Article

Organization & Environment
2015, Vol. 28(4) 355–373

DOI: 10.1177/1086026615623059
oae.sagepub.com

Managing the Poverty–CO2 Reductions Paradox: The Case of China and the EU

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Abstract

This article examines the "Poverty–CO2 (carbon dioxide) Reductions Paradox," wherein reducing poverty through economic growth simultaneously increases CO2 emissions from increased production and consumption, at a time in history when CO2 emissions must be reduced to avoid climate change catastrophes. Paradox theory and integrative social contracts theory are applied to help understand the evolving behaviors of China, the world's largest CO2 emitter, and the European Union, a CO2 reduction leader, from 1990 to 2015 at the national and international levels. The environmental results of these activities have become species-threatening. The principle of fairness/justice is offered in order to guide efforts to resolve the paradox in a way that avoids irreversible climate changes projected to begin around 2050. Prominent stakeholder injustice claims are highlighted for future scholarship and policymaking considerations.

Keywords

climate change, European Union, China, carbon dioxide emissions, greenhouse gases, paradox theory, integrative social contracts theory, Kyoto Protocol, justice, fairness

Introduction

The basic needs of life include food, clean air, water, and shelter. Products and services that enhance the quality of life are also important, as is meaningful employment with sufficient income to pay for these. Some nations are better at fulfilling these citizen needs than others. According to the most recent estimates, about 1.0 billion people—14.5% of the world's population—lived in extreme poverty in 2011 (World Bank, 2015b). Carbon dioxide (CO2) emissions, meanwhile, are escalating to historical highs. According to climate change experts, these CO2 emission rates, if unabated, will create "long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" (IPCC, 2014a, p. 8).

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These two issues form the basis of a "Poverty–CO2 Reductions Paradox," wherein reducing poverty through economic growth simultaneously increases CO2 emissions from increased production and consumption, at a time in history when CO2 emissions must be reduced to avoid climate change catastrophes. As developing nations climb out of poverty and malnourishment, and developed nations seek to enhance their standards of living, environmental conditions worsen. At the same time, forcing developing nations such as China and India to reduce CO2 emissions restrains their ability to rise out of poverty.

We must treat all moral claims regarding the poverty–CO2 reductions paradox seriously. It is easy, in the abstract, to advocate for environmentally responsible economic development. But given the high costs associated with clean technology, many lives and livelihoods in developing nations are placed at risk. China is by far the largest CO2 emitter, and projected to maintain that position for many years. According to Phillip Stalley (2013),

> Material economic interests, the domestic policy-making process, and normative equity concerns all drive the Chinese position in the same direction. But scholars have typically paid insufficient attention to the latter and failed to recognize the extent to which China's position is bolstered and guided by a moral component. (p. 6)

An expanding global population and economic growth means greater consumption of fossil fuels. Yet life on Earth as we know it cannot be sustained if every developing nation industrializes as did European Union (EU) nations, the United States, and Japan, emitting billions of tons of CO2. Which is the lesser of two evils, people living in extreme poverty or catastrophic climate change impacts caused by increased CO2 emissions? How should the poverty–CO2 reductions paradox be managed at the national and international levels?

This article examines how a high–carbon-emitting developed nation that has become an environmental leader (the EU) and a high–carbon-emitting developing nation (China) have addressed the paradox. The EU is considered, rather than the United States, because its members took a leading role in the development and implementation of the Kyoto Protocol, innovative environmental regulations, and initiatives intended to force China and other nations to reduce their carbon emissions.

We begin by discussing climate change, economic growth, and CO2 emissions. Next, we introduce two previously unlinked theories—paradox theory and integrative social contracts theory (ISCT)—to examine the poverty–CO2 reductions paradox behaviors of the EU and China. Last, we use these theories to provide guidance for resolving the paradox based on the principle of fairness/justice.

Background: Climate, CO2, and Economic Growth

Climate Change and CO2 Emissions

Many organizations are diligently documenting and explaining the nature, causes, and impacts of climate change, including the Intergovernmental Panel on Climate Change (IPCC), International Energy Agency (IEA), National Aeronautics Space Administration (NASA), the World Bank, and the World Meteorological Organization (WMO). This section briefly outlines key findings of these organizations with respect to recent climate changes.

The 2001-2010 decade was the warmest since 1850, with a mean global air temperature of 14.47 °C (58.046 °F; WMO, 2013). The decade included 9 out of the 10 hottest years on record, with an average temperature that was 0.47 °C (0.846 °F) higher than that for 1961-1990 (WMO, 2013), and 0.85°C (1.53°F) higher than that for 1880 when multiple independent databases first existed (IPCC, 2014a). The warming trend continued into the next decade, with 2014 the warmest year in recorded history (WMO, 2015).

Warmer temperatures have been blamed for the increase in severity of heat waves, droughts, storms, and flooding throughout the world. NASA's (2015) "vital signs" website reports that Artic ice is declining 13.3% per decade relative to 1981-2010 average. This has caused sea levels to rise 3.20 mm per year since 1993 (NASA, 2015), double the annual 1.6 mm rising trend during the 20th century (WMO, 2015), threatening low-elevation coastal areas and small islands.

These geographic changes, in turn, have negatively affected water management systems, agriculture, food security, forestry, health, and tourism. Forests are shrinking and deserts expanding. Weather-related deaths, injuries, and property damages have risen significantly, with deaths from heat waves increasing from 6,000 in the period 1991-2000, to 136,000 for 2001-2010 (WMO, 2013). National governments have collapsed in part due to their inability to manage these severe weather conditions, leading to environmental refugees seeking more hospitable living conditions (Brown, 2011).

