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Leadership EKC augmentation for social wellbeing: an exploration of situational leadership

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Abstract

Empirical studies provide a convincing argument that a cleaner environment ensures a better standard of living and has far-reaching economic gains. Researchers have widely tested the Environmental Kuznets Curve (EKC) to identify the link between emissions and economic activity. Still, they majorly ignored exploring the factors that could work as policy interventions in shifting or flattening the EKC curve for human wellbeing. This study has explored selected 50 countries for exploring the potential of leadership in moderating the EKC relationship. The Panel data model results showed that leadership is instrumental in moderating EKC. Some of the prominent indicators, like Team-Oriented Leadership and Participatory Leadership have shown an ability to reduce the net Carbon Dioxide (CO2) emissions in the economy. Policymakers could inculcate a sustainable/green leadership environment in achieving several Sustaimable Development Goals (SDGs).

Keywords Situational Leadership · Variable Effects Model · CO2 emission · Environmental Kuznets Curve

Introduction

Sustainable development has become one of the most important agenda points of scholars and policymakers (Delina & Sovacool, 2018). The literature discusses sustainable development from two broader perspectives regional development and national innovation (Kurpayanidi, 2021). The regional environment is about policy framework, government support programs, and environmental conditions supporting sustainability (Potts, 2010). However, in this perspective, personalities, competencies, and skills are missing that play an important role in executing a strategic environmental framework in a region. In this regard, leaders' competencies and skills are required to develop new insights (Das et al., 2011) – modern production techniques, high-quality products, increase market share, and gain competitive advantage by using advanced technology and executing these insights towards sustainable development. Organizations should develop explorative or exploitative capabilities which help them in the novel applications of their insights (Hernández et al., 2022). Proactive environmental strategies are the ultimate option in the direction of sustainable and profitable

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impact on the natural environment (Aragón-Correa & Rubio-López, 2007).

Scholars have been trying to investigate the role of the situational leadership perspective (Berkel, 2007; Brown & Stone, 2007; Deif, 2011; Despeisse et al., 2012; Dües et al., 2013; Hoof & Lyon, 2013; Siaminwe et al., 2005; Singh et al., 2012; Stone, 2006) and its relationship with environmental performance (Lo et al., 2012; Schoenherr, 2012; Wagner & Schaltegger, 2004; Zhu et al., 2005). However, there is still a gap in the literature to discuss the non-linear impact of leadership on a green environment.

The friction in a CO2 footprint creates resource inefficiency in achieving sustainable development goals (SDGs) (Bozkurt & Akan, 2014). Countries face multiple challenges and difficulties in achieving economic development and growth objectives. With the increase in growth, national production and consumption strain non-renewable resources, leading to an ecological footprint and global warming. Fossil fuels are the major energy source used, which is combustible, and their consumption supersedes production. These sources produce CO2 and other greenhouse gases, which is the reason for reducing environmental quality and increasing temperatures. The national decision making process involves a rational thinking process to overcome the environmental issues. Therefore in the decision making process, the role of leadership is significant to mobilize the resources and to engage and motivate all stakeholders for a sustainable environmental position. Policy implications of this study cover both strategic insights and strategic implementation process framework that will help countries to overcome the CO2 problem.

Studies in environmental economies point out that there is a light at the end of the tunnel. The theory of the Environmental Kuznets Curve (EKC) advocates resource scarcity pressure with increased economic activity. This pressure will eventually motivate the state actors to adopt production measures that are CO2 neutral, leading to the evolution of the inverted U-shaped EKC curve. On exploring this particular domain of knowledge, Uddin, Rahman (Uddin et al., 2011) emphasized the importance of leadership's decision-making process towards curbing CO2 emissions. Since industrial organizations need continuous functional level involvement of their leadership across the globe, their relevant capabilities could help explore new novel insights and steps necessary to address global warming challenges for developed and developing countries. Leadership is the ideal way to make relationships between strategizing and organizing. The nature of leadership is dynamic and changes according to the situation when strategy becomes strategizing, and organization becomes organizing (Colville & Murphy, 2006).

This study explores how situational leadership could support high-level positioning and improve green production induced by competitive advantage. There is an increase in the development of green policies as the concern towards a clean and protective environment initiative (Gunasekaran & Gallear, 2012; Sarkis et al., 2011). The intervention via leadership will generate proactivity in the production process towards sustainability. The manufacturing industries require a proactive rather than reactive approach to develop green environmental policies, which can help faster transformation towards cleaner production. UNEP (UNEP, U, 2011) report provided that the global manufacturing industry uses 35 percent of the total electricity consumed globally, and it also generates 20 percent CO2 emissions.

Environment pollution / CO2 emissions are higher in countries with higher economic activities and higher economic growth. Higher production and manufacturing activities lead to higher friction in pollution to the environment. But pollution can be decreased by the countries that have developed their infrastructure and made strategic plans for the sustainability of the environment, that requires a strong and clear vision of leaders. Previous studies for the past two decades has been focused on and confirmed the connection between production, economic growth, and energy use had a significant effect on pollution or CO2 emissions (Alam et al., 2016; Antonakakis et al., 2017; Bekhet et al., 2017; Bildirici, 2017; Chaudhary & Bisai, 2018; Chiu, 2017; Han et al., 2018; He et al., 2017; Riti et al., 2017; Robaina-Alves et al., 2016; Song et al., 2018; Zhang et al., 2017; Zhao et al., 2017), but no research is available on the role of leadership in the elimination of pollution and environment protection. This research study will help clear the gap between early research by analyzing the data from several countries to examine the moderating impact of leadership styles on the relationship between production and pollution. This study has developed a model on the role of leadership for policy implications to reduce CO2 emissions, and a dynamic leadership style will be ultimate according to the circumstances or the situation.

This research analyses the role of different leadership styles, including participative, humane charismatic, team-oriented, self-protective, and autonomous leadership, in reducing CO2 intensity from economic activities. Previous researchers studied leadership as the most important factor that impacts entrepreneurship (Elenkov & Manev, 2005; Ensley et al., 2006; Harrison et al., 2018; Hornsby et al., 2002). Further, few researchers also linked leadership and entrepreneurship specifically towards green projects (Cogliser & Brigham, 2004; Ensley et al., 2006; Gupta et al., 2004; Hemmen et al., 2013; Vecchio, 2003). This study analyses leadership's role in reducing pollution at the macroeconomic level because of increased production activities based on green entrepreneurial and innovational development. This study will help government policymakers, organizations, and suppliers develop leadership strategies to improve economic growth and eliminate the ecological footprint.

Environmental pollution is harmful in all its ways as it damages the natural ecosystem and causes a loss of the economic interest and benefits of the organizations. So, the organizations have set their goals to protect the environment besides making their profits. Environment protection strategies create customer value which is beneficial for the organizations (Chen et al., 2017). External factors force the organizations to adopt environmental innovation, such as laws, policies and regulations suggested or enforced by stakeholders (Jaffe & Palmer, 1997; Kammerer, 2009; Liao, 2018). Researchers are focusing on the potential of leadership style that forces organizations to innovate for sustainable production. In organizations, managers deal with operational issues, while strategic thinkers are needed to develop environment surveys to take responsibility for the future (Wilson, 1981). Organizations are needed to develop dynamic capabilities in their employees to cultivate leadership skills in them so they can perform according to the required conditions (Bocken & Geradts, 2020).

Currently, researchers are taking an interest in environmentally friendly manufacturing practices (Choi et al., 2012) under the premise of the Sustainable Development Goal strategy. Many researchers have focused on green manufacturing and its application by merely focusing on environmental conditions and regional innovation processes (Bai & Sarkis, 2010; Bierma & Waterstraat, 1999; Hoof & Lyon, 2013; Hsu & Hu, 2009; Ku et al., 2010; Lo et al., 2012; Testa & Iraldo, 2010; Vachon & Klassen, 2006), but limited studies have shown the role of individual decision-making process towards green environment. Leadership skills and abilities play an important role in the green environment. This study will contribute to ranking the different forms of leadership styles in their ability to induce cleaner production.

Based on the literature, with the support of situational leadership theory, the role of leadership (Berkel, 2007; Brown & Stone, 2007; Deif, 2011; Despeisse et al., 2012; Dües et al., 2013; Hoof & Lyon, 2013; Siaminwe et al., 2005; Singh et al., 2012; Stone, 2006) and environmental performance (Lo et al., 2012; Schoenherr, 2012; Wagner & Schaltegger, 2004; Zhu et al., 2005), the objective of this paper is to study the moderating role of leadership characteristics in the relationship between production and pollution which is known as Environmental Kuznets Curve (EKC). We built an argument that higher production leads to higher pollution, but with the effective role of leadership, the pollutive effect of economic activities can be reduced.

The ecological footprint is higher in countries with higher economic activities and weaker fossil resource utilization restraints. Higher production and manufacturing activities lead to higher friction concluding to global warming. Global warming could be decreased in countries with developed infrastructure via strategic planning for environmental sustainability. Such effort requires a strong and clear vision of leaders. Studies for the past two decades have focused on the connection between production, economic growth, and energy use and have found a link to CO2 emissions (Alam et al., 2016; Antonakakis et al., 2017; Bekhet et al., 2017; Bildirici, 2017; Chaudhary & Bisai, 2018; Chiu, 2017; Han et al., 2018; He et al., 2017; Riti et al., 2017; Robaina-Alves et al., 2016; Song et al., 2018; Zhang et al., 2017; Zhao et al., 2017). However, the role of leadership in the broader context is missing, and there is a shortage of research on the role of different leadership styles in catalyzing CO2-neutral transformation. This research study will help fill the gap and propose a new intervention in achieving SDGs.

