RESEARCH ARTICLE

National culture's influence on environmental performance of countries: A study of direct and indirect effects

Rosa Maria Dangelico[1] | Luca Fraccascia[1,2] | Alberto Nastasi[1]

[1]Department of Computer, Control, and Management Engineering "Antonio Ruberti", Sapienza University of Rome, Rome, Italy

[2]Department of Industrial Engineering and Business Information Systems, University of Twente, Enschede, The Netherlands

Correspondence
Luca Fraccascia, Department of Computer, Control, and Management Engineering "Antonio Ruberti", Sapienza University of Rome, Via Ariosto 25, 00185 Rome, Italy.
Email: luca.fraccascia@uniroma1.it

Abstract

The effect of national culture on country environmental performance has received attention during the past few years. However, previous studies considered a subset of cultural dimensions, focused on diverse environmental performance measures, provided contrasting results, and did not adequately investigated the mediating effects of socio-economic variables. In this study, we investigate the impact of all cultural dimensions (power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, indulgence) on three environmental performance measures at the country level: the environmental performance index and its two main overarching objectives. Both direct and indirect effects, through three socio-economic variables (population growth, education, income), are tested using a sample of 62 countries. Results show that the effect of cultural dimensions may vary based on the specific cultural dimension and the type of environmental performance measure considered. Masculinity and indulgence directly impact on environmental performance. Power distance has no influence on environmental performance measures. The other dimensions affect environmental performance through the mediating effect of socio-economic variables.

KEYWORDS
environmental performance, environmental performance index, national culture, sustainability, sustainable development

1 | INTRODUCTION

Nowadays, the environmental pressures on the Planet have increased to an extent never seen before (The World Bank, 2017; Wiedmann et al., 2015) and they are responsible for huge damages to the ecosystems, as global climate change and loss of biodiversity (IPCC, 2014; Madreimov & Li, 2019; Weber, Peters, Guan, & Hubacek, 2008), which, in turn, have consequences from the economic perspective (do Prado et al., 2020). Therefore, one of the greatest issues at the global level concerns the enhancement of the environmental

performance of production and consumption activities, for example, by promoting eco-innovations and green products (Dangelico, 2016; Fraccascia, Giannoccaro, & Albino, 2018; Song, Wang, & Ma, 2020).

However, when considering the environmental performance at the country level, relevant differences among countries can be observed (e.g., Fraccascia & Giannoccaro, 2019; Wiedmann et al., 2015). Traditionally, scholars demonstrated that the environmental performance of a country can be affected by its level of economic development (Antoci, 2009; Grossman & Krueger, 1995; Kestemont, Frendo, & Zaccaï, 2011; Mukherjee & Chakraborty, 2013) as well as

by social capital and human development of that country (e.g., Grafton & Knowles, 2004).

Recently, some studies have investigated the influence of the national culture on the environmental performance of countries (e.g., Lahuerta-Otero & González-Bravo, 2018; Onel & Mukherjee, 2014; Park, Russell, & Lee, 2007; Peng & Lin, 2009). When considering the national culture, these studies referred to the theoretical framework developed by Hofstede (1980), which defines the country culture through four cultural dimensions: power distance, individualism, masculinity, and uncertainty avoidance. These studies demonstrated that the aforementioned cultural dimensions can affect the environmental performance of countries.

The theoretical framework developed by Hofstede (1980) has been later updated and two further dimensions have been added: long-term orientation and indulgence (Hofstede, Hofstede, & Minkov, 2010). However, the aforementioned studies have considered only the original four dimensions of Hofstede's model. Recently, Lahuerta-Otero and González-Bravo (2018) integrated the original framework to consider also the impact of Long-term Orientation. Nevertheless, the impact that Indulgence plays on the environmental performance of countries has not been investigated in the literature so far and previous studies on the effect of the first four cultural dimensions provided contrasting results on the significance and on the sign of the effects. Further, Onel and Mukherjee (2014) showed that when socio-economic variables are simultaneously considered with cultural variables, the latter lose their significant effect on environmental performance. However, the possible mediating effect of socio-economic variables has not been adequately investigated in the literature so far. Only the study by Peng and Lin (2009) tested the mediating effect of education, calling for further research on more possible mediators of the relationships between cultural dimensions and the environmental performance of countries.

This article is aimed at filling the aforementioned gaps and shedding light on contrasting results of previous studies. We investigate the impact of the six cultural dimensions defined by Hofstede (i.e., power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence) on three measures of environmental performance at the country level: the environmental performance index (EPI) and its two overarching objectives, that is, environmental health and ecosystem vitality. Both direct and indirect—through three socio-economic variables: education, income, and population growth—effects are tested. In particular, the direct effects are tested via a series of regression analyses, while the indirect effects are tested by following the three-step approach proposed by Baron and Kenny (1986).

Specifically, this study attempts to answer the following research questions: (a) what is the effect of the national culture (defined by the six cultural dimensions) on the environmental performance of countries?; (b) do country socio-economic factors mediate the aforementioned relationship?

The remainder of the article is structured as follows. In Section 2, the relevant literature is analyzed and the hypotheses are developed. Section 3 presents the methodology used for this study. Section 4 shows the results. The article ends with discussion and conclusions in Section 5.

2 | LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In this section, we review previous studies investigating the effect of the six cultural dimensions defined by Hofstede (i.e., power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence) on the environmental performance of countries. In particular, in Section 2.1, we present the measures of environmental performance used by the reviewed studies. In Section 2.2, we describe the six cultural dimensions considered in this article, we present findings of previous studies investigating the effects of these dimensions on the environmental performance of countries, and finally we develop the hypotheses.