An overwhelming majority of climate scientists (about 97%) claim that the past century's warming trend is very likely due to human activities (NASA, 2015). Greenhouse gas (GHG) emissions are the greatest contributor to climate change trends, blanketing the earth and affecting atmospheric radiation levels, which influence surface temperatures. The primary human contribution to GHG is CO2 emitted from conventional fossil fuels used for energy production, particularly coal. CO2-emitting fossil fuels (oil, coal, and natural gas) account for 82% of the world's energy supply and 70% of GHG emissions (IEA, 2014). Coal accounts for 44% of CO2 emissions, followed by oil (35%) and natural gas (21%).

Globally, CO2 emissions, which have a long atmospheric lifetime, have more than doubled between 1971 and 2012, from 14 billion to about 32 billion metric tons, which includes a 51% increase from 1990 to 2012 (IEA, 2014). These emissions are projected to increase by another 56% between 2010 and 2040 due to higher levels of industrialization and consumption (U.S. Energy Information Administration, 2013). The volume of CO2 atmospheric concentrations has also risen, from a steady level of 280 parts per million (ppm) in the pre–industrial era to more than 400 ppm in 2015 (IEA, 2014; NASA, 2015). CO2 atmospheric concentrations increased more between 2012 and 2013 than any year in the previous 30 years (WMO, 2015).

With increasing CO2 emissions, the weather will continue to become warmer, and extreme weather conditions—heat waves and heavy rains—are predicted to occur more frequently and last longer (IPCC, 2014a). Damages associated with flooding, droughts, and the rise in sea level are felt most intensely by poorer nations that are least equipped to manage them. Climate scientists estimate that an increase beyond 2 °C (3.6 °F) above preindustrial levels will cause significant changes in water availability, falling crop yields that puts more people at risk for hunger, and a rising intensity of storms, draughts, and flooding (Stern, 2007). In 2009, the IPCC agreed to target not surpassing the 2 °C benchmark. To attain this goal, global CO2 emissions would need to be reduced in half by 2050 and atmospheric CO2 levels capped at 550 ppm (Stern, 2007). If not attained, environmental and human damages will escalate as temperatures increase 4 °C by 2100 (World Bank, 2012).

Population, Economic Growth, and National CO2 Emissions

In 2015, the world's population reached 7.3 billion people and continued to expand at a net increase rate of about 220,000 people a day (Worldometers, 2015). The fastest growing populations are in emerging-market and developing nations (IMF, 2015). As world population increases, so does the need for economic growth, and more energy and fossil fuel consumption.

In 2011, about 1.0 billion people in the world lived in extreme poverty, defined as living on $1.25 a day or less (World Bank, 2015b; see Table 1). In China, 84 million people (6% of population) lived in extreme poverty, down from 124 million (9%) just a year earlier, and from 689 million people (61%) in 1990. Undernourishment in China declined from 289 million people

Table 1. Economic, Poverty, and CO2 Data.

	Social/economic indicators					Environmental indicators			
Country and population, 2014	Extreme poverty ($1.25 or less per day), 2011[a]	Undernourished people, 2010-2012[b]	GNI per capita, 2014[c]	GDP (in trillions), 2014[c]	GDP growth, 2014[c]	CO2 total emissions metric tons (in billions), 2012[d]	CO2 total emissions metric tons (in billions), 1990-2012 % change[d]	CO2 (kilograms) per capita emissions, 2012[d]	CO2 (kilograms) per GDP (Intensity)[d]
World: 7.3 billion	1.0 billion (14.5%)	821 million (12%)	$10,858	$77.9	2.5%	31.7	+51.3%	4.5	0.58
European Union-28: 508 million	0%	e	$35,678	$18.5	0.4%	3.5	−13.8%	6.9	0.24
United States: 319 million	0%	e	$55,200	$17.4	3.6%	5.1	+4.2%	16.2	0.36
China: 1.4 billion	84 million (6.4%)	163 million (12%)	$7,380	$10.4	7.4%	8.2	+265.5%	6.1	1.81
India: 1.3 billion	288 million (23.6%)	190 million (16%)	$1,610	$2.1	7.3%	1.9	+236.6%	1.6	1.41

Note. CO2 = carbon dioxide; GNI = gross national income; GDP = gross domestic product.
[a]World Bank (2015b). [b]Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), & World Food Programme (WFP; 2015). [c]World Bank (2015a). [d]International Energy Agency (2014). [e]FAO, IFAD, and WFP (2015) report "<5%" rather than a specific amount for developed nations.

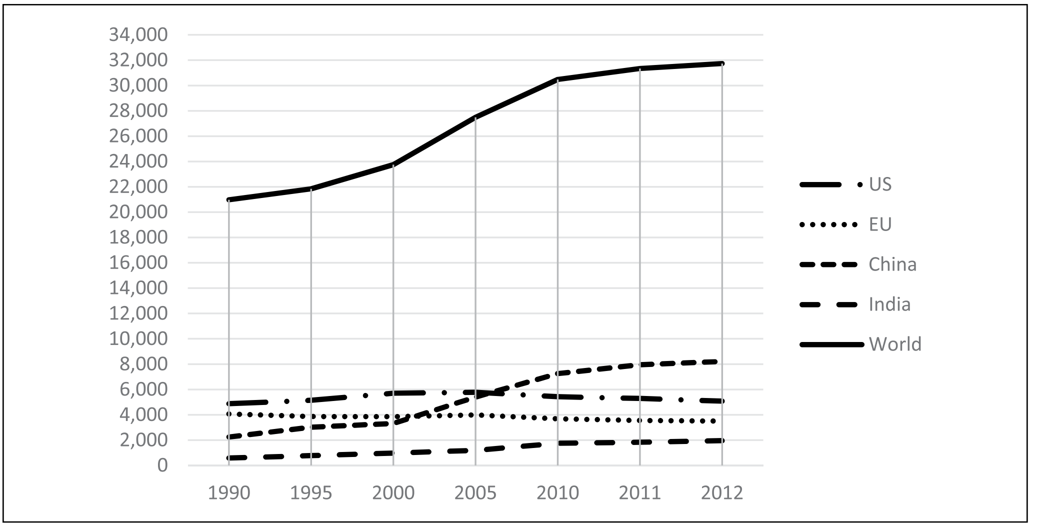

Figure 1. CO2 emission for World, China, United States, EU-28, and India from 1990 to 2011; unit: million metric tons.
Source. International Energy Agency (2014).
Note. EU = European Union. EU statistics for 1990 onward are reported by IEA for all current 28 EU nations as a group, rather than for the original 15 EU nations.