The contribution of this paper is to create empirical justification on the role of leadership in eliminating pollution CO2 emissions. The results of this study reveal that different leadership styles have a different impacts on CO2 emissions. This study influences the role of leadership and provides a new vision to policymakers. Policymakers can design policies and focus on the development of leaders so they can take measures to eliminate pollution with their long-term visions and strategies. Countries with higher economic growth have higher pollution, but with strong leadership qualities, they can develop norms, procedures, and infrastructures that will help them to reduce pollution. This study will help government policymakers, organizations, and suppliers develop leadership strategies to improve economic growth as well as eliminate CO_2 to improve environmental quality.

Literature review

Energy has improved life throughout the world, and it is vital for social and economic development. Technology development could ensure sustained energy consumption. Investors, industries, and policymakers have recognized the importance of electricity in manufacturing. In many countries, the electricity supply infrastructure is being expanded (Houghton, 1997; MF 2003; Williams, 2005). The expansion of energy consumption comes with higher production and CO2 emissions, harming the environment (Alkhathlan & Javid, 2013). To eliminate global warming, policymakers and academicians have necessitated reducing CO2 emission of greenhouse gases (Zhang & Cheng, 2009).

CO2 neutrality in the production process indicates its environmental performance. Since 2016, the Paris agreement was enforced, and emissions reductions are getting more attention. Countries are participating in formal unions to work together, such as nationally determined contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC), to reduce greenhouse gas (GHG) emissions (ADB, 2015).

In their empirical study, Chen and Chang (Chen & Chang, 2013) demonstrated that green creative thinking depends

on an attitude towards environmental concerns and leadership. In their empirical study, Mittal and Dhar (Mittal & Dhar, 2016) revealed that leadership fosters creative green behavior among employees, which compels them to eliminate water and paper waste and improve recycling. These empirical studies foster the argument that green leadership promotes green creative behavior for environmental protection (Jia et al., 2018; Singh et al., 2020; Tuan, 2020). Green transformational leadership is the leaders' behavior that motivates their employees for green creative behavior to achieve environmental goals and inspire them to work for environmental protection (Chen & Chang, 2013). Such leadership motivates the employees to work for the organizational goals over their personal goals and assists them in achieving environmental goals and generating novel ideas for environmental performance (Mittal & Dhar, 2016).

Organizations are promoting leadership to protect their environments, as with effective leadership and strategies, environmental pollution can be reduced quickly. With their social and ethical abilities, responsible leaders interact with the stakeholders internally and externally (Maak & Pless, 2006; Yao et al., 2020). Responsible leaders provide stakeholders with a platform for discussions and act as agents to balance the internal and external stakeholders' interests (Scherer & Patzer, 2011; Voegtlin, 2011). Implementing the organizations' environmental protection strategy depends on the leaders. Values that support leadership and their actions are based on assumptions that leaders work with individuals who take responsibility for the betterment of society and have enough capacity to promote sustainability. The ethical values of the leaders have the potential to work as a driving force for sustainability and development either at a small level or global level (Vinkhuyzen & Karlsson-Vinkhuyzen, 2014).

This research is supported by Situational Leadership Theory (SLT), introduced as a life cycle of leadership (Hersey & Blanchard, 1969). At the time of emergence, the basic principle of this theory was to direct the newly hired employees. Later on, as the employees became senior, the supportive nature of leadership was encouraged. This theory was revised by Hersey, Blanchard (Hersey et al., 1977) to provide a more detailed version of the original model. This theory has two dimensions, i.e., directiveness and supportiveness. Directive behavior of leaders demonstrates that the leader is setting goals and evaluating the results, while supportive behavior demonstrates warmth, support, and understanding behavior. Leaders with supportive and favorable behavior move with the nature of the job and cultural changes for the development of employees and organizations. SLT demonstrates the adaptive and flexible behavior of the leader that positively impacts others (Brouer et al., 2013; Yukl, 2010). STL focuses on leaders' abilities and the opportunities leaders get to develop confidence and skills in their followers. Most leadership theories have adopted this developing behavior, such as transformational leadership and servant leadership (Bass & Avolio, 1994; Dierendonck, 2011; Konczak et al., 2000), and other leadership theories also develop the skills into their followers. According to SLT, supportiveness and directiveness dimensions affect job satisfaction and improve the effectiveness of the leaders (Piccolo et al., 2012).

The GLOBE study has identified 21 different dimensions of leadership (House, et al., 2002). It was later considered six dimensions, including charismatic leadership, humane leadership, participative leadership, autonomous leadership, participative leadership, and self-protective leadership. House, Hanges (House, et al., 2004) defined these six leadership dimensions as the dimensions of global leadership. First, the team-oriented dimension of leadership focuses on team building and developing a common goal for the team. Second, the participative dimension of leadership focuses on the degree of the leaders or managers, they involve other members in the organization in their decision making and implementing those decisions. Third, humane leadership focuses on the considerate and supportive behavior of the leaders. Fourth, autonomous leadership focuses on the individualistic and independent attitude of the leaders. Fifth, the self-protective dimension elaborates the leadership as protective and face-saving for individuals and the other groups. The last dimension of leadership is charismatic, which focuses on inspiring, motivating, and expecting higher performance from others by following the organization's values. In their study, Den Hartog, House (Hartog et al., 1999) supported the significance of charismatic leaders in diverse cultures. This research mainly focused on charismatic and autonomous leadership as they stated these types of leadership focus more on entrepreneurship (Stephan & Pathak, 2016). Coker, Flight (Coker et al., 2017), Gupta, MacMillan (Gupta et al., 2004), Ling, Simsek (Ling et al., 2008), and Muralidharan (Muralidharan, 2018) also conducted a study, and they provided empirical evidence that leadership especially charismatic and autonomous are associated with entrepreneurship.

Following Table 1 can best explain the strategies and outcomes of each type of leadership in green manufacturing and reducing pollution:

Despite the vast research on leadership, the impact of leadership between production and pollution, especially using the six types of leadership participative, team-oriented, charismatic, humane, self-protective, and autonomous, is broad and undefined. To address this issue, this paper explores theoretically how these types of leadership affect the EKC relationship and test empirically. Leaders foster entrepreneurial activities in the countries, more the entrepreneurship will rise, more products will be produced that increase the overall productivity of a country. Higher productivity will also raise the pollution and CO2 emissions in the country if the entrepreneurial vision is not directed

Table 1 Role of Different Leadership Styles and their Outcomes

Leadership style	Green manufacturing Strategies	Decision outcome favoring green environment
Autonomous leadership	Functional autonomy to production processes by a distribution of power to followers	Flexibility in decision making results in adaptability according to changes in the environment
Humane leadership	Engaging employees through care and affection that enhance responsibility	Socialization and collaboration increase engagement that brings collective responsibility towards the environment
Charismatic leadership	Inspire individuals to follow production quality standards	Engagement in operational activities with more passion and enthusiasm
Team orientation Leadership	Task orientation and people orientation is high that bringing collective production efficiency	Create synergy in work force
Participative Leadership	Involve individuals in decision making and implementing those decisions	Develop motivation in employees to work for productive results
Self-Protective Leadership	Strong competitors confirm safety and successful goal achievement	work for environmental protection and quality to take competitive advantages over their rivals

towards sustainability. The developed countries with advanced infrastructure can eliminate pollution by developing clean technology, but with effective leadership, they can eliminate pollution further using the same resources. This paper aims to analyze the moderating role of different leaders and how leaders can control the pollution caused by higher productivity in an EKC model. In this study, we use 6 types of leadership, discussed in Table 1 to analyze their moderating impact on the relationship between production and pollution.

Autonomous leadership and EKC

Autonomous leadership is an individualistic and independent dimension of leadership (House, et al., 2004). Leaders and managers have different approaches to dealing with autonomous leadership and using their powers. The power distribution measurement can test how much less powerful a leader or manager is, how much power, freedom, and autonomy are given to them, and how they work by demonstrating these power and autonomous behaviors (Bass & Bass, 2009). Autonomous leadership takes full control over their followers and employees and is solely responsible for their decisions. Authoritative and autonomous leadership are correlated in doing their work and tasks in organizational settings (Bass & Bass, 2009). Bass and Barrett (Bass & Barrett, 1972) called this behavior of leaders as a directive. The directive of autonomous leaders make their decisions with their sole responsibility, and they are active in decision making and providing solutions to the problems, and their followers are expected to get guidelines by their decisions.

Stephan and Pathak (Stephan & Pathak, 2016) demonstrated that such leaders prefer to work individually and avoid risk and uncertainty. Gupta, MacMillan (Gupta et al., 2004) and Muralidharan (Muralidharan, 2018) revealed that autonomous leaders prefer to work individually, to affect entrepreneurship negatively. Coker, Flight (Coker et al., 2017) revealed that autonomous leaders decrease entrepreneurship activities with social objectives.

With their individualistic and independent approaches, autonomous leaders develop policies and strategies that can protect the environment as their followers get guidelines from their decisions and work according to the instructions and decisions made by autonomous leaders. So, autonomous leaders have no restrictions on decision making and asking someone for suggestions, and standing by their sides, they only have to make decisions and expect their followers to implement those decisions. Autonomous leadership can be effective in playing its role in eradicating pollution. Autonomous leadership has not been studied from environmental perspective. This initial study will reveal the impacts of autonomous leadership on reducing pollution caused by higher productivity. So, based on these arguments, we built a hypothesis as:

H1: Autonomous leadership has a moderating effect on the linear relationship between economic activity/productivity and CO2 emissions

Humane leadership and EKC

Humane leadership is caring, supportive, considerate, and thoughtful leadership (House, et al., 2004). A study conducted by Miller, Marchel (Miller et al., 2008) collected the participants' views about humane leadership. All the participants explained the meaning of inhumane that increased the humane value of leadership.

Humane leaders work for the people with their supportive behavior, and they are encouraged to work in corresponding with the transformation of organizational culture into a human organization. Humane leaders are developed in

human organizations with specific environments and social settings to develop an engaged and dedicated workforce (Miller et al., 2010).