2.1 | Measures of environmental performance of countries

The impact of national culture on countries' environmental performance has been investigated using different measures of environmental performance that follow the evolution of environmental performance measures at the country level developed over time. Specifically, the study by Park et al. (2007) considered the environmental sustainability index (ESI), developed by the joint efforts of the Yale Center for Environmental Law and Policy and the Columbia University Center for International Earth Science Information Network, in collaboration with the World Economic Forum and the European Commission Joint Research Centre (Esty, Levy, Srebotnjak, & De Sherbinin, 2005). This index was developed for the first time with a pilot in 2000 and then improved in the subsequent versions of 2001, 2002, and 2005. The ESI quantifies countries' overall progress toward environmental sustainability. This index ranges between zero (bad environmental performance) and 100 (good environmental performance) and relies (in its 2005 version) on a set of 76 underlying variables combined into 21 indicators belonging to five components. Instead of considering the overall index, other studies focused on some of its building blocks: the social and institutional capacity for environmental sustainability (one of the five components of ESI, determined by 24 variables combined into four indicators) (Husted, 2005; Peng & Lin, 2009) and the environmental innovation (World Economic Forum Survey on private sector environmental Innovation—one of the 76 variables of the ESI) (Vachon, 2010). Vachon (2010) also used the Green corporatism, a construct measured by seven questions from the Global Competitiveness Report 2004–2005 developed by the World Economic Forum (2004).

A further evolution of country-level environmental performance measures is the EPI, developed by the Yale Center for Environmental Law and Policy and the Center for International Earth Science Information Network of Columbia University, in collaboration with the

World Economic Forum and the Samuelson Foundation, and released every 2 years starting from 2006. Onel and Mukherjee (2014) used one of the two main overarching objectives of the 2010 EPI: the environmental health, determined by human health-related variables such as child mortality, indoor air pollution, availability of drinking water, availability of adequate sanitation, and urban particulates. Finally, Lahuerta-Otero and González-Bravo (2018) used the two overarching objectives and selected indicators from the 2014 EPI: health impacts, air quality, water and sanitation, water resources, agriculture, biodiversity and habitat, climate and energy.

2.2 | National culture

2.2.1 | Power distance

Power distance is defined as "*the extent to which the less powerful members of organizations and institutions accept and expect that power is distributed unequally*" (Hofstede, Hofstede, & Minkov, 2011, p. 61). High power distance cultures are characterized by the existence of formal hierarchical positions, where subordinates are highly dependent on their superiors and have a strong respect for the authority. Centralization of power, control, hierarchy, and resistance to changes in the distribution of power are the key pillars of societies characterized by high power distance. In these societies, leaders tend to have high authoritarian attitudes, while subordinates do not expect to be involved in taking decisions, but rather they look forward to receive orders from leaders. This suggests that creativity is not encouraged in these cultures (Husted, 2005; Katz, Swanson, & Nelson, 2001); this results in low capabilities of companies to innovate (e.g., Burns, Kick, Murray, & Murray, 1994; Shane, 1993; Thompson, 1967), even with regard to environmental innovations. The high respect for the authority is responsible for a scant social debate capacity for better environmental conditions, which results in poor interventions of the private sector in social issues and environmental problems (Husted, 2005; Katz et al., 2001; Onel & Mukherjee, 2014). Alternatively, personal responsibility and autonomy are encouraged in low power distance societies, where all the citizens are more likely to have similar rights and wealth. It is much easier that open discussions on environmental and social issues take place and that citizens actively support programs of environmental improvement (Husted, 2005). Furthermore, communication across hierarchical boundaries is more common in low power distance cultures, leading to stronger capabilities of companies to innovate (Shane, 1993; Williams & McGuire, 2005). Most previous empirical evidence demonstrated that power distance has a negative effect on the environmental performance (Lahuerta-Otero & González-Bravo, 2018; Park et al., 2007; Peng & Lin, 2009), even though Onel and Mukherjee (2014) showed a nonsignificant influence and Vachon (2010) found mixed results.

Based on these considerations, we hypothesize that:

H1: The higher the level of power distance of a country, the lower the environmental performance of that country will be, ceteris paribus.

2.2.2 | Individualism versus collectivism

This dimension shows whether the individual interests are more important than those of a group or vice versa. Societies with high individualism (i.e., individualistic societies) recognize strong importance to personal interests; alternatively, societies with low individualism (i.e., collectivistic societies) recognize the interests of the society as more important than the individual ones. This dimension also reflects the strength of ties between individuals. In fact, relationships among individuals are weak in individualistic societies, where it is assumed that everyone's responsibility is to take care only of himself/herself and his/her immediate families (Hofstede, 1980; Ringov & Zollo, 2007). Alternatively, in collectivistic societies people are connected through strong groups that protect them during their life and to which people are assumed to be loyal.

According to the literature, the values characterizing individualistic societies may determine the emergence of environmental groups aimed at improving the environment individuals live in. In fact, the widespread presence of these environmental groups is more likely in individualistic societies rather than in collectivistic societies (Katz et al., 2001). Hence, the higher the level of Individualism of one country, the higher the institutional capacity of that country in responding to environmental problems will be (Husted, 2005). Individualistic societies also show a higher propensity to innovate compared to collectivistic societies. In fact, the innovation initiation is often seen as the act of a single individual rather than of a group (Williams & McGuire, 2005). Since individualistic societies give high importance to personal autonomy (Herbig & Dunphy, 1998; Waarts & Van Everdingen, 2005), employees have more opportunities to innovate, and this may reflect on the development of eco-innovations too.