(24%) in 1990-1992 to 163 million (9%). Although this case study is primarily about the EU and China, data for the United States and India are included in Table 1 for comparative purposes raised later.

Obviously, economic prosperity is preferred to poverty. China and India, which account for 37% of the world's population, have made remarkable progress reducing extreme poverty through economic growth. Nonetheless, their gross national income (GNI) per capita remains very low relative to the United States and the EU (see Table 1). Both nations have much more to do to "catch up" with the lifestyles the United States and EU offer their citizens, which increases their CO2 emissions.

Figure 1 shows trends in CO2 emissions for the EU-28, the United States, and China, the world's three largest economies (IEA, 2014). China surpassed the United States in CO2 emissions in 2006. In comparing China and the EU, China accounts for 26% of all CO2 emissions and 19% of the world's population, while the EU accounts for 13% of CO2 emissions and 9% of world's population. Between 1990 and 2012, the EU-28 decreased CO2 emissions by 14%, while China increased by 266%, from 2.2 billion to 8.2 billion metric tons. China's numbers have recently been called into question when the government revised coal consumption upward by as much as 17%, possibly dating back to 2000 (Buckley, 2015).

CO2 intensity (CO2 emitted per GDP [gross domestic product]) is another key indicator monitored worldwide because it considers the size of a nation's economy. China has made substantial CO2 intensity improvements, declining by 58% between 1990 and 2012, better than the EU's 41% decline. But in absolute amounts, China's 2012 emission intensity level was still about 8 times that of the EU.

Despite their economic progress through high-carbon industrialization, the GNI per capita of China ($7,380) and India ($1,610) remains far behind that of the United States ($55,200) and EU ($35,678). About 24% of the people in India live in extreme poverty and 23% have no electricity. If the 150 other emerging-market and developing nations follow a traditional industrialization path, global CO2 emissions will continue to skyrocket, increasing the likelihood of the most devastating climate change scenarios occurring. Therefore, not only must developed nations reduce their CO_2 emissions but CO_2 restraints must be put on developing nations trying to achieve the economic prosperity found in the United States and EU.

Theoretical Foundations

Should people born in nations experiencing extreme poverty be denied the opportunity to experience the more humane, yet high-carbon consumption, lifestyles of their developed nation counterparts? If not, should the future of life on earth be risked while developing and developed nations improve economic and social well-being through high-carbon economic growth? The answer to this problem seems simple—environmentally responsible economic development. Unfortunately, low-carbon and clean technologies are either expensive, thus unaffordable, or still under development, thus unavailable to low-income nations where deaths due to malnutrition occur daily. Two particular theories not previously connected may be helpful in framing an answer: paradox theory and ISCT.

Paradox Theory

A paradox consists of "contradictory yet interrelated elements that exist simultaneously and persist over time" (Smith & Lewis, 2011, p. 232). How to reduce poverty and CO_2 emissions simultaneously will be referred to as the "Poverty–CO_2 Reductions Paradox." The term *poverty* is used rather than *economic growth* to highlight the starkness of the economic growth element for developing nations.

The formulation of capitalism is based on Adam Smith's resolution to an ethical and economic paradox (Collins, 1988). Smith examined how pursuing one's economic self-interest improved the general welfare more so than direct government intervention. Smith reasoned that people are psychologically inclined to improve their own economic quality of life. This has an accumulated general welfare impact because it often entails fulfilling the needs of others. But wouldn't self-interested people harm others to get what they wanted? Usually not, Smith argued, due to empathy, conscience, belief in God, and reason. When a selfish individual becomes aware that someone is being harmed by his/her actions, the individual often imagines how s/he would feel if similarly harmed, empathizes with the victim, and refrains from the harmful behavior. When these self-regulating moral governance systems fail, a strong system of justice, complemented by appropriate government regulations, is essential to punish those whose actions inappropriately harm others. Based on this theoretical framework, Smith maintained that individuals should be granted extensive personal and economic liberty.

However, Smith's paradox resolution has contributed greatly to the current poverty–CO_2 reductions paradox: free market poverty reduction efforts accelerate climate change due to increased CO_2 emissions associated with economic growth. Jevons paradox notes that the technology efficiency solution to the poverty–CO_2 reductions paradox may further exacerbate the problem, rather than solve it (Alcott, 2005). Technology efficiencies often increase consumer demand for consumption of a natural resource, such as coal.

To date, paradox theory has been used to frame and understand paradoxical issues, such as reconciling economic performance with social and environmental performance, rather than hypotheses testing. Van der Byl and Slawinski's (2015) review of corporate sustainability research highlights four general approaches to resolving the paradoxical tensions among the triple bottom line social, environmental, and financial factors: (1) *win–win approach*—situations in which improving one factor enhances another, (2) *trade-off approach*—situations in which one factor is relinquished for another, (3) *integrative approach*—situations in which the factors are balanced without favoring one over the other, and (4) *paradox approach*—situations in which the interrelatedness among factors is more deeply explored to develop creative both/and solutions. Based on the Van der Byl and Slawinski typology, we hypothesize the following:

> **Hypothesis 1:** Short-term progress on resolving the "Poverty–CO2 Reductions Paradox" will likely be based on win–win and trade-off approaches, while long-term progress will be based on integrative and paradox approaches.