Humane leadership is compassionate and generous beside considerate and supportive. Humane leadership is very effective and plays its leadership role in Sub Sahara Africa (SSA) countries in poverty, violence, and corruption. Tanzania's late president, Julius Nyerere, based his leadership on a paternalistic ideology philosophy on ujamaa (i.e., familyhood). According to this idealogy, society is perceived as the family's addition or extension, and leaders play a role in caring for and helping their family (Dorfman et al., 2004).

With their supportive, caring, and thoughtful traits, Humane leaders develop policies and strategies to protect the environment as they are so caring for the organization and society. They take society as their family, so they are very keen to better society and the environment. So, humane leaders can be effective in playing their role in eradicating pollution. Humane leadership has not been studied with the environmental perspective, and this is the initial study that will reveal the impacts of humane leadership on reducing pollution caused by higher productivity. So, based on these arguments, we built a hypothesis as:

H2: Humane leadership has a moderating effect on the linear relationship between economic acitivity/productivity and CO2 emissions

Charismatic leadership and EKC

Charismatic leadership behavior is considered the most critical in satisfaction among leadership behaviors (Thite, 2000). The term "charisma" was first introduced by Weber (Weber, 1963), describing it as some superhuman quality. Weber has defined a charismatic leader as narcissistic, mystical, and personally attractive (Bass & Bass Bernard, 1985). One quality of charismatic leaders is attributed personality, which is considered extraordinary in research (Conger & Kanungo, 1988). Charismatic leaders focus on organizational and team goals instead of individual ones, so the team members work to achieve their goals collectively with a commitment that enhances overall organisational performance. Charismatic leaders develop motivation and excitement into followers towards achieving their goals (Burns, 1978) and such leaders are idealized (Seltzer & Bass, 1990).

Charismatic leaders are most desirable in most cultures (House, et al., 2004). Charisma reflects the aspect or feature of transformational leadership, so in research, the use of charismatic and transformational leadership is interchangeable (Hemmen et al., 2013). Charismatic and transformational leadership is linked with organizational performance (Frese & Gielnik, 2014), team decision-making skills (Dionne et al., 2004; Zhou et al., 2017), and innovations (Kraft & Bausch, 2016). It is found that such leaders have an impact on product innovation and organizational entrepreneurship. Charismatic leadership positively impacts in different contexts such as business (Barling et al., 1996; Ensley et al., 2006; Jung et al., 2003), public sector (Rafferty & Griffin, 2004), military (Bass et al., 2003; Hardy et al., 2010) and education (Koh et al., 1995).

Charismatic leadership is also concerned with the human issues in the organization. Howell and Avolio (Howell & Avolio, 1992) have divided charismatic leaders into two types, ethical and unethical leaders. Ethical leaders work for the organization's benefits, motivate, support, and coach the followers to become leaders, use their power and authority to support and help others, always communicate in two ways, and set values and standards for organizational and societal benefits. Ethical leaders do what is the spirit of the leaders (McPree, 2004), and they do all the things for the benefit of others.

Charismatic leadership has not been studied with the environmental perspectives, and this is the initial study that will reveal the impacts of charismatic leadership on reducing pollution caused by higher productivity. So, based on these arguments, we built a hypothesis as:

H3: Charismatic leadership has a moderating effect on the linear relationship between economic activity/productivity and CO2 emissions

Team-oriented leadership and EKC

Team-oriented leadership focuses on creating effective teams and implementing common goals among team members (House, et al., 2004; Javidan et al., 2006). A study conducted in Zimbabwe and Zambia demonstrated that these countries take team-oriented leadership as the most effective type of leadership. According to research, team-oriented leaders have been doing so much to benefit organizations and societies (Wanasika et al., 2011). Numerous studies have been conducted in different cultures which claimed that team-oriented leadership is effective and favorable in all the cultures, especially in Soth Asia (Thailand, Iran, Indonesia, Philippines, Malaysia, and India), Eastern Europe (Slovenia, Albania, Poland, Greece, Hungary, Georgia, Russia, and Kazakhstan), and Latin America (Colombia, Brazil, Bolivia, Argentina, and Mexico (Chhokar, 2009). Countries with uncertainty avoidance and low risk-takers prefer team-oriented leaderships (House, et al., 2004).

According to research, leaders with team orientation can make a big difference in making the team more effective and well-performing (Morgeson, 2005; Zaccaro & Klimoski, 2002). Research conducted by Eduardo (Eduardo, 2005) presented a team model that was one of the big five contributors to the effectiveness of teams. Leaders are the ones who

set rules for team effectiveness and motivate the teams to engage in the activities that enhance their performance (Cascio & Shurygailo, 2003). Leaders, especially team-oriented leaders, are a significant part of team effectiveness.

Numerous studies have proved the effect of leadership on the performance of teams depending on the goals and objectives of the teams (Wageman, 2001). Team-oriented leaders develop teams to work more smoothly so they can achieve all the set objectives. The main benefit of team-oriented leaders is, they develop cohesiveness and performance of the teams. A meta-analysis study found that team performance and cohesion are related to each other (Gully et al., 1995; Mullen & Copper, 1994), but the cause and effect of this relation are still unclear (Chansler et al., 2003).

Team-oriented leaders are desirable when the situation changes as they have their teams and set goals to perform well through their teams with less time. As team-oriented leaders work for the benefit of their teams and work for the societal benefits, they can also work for environmental protection and eliminate pollution in the countries.

Team-oriented leadership has not been studied with the environmental perspectives. This initial study will reveal the impacts of team-oriented leadership on reducing pollution caused by higher productivity. So, based on these arguments, we built a hypothesis as:

H4: Team-oriented leadership has a moderating effect on the linear relationship between economic activity/productivity and CO2 emissions.

Participative leadership and EKC

Opposite to the individualistic aspects of leadership, participative leadership is related to sharing in their decision processes. Participative leadership is accepted in organizations as it encourages the managers and their employees to work together to achieve their set common goals more productively and effectively (Jong & Witteloostuijn, 2004). Numerous studies have been favored participative leadership (Eisenhardt, 1989). These studies demonstrate that