Previous empirical evidence demonstrated that Individualism has a positive influence on the environmental performance (Lahuerta-Otero & González-Bravo, 2018; Onel & Mukherjee, 2014; Peng & Lin, 2009; Vachon, 2010), with the exception of Park et al. (2007) who found a nonsignificant effect.

Based on these considerations, we expect that:

H2: The higher the level of individualism of a country, the higher the environmental performance of that country will be, ceteris paribus.

2.2.3 | Masculinity versus femininity

This cultural dimension concerns the degree to which a society emphasizes masculine values, such as ambition, competition, power, materialism, personal career, and orientation toward achievement. The higher the level of masculinity of a country, the higher the importance people give to these values. Alternatively, societies with low level of masculinity give more importance to values such as discretion, modesty, tolerance, solidarity, and quality of life.

The high attention to profit and the low value for the quality of life suggest that, in countries with high masculinity, companies would

be less prone to enhance their environmental performance and they would even be able to damage the natural environment in order to obtain a greater profit (Hofstede, 2001; Palmer, Oates, & Portney, 1995).

Most of the previous empirical evidence demonstrated that masculinity has a negative effect on the environmental performance (Lahuerta-Otero & González-Bravo, 2018; Park et al., 2007; Peng & Lin, 2009), with the exception of Onel and Mukherjee (2014) and Vachon (2010), who found nonsignificant effects.

Based on these considerations, we expect that:

H3: The higher the level of masculinity of a country, the lower the environmental performance of that country will be, ceteris paribus.

2.2.4 | Uncertainty avoidance

This cultural dimension concerns the extent to which the members of a culture feel threatened by uncertain or unknown situations (Hofstede, 2001). In societies characterized by high level of uncertainty avoidance, individuals tend to feel threatened by unknown situations and they barely tolerate ambiguous situations or deviations from the norms. Accordingly, a strong resistance to change is typical of these societies (Kale & Barnes, 1992). Alternatively, in societies characterized by low level of uncertainty avoidance, individuals tend to be more tolerant to risks and to tackle uncertain situations more easily. Hence, a low resistance to change can be observed in these societies (e.g., Kale, 1991; Nakata & Sivakumar, 1996; Ueno & Sekaran, 1992).

Since the deterioration of the environmental conditions could lead to unknown situations, individuals living in societies characterized by high uncertainty avoidance would desire to have stable environmental health conditions to avoid risks in their lives. Previous empirical studies provided mixed results, with Peng and Lin (2009) and Onel and Mukherjee (2014) showing a positive effect of uncertainty avoidance on environmental performance, Vachon (2010) reporting a negative effect, and Lahuerta-Otero and González-Bravo (2018) and Park et al. (2007) showing nonsignificant effects.

Based on the aforementioned theoretical considerations, we expect that:

H4: The higher the level of uncertainty avoidance of a country, the higher the environmental performance of that country will be, ceteris paribus.

2.2.5 | Long-term orientation versus short-term orientation

This cultural dimension regards the connection of the past with the current and future actions and challenges. Long-term orientation refers to virtues that look to future results. Values related to long-term orientation are perseverance, thrift, ordering relationships by status, having a

sense of shame, learning, honesty, adaptability, dependability, and self-discipline. The opposite is short-term orientation, whose main values are the respect for tradition and the fulfillment of social obligations; it refers to virtues linked to the past and the present (Hofstede, 2011).

While long-term oriented companies adopt a result-focused approach in the long period, short-term oriented companies are focused on the profit in the short period (Hofstede, Hofstede, Minkov, Salvetti, & Simonetti, 2014; Mamman & Saffu, 1998). Accordingly, entrepreneurs and managers of the latter type of companies are reluctant to adopt business management policies oriented to environmental sustainability and innovation, since these practices require long-term oriented investments, which could erode the economic performance in the short period (Hofstede et al., 2014; Nakata & Sivakumar, 1996). Alternatively, long-term oriented companies can be expected to invest with the aim of achieving new and strong market positions, sacrificing part of short-term results (Hofstede et al., 2014). Since tackling environmental sustainability requires the adoption of a long-term perspective, it can be expected that long-term oriented societies are more prone to invest in environmental protection than short-term oriented ones. According to this, Lahuerta-Otero and González-Bravo (2018) highlighted the positive impact of long-term orientation on the environmental performance of countries related to biodiversity and habitat. The same authors also found a negative - even though less significant - effect on air quality performance and non significant effects on other measures.

Based on these considerations, we expect that:

H5: The higher the long-term orientation of a country, the higher the environmental performance of that country will be, ceteris paribus.

2.2.6 | Indulgence versus restriction

Indulgence "*stands for a society that allows relatively free gratification of basic and natural human desires related to enjoying life and having fun*" (Hofstede et al., 2011, p. 519). Alternatively, restriction "*stands for a society that controls gratification of needs and regulates it by means of strict social norms*" (Hofstede, 2011, p. 15). People living in indulgent societies are encouraged to spend money and engage themselves in pleasurable activities. Alternatively, in societies characterized by low indulgence, these practices are considered somewhat limited and governed by rigid social norms.

In the literature, no studies investigated so far the impact of this cultural dimension on the country's environmental performance. However, considering the managerial context, we can suppose that managers of companies operating in indulgent societies are more encouraged to make environmental investments (with fewer constraints in terms of spending limits) than managers of companies operating in less indulgent societies, with a positive impact on company's environmental performance. Furthermore, we can suppose that, in these companies, employees have more time and freedom to experiment and innovate, since indulgence can positively affect innovation outputs

(Prim, Filho, Zamur, & Di Serio, 2017). This would have a positive effect on environmental performance of companies, which greatly depends on employees' innovative environmental ideas (Ramus, 2001). Better companies' environmental performance will result in better country's one.