Management theorists need to explicitly state how organizational behaviors impact environmental sustainability and long-term quality of life improvements. Whichever of the four approaches is chosen to resolve the poverty–CO2 reductions paradox affects people, thus the paradox resolution within and between nations must include a moral framework. However, paradox theory currently lacks an explicit moral framework. ISCT can help address this weakness.

Integrative Social Contracts Theory

Sustainability is a morally complex issue requiring normative theory to guide decision choices. Value judgments are used to determine and weigh which decisions, policies, and measures are most beneficial or detrimental to the environment and people (IPCC, 2014b). Such analysis raises issues of justice, equity, and fairness.

ISCT is a normative theory grounded in empirical research that provides behavioral guidance under conditions of national and international moral uncertainty (Donaldson & Dunfee, 1994, 1999). ISCT recognizes two levels of moral obligations, one at the theoretical macro-social contract level aligned with universal hypernorms, and the other at the micro-social contract level aligned with local community norms.

ISCT frames an appropriate moral response based on four principles: *Principle 1*—local economic communities may specify ethical norms for their members through micro-social contracts; *Principle 2*—norm-specifying micro-social contracts must be grounded in informed consent buttressed by a right of exit; *Principle 3*—to be obligatory, a micro-social contract must be compatible with hypernorms; and *Principle 4*—in case of conflicts among norms satisfying Principles 1 to 3, priority must be established through the application of rules consistent with the spirit and letter of the macro-social contract.

Macro-social contract hypernorms represent a convergence of generally held philosophical, religious, and cultural beliefs that all rational people would agree are binding on everyone. They include fundamental human rights centered on an obligation to respect the dignity of every person. Donaldson and Dunfee (1999) offer hypernorm criteria, such as well-known global standards that have widespread consensus, but not a specific list. Using their criteria, the Universal Declaration of Human Rights (UDHR; United Nations [UN], 1948) principles and UN Global Compact (UNGC; 2015) principles qualify as hypernorms.

For our purposes, there are six essential hypernorms contained in these documents: (1) the right to liberty and security of person (UDHR Article 3); (2) the right to work and protection against unemployment (UDHR Article 23.1); (3) the right to an adequate standard of living, including food (UDHR Article 25.1); (4) supporting a precautionary approach to environmental challenges (UNGC Principle 7); (5) undertaking initiatives to promote greater environmental responsibility (UNGC Principle 8); and (6) encouraging the development and diffusion of environmentally friendly technologies (UNGC Principle 9).

ISCT has been used to analyze a wide variety of cross-cultural issues and conflicts within and between nations, including gender discrimination, bribery, downsizing, and product pricing (Dunfee, 2006). ISCT research has consistently found that moral convictions shape cross-cultural and international disputes, giving legitimacy to both local moral standards and universal ethical principles. Based on ISCT development and analysis, we hypothesize the following:

Hypothesis 2: National micro-social contracts are likely to be crafted within the moral boundaries of hypernorms and approved by interested parties.
Hypothesis 3: When norm conflict occurs between two nations, the nation in greater alignment with the hypernorm will likely hold the other nation accountable to it.

How the poverty–CO2 reductions paradox plays out from 1990 to 2015, within and between the EU and China, is explored in the following two sections, and then analyzed based on these hypotheses. As noted earlier, the EU was chosen because it is a high–carbon-emitting developed nation that became an environmental leader in developing and implementing the Kyoto Protocol, innovative regulations, and initiatives to influence the carbon-emitting behaviors of other nations. China was chosen because it is a developing nation that became the world's largest carbon emitter during that same time period.

The EU and China's Micro-Social Contract Efforts

Climate change was initially detected by climate scientists in the 1970s (Barrett, 2013). The 1992 UN Earth Summit discussions led to the development of the UN Framework Convention on Climate Change (UNFCCC), an international treaty covering all 196 UN member nations. The treaty contained a nonbinding agreement to limit human-caused GHG emissions and develop a national inventory that would serve as a historical 1990 benchmark by which to measure future progress. The treaty signatories meet at an annual "Conference of the Parties" (COP) to assess progress. The WMO and UN Environmental Programee (UNEP) created the IPCC, open to all WMO and UNEP members, to serve as an international scientific body providing UNFCCC data and advice.

In 1997, the UNFCCC's Kyoto Protocol established specific national targets aimed at reducing global GHG emissions for the 2008-2012 time period to 5% below the 1990 benchmarks. The targets were legally binding on only developed nations because they contributed most to the problem. The Kyoto Protocol targets have influenced the EU and China's CO2 emissions reduction efforts.

European Union

The EU, second only to the United States in GHG emissions at the time of the Earth Summit, has pursued a sustainability leadership role in meeting Kyoto targets (Wurzel & Connelly, 2010). Rising sea levels threaten one third of the EU population that lives 50 km from the coast and generates 30% of the EU's GDP. The EU signed as a group to meet its 8% reduction target, and then allocated specific national targets to allow trade-offs as needed among member nations.

Table 2 describes the EU's three major CO2 reduction initiatives: carbon taxes (Andersen, 2010; Sumner, Bird, & Dobos, 2011), other environmental taxes (Taxation and Customs Union, 2014), and an Emissions Trading System (ETS; Barrett, 2013; Convery, 2009; European Commission [EC], 2013). Many other efforts, such as efficiency standards, have been taken by the EU and member nations.

Scholars and researchers have questioned the degree of success for these initiatives. For instance, some regard the EU ETS a failure for a variety of pragmatic and political reasons, including unclear rules, compliance concerns, problems with the permit allocation process, and a mispricing of carbon credits (Lohmann, 2008; Reyes & Gilbertson, 2010; Wettestad, 2014).

Nonetheless, the combination of these and other initiatives has enabled the EU to reduce CO2 emissions compared to the Kyoto 1990 benchmark, while growing its economy. The original EU-15 treaty participants achieved 8.3% CO2 reductions from 1990-2012, exceeding the 8% target (IEA, 2014). When the 13 nations that joined the EU since the Kyoto treaty are included in the total, the overall rate of decline rises to 13.8% over the same time period.