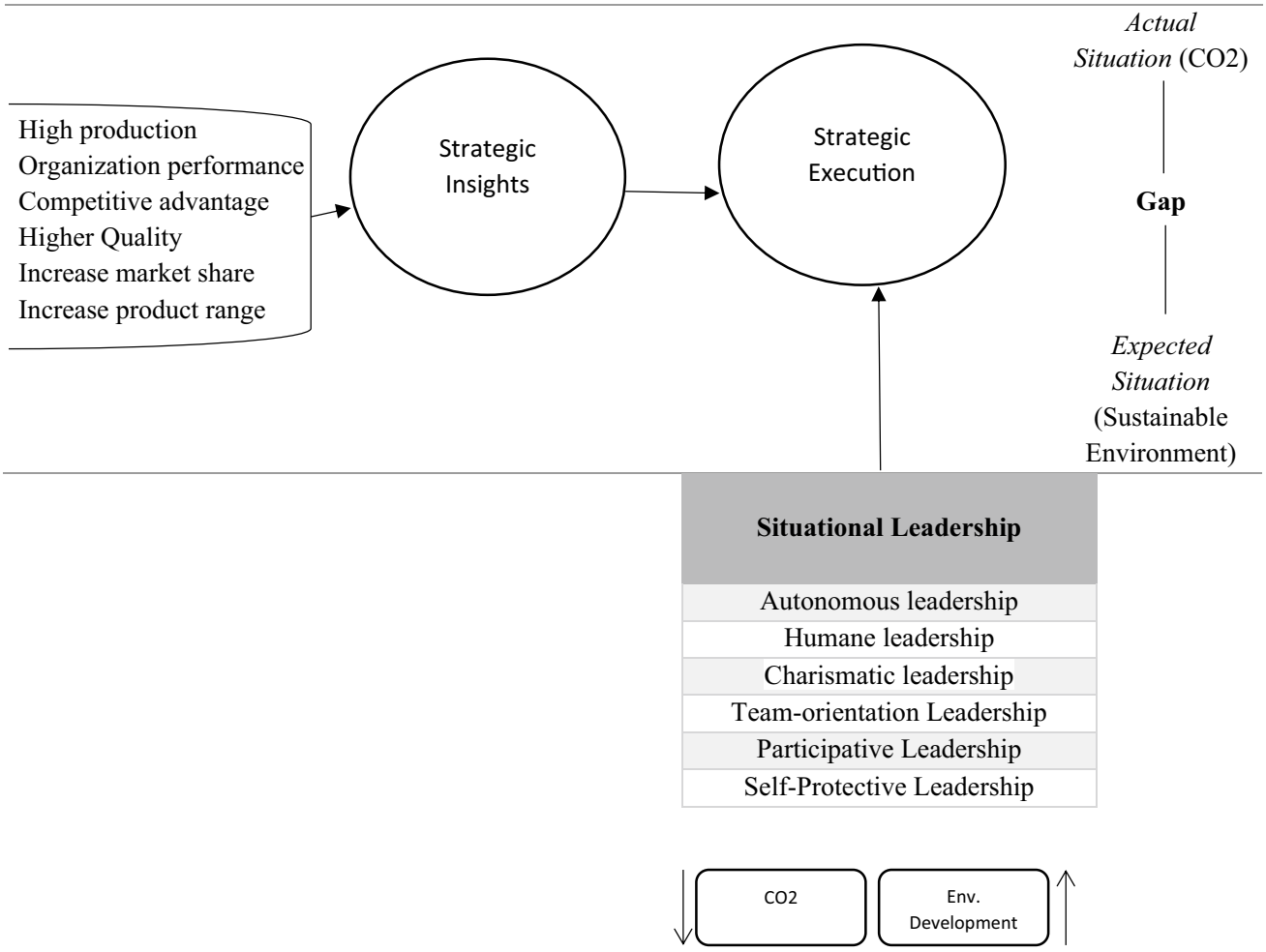


Fig. 1 Theoretical Framework*Blend of Leadership

Table 2 Variable Construction and Sources

Name (Symbol)	Definition	Source
CO2 Emissions (LCO)	Natural Log of CO2 Emissions per capita	World Development Indicators
GDP Per Capita (LGDP)	Natural Log of GDP Per Capita Current US$	World Development Indicators
Population Density (LPDEN)	Natural Log of Population Density Per Square Km	World Development Indicators
Institutional Quality (INST)	The formal, legally binding formal and informal constraints[1]	World Economic Forum
Financial Market Development (FMD)	It is a composite of depth and stability indicators of financial market[2]	World Economic Forum
Charismatic Leadership (CHL)	It is reflective of ability to inspire, motivate and expect high performance outcomes from others. It includes self-sacrifice, integrity, decisiveness and performance orientedness	House et al. (House, et al., 2013)
Team Oriented Leadership (TOL)	It emphasizes effective team building and implementation of common goal. It includes collaboration, team integration, diplomatics, malevolent and administrative competency	House et al. (House, et al., 2013)
Self Protective Leadership (SPL)	It focuses on ensuring the safety of individual and group through face saving. It includes self-centered, status conscious, conflict inducer, face-saver and procedural behaviours	House et al. (House, et al., 2013)
Participatory Leadership (PAL)	It is reflective of the degree to which managers involve others in making decisions. It includes nonparticipative and autocratic behaviour	House et al. (House, et al., 2013)
Humane Oriented Leadership (HOL)	It is reflective of supportive leadership. It includes modesty and humane orientation	House et al. (House, et al., 2013)
Autonomous Leadership (AUL)	It refers to independent and individualistic attributes. It includes individualistic, independent, autonomous and unique characteristics	House et al. (House, et al., 2013)

[1]Institutions is an index of 22 items in 7 groups which include from questinnaire from individuals and secondary data available at country level. The survey is conducted on average of 14,000 business executives each year in each country. All of the questions are converted to a scale of 1 worst to 7 best

[2]Financial market development is an index of 8 items which are surveyed from 14,000 business executives every country in the sample for every year. The items are scaled to 1 worst to 7 best

participative leadership is more successful in organizations than other kinds of leadership (Ogbonna & Harris, 2000). Empirical research has found that participative leadership positively affects job performance, reducing turnover rates (Spector, 1986). Participative leadership affects more job performance than individualistic leadership (Bass & Bass, 2009).

Research conducted by Van Hemmen, Alvarez (Hemmen et al., 2015) demonstrated that participative leadership positively affects innovation and entrepreneurship across different countries. Collaborations among the leaders and employees let them face all the issues and find innovative solutions to all the problems. Franco and Haase (Franco & Haase, 2017) conducted a study in Portugal and found that entrepreneurship results from participative leadership. As per this research, participative leaders motivate collaborations and participation in decision-making, resulting in collaborative entrepreneurship. This is also supported by Yan and Yan (2016). These researchers found that collaborations foster innovation and entrepreneurship that impact the performance of the organizations. More entrepreneurship will result in higher productivity and higher productivity without clean technologies resulting in pollution.

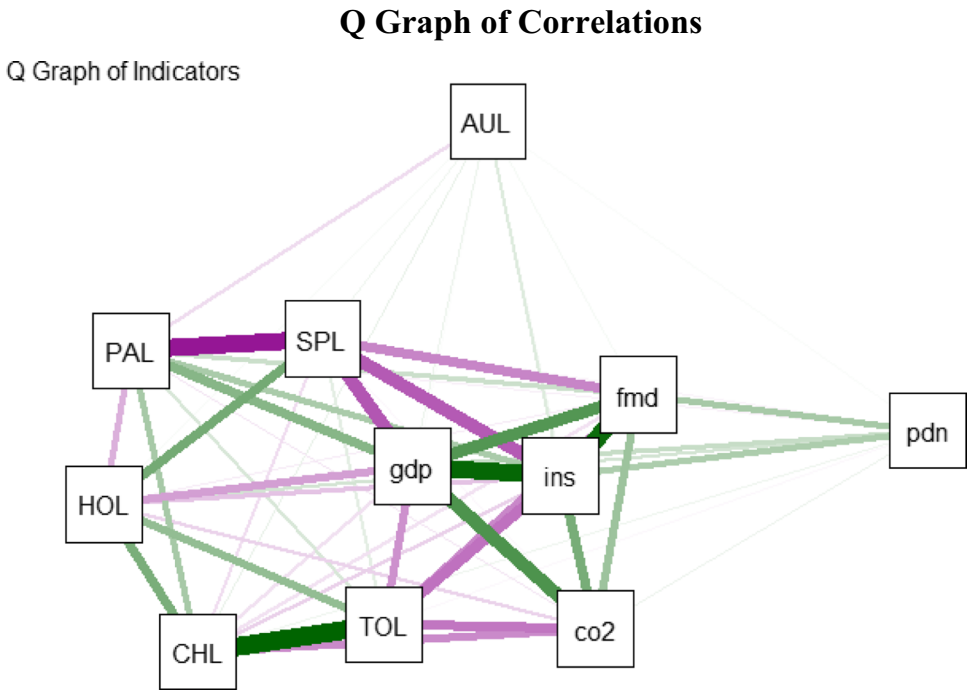
Participative leadership is found to be desirable in various cultures. As per the research, these countries recommend participative leadership Germanic Europe (Switzerland, Austria, Netherlands, and Germany), Anglo (United States, Canada, United Kingdom, New Zealand, Ireland, South Africa, and Australia), and Nordic Europe (Sweden Finland, and Denmark) (Chhokar, 2009).

Participative leaders work with the collaboration of others and complete all the goals by allowing others for suggestions. Participative leaders work by adding others to take their part into decisions, so they also consider the benefits of

Table 3 Descriptive Statistics

Variables	Mean	Std. Dev	Skewness	Kurtosis
LCO	0.772	1.505	-0.651	2.811
LGDP	8.648	1.429	0.016	2.165
INST	4.104	0.875	0.587	2.379
FMD	4.149	0.740	0.105	2.649
LPDEN	4.356	1.477	0.118	5.280
CHL	5.840	0.351	-1.875	7.220
TOL	5.786	0.273	-1.655	6.488
SPL	3.435	0.394	0.236	3.322
PAL	5.383	0.388	-0.178	2.425
HOL	4.863	0.379	-0.354	2.923
AUL	3.814	0.446	-0.491	4.247

Fig. 2 Q Graph of Correlations



others, then they can also work for the environment protection and to eliminate pollution in the countries.

Participative leadership has not been studied with the environmental perspective. This initial study will reveal the impacts of participative leadership on reducing pollution caused by higher productivity. So, based on these arguments, we built a hypothesis as:

H5: Participative leadership has a moderating effect on the linear relationship between economic activity/productivity and CO2 emissions.

Self-protective leadership and EKC

Self-protective leadership is self-centered, status-conscious, focusing on the security and safety of the individual and group and their own (House, et al., 2004). This type of leadership confirms the safety of the leaders first. Self-protective leaders work smoothly to achieve their goals and interests that are preferable for them, and they work with care and strategically to achieve success. They also collaborate to achieve their goals and sometimes get into conflicts if necessary to achieve their objectives. These leaders face everything with courage and competitive abilities, and they prefer that their relations with others be smooth (Dorfman et al., 2012; House, et al., 2014). Self-protective leaders are desirable in Middle Eastern, Southern, Confucian Asian, and Latin American cultures with status-consciousness and face-saving. This type of leadership is found in other cultures such as Anglo, Northern, and Germanic, European cultures, but these cultures perceive self-protective leadership negatively (Dorfman et al., 2004). As in these cultures, their desirable leaders should be easy to access and have the courage to discuss decisions with their followers (Brodbeck et al., 2008). Self-protective leaders are more suitable in individualistic cultures as their self-centered nature. Self-protective leaders do not encourage Entrepreneurship as they motivate employees as well as other types of leaders do. Such leadership is not desirable by the stakeholders as these leaders focus on their own goals and not on others (Stephan & Pathak, 2016).

Self-protective leadership has not been studied with environmental perspective. This initial study will reveal the impacts of self-protective leadership on reducing pollution caused by higher productivity. So, based on these arguments, we built a hypothesis as:

H6: Self-protective leadership has a moderating effect on the linear relationship between economic activity/productivity and CO2 emissions.

In all proposed hypotheses, this study is building up a notion that as per EKC theory, economic activity will achieve self–sustainability after achieving a certain level. However, in literature, several studies have criticized the fact that this certain level is never achieved. We would never experience sustainability without intervention. This study presents the leadership traits as possible interventional measures that can shift the EKC curve so that the threshold of economic activity to achieve sustainability is achieved sooner.

