however, it is expected that a 56% increase in CO2 emissions would result from energy consumption, but a minimal negative effect of economic growth on environmental pollution would be experienced on climate change in China. This is obvious from the positive but insignificant value of economic growth on CO_2 emissions in the long run. Instituting the PTR strategy is, therefore, a step in the right direction in achieving SDGs 7 and 13.

5. Conclusion and Policy Implications

In an effort to contribute to China's pursuit of sustainable development goals number (SDG 7 and 13), this paper attempted to address the issues of increased CO_2 emissions by treading a new path. Blue Ocean strategy as a marketing strategy was introduced to address the high emissions rate in China against the traditional disruptive innovation-emissions nexus. The ARDL approach to co-integration, multiple linear regression (MLR), and Granger causality test were the methods used. Empirically, it was found that disruptive innovation and the Blue Ocean strategy can combat emissions in China; notwithstanding, the Blue Ocean strategy curbs emissions much better. A diversion of marketing strategy from the Red Ocean to the Blue Ocean Strategy attenuates emissions. Economic growth and urbanization were found to increase CO_2 emissions. Results revealed a uni-directional relationship between blue ocean strategy and CO_2 emissions, urbanization and CO_2 emissions, disruptive innovation and CO_2 emissions, disruptive innovation and economic growth. A feedback effect was found between urbanization and economic growth, blue ocean strategy and economic growth, and then disruptive innovation and urbanization. A feedback effect was also found between the blue ocean strategy and disruptive innovation.

Based on the findings, we propose that in order for China to achieve Sustainable Development Goal number 13 (SDG 7 and 13), which addresses clean energy use and climate change respectively, the government should support private and public sectors with Green Climate Fund (GCF) to move into Blue Ocean Strategy as well instead of wallowing in the red oceans. This would help address the climate change issues in China in that industries would be moved to improvise environmental-related technologies and better production processes, among others, which could earn them a trademark followed by a patent. Blue ocean strategy and disruptive innovation should be encouraged in all sectors of the Chinese economy.

Some shortcomings in this study lie with data availability. Much of the period was not covered due to a lack of data on the topic in question. Data on trademarks was insufficient and began in 1990; hence, the shorter period was captured.

Acknowledgment

We appreciate the financial support from the National Natural Science Foundation of China (No. 71603105), Natural Science Foundation of Jiangsu, China (No. SBK2016042936), Science Foundation of Ministry of Education of China (No. 16YJC790067), and China Postdoctoral Science Foundation (Nos. 2017M610051, 2018T110054).

Nomenclature

Carbon dioxide emissions	(CO_2) emissions.
Autoregressive Distributed Lag Model test	(ARDL) test
Multiple Linear Regression	(MLR)
Vector Error Correction Model Granger Causality	(VECM) Granger Causality
Simulated Generalized Method of Moments	(SGMM) method
Sustainable Development Goal number 7 and 13	(SDG 7 and 13)
Green Climate Fund	(GCF)
Disruptive Low Carbon Innovation	(DLCI)
World Development Indicators	(WDI)
Augmented Dickey-Fuller unit root test	(ADF) test
Philips Perron unit root test	(PP) test

Author Contributions

The author prepared the manuscript, reviewed and approved the final version for submission.

Conflict of Interest Statement

There is no conflict of interest

Data Reliability Statement

Data was collected from a reliable source for this research. Data was sourced from World Development Indicators, World Bank database.

Funding

There is no funding available for the present study.

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