Table 2. Major EU CO2 Reduction Initiatives.

Carbon taxes: EU businesses and utilities are taxed for their carbon emissions or the carbon content of their products. Carbon tax rates vary across EU nations by energy source, industry sector, emitters within a sector, and time horizon.
Other environmental taxes: These include energy, transport fuel, freight, noise, and congestion taxes. Energy tax adjustments and exemptions are made due to competitive impacts, such as affordability and market share concerns.
Emissions Trading System (ETS): The EU ETS, initiated in 2005, is the world's first cap-and-trade program for CO2 emissions. The ETS goal is to reduce emissions to a level 21% lower than the 2005 benchmark by 2020, and 43% lower by 2030.The ETS covers more than 11,000 power stations, industrial plants, and airlines. Emission allowance permits are based on historical performance. Each year the total number of permits available is gradually reduced to meet emissions reduction targets. The permits were initially free, and gradually permits are being priced with the goal of all permits being auctioned by 2027.

Note. EU = European Union; CO2 = carbon dioxide.

Initially, there were concerns that these initiatives, which increased the cost structure of EU goods, would damage competitiveness by increasing consumer prices. Firms would outsource or relocate to developing nations with lower costs, resulting in job and tax losses. Carbon emissions would simply follow the firm to its new host nation, thus not solving the global problem. However, studies suggest that these concerns were unwarranted. The overall impact of carbon and energy taxes on EU firms' competitiveness has been weak, with no or relatively small negative impacts on employment levels, profitability, firm relocation, or carbon leakage (EC, 2015a; Reinaud, 2009; Wråke, Burtraw, Löfgren, & Zetterberg, 2012).

EU's future GHG emission goals remain ambitious. Environmental goals for 2020 include emitting 20% less than the 1990 GHG emissions benchmark, sourcing 20% of energy from renewable resources, achieving 20% improvement in energy efficiency, and committing 20% of the EU budget to climate change actions (EC, 2015a). GHG emission reduction goals include a 40% reduction from the 1990 benchmark by 2030, a 60% reduction by 2040, and an 80% reduction by 2050. Member nations have their own ambitious goals. Germany, for example, aims to increase its reliance on renewable energy, which accounted for 20% of its electricity generation in 2011, with targets of 35% by 2020 and 65% by 2040 (U.S. Energy Information Administration, 2013).

China

Since implementing free market reforms in 1978, China has made remarkable progress creating jobs and reducing extreme poverty by growing its economy at a 10% average annual rate (Leggett, 2012). More than 600 million Chinese were removed from extreme poverty conditions between 1990 and 2012. With low labor costs, China continues to attract foreign investments, making it the world's largest exporter.

China's efforts to combat climate change have focused on reducing CO2 emission intensity, rather than total CO2 emissions. China's policy is grounded in Kyoto's "common but differentiated responsibilities" principle for developed and developing nations. China's leaders insist that developed nations fulfill their legally binding obligations and transfer clean energy technologies to developing nations. According to China's 2011 climate change action statement (Information Office of the State Council of the People's Republic of China, 2011):

> By the UN standard for poverty, China still has a poverty-stricken population of over 100 million, thus it faces an extremely arduous task in developing its economy, eliminating poverty and improving

Table 3. Major China CO2 Emission Intensity Reduction Initiatives.

Goal setting: China relies on 5-year plans to guide social and economic development. The 12th Five-Year Plan (2011-2015) includes a CO2 emission intensity reduction goal of 17% compared to 2010, and 40-45% by 2020 compared to 2005; and increasing renewable energy sources from 7% to 15% by 2020, to 28-32% by 2030, and to 30-45% by 2050.
Energy efficiency standards: Enterprises are required to conduct clean production technology audits and report results to local governments and media. By 2010, approximately 1,650 energy efficiency standards had been developed, including 700 national standards, 500 industry standards, and 350 regional standards. In 2014, emission standards were established for many main contributors of pollutants, such as boilers, chemicals, and vehicle fuels.
Emissions Trading System (ETS): Seven cities and provinces are piloting their own carbon ETS programs with plans to implement a national ETS in 2016. Historical performance-based CO2 emission targets are assigned to each enterprise and building. The Shenzhen ETS covers 635 companies and institutions that emitted more than 5,000 tons of CO2, and 197 government and public buildings over 10,000 and 20,000 square meters in size, respectively.
Low-carbon cities: Between 2010 and 2012, 42 cities and provinces have been designated low-carbon economies and are required to develop a GHG emissions baseline and target indicators, formulate policies, provide support, and report results. City governments restrict cars sold and when driven, and have been assigned goals to increase the use of electric vehicles.
Certified Emission Reduction Projects (CERs): Developed nations earn carbon credits to meet Kyoto targets by investing in CO2 reduction emission projects in developing nations. China accounts for 60% of CER project credits earned for a wide range of activities, such as increasing renewable energy, improving energy efficiency, and reducing energy consumption.

Note. EU = European Union; GHG = greenhouse gas.

> the people's livelihood. … Developed countries should be responsible for their accumulative emissions during their 200-odd years of industrialization, which is the main reason for the current global warming, and they should naturally take the lead in shouldering the historical responsibilities to substantially reduce emissions . . . [and] provide financial support and transfer technologies to developing countries.

In 2012, China's energy source mix remained heavily dependent on fossil fuels, with 67% reliance on coal, 18% on oil, 5% on natural gas, and just 10% on renewable energy (IEA, 2014). As a result, China has unhealthy levels of air and water pollution. In 2014, only 16 out of 161 monitored cities met established air quality standards (National Bureau of Statistics of China, 2015, February 26), with outdoor air pollution contributing to an estimated 1.6 million deaths annually.