Table 4 Correlation Matrix

	CO2	GDP	INST	FMD	PDEN	CHL	TOL	SPL	PAL	HOL	AUL
CO2	1.000	0.590	0.446	0.325	0.057	-0.389	-0.455	-0.025	-0.079	-0.147	0.046
GDP	0.590	1.000	0.830	0.572	0.187	-0.100	-0.365	-0.561	0.397	-0.319	0.061
INST	0.446	0.830	1.000	0.804	0.271	-0.152	-0.470	-0.547	0.283	-0.199	0.108
FMD	0.325	0.572	0.804	1.000	0.293	-0.096	-0.397	-0.406	0.174	-0.059	0.029
PDEN	0.057	0.187	0.271	0.293	1.000	0.049	-0.023	-0.037	-0.049	0.145	0.015
CHL	-0.389	-0.100	-0.152	-0.096	0.049	1.000	0.846	-0.112	0.292	0.439	0.071
TOL	-0.455	-0.365	-0.470	-0.397	-0.023	0.846	1.000	0.091	0.130	0.359	0.009
SPL	-0.025	-0.561	-0.547	-0.406	-0.037	-0.112	0.091	1.000	-0.773	0.462	0.048
PAL	-0.079	0.397	0.283	0.174	-0.049	0.292	0.130	-0.773	1.000	-0.264	-0.116
HOL	-0.147	-0.319	-0.199	-0.059	0.145	0.439	0.359	0.462	-0.264	1.000	0.023
AUL	0.046	0.061	0.108	0.029	0.015	0.071	0.009	0.048	-0.116	0.023	1.000

Literature argues that economic development and CO2 emissions are a zero-sum game, As the economic development increases, CO2 emissions also rise. But we argue that it is not a zero-sum game when economic developments are made, CO2 emissions can also lower down with the strong leadership, the style of leadership is dependent on the situation (shown in Fig. 1). So situational leadership is ideal for developing policies and implications to decrease CO2 emissions with the advancements of economies. Few researchers have studied the impact of institutional quality on CO2 emissions. Apergis and Ozturk (Apergis & Ozturk, 2015) analyzed from 1990 to 2011, covering 14 Asian countries using four indicators for institutional quality: corruption control, quality of regulations, and absence of violence and political stability, and government effectiveness. He concluded that all the quality indicators for institutions significantly impact CO2 emissions. Abid (Abid, 2016) conducted a study using the data from Sub-Saharan Africa countries from 1996 to 2010 by using quality indicators for institutions. He concluded that corruption control, government effectiveness, political stability, and democracy reduce pollution, and implementation of laws lead to environmental protection. A study analyzed the North African and Middle East countries from 1996 to 2015 by Gholipour and Farzanegan (Gholipour & Farzanegan, 2018) concluded that government spending more on environmental protection reduces CO2 emissions. A study by Wawrzyniak and Doryń (Wawrzyniak & Doryń, 2020), using 93 developing countries' data over the period from 1995 to 2014, found that improvements in institutional quality can increase Gross Domestic Product (GDP), and as a result, it reduces CO2 emissions.

The development of financial markets and financial capital of the countries impacts the environment quality. Different researchers, including Claessens and Feijen (Claessens & Feijen, 2007), Halicioglu (Halicioglu, 2009), Tamazian, Chousa (Tamazian et al., 2009), and Tamazian and Rao (Tamazian & Rao, 2010), have suggested that financial development of the countries provide eco-friendly services at a reduced cost that ultimately reduces pollution created by energy. Financial development, good governance, and laws improve the environment and reduce emissions (Claessens & Feijen, 2007). Tadesse (Tadesse, 2005) suggests that financial development promotes innovation and technological advancements, which increase economic growth, and when countries are economically strong, they invest more in reducing pollution and CO2 emissions. Claessens and Feijen (Claessens & Feijen, 2007) suggested that strong financial markets and institutions can provide funding to eliminate harmful gasses to protect the environment. A study conducted by Shahbaz, Solarin (Shahbaz et al., 2013) in Malaysia from 1971 to 2011 analyzes the impact of financial development on CO2 emissions. Results of this study revealed that financial developments reduce CO2 emissions in the Malaysian economy.

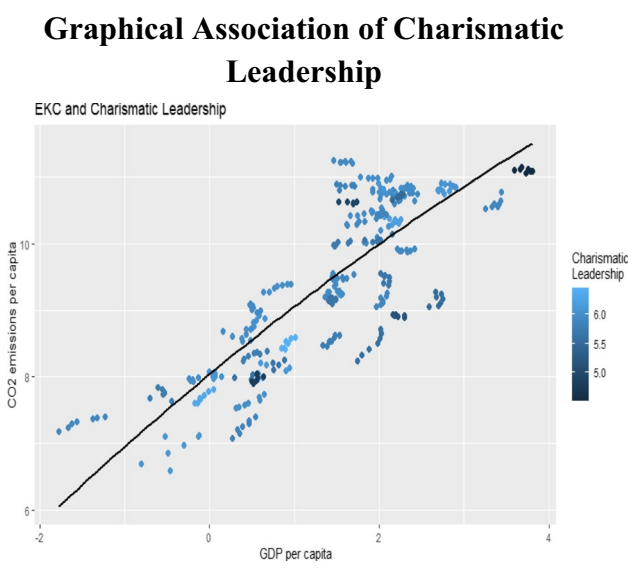
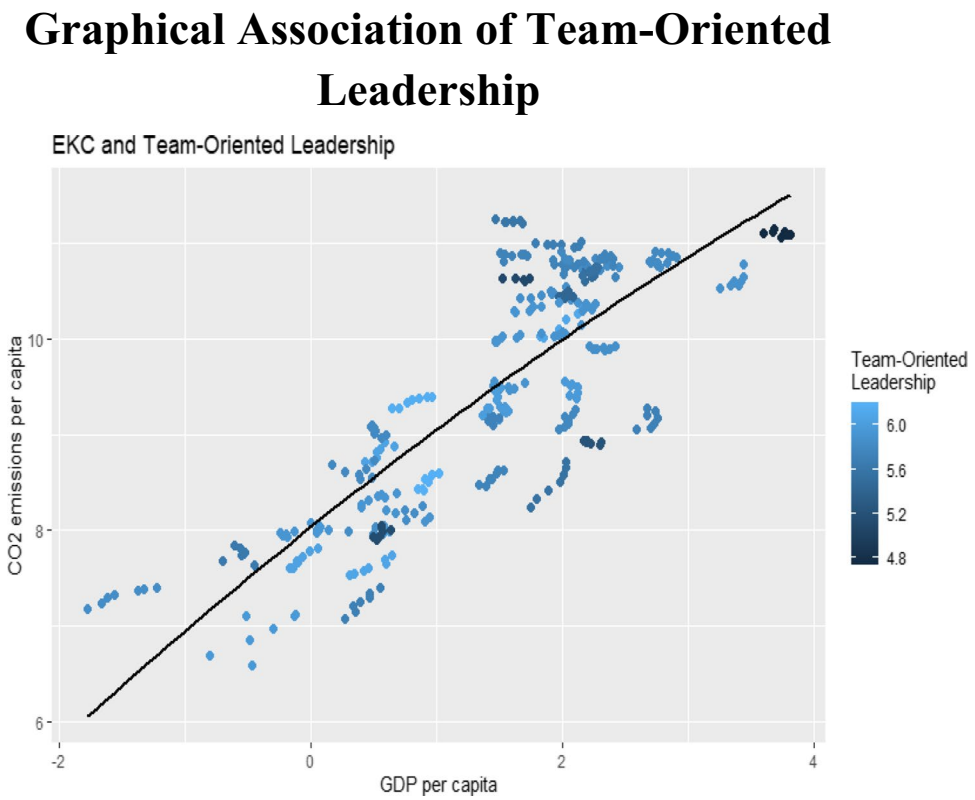


Fig. 3 Graphical Association of Charismatic Leadership

Fig. 4 Graphical Association of Team-Oriented Leadership



The size of the population also impacts CO2 emissions. A positive correlation was found between population and Nitrogen Oxides (NOx) (Lamsal et al., 2013; Sarzynski, 2012) and pollution (Glaeser, 1998). A study conducted by Cole and Neumayer (Cole & Neumayer, 2004) to analyze the impact of population size on pollution emissions concluded that the relationship between population and pollution is very complex. They found that population affect pollution but this effect increases as the population increases. A study conducted in California by [Cramer (Cramer, 1998), Cramer (Cramer, 2002)] and Cramer and Cheney (Cramer & Cheney, 2000) found that population affects pollution emissions. Dietz and Rosa (Dietz & Rosa, 1997) and [York, Rosa (York et al., 2003), York, Rosa (York & Rosa, 2003b)] studied the role of population and technology in energy use and CO2 emissions. They found an elastic relationship between energy and CO2 emissions, if a population increases by 1%, then CO2 emissions also increase by 1%.

Methods

Sample Countries and Time Periods

This study has selected the population of 50 countries for which the leadership characteristics are assessed (House, et al., 2014) between the years 2008 to 2018.

