

THE IMPACT OF NATIONAL CULTURE ON THE GROWTH OF A NATION'S ENVIRONMENTAL PERFORMANCE

Craig Nadig¹, Robert Engle²

¹Quinnipiac University, USA

²Professor Emeritus, International Business, Quinnipiac University, USA

Abstract

The primary objective of this paper is to examine the relationship that national culture has with growth rates in environmental performance over a 10-year period. Given the global climate challenges touching virtually every continent, the urgency for countries to improve their environmental performance has never been greater. A country's citizens, its organizations - both governmental and non-governmental - increasingly recognize the importance of finding ways to improve performance on a national basis. This study examines the potential role that national cultural values play in relation to improving a nation's environmental performance over time. In this study, differences in a country's environmental performance over the period of a decade are examined in relationship to a country's cultural values. In addition, an economic component, a measure of gross domestic product, is also used in this study's research model. Using a variety of statistical analysis procedures, including necessary condition analysis, the results of this study suggest national culture does make a significant difference in environmental growth rates. Results suggest that all but one of the cultural dimensions examined in a 69-country database are necessary for growth of environmental performance to take place. In addition, the results also suggest there is one specific cultural dimension which may be particularly significant in contributing specifically to the rate of growth in environmental performance over a 10-year period. Potential implications of this research for researchers, organizations, and governments are briefly discussed.

Keywords

Environmental Performance Growth, National Culture, Necessary Condition Analysis

1. Introduction

Climate change is one of the biggest issues in our current time and it is important to place a focus on environmental performance. The numerous negative effects that climate change has on our environment are well known. According to the United States EPA (2022), climate change will result in more frequent and severe heat waves which pose risks to the population. Climate change will also worsen air quality and pollution, which again, pose a greater risk to human health. Rising sea levels because of climate change will also pose a threat to coastal areas in the future, and finally, there is the risk of ecosystem damage/change which has the potential to severely alter the reproductive/migration patterns of many animals. Other than the harm that this causes to our environment, our global economy will also suffer. Alister Doyle (Doyle 2018) suggested the importance of fighting climate change and the impact that this would have on the global economy using the example that the Paris Accord, among almost 200 nations, set a goal of limiting a rise in average world surface temperatures to well below 2 degrees Celsius (3.6 Fahrenheit) above pre-industrial times by 2100, while pursuing efforts for 1.5C (2.7F). By the end of the century, the world would be about three percent wealthier under the 1.5C target relative to 2.0C. This represents about \$30 trillion in cumulative benefits between now and 2100" (Doyle 2018). Given the economic downfalls and natural repercussions of climate change, it is of utmost importance that nations around the world do as much as possible to stem the negative effects.

There are many studies that explore the relationship that national culture has with EPI such as (Vu 2023), (Dangelico et. al 2020) etc.; but little to no literature that looks into the relationship that national culture has with EPI 10-year growth rates. As a result, this paper's goal is to add to the discussion regarding the relationship that national culture has with overall environmental performance. Yale University's Environmental Performance Index

or EPI determined the source for the basis of what constitutes environmental performance for an individual nation which is calculated based on multiple environmental categories, resulting in a country's EPI score.

The components for culture were derived from Geert Hofstede and his six cultural dimensions of *long-term vs. short-term orientation* (LT/ST), *individualism vs. collectivism* (I/C), *masculinity vs. femininity* (M/F), *indulgence vs. restraint* (I/R), *uncertainty avoidance* (UAI), and *power distance* (PD) (Hofstede et al. 2010). These cultural variables were compared to a 10-year change in EPI score to see what effects that culture had on a nation's 10-year change in EPI score. In addition, GDP per capita (PPP) was used as a control variable to see if this economic measure had a potential significant effect on a nation's 10-year change in EPI score, as research has frequently identified GDP per capita as having a significant effect on the behavior of a nation. The sections of this paper include a literature review, methodology, research question(s), results, discussion/conclusion, and further research/limitations. The purpose of this paper is to evaluate the potential relationship between national culture and 10-year change in EPI scores with GDP per capita (PPP) as a control variable.

2. Literature Review

2.1 EPI/EPI 10-Year Growth:

One of the main ways that environmental performance is measured is from the widely used Yale University's EPI or Environmental Performance Index. The importance of the EPI can be quoted directly from Yale University, "The EPI offers a scorecard that highlights leaders and laggards in environmental performance and provides practical guidance for countries that aspire to move toward a sustainable future. EPI indicators provide a way to spot problems, set targets, track trends, understand outcomes, and identify best policy practices. Good data and fact-based analysis can also help government officials refine their policy agendas, facilitate communications with key stakeholders, and maximize the return on environmental investments" (Wolf et al. 2022). The EPI for a country is scored from the following categories: Biodiversity, Ecosystem Services, Fisheries, Acidification, Agriculture, Water Resources, Air Quality, Drinking Water, Waste Management, and Climate Policy (Wolf et al. 2022). The progress that a nation makes on its EPI performance is imperative, as it highlights whether a nation is improving its standing for the future given the ramifications that can come from inaction on the climate crisis. While there is some research literature available that addresses the relationships between a given year's EPI rate and national culture, as well as gross domestic product, the available literature regarding the relation between EPI 10-year growth rates and national culture appears not to have been addressed.

2.2 Cultural Dimensions:

Geert Hofstede's six cultural dimensions were utilized for the cultural components that were measured along with Geert Hofstede's definition of national culture. According to Hofstede "culture can be described as collective programming of the mind; it manifests itself not only in values but in more superficial ways; in symbols, heroes and ritual" (Hofstede, 2001). National culture is essentially the overarching shared values between a group of people in a nation along with the emphasis on the continued stability of the core values of a nation. The result of such national culture is that the individual "carries within himself an indelible pattern of behavior." (Hofstede, Hofstede & Minkov, 2010, p.4). Below, the definitions for each of the six cultural categories are provided:

Power Distance (PD): According to Hofstede:

"This dimension deals with the fact that all individuals in societies are not equal - it expresses the attitude of the culture towards these inequalities amongst us. Power Distance is defined as the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally" (Hofstede et al. 2022).

Individualism vs. Collectivism (I/C): According to Hofstede:

"The fundamental issue addressed by this dimension is the degree of interdependence a society maintains among its members. It has to do with whether people's self-image is defined in terms of "I" or "We". In Individualist societies people are supposed to look after themselves and their direct family only. In Collectivist societies, people belong to 'in groups' that take care of them in exchange for loyalty" (Hofstede et al. 2022).

Uncertainty Avoidance (UAI): According to Hofstede:

"The dimension Uncertainty Avoidance has to do with the way that a society deals with the fact that the future can never be known: should we try to control the future or just let it happen? This ambiguity brings with it anxiety and different cultures have learned to deal with this anxiety in different ways" (Hofstede et al. 2022