Table 3 describes China's five major CO2 emission intensity reduction initiatives: goal setting (Information Office of the State Council of the People's Republic of China, 2011; Kayode Oniemola, 2014), energy efficiency standards (Leggett, 2012), ETS (Duan, Pang, & Zhang, 2014; Mao, 2014), low-carbon cities (Baeumler, Ijjasz-Vasquez, & Mehndiratta, 2012), and Certified Emission Reduction (CER) projects (UNEP DTU Partnership, 2015). Carbon taxes, debated in China since 2008, have not been implemented due to their projected negative impact on economic development and living standards (Jeffery & Shen, 2012).

China's interrelated environmental policies have been greatly influenced by Kyoto Protocol developments and the experiences of other nations. For instance, China began partnering on CO2 emission reduction projects with developed nations in 2004 as a result of Kyoto's Clean Development Mechanisms, such as CERs, that encouraged collaboration between developed and developing nations. In 2009, when China pledged to reduce CO2 emission intensity in 2020 by 40% to 45% compared to a 2005 benchmark, government officials decided to replicate the EU ETS model to help achieve the goal (Mao, 2014). In 2014, China pledged to have emissions peak no later than 2030.

EU and Other Strategies to Pressure China

Despite these efforts, China still has, by far, the world's highest CO2 emissions, and its percentage of global CO2 emissions continues to rise. China's escalating CO2 emissions, in combination with India's, will make it nearly impossible to meet the IPCC goal of halving global CO2 emissions by 2050. At the 2011 COP annual meeting, participants agreed to develop a legally binding GHG emission reduction plan for all nations by its December 2015 meeting in Paris that would take effect in 2020. According to initial plans, developing nations, such as China, are to cap emissions and have access to a Green Climate Fund to offset some associated costs.

The EU continues to take a leadership role in pressuring China to limit CO2 emissions through bilateral agreements and attempts to tax the carbon content of imports. Disappointingly, the EU–China annual summit, initiated in 1998, has resulted in minimal transfer of climate change ideas, policies, and institutions from the EU to China (Torney, 2015). The most noteworthy agreement so far has been to develop carbon capture and storage technology to be used in nearly all coal-fired power plants by 2020 (EC, 2015b).

In 2008, the EU announced plans to levy GHG emission fees beginning in 2012 for all airplanes landing in, or departing from, EU airports, and to make these emissions subject to EU ETS regulations (Barrett, 2013). International airlines began reporting their EU emissions in 2012, but then the United States passed the ETS Prohibition Act on the grounds that requiring U.S. domestic airlines to participate in the EU ETS program violated U.S. national sovereignty rights. China and other non-EU nations soon adopted the sovereignty rights violation position as well.

The EU has also sought to levy a carbon border tax adjustment (BTA) against nations that do not enforce internationally determined CO2 reduction emissions, which would provide China a financial incentive to reduce total emissions (Wråke et al., 2012). The BTA would be an import tax based on either the product's carbon content or the amount of CO2 emitted during the production process, to offset higher EU product prices due to its sustainability policies. BTAs, overseen by the World Trade Organization (WTO), must be applied in a nondiscriminatory manner, that is, against all importers in a similar situation (Davidson Ladly, 2012).

China claimed the EU's BTA plan violated the Kyoto "common but differentiated responsibilities" principle because it pushes GHG emission reduction mitigation costs onto developing nations, costs that should be assigned to developed nations (Jeffery & Shen, 2012; Monjon & Quirion, 2011). China also claimed that a carbon BTA would violate WTO antiprotectionism policies.

Researchers have concluded that BTAs would significantly inhibit China's industrialization. Economic growth goals would be difficult to meet because China's primary energy source is coal and the additional costs would restrain exports (Bao, Tang, Wang, & Qiao, 2013). A BTA-induced increase in export costs for China's high-energy consumption enterprises would cause a decline in exports, manufacturing output, employment, and GDP (Libo & Weiqi, 2010). Research studies also suggest that BTAs would have little influence on China reducing its CO2 emissions (Bao, Tang, & Yang, 2010).

Results and Discussion

Following the 2014 COP meeting, experts stated that the legally binding CO2 emissions reduction plans being developed for 2020 enforcement would only achieve half the reductions necessary to prevent the earth from surpassing the preindustrial 2°C temperature increase benchmark (Davenport, 2014). In this section, we examine the behaviors of China and EU regarding the poverty–CO2 reductions paradox based on their paradox theory resolution approaches (Hypothesis 1) and ISCT activities (Hypotheses 2 and 3), to garner lessons learned that may improve the likelihood of future success.

Paradox Theory Resolution Approaches (Hypothesis 1)

The poverty–CO2 reductions paradox is experienced on national and international levels. According to Hypothesis 1, short-term progress will likely be achieved through win–win and trade-off resolution approaches, while long-term progress will be achieved through integrative and paradox resolution approaches.

On the national level, the EU remained economically competitive by implementing carbon taxes, environmental taxes, the EU ETS, and efficiency standards, thus generally forcing the integration of economic and environmental goals among member nations.

On the international level, the EU undertook a trade-off approach that emphasized reducing CO2 emissions. Minimal EU effort was directed to addressing China's concern for reducing extreme poverty. Two major efforts—BTAs and inclusion of international airlines emissions in the EU ETS—have failed to date because they inadequately account for China's sovereign rights and economic impacts. The most prominent win–win solution was a joint venture to develop carbon capturing technology that may affect job creation in China.

In its effort to become a global economic power, China initially applied a trade-off approach at the national level that focused on extreme poverty reduction through economic growth. In the 2000s, it adopted win–win and integrative approaches in response to Kyoto Protocol expectations. Goal setting, energy efficiency standards, ETS, low-carbon cities projects, and CER initiatives forced smaller political units to simultaneously meet CO2 emission reduction and economic growth goals.