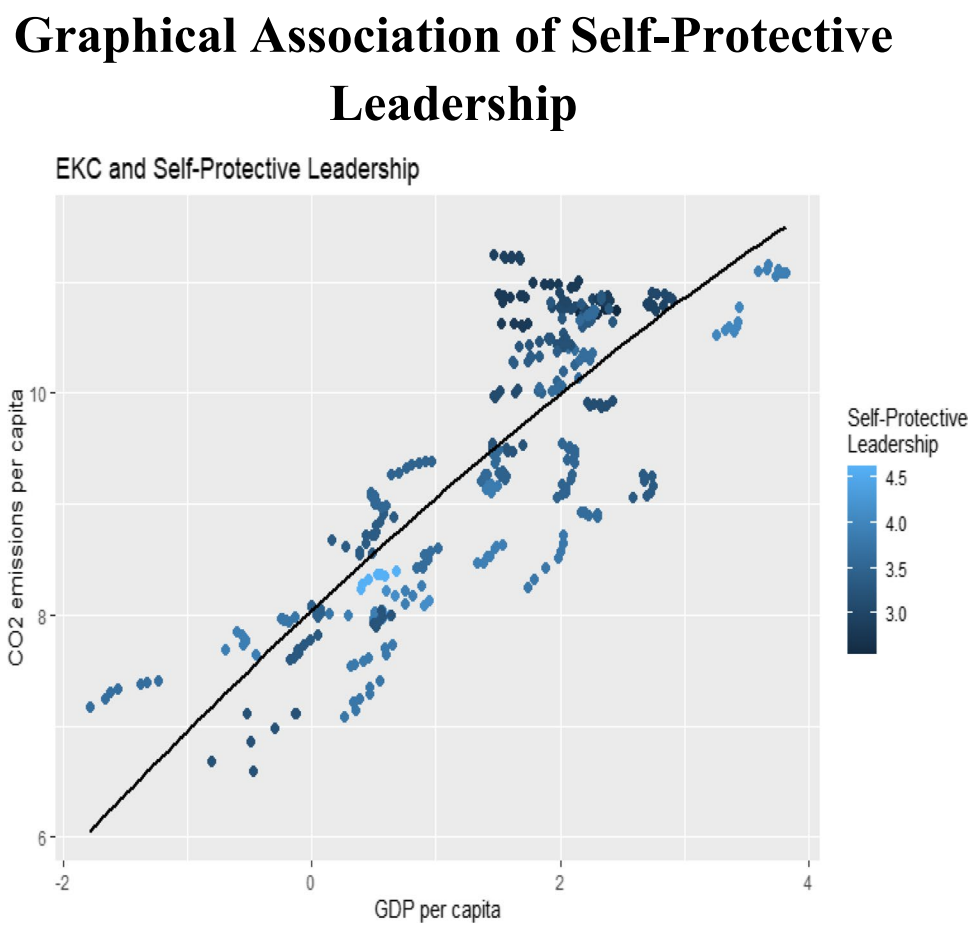
Variables and Data Sources

Table 2 discusses the list of variables used in this study. Here LCO is a dependent variable that is estimated against LGDP and $LGDP^2$ to form an EKC relationship. While INST, FMD and LPDEN are the controlling variables. Further, this study has proposed the indicators of leadership, i.e. CHL, TOL, SPL, PAL, HOL, AUL, as moderating factors to the EKC relationship. The data of leadership traits are collected using a survey including 112 items measuring leadership attributes and behaviours. This survey included 17,000 managers from 62 countries. There were a total of 21 dimensions of leadership which were grouped into 6 global leadership traints shown in Table 2. All of the groups measure specific leadership traits on a scale of 1–7 in which 1 is very low trait and 7 is very high trait, and country average of the survey is reported as a secondary data by House et al. (House, et al., 2013).

Theoretical model and estimation equation

This study builds on the EKC relationship, exploring the quadratic effect of economic activity/productivity (LGDP) on environmental quality (LCO). This study proposes that the indicators of leadership shift the cutoff point left and right for this, the leadership indicators are shown as interaction effect with LGDP. And this study restricts the EKC shift to left and right

Fig. 5 Graphical Association of Self-Protective Leadership



only by not adding the interaction term with $LGDP^2$ (Haans et al., 2016). This means that leadership could moderate the evolution of inverted U shaped EKC relationships to change the turning point by moving the EKC curve left or right (Haans et al., 2016), which are also the proposed hypothesis in the study for the leadership indicators. This study has included the controlling factors like population density (LPDEN), institutional quality (INST) and financial market development (FMD) which are commonly used indicators explaining CO2 and are relevant to the business context in which leadership traits are being used. Equations 1, 2, 3, 4, 5, and 6 provide the estimation equations for this study.

$$LCO_{it} = \alpha_1 + \alpha_2 LGDP_{it} + \alpha_3 LGDP_{it}^2 + \alpha_4 LGDP * CHL_{it} + \alpha_5 LPDEN_{it} + \alpha_5 INST_{it} + \alpha_5 FMD_{it} + \varepsilon_{it} \quad (1)$$

$$LCO_{it} = \alpha_1 + \alpha_2 LGDP_{it} + \alpha_3 LGDP_{it}^2 + \alpha_4 LGDP * TOL_{it} + \alpha_5 LPDEN_{it} + \alpha_5 INST_{it} + \alpha_5 FMD_{it} + \varepsilon_{it} \quad (2)$$

$$LCO_{it} = \alpha_1 + \alpha_2 LGDP_{it} + \alpha_3 LGDP_{it}^2 + \alpha_4 LGDP * SPL_{it} + \alpha_5 LPDEN_{it} + \alpha_5 INST_{it} + \alpha_5 FMD_{it} + \varepsilon_{it} \quad (3)$$

$$LCO_{it} = \alpha_1 + \alpha_2 LGDP_{it} + \alpha_3 LGDP_{it}^2 + \alpha_4 LGDP * PAL_{it} + \alpha_5 LPDEN_{it} + \alpha_5 INST_{it} + \alpha_5 FMD_{it} + \varepsilon_{it} \quad (4)$$

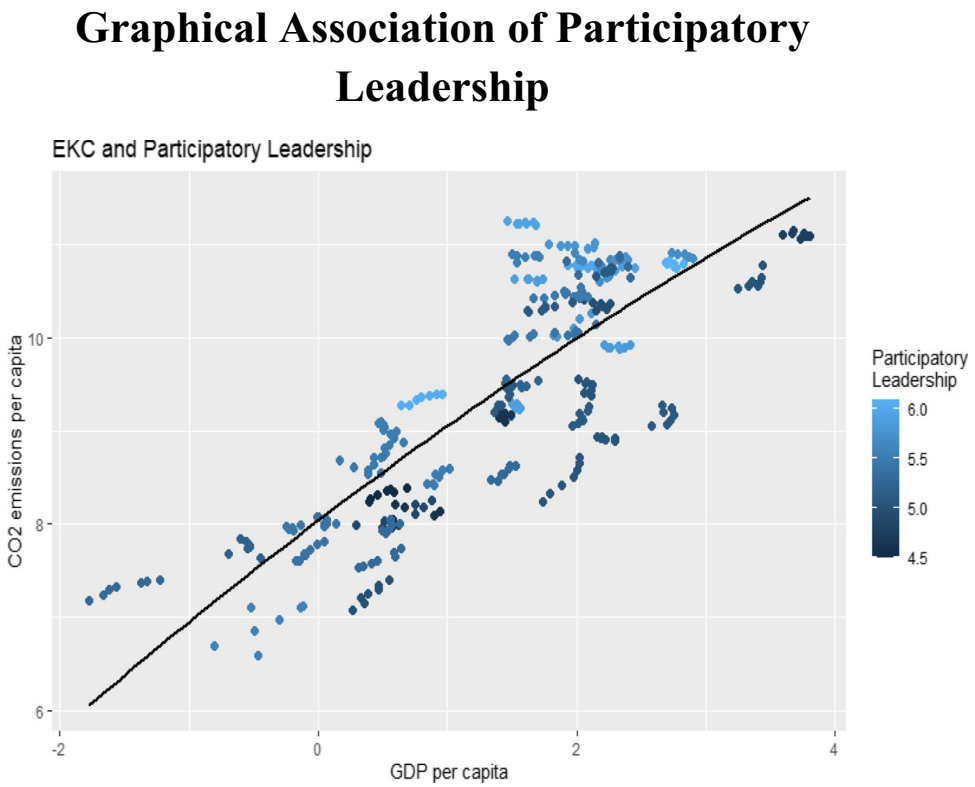
$$LCO_{it} = \alpha_1 + \alpha_2 LGDP_{it} + \alpha_3 LGDP_{it}^2 + \alpha_4 LGDP * HOL_{it} + \alpha_5 LPDEN_{it} + \alpha_5 INST_{it} + \alpha_5 FMD_{it} + \varepsilon_{it} \quad (5)$$

$$LCO_{it} = \alpha_1 + \alpha_2 LGDP_{it} + \alpha_3 LGDP_{it}^2 + \alpha_4 LGDP * AUL_{it} + \alpha_5 LPDEN_{it} + \alpha_5 INST_{it} + \alpha_5 FMD_{it} + \varepsilon_{it} \quad (6)$$

Estimation model

The panel data estimation approach is feasible for data varying across the cross-sections and time periods. Panel data models can also assess the effects of time-invariant variables such as leadership characteristics because of their variation across cross-sections. Further, since the periods per cross-section are less than 20, this study resorts to simple panel data models as variables can be assumed stationary. This study has availed Panel Feasible Generalized Model (FGLS). This is a variant of Fixed and Random