Based on these considerations, we expect that:

H6: The higher the indulgence of a country, the higher the environmental performance of that country will be, ceteris paribus.

The impacts of cultural dimensions on the aforementioned measures of environmental performance as resulting from reviewed studies are displayed in Table 1.

3 | METHODOLOGY

We test both the direct and indirect effects of cultural dimensions on environmental performance through regression analysis. In the following, the measures and the sample used are presented.

3.1 | Measures

3.1.1 | Environmental performance

We investigate the impact of national culture on the environmental performance of countries, as reported by the EPI. The 2014 EPI was created through the collaboration between the Yale Center for Environmental Law and Policy and the Center for International Earth

Science Information Network at Columbia University with the Samuel Family Foundation and the World Economic Forum (Hsu et al., 2014). The index was calculated for 178 countries, which represent 99% of the world population, 98% of global area, and 97% of world GDP. The index is based on 20 indicators combined into nine categories. Each category is related to one of the two core areas of the index, which correspond to different overarching objectives: environmental health, which concerns the protection of human health, and the ecosystem vitality, which is related to the protection of the natural environment. Table 2 depicts objectives, categories, and indicators considered by the EPI.

In this study, we evaluate the effect of different dimensions of culture on the total score of this index and on the scores of its two main overarching objectives: environmental health and ecosystem vitality.

3.1.2 | Cultural dimensions

Measures of the six cultural dimensions presented in Section 2.2 were computed by Hofstede for 111 countries (http://www.geerthofstede.nl/). For each dimension, a measure ranging between 0 and 100 is provided.

3.1.3 | Socio-economic variables

Similarly to previous studies (e.g., Lahuerta-Otero & González-Bravo, 2018; Onel & Mukherjee, 2014; Park et al., 2007; Peng & Lin, 2009),

TABLE 1 A synthesis of the impact of five national culture dimensions on different measures of environmental performance as reported in previous studies

Reference	Measure	Power distance	Individualism	Masculinity	Uncertainty avoidance	Long-term orientation	Indulgence
Park et al. (2007)	ESI	(−)		(−)		(n.i.)	(n.i.)
Peng and Lin (2009)	SIC for environmental sustainability (a component of the ESI)	(−)	(+)	(−)	(+)	(n.i.)	(n.i.)
Vachon (2010)	Green corporatism	(−)	(+)		(−)	(n.i.)	(n.i.)
	Environmental innovation (World Cconomic Forum survey on private sector environmental innovation—a variable within the EPI)		(+)		(−)	(n.i.)	(n.i.)
Onel and Mukherjee (2014)	Environmental health (one of the two overarching objectives of the EPI)		(+)		(+)	(n.i.)	(n.i.)
Lahuerta-Otero and González-Bravo (2018)	Environmental health, ecosystem vitality (the two overarching objectives of the EPI), and selected indicators	(−)	(+)	(−)		(+/−)	(n.i.)

Note: (−) indicates a negative significant effect of the cultural dimension on the country performance. (+) indicates a positive significant effect of the cultural dimension on the country performance. Empty cell means that the effect of the cultural dimension on the country performance is not significant. (n.i.) means that the effect of that specific cultural dimension has not been investigated. For Lahuerta-Otero and González-Bravo (2018) (+) and (-) are referred to specific measures of environmental performance.
Abbreviations: EPI, environmental performance index; ESI, environmental sustainability index; SIC, social and institutional capacity.

TABLE 2 Objectives, categories, and indicators belonging to the environmental performance index—based on Hsu et al. (2014)

Overarching objective	Category	Indicator
Environmental health	Health impacts	*Child mortality* The probability of a child dying between his/her first and fifth birthday
	Air quality	*Air pollution—average exposure to PM$_{2.5}$* Population-weighted exposure to PM$_{2.5}$ in micrograms per cubic meter (µg/m^3)
		Air pollution—PM$_{2.5}$ exceedance Average of the percentage of the population exposed to PM$_{2.5}$ levels at 10, 15, 25, and 35 µg/m^3
		Household air quality The percentage of the population burning solid fuel (biomass such as wood, crop residues, dung, charcoal, and coal) for cooking
	Water and sanitation	*Access to drinking water* The proportion of a country's total population with access to an "improved drinking water source" as a main source of drinking water
		Access to sanitation The percentage of a country's population that has access to an improved source of sanitation
Ecosystem vitality	Water resources	*Wastewater treatment* Measures how well countries treat wastewater from households and industrial sources before it is dumped into the environment
	Agriculture	*Agricultural subsidies* The degree of environmental pressure exerted by subsidizing agricultural inputs
		Pesticide regulation The status of countries' legislation regarding the use of chemicals listed under the Stockholm convention on persistent organic pollutants
	Forests	*Change in forest cover* The percent change in forest cover between 2000 and 2012 in areas with greater than 50% tree cover
	Fisheries	*Fish stocks* The percentage of a country's total catch that is comprised of species listed as overexploited or collapsed
		Coastal shelf fishing pressure The total catch from trawling and dredging equipment divided by the total area of each country's exclusive economic zone
	Biodiversity and habitat	*Critical habitat protection* The percent of sites identified by the Alliance for zero extinction that have partial or complete protection
		Terrestrial protected areas (national biome weight) Assesses the protection of biomes weighted by the proportion of a country's territory the biome occupies
		Terrestrial protected areas (global biome weight) Assesses the protection of biomes weighted by their globally proportional abundance
		Marine protected areas The percentage of country's exclusive economic zone that is under protection
	Climate and energy	*Trend in carbon intensity*
		Change of trend in carbon intensity
		Trend in CO$_2$ emissions per KwH

several socio-economic variables have been considered in this study: per capita income, population growth, and education. However, differently from previous studies, we test the mediating role of these variables—only Peng and Lin (2009) adopted a similar approach and only for the education variable. In the literature, the positive impact of income and education on the environmental performance of countries has been highlighted (e.g., Mariani, Pérez-Barahona, & Raffin, 2010).