At the international level, China has primarily taken a trade-off approach supplemented by a win–win approach. China's focus on poverty reduction, justified based on Kyoto's "common but differentiated responsibilities" principle, significantly contributed to global increases in CO2 emissions. China also occasionally adopted a win–win approach at this level, becoming the world's largest recipient of CER projects for reducing CO2 emissions.

The EU and China applied trade-off and integrative approaches on the national level, and primarily trade-off approaches, and occasionally win–win approaches, on the international level. This mix of paradox resolutions led to large poverty reduction gains in China and significant CO2 emission reductions in the EU but not aggregate CO2 emission reductions in China or globally. The development of, and compliance with, internationally agreed-on carbon emission limits will require more win–win and integrative opportunities that do not damage poverty eradication efforts.

ISCT Activities (Hypotheses 2 and 3)

National governments must simultaneously manage innumerable injustices and competing interests within their borders and in relationships with other nations. In terms of Hypothesis 2, the EU and China created micro-social contracts supported by hypernorms to address poverty and CO2 emission reductions. The EU's emphases on remaining economically competitive are aligned with limiting unemployment (UDHR Article 23) and achieving an adequate standard of living (UDHR 25) for its citizens. The EU's emphases on CO2 emissions reduction are aligned with all three UNGC hypernorms: being precautionary, promoting environmental responsibility, and diffusing environmentally friendly technologies.

China, likewise, has made policy decisions under the same hypernorm principles that guided the EU. However, China's micro-social contracts do not represent authentic norms—approved by interested parties—because its authoritarian, single-party political system restricts freedom of speech, press, and assembly, violating UDHR Article 3.

In terms of Hypothesis 3, the EU's aggregate CO2 emissions reduction policy, compared to China's CO2 emissions intensity metric, is in greater alignment with environmental hypernorms.

In the 2000s, China began to promote environmental responsibility and diffuse environmentally friendly technologies; however, its CO2 emissions more than doubled between 2000 and 2012, making it more difficult to achieve IPCC's 2050 global targets. This risk will intensify as Chinese consumption grows and other developing nations begin to industrialize.

As predicted by Hypothesis 3, the EU tried to restrict China's moral free space and hold China environmentally accountable by unilaterally establishing a BTA and airline emission regulations. These efforts, however, have failed to date due to claims of sovereignty rights violations and unfair trade practices.

Fairness Resolution

In 2014, the IPCC noted that absent additional mitigation, "warming is more likely than not to exceed 4°C above pre-industrial levels by 2100" (p. 10). The atmosphere is shared among all nations. Reliance on fossil fuels by communist, socialist, and capitalist nations for economic growth to enhance their citizens' quality of life has created an environmental tragedy of the commons (Hardin, 1968). Each nation, acting independently and rationally according to its short-term economic self-interests, is behaving contrary to the group's long-term best interests by destroying a common resource, atmospheric conditions.

How do we escape this dangerous quagmire? Donaldson and Dunfee (1994) maintained that consistency with alternative norms should serve as the basis for prioritizing conflicting norms. A well-established alternative norm continually raised by China is that of fairness, which is synonymous with justice (Rawls, 1985). Philosophers have long argued that justice is the most essential value for securing societal peace and the good life (Aristotle, 2011). The principle of justice, which refers to giving people what they deserve, unifies UDHR and UNGC hypernorms.

Fairness claims have shaped Kyoto Protocol's development and evolution. During the 1990s, it was considered fair to hold developed nations accountable for reducing their CO2 emissions, and to allow developing nations to use a carbon intensity, rather than an emission reduction, metric. Kyoto's inability to generate international agreements that adequately limit carbon emissions is also rooted in fairness claims (Conklin, 2012; Kutney, 2014). The United States did not ratify Kyoto, and Canada and Japan withdrew from the second commitment period (2012-2020), for reasons of fairness: Their assigned emission reduction goals would harm their national economies while China, a major competitor, was exempt. As a result of these actions, the 2012-2020 Kyoto commitment period only covers reductions for 15% of total global CO2 emissions.

All claims of unfairness and injustice associated the poverty–CO2 reductions paradox must be acknowledged and engaged, rather than ignored or discounted. Table 4 summarizes the major unfairness/injustice claims raised in this article.

Addressing the injustices associated the poverty–CO2 reductions paradox will entail international, regional, national, and subnational regulatory engagement. According to Adam Smith, regulation is justified when empathy fails to generate other-regarding sentiments or economic self-interest pursuits fail to achieve desired general welfare outcomes (Collins & Barkdull, 1995). These types of regulations highlight inefficiencies and spur the creation of innovations to address them (Porter & van der Linde, 1995).

At the international level, the UN and WTO must become even more involved without threatening national sovereignties. Individuals tend to resist, or very slowly accept, externally imposed procedural processes and outcomes. Fairness and transparency are particularly essential because people employed in high-carbon industries and ancillary businesses will have to change their livelihoods, and those living high-carbon lifestyles must make adjustments.

Regulatory policy makers must acknowledge the injustices listed in Table 4, empathize with those affected, and commit to seeking justice. This process involves extensive dialogue within

Table 4. Major Unfairness and Injustice Claims.

Economic injustices	Political injustices
• People live in extreme poverty. • Developed nations inadequately distribute wealth to developing nations.	• Sovereign rights are violated. • Corrupt political officials in developing nations divert technology and monetary transfers.
Environmental injustices	**Economic-environmental injustices**
• Humans may become extinct from excessive carbon dioxide emissions causing climate change. • Developing nations are not held accountable for their aggregate carbon dioxide emissions. • The living conditions of future generations are being sacrificed on behalf of current generations.	• Holding developing nations accountable for environmental harms generated mostly by developed nations that economically benefited from them. • Developed nations are not sharing clean and low-carbon technologies with developing nations at an affordable price. • People in developed nations live high-carbon consumer lifestyles.

and between nations, wherein experiences are expressed and heard. Historically, this has been difficult to achieve due to tendencies toward autocratic abuse of political power and perceiving opposing viewpoints as threatening. Private party rule-making can be helpful input, even if often prone to participant biases (Green, 2013).