Fig. 6 Graphical Association of Participatory Leadership



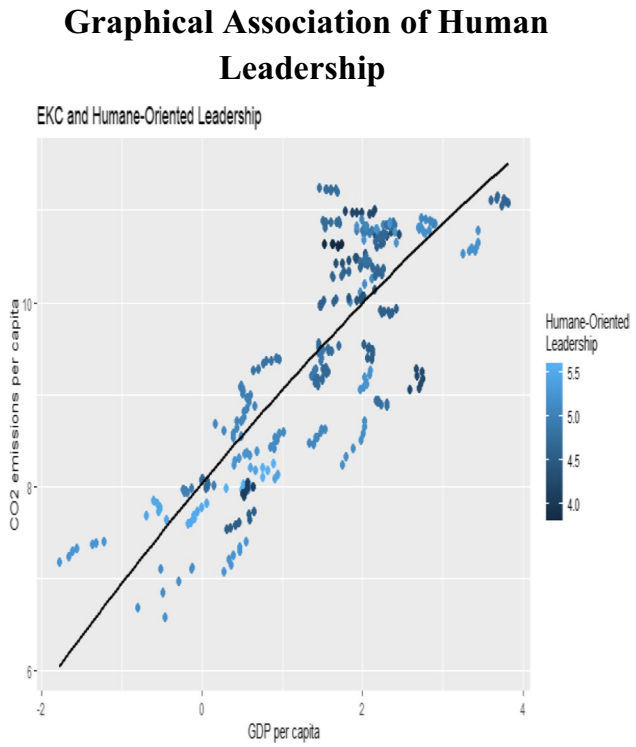


Fig. 7 Graphical Association of Human Leadership

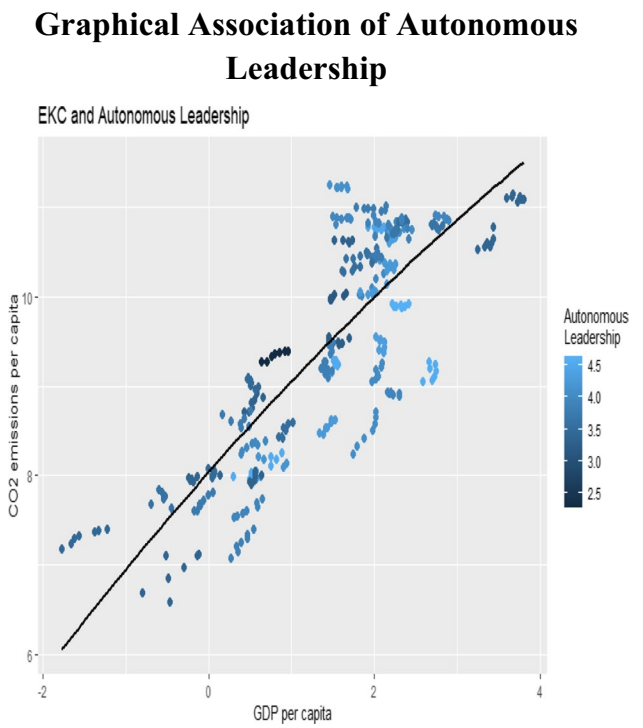


Fig. 8 Graphical Association of Autonomous Leadership

Table 5 Estimates of LCO using FGLS model

Indep. Vars	CHL model	TOL model	SPL model	PAL model	HOL model	AUL model
	Coefficients (Probabilities)					
LGDP	3.216 (0.00)	3.917 (0.00)	2.129 (0.00)	3.004 (0.00)	2.871(0.00)	2.648 (0.00)
$LGDP^2$	-0.122 (0.00)	-0.158 (0.00)	-0.087 (0.00)	-0.105 (0.00)	-0.119(0.00)	-0.114 (0.00)
INST	-0.079 (0.00)	-0.106 (0.00)	0.016 (0.55)	-0.008 (0.82)	-0.024(0.29)	-0.118 (0.00)
FMD	0.106 (0.00)	0.108 (0.00)	0.102 (0.00)	0.074 (0.00)	0.075 (0.00)	0.174 (0.00)
LPDEN	-0.032 (0.00)	-0.042 (0.00)	-0.091 (0.00)	-0.085 (0.00)	-0.022(0.00)	-0.0005 (0.00)
LGDP*CHL	-0.043 (0.00)					
LGDP*TOL		-0.050 (0.00)				
LGDP*SPL			0.065 (0.00)			
LGDP*PAL				-0.057 (0.00)		
LGDP*HOL					0.004 (0.20)	
LGDP*AUL						0.042 (0.00)
const	-15.48 (0.00)	-18.36 (0.00)	-12.97 (0.00)	-14.37 (0.00)	-15.15 (0.00)	-14.99 (0.00)
Post Regression Statistics						
Obs	350	350	350	350	350	350
Groups	50	50	50	50	50	50
Wald chi^2 (prob)	15,481 (0.00)	8529 (0.00)	4750 (0.00)	10,280 (0.00)	9160 (0.00)	4033 (0.00)
Moderation Effects						
Cut off[a]	13.1803	12.3956	12.2356	14.3048	12.0630	11.6140
At 25 per. moderation[b]	12.1652	11.4889	13.4273	12.9259	12.1413	12.2532
At 50 per. moderation[c]	12.1370	11.4715	13.5207	12.8363	12.1442	12.3214
At 75 per. moderation[d]	12.1212	11.4557	13.6029	12.7576	12.1501	12.3656

[a] cut off value at zero leadership characteristic

[b] cut off value at 25 percentile of leadership characteristic

[c] cut off value at 50 percentile of leadership characteristic

[d] cut off value at 75 percentile of leadership characteristic

per. = percentile

Effect models, which allows the standard errors to vary across the cross-sections (Aziz et al., 2020; Hameed et al., 2021; Hassan et al., 2020; Kalim & Arshed, 2021).

Results and Discussions

Descriptives and associations

Table 3 discusses the descriptive statistics of the variables used in the study. Here only for the case of LCO, the mean value is smaller than the standard deviation, which makes it under dispersed, while all others are overdispersed. Assessing the skewness and kurtosis values shows that statistically, none of the variables are normally distributed. This study assumed that variables are asymptotically normal as per central limit theorem.

Here from Fig. 2 we can see that the strength of correlations defines the distance between the variables. This plotting helps to see the proximity of the variables in terms of correlation (negative or positive), which the correlation matrix fails to provide. Here we can see that LGDP is associated with INST, FMD, LCO and SPL. At the same time, CHL and TOL and PAL and SPL are also associated. Table 4 provides the correlation matrix, where GDP, INST, FMD and LPDEN are positively associated with CO2 while other than AUL, all indicators of leadership are negatively associated with CO2. Where we can see that none of the two independent variables are highly correlated with each other, it rules out the likelihood of multicollinearity in the data.

Since this study has proposed that the leadership styles are moderating the EKC relationship, the scatter plots are prepared between CO2 and GDP while the third axis of leadership style is presented in color, where brighter color shows the high value of leadership style. The purpose of Figs. 3, and 4 are to assess the association of leadership style on the EKC relationship. From Figs. 3, and 4, there are plots of LCO and LGDP association with contrasts of leadership style. Here in Fig. 3 it is shown that the high charismatic leadership traits are located near or below the line indicating that for higher

Table 6 List of Countries

Albania	Italy
Argenta	Japan
Australia	Kazakhstan
Austria	Kuwait
Bolivia	Malaysia
Brazil	Mexico
Canada	Morocco
China	Namibia
Colombia	Netherlands
Costa Rica	New Zealand
Czech Republic	Nigeria
Demark	Philippines
Ecuador	Poland
Ei Salvador	Portugal
Finland	Qatar
France	Singapore
Georgia	Slovenia
Germany	South Africa
Greece	Spain
Guatemala	Sweden
Hungary	Switzerland
India	Thailand
Indonesia	Turkey
Ireland	Zambia
Israel	Zimbabwe

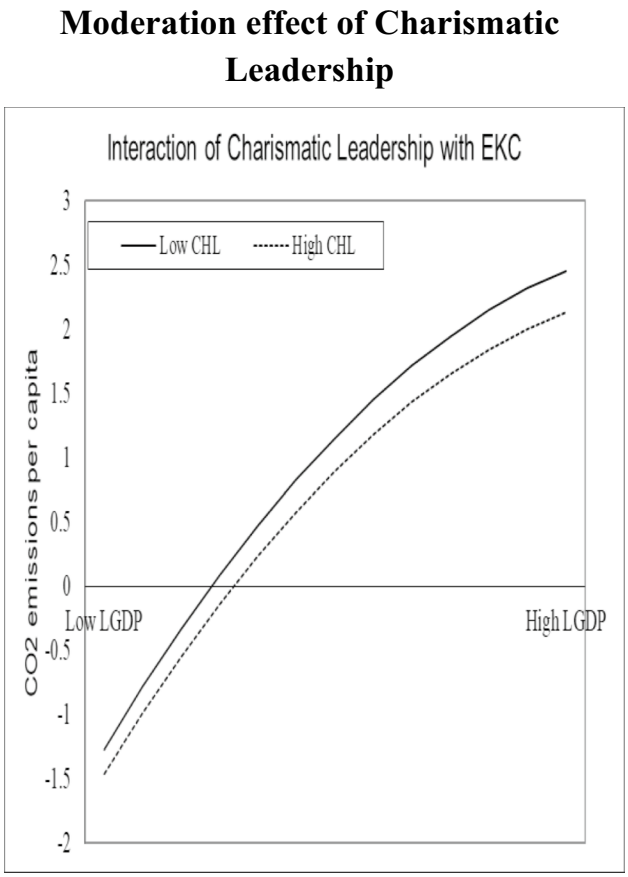


Fig. 9 Moderation effect of Charismatic Leadership

charismatic leardership there is lower CO2 emissions at any particular GDP value. This hints the negative moderating role of CHL on CO2.

Similar is the case with team oriented leadership (TOL) in Fig. 5, self protective leadership (SPL) in Fig. 6, humane leadership (HOL) in Fig. 7 and autonomous leadership (AUL) in Fig. 4. All of these leadership traits are negatively moderating CO2 emissions. For the case of participatory leadership (PAL) in Fig. 8, the high incidents are above the line, pointing that it has increased CO2 emissions from GDP. This means that PAL is positively moderating CO2 emissions. This evidence led this study to use the leadership traits as a moderator to the EKC relationship and propose it as a green growth policy intervention.

Regression estimates

Table 5 provides the regression estimates of 6 models shown in Eqs. 1, 2, 3, 4, 5 to 6. Here using the sample of 350 country-year observations of unbalanced panel data, all Wald Chi^2 values are significant, indicating that models are fit. Here for all models, the financial market development positively affects CO2 emissions. This is because, for a given leadership quality, an increase in financial development increases economic activity, which adds to CO2 emissions.

This outcome is different from the literature as empirical studies did not account for the changes in leadership characteristics. For CHL, TOL, and AUL, an increase in institutional quality reduces CO2 emissions, while insignificant for other models. This is because it provides a framework for increasing GDP and reducing the pollution haven effect for foreign investors. The results are similar to Wawrzyniak and Doryń (Wawrzyniak & Doryń, 2020). Lastly, population density negatively affects CO2 emissions for all models. Literature states that generally, population density has a positive effect on CO2 emissions, but with the selected sample of this study, it has a negative effect. For all models, the coefficient of LGDP is positive while the coefficient of $LGDP^2$ is negative, which confirms the presence of the EKC relationship. The first row of the moderation effects in Table 4 shows the cut-off value of the EKC curve. These values represent that if the LGDP value is above this threshold, a further increase in GDP will increase the environmental quality. This cut-off is the lowest for the case of Humane and Autonomous Leadership.

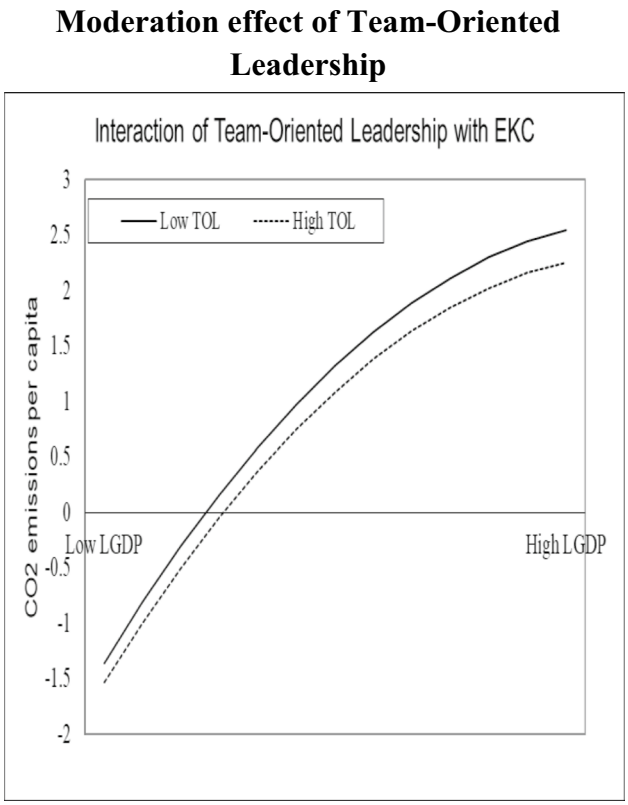


Fig. 10 Moderation effect of Team-Oriented Leadership

Based on the interaction effects of leading indicators, only Self-Protective and Autonomous Leadership characteristics positively affect the threshold, while others have negative.

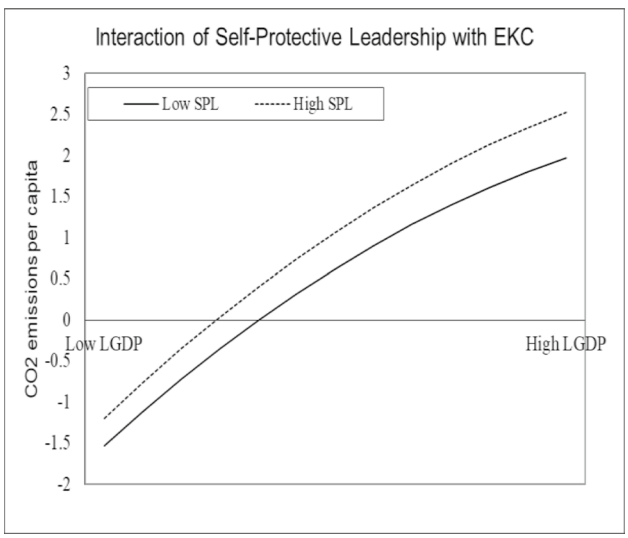


Fig. 11 Moderation effect of Self-Protective Leadership

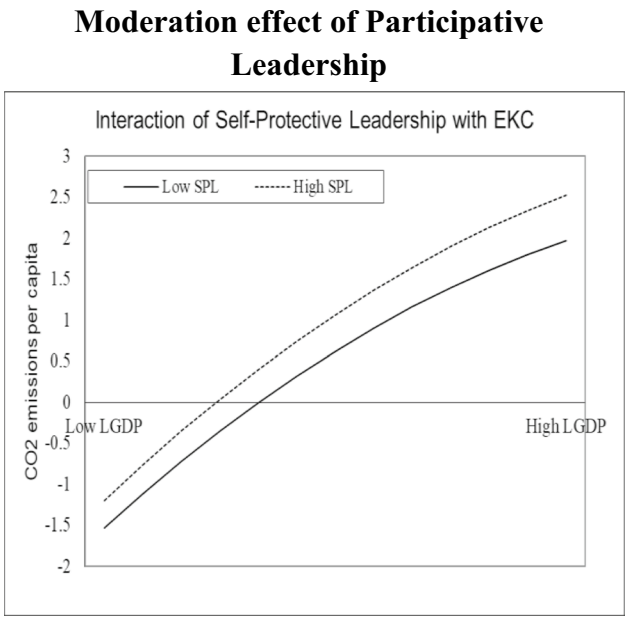


Fig. 12 Moderation effect of Participative Leadership

Assessing from the last three rows of the moderation effect in Table 6, it can be seen that there is a gradual decrease for all indicators of leadership because of an increase in their value except for Self-Protective, Humane, and Autonomous Leadership.

Lastly, Figs. 9, 10, 11, 12, 13, and 14 plot the interaction effects of moderators on the EKC relationship. Here it is evident that from Figs. 4, 9 and 11, an increase in

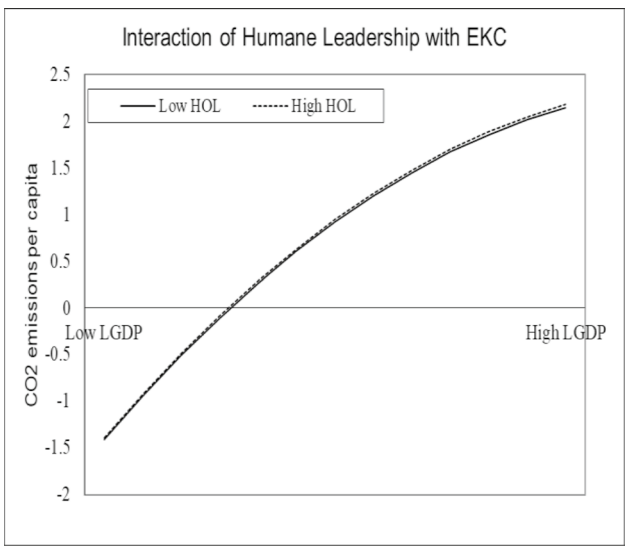


Fig. 13 Moderation effect of Humane Leadership

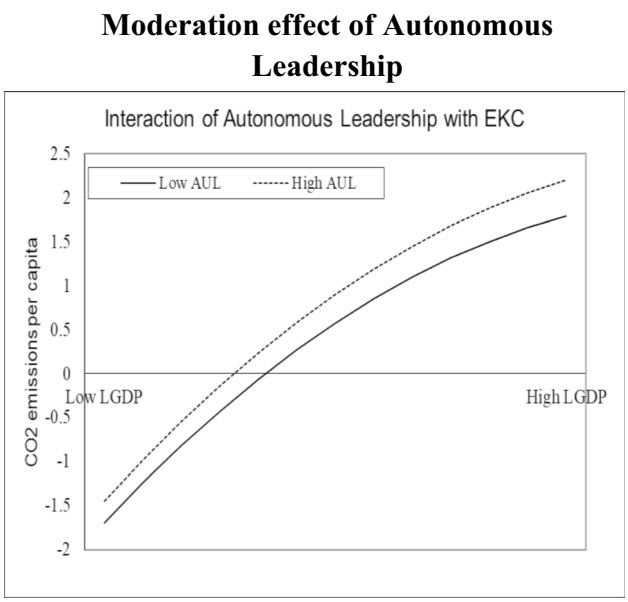


Fig. 14 Moderation effect of Autonomous Leadership

Charismatic, Team-Oriented and Participative Leadership tends to reduce the CO2 produced from each unit of GDP increased. The results clearly show that climate emergencies require engaging people by focusing on how to increase their participation and how to motivate them. According to situational leadership theory, charismatic leadership, team-oriented, and participative leadership styles are closely similar to country club leadership styles that require high level of involvement of people. Standing with people and giving a friendly environment without putting pressure on them creates a flexible environment that results in a creative solution to control CO2 emissions. Thus they have inherited the ability to increase sustainability in economic activity. While, from Fig. 10 and 13, it is shown that increase in Self-Protective and Autonomous Leadership, there is an increase in CO2 being produced from each unit of GDP. Both leadership styles closely link with the teller style of leadership. Self-proactive leadership style focuses on competition, but large scale organizations with high fixed cost could not adapt quickly to environmental change. For instance, Japanese car manufacturers outbreak the competition by introducing oil efficient cars in USA automobile market. In response, USA automobile manufacturers had lost big market share and could not respond to their rivals. On the other hand, Autonomous leadership style focuses on empowering people, but reducing CO2 emissions requires intrinsic motivation that boosts self-efficacy among people as in the case of country club leadership style. Thus these two characteristics are reducing the sustainability factor in economic activity.

Conclusion and policy implications

Literature has been discussing the impact of production on environmental quality. This paper is the key initiative to focus on the intervention potential of leadership styles under situational leadership theory. We argue that pollution also increases when production increases, but economic activity can be made sustainable with effective leadership intervention. Developed countries can develop a cleaner production model using innovation, but developing countries are not that fortunate.

This study has proposed a new line of intervention, that is via leadership. According to the study, if countries have effective leaders who have a strong vision, they can take the initiative and lead to reducing pollution from their production processes. This study theoretically and empirically assesses the potential of leadership styles in moderating the EKC generally across 50 countries. Economic growth slows down as a result of the depletion of natural resources in the countries, but if the countries develop clean technology utilization under effective leadership, they can prosper and develop a protective quality environment. The results showed that different leadership styles have different impacts on EKC at a national level. Thus, policymakers in different organizations and countries can develop and align their leadership styles that suit their sustainability and cleaner growth requirements. Countries can develop their curriculum, and businesses can calibrate their vision and missions to ensure leadership characteristics that promote cleaner production. The generalized results can be used to form a strategic framework at the country level to reform the leadership environment within businesses to help economic activity become greener.

Future studies can explore countrylevel effects of leadership moderation, these estimates will tell what it the current effect of their actual level of leadership and using this generalized results the policy can be formed towards learning from nations whose leadership environment benefits beyond business growth.

Author's contributions Conceptualization: Arshad, N; Guo, J, Khan, YA; Methodology: Khan, YA; Munir, M: Formal analysis and (field/laboratory) investigation: Hameed, K, Munir, M; Khan, YA, Guo, J: Writing—original draft preparation: Seher, A; Arshad, H; Khan, YA: Writing—review and editing: Khan, YA.

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Data availability All results reported in this research was carried out in R-studio computational environment.Data used in this research are taken from World Development Indicator avaliable at: https://databank.worldbank.org/source/world-development-indicators and World Economic Forum avaliable at: https://www.weforum.org/

Declarations

Ethics approval and consent to participate This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of interest None.

Competing interest The author declares no competing interest.

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