On the contrary, population growth has often been cited as a cause of environmental degradation (e.g., Burns et al., 1994; World Commission on Environment and Development, 1987). As a measure of per capita income (in the remainder of the paper referred to as *income*), we considered the gross domestic product divided by midyear population. As a measure of *population growth*, we considered the exponential rate of growth of midyear population from year $t - 1$ to year t,
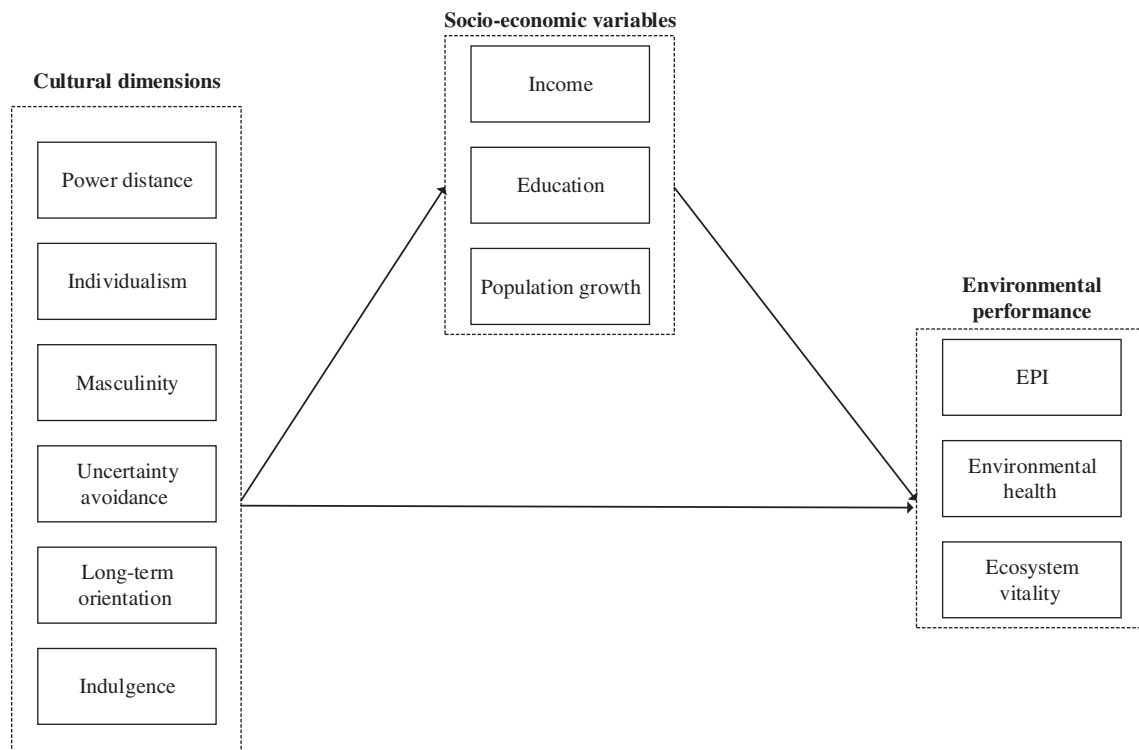
FIGURE 1 Conceptual model

expressed as a percentage. Data on *income* and *population growth* come from the World Bank (http://data.worldbank.org/indicator) and are referred to 2013. As a measure of *education*, we considered the total enrollment in tertiary education expressed as a percentage of the population of official tertiary education age. Data on *education* were taken from the Global Competitiveness Report 2012–2013 (http://www3.weforum.org/docs/GCR2014-15/GCI_Dataset_2006-07-2014-15.xlsx).[1]

3.2 | Sample

The sample was created starting from all countries for which the EPI data were available. Then, countries for which data about all the cultural dimensions were not available were excluded. This process led to a sample made of 62 countries. Appendix reports the list of countries in the sample.

Figure 1 graphically represents the conceptual model of this study.

4 | DATA ANALYSIS AND RESULTS

A normality check through skewness and kurtosis was performed for all considered variables, indicating no significant departure from normality. Correlation analysis was then performed. Table 3 shows the results of the correlation analysis among measures of cultural dimensions, environmental performance, and socio-economic variables.

Correlation analysis shows a positive and significant relationship between *individualism* and all the three measures of environmental performance. On the contrary, there is a negative and significant relationship between *power distance* and all the three measures of environmental performance. *Masculinity* and *uncertainty avoidance* do not display any significant relationship with environmental performance measures. The correlation analysis shows a positive and significant link between *long-term orientation* and both *EPI* and *ecosystem vitality* as well as between indulgence and both *EPI* and *environmental health*.

Then, a series of regression analyses was performed. In particular, for each dependent variable, six models are tested. Model (1) includes only the cultural variables. In models (2–4) one socio-economic variable per time is added—that is, *population growth* in model (2), *education* in model (3), *income* in model (4). In model (5) *population growth* and *education* are simultaneously included and, finally, in model (6) *income* is added. Results are reported in Tables 4–6. Variance inflation factors (maximum value 2.722) show that there is no collinearity among explanatory variables (Hair, Black, Babin, Anderson, & Tatham, 2006).

From the regression analysis, we can infer the following results.

Power distance does not have significant influence on any of the three measures of environmental performance in any of the models.

Individualism has significant and positive effects on all the three measures of environmental performance in models (1–3 and 5) as well as on *EPI* and *environmental health* in model (4). However, its influence on all three measures of environmental performance in model (6) is not significant.

TABLE 3 Correlation matrix

	Mean	SD	Power distance	Individualism	Masculinity	Uncertainty avoidance	Long-term orientation	Indulgence	Income	Population growth	Education	EPI total score	Environmental health	Ecosystem vitality
Power distance	58.68	20.50	1											
Individualism	45.97	23.55	−.649***	1										
Masculinity	48.89	19.81	.153	.035	1									
Uncertainty avoidance	67.27	22.10	.229*	−.221*	.038	1								
Long-term orientation	49.15	23.06	.004	.100	.008	−.014	1							
Indulgence	47.77	22.09	−.306**	.143	.087	−.109	−.488***	1						
Income	27,305.38	24,711.06	−.633***	.625***	−.080	−.289**	.114	.353***	1					
Population growth	.63	.76	.051	−.146	.168	−.343***	−.283**	.328***	.189	1				
Education	54.56	23.66	−.355***	.387***	−.179	.097	.216*	.130	.333***	−.372***	1			
EPI	63.91	14.54	−.528***	.615***	−.017	−.045	.218*	.228*	.735***	−.238*	.593***	1		
Environmental health	80.99	17.26	−.498***	.564***	−.099	.031	.085	.349***	.655***	−.226*	.654***	.903***	1	
Ecosystem vitality	52.52	14.71	−.480***	.573***	−.049	−.098	.293**	.102	.698***	−.215*	.465***	.942***	.705***	1

Abbreviation: EPI, environmental performance index.

* $p < .10$; ** $p < .05$; *** $p < .01$, two-tailed test.

TABLE 4 Regression results related to the effects of cultural dimensions and socio-economic variables on EPI

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cultural dimensions	Power distance	−.162	−.156	−.131	−.018	−.130	.049
	Individualism	.470***	.431***	.363***	.265**	.353***	.074
	Masculinity	−.041	−.014	.029	.004	.037	.113
	Uncertainty avoidance	.132	.069	.056	.192**	.033	.039
	Long-term orientation	.311***	.286**	.206*	.175*	.202*	.025
	Indulgence	.280**	.321**	.196*	.092	.219*	.056
Socio-economic variables	Population growth		−.165			−.072	−.284***
	Education			.336***		.314***	.251***
	Income				.561***		.688***
	F	9.202***	8.341***	10.570***	13.434***	9.199***	17.820***
	R²	.501	.520	.578	.635	.581	.755
	Adj. R²	.447	.457	.523	.588	.518	.713

Note: N = 62.

Abbreviation: EPI, environmental performance index.

* p < .10; ** p < .05; **** p < .01.

TABLE 5 Regression results related to the effects of cultural dimensions and socio-economic variables on *environmental health*

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cultural dimensions	Power distance	−.093	−.086	−.054	.016	−.053	.082
	Individualism	.473***	.432***	.340***	.320**	.332***	.122
	Masculinity	−.146	−.117	−.059	−.113	−.053	.005
	Uncertainty avoidance	.210**	.141	.114	.255***	.096	.100
	Long-term orientation	.240**	.214*	.109	.139	.106	−.027
	Indulgence	.406***	.449***	.300***	.265**	.319***	.197*
Socio-economic variables	Population growth		−.177			−.58	−217**
	Education			.419***		.402***	.354***
	Income				.420***		.517***
	F	9.018***	8.268***	12.384***	10.277***	10.731***	14.602***
	R²	.496	.517	.616	.571	.618	.716
	Adj. R²	.441	.455	.566	.516	.561	.667

Note: N = 62.

* p < .10; ** p < .05; *** p < .01.

Masculinity has a significant effect only on *ecosystem vitality* in model (6).

Uncertainty avoidance has significant and positive effects on *EPI* in model (4), on *environmental health* in models (1 and 4).

The effect of *long-term orientation* is significant and positive on EPI in models (1–5), on *environmental health* in models (1 and 2) and on *ecosystem vitality* in models (1–3, and 5).

Indulgence has a significant and positive effect on *EPI* in models (1–3 and 5), on *environmental health* in all models (1–6), and no significant effects on *ecosystem vitality*.

To test the mediating effect of the socio-economic variables on environmental performance, we followed the three-step approach proposed by Baron and Kenny (1986). Thus, we tested the effect of cultural variables on *population growth*, *education*, and *income* (Table 7).

According to the results in Tables 4–7 we can derive the following mediation effects.

The effect of *uncertainty avoidance* on *environmental health* seems to be mediated by *education and population growth*. The effect of *long-term orientatio*n on *environmental health* seems to be mediated by

TABLE 6 Regression results related to the effects of cultural dimensions and socio-economic variables on *ecosystem vitality*

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Cultural dimensions	Power distance	−.195	−.190	−.174	−.041	−.173	.017
	Individualism	.404***	.373**	.332**	.187	.322**	.026
	Masculinity	.047	.069	.094	.095	.102	.183**
	Uncertainty avoidance	.054	.003	.003	.118	−.020	−.014
	Long-term orientation	.324***	.304**	.253**	.180	.249**	.062
	Indulgence	.144	.177	.087	−.055	.111	−.061
Socio-economic variables	Population growth		−.133			−.073	−.297***
	Education			.225*		.204	.137
	Income				.596***		.729***
	F	6.955***	6.148***	6.735***	10.775***	5.862***	11.452***
	R^2	.431	.444	.466	.583	.469	.665
	Adj. R^2	.369	.371	.397	.529	.389	.607

Note: N = 62.
* $p < .10$; ** $p < .05$; *** $p < .01$.

TABLE 7 Regression results related to the effects of cultural dimensions on socio-economic variables

		Socio-economic variables		
		Income	Population growth	Education
Cultural dimensions	Power distance	−.258**	.038	−.093
	Individualism	.364***	−.233	.317**
	Masculinity	−.080	.165	−.209*
	Uncertainty avoidance	−.107	−.386***	.228*
	Long-term orientation	.241**	−.147	.313**
	Indulgence	.335***	.245*	.252*
	F	12.331***	4.274***	4.219***
	R^2	.574	.318	.315
	Adj. R^2	.527	.244	.241

Note: N = 62.
* $p < .10$; ** $p < .05$; *** $p < .01$.

education and *income*. The effect of *long-term orientation* on *ecosystem vitality* seems to be mediated by *income*.

The effects of *individualism* on *EPI* and *environmental health* seem to be mediated by *income* and *education*. The effect of *individualism* on *ecosystem vitality* seems to be mediated by *income*.

The effect of *indulgence* on *EPI* seems to be mediated by *income* and *education*.

Based on the above analysis, we can derive the following results of hypothesis testing, as reported in Table 8.

5 | DISCUSSION AND CONCLUSION

This study investigated the effect of six dimensions of national culture (power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence) on three measures of environmental performance (*EPI* and its two overarching objectives: *environmental health* and *ecosystem vitality*) using a sample of 62 countries.

Our study shows that cultural dimensions do affect environmental performance of countries. However, we found that the effect might vary based on the specific cultural dimension and the type of environmental performance measure that are considered.

The only cultural dimensions having a direct impact on environmental performance are *masculinity* (only direct effect) and *indulgence* (both direct and indirect). Power distance has no influence on any of the environmental performance measures. All the other dimensions affect environmental performance through the mediating effect of socio-economic variables (*income* and/or *education*). *Individualism* and *long-term orientation* positively affect all measures of environmental performance.

The positive effect of *individualism* on environmental performance means that individualistic societies, where great relevance is given to

TABLE 8 Hypothesis testing results

Environmental performance hypothesis	EPI	Environmental health	Ecosystem vitality
H1: Power distance → environmental performance (+)	Not supported	Not supported	Not supported
H2: Individualism → environmental performance (+)	Supported (indirect, fully mediated by *income* and *education*)	Supported (indirect, fully mediated by *income* and *education*)	Supported (indirect, fully mediated by *income*)
H3: Masculinity → environmental performance (−)	Not supported	Not supported	Not supported (direct and positive)
H4: Uncertainty avoidance → environmental performance (+)	Not supported	Supported (indirect, fully mediated by *education*)	Not supported
H5: Long-term orientation → environmental performance (+)	Supported (indirect, fully mediated by *income* and *education*)	Supported (indirect, fully mediated by *income* and *education*)	Supported (indirect, fully mediated by *income*)
H6: Indulgence → environmental performance (+)	Supported (indirect, fully mediated by *income* and *education*)	Supported (direct and indirect, partially mediated by *income* and *education*)	Not supported

Abbreviation: EPI, environmental performance index.

the interests of individuals, have better environmental performance than collectivistic ones. This may be explained by the fact that values characterizing individualistic societies favor the emergence of environmental groups (Katz et al., 2001) that exert pressures on companies and governments and raise environmental awareness of the whole society.

This result is in accordance with previous studies conducted by Lahuerta-Otero and González-Bravo (2018), Onel and Mukherjee (2014), Peng and Lin (2009), and Vachon (2010), while it is in contrast with Park et al. (2007), who found a nonsignificant effect.

The positive influence of *long-term orientation* means that societies where great importance is given to future benefits by sacrificing in part short-term ones are characterized by better environmental performance than short-term oriented societies. *Long-term orientation* is a key aspect of the sustainable development concept, as defined in the Brundtland report (World Commission on Environment and Development, 1987), since this concept highlights that today generations should satisfy their own needs without compromising the capability of future generations to satisfy their ones. This result is partly consistent with Lahuerta-Otero and González-Bravo (2018) (who found mixed results for different measures of environmental performance), while no comparison is possible with previous studies' results, since they did not include this cultural dimension.

The positive effect of *uncertainty avoidance* means that societies whose members feel threatened by uncertain or unknown situations are characterized by better environmental performance. This may be explained by the fact that the deterioration of the natural environment can lead to unknown situations, linked for instance to climate change, extreme weather events, and high levels of pollution. Thus, societies characterized by higher uncertainty avoidance tend to protect the natural environment to have stable environmental health conditions, so avoiding the unknown effects of environmental degradation. This result is in accordance with Onel and Mukherjee (2014) and Peng and Lin (2009), whereas it is in contrast with Lahuerta-Otero and González-Bravo (2018) and Park et al. (2007),

who found a nonsignificant effect, as well as with Vachon (2010), who found a negative effect.

The positive influence of *masculinity* on environmental performance means that societies emphasizing masculine values, such as ambition, competition, power, materialism, personal career, and orientations toward achievement have better environmental performance. This counterintuitive result was not expected as it is in contrast with previous studies finding nonsignificant (Onel & Mukherjee, 2014; Vachon, 2010) or negative effect (Lahuerta-Otero & González-Bravo, 2018; Park et al., 2007; Peng & Lin, 2009) and would deserve further investigation in future studies.

The nonsignificant effect of *power distance* on environmental performance means that a society's levels of centralization of power, control, hierarchy, and resistance to changes in the distribution of power do not affect its environmental performance. This result is in accordance with Onel and Mukherjee (2014) and Vachon (2010) (with regard to the effect on environmental innovation), while it is in contrast with Lahuerta-Otero and González-Bravo (2018), Park et al. (2007), and Vachon (2010) (with regard to the effect on green corporatism), and Peng and Lin (2009), who found a negative influence.

The positive effect of *indulgence* on environmental performance highlights that societies where more freedom is given to people on how to spend money and engage in pleasurable activities are characterized by better environmental performance. This may be due to the fact that higher *indulgence* in society also reflects into companies' culture, so that managers are provided with more freedom to make environmental investments and employees are encouraged to experiment and innovate, so positively impacting on company's environmental performance and, consequently, on country's environmental performance. Prim et al. (2017) highlighted that *indulgence* has a positive effect on innovation outputs of countries, but no study so far investigated the effect of this cultural dimension on environmental performance. Thus, our study's results related to *indulgence* are completely new.

Further, our results show that *income* and *education* act as mediators of the relationships between some cultural variables and environmental performance. The mediating role of *income* is consistent with Liñán and Fernandez-Serrano (2014) who highlighted that the differences in income among countries are partly due to cultural dimensions and with Onel and Mukherjee (2014) who highlighted that income has a positive effect on environmental health. The mediating effect of *education* is in accordance with the study by Peng and Lin (2009), who highlighted that education of a country acts as a bridge linking cultural values and environmental performance.

This research has several theoretical contributions.

First of all, it is the first study to consider all cultural dimensions identified by Hofstede et al. (2010). Indeed, most of the previous studies on the relationship between national culture and environmental performance (Onel & Mukherjee, 2014; Park et al., 2007; Peng & Lin, 2009; Vachon, 2010) analyzed the first four dimensions, while only one more recent paper (Lahuerta-Otero & González-Bravo, 2018) added the fifth dimension (*long-term orientation*). Our study is the first one to investigate the effect of the cultural dimension *indulgence* on environmental performance, showing that this so far neglected dimension has a significant and positive impact on environmental performance (in particular, on *environmental health* and *EPI*).

Second, we considered three measures of environmental performance (*EPI* and its two overarching objectives). This allowed us to highlight that, ceteris paribus, the effect of cultural dimensions may vary based on the type of environmental performance that is considered. This shows that inconsistencies found among previous studies' results may be due to the different types of measures that have been considered.

Third, we analyzed the mediating effect of socio-economic variables in the link between cultural variables and environmental performance. Onel and Mukherjee (2014) highlighted that when socio-economic variables are simultaneously considered with cultural variables, cultural variables lose their significant effect. However, the possible mediating effect of socio-economic variables has not been investigated in their study, and, to the best of our knowledge, only the study by Peng and Lin (2009) tests the mediating effect of only one socio-economic variable, namely *education*. Our study is the first one to investigate the mediating effect of three socio-economic variables (*income*, *education*, and *population growth*), highlighting that, besides *education*, also *income* acts as a mediator.

This research has some limitations that should be acknowledged and suggests directions for future research. In particular, through the analysis of mediation effects, our study suggests that complex relationships among socio-economic variables and cultural variables do exist and this affects their influence on environmental performance. An analysis of mediation effects has been conducted. However, other types of relationships could exist among variables (e.g., moderation effects). Thus, future studies should be devoted to deepen scholars' understanding on the complex relationships among socio-economic variables and cultural variables in their effects on environmental performance of countries.

Further, our study used Hofstede's measures of national culture dimensions. Alternative measures have been suggested in the literature (e.g., Halkos & Zisiadou, 2018; Schwartz, 2004). Future studies could test the effect of national culture on environmental performance of countries using these measures to shed light on other cultural dimensions that may affect environmental performance.

ORCID

Rosa Maria Dangelico https://orcid.org/0000-0002-9862-1774
Luca Fraccascia https://orcid.org/0000-0002-6841-9823

ENDNOTE

[1] The value of tertiary education of Germany was taken from the World Bank database, since not available on the Global Competitiveness Report. The values of per capita income and population growth of Taiwan were taken from the Global Competitiveness Report and http://www.statista.com/statistics/319798/taiwan-population, respectively, since these were not available on the World Bank database.

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APPENDIX A.

List of countries in the sample

1. Argentina
2. Australia
3. Austria
4. Bangladesh
5. Belgium
6. Brazil
7. Bulgaria
8. Canada
9. Chile
10. China
11. Colombia
12. Croatia
13. Czech Republic
14. Denmark
15. El Salvador
16. Estonia
17. Finland
18. France
19. Germany
20. Greece
21. Hungary
22. India
23. Indonesia
24. Iran
25. Ireland
26. Italy
27. Japan
28. Latvia
29. Lithuania
30. Luxembourg
31. Malaysia
32. Malta
33. Morocco
34. Mexico
35. Netherlands
36. New Zealand
37. Norway
38. Pakistan
39. Peru
40. Philippines
41. Poland
42. Portugal
43. Republic of Korea
44. Romania
45. Russian Federation
46. Serbia
47. Singapore
48. Slovak Republic
49. Slovenia
50. Spain
51. Sweden
52. Switzerland
53. Taiwan
54. Thailand
55. Trinidad and Tobago
56. Turkey
57. United Arab Emirates
58. United Kingdom
59. United States
60. Uruguay
61. Venezuela
62. Vietnam