COP agreements are based on consensus among all nations. This unwieldy process has generated less than optimal decisions, making environmental catastrophe more possible. An "inclusive minilateralism" process consisting of representatives from three factions—the most responsible nations, most capable nations, and most vulnerable nations—may be more efficient and effective (Eckersley, 2012).

International agreements are just one aspect of a portfolio of actions that must be taken. Reducing carbon emissions will entail new technologies for energy efficiency, renewables, and carbon capture. As Jevons paradox highlights, these mitigating technologies must extend beyond more efficient fossil fuel production and consumption. The electricity, heating, and transportation sectors need different, yet integrated, mitigating technology inputs, such as geothermal and solar energy, smart grids, carbon capture and storage, enhanced batteries, and lower weight cars operating on clean energy (IPCC, 2007).

Even if affordable clean technologies were available to achieve low-carbon economic growth, integrative and win–win resolution approaches need to be undertaken to determine linkages among the four types of injustices listed in Table 4 to generate long-term justice benefits. Similarly, these resolution approaches need to be pursued to generate short-term justice benefits, such as protecting the poor from climate change–related damages (World Bank, 2016).

Some pieces are already in place for addressing the injustices associated with the poverty–CO2 reductions paradox. The UN has had success encouraging integrative approaches with its Millennium Development Goals (UN, 2015). Three of these eight goals are central to the poverty–CO2 reduction paradox: Eradicate extreme poverty and hunger (Goal 1), ensure environmental sustainability (Goal 7), and develop a global partnership for development (Goal 8). Other major initiatives underway include economic assistance to reduce extreme poverty (UN, 2015), serving consumer and job needs in low-income nations (Prahalad & Hart, 2002), a Green Fund to subsidize clean energy technology transfers to developing nations (Green Climate Fund, 2015), and joint ventures (UNEP DTU Partnership, 2015).

These changes have been influenced by stakeholder pressures to achieve justice/fairness. In the United States, smaller political units—such as California and New York City—have developed their own 2050 environmental benchmarks, cap and trade systems, and quality of life regulatory policies that influence national policy making (Nagourney, 2015). Antipollution protests are occurring more often in China and policy makers are beginning to realize that economic success is dependent on environmental protection efforts (Wong & Buckley, 2015). Pope Francis's (2015) first encyclical directed Catholics worldwide to engage in environmental and poverty issues. Organizations such as 350.org are encouraging colleges and other institutions to divest from fossil fuel companies.

Fair regulation also requires active involvement by business organizations. Adam Smith correctly noted that the general welfare can improve through pursuit of economic self-interest within moral constraints. Regulation is often the result of organizational moral governance system failures. Business organizations have too often addressed the paradox between economic growth and the environment with a trade-off resolution approach strongly favoring economic growth to the detriment of the environment. More recently, some organizational leaders have been pursuing win–win opportunities. In the decades ahead, organizational leaders seeking competitive advantages will need to delve deeper into the tension points between profits and the environment, and develop integrative resolutions where their own economic growth and environmental performance are naturally balanced without favoring one over the other.

The regulatory rules and initiatives associated with the poverty–CO_2 reductions paradox must happen quickly. India, with 24% of its population living in extreme poverty, is following China's lead. Despite already having some of the most polluted cities in the world, India's energy minister stated in 2014 (Harris, 2014),

> India's development imperatives cannot be sacrificed at the altar of potential climate changes many years in the future . . . The West will have to recognize we have the needs of the poor.

Concluding Comments

Key economic and environmental indicators tell a sad story. Economically, 1.0 billion people (14.5%) lived in extreme poverty in 2011, and India had GNI per capita of only $1,610 in 2014. Environmentally, the 2001-2010 decade was the warmest on record, reflecting a 0.85 °C (1.53 °F) increase since 1880. Global CO_2 emissions increased by 51% between 1990 and 2012, and CO_2 atmospheric concentrations have increased from a steady level of 280 ppm in the pre–industrial era to more than 400 ppm.

The poverty–CO_2 reductions paradox highlights the interrelationship between these economic and environmental factors. Economic progress, along with population growth, increases energy demand. Low-cost and convenient fossil fuels currently account for 82% of the world's energy supply. As developing nations industrialize out of poverty, and developed nations continue to improve their economic quality of life, high-carbon production and consumption habits worsen environmental conditions.

Absent additional mitigations, preventative 2050 benchmarks will not be achieved. To put a human face on those affected by this potential catastrophe, scholars and researchers need to look no further than the traditional undergraduate students we currently teach: They will be about 55 years old in 2050.

This article examined how the EU and China have addressed the poverty–CO_2 reductions paradox on the national and international levels since 1990. Paradox theory clearly articulated resolution approaches but was found to lack a moral foundation. ISCT was found to offer paradox theory an explicit moral foundation. Combined, they provided significant explanatory power in describing the EU and China's evolving behaviors, and suggest a justice/fairness framework for weighing decision choices. Additional theory building and research are needed to develop and implement paradox theory and ISCT resolution strategies on the national and international levels, and to provide direction and hope for the future.

The Kyoto Protocol, despite its defects, has fostered convergence between the EU and China's environmental policies and processes. The challenge is resolving economic growth and environmental sustainability conflicts through win–win, integrative, and paradox approaches, rather than trade-off resolutions. Unfortunately, the behavioral outcomes to date are record high carbon emissions and temperatures. Incremental and drastic policy changes are required. Future economic successes in developing and developed nations are dependent on reducing CO2 emissions. Leadership from many societal sectors, including higher education, is essential.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was funded in part by Beijing Municipal Institutions' "The Importation and Development of High-Caliber Talents Project" (Code: CIT&TCD201404083) and "Senior Visiting Scholar Project of Funding Program for Academic Human Resources Development" (Code: 067135300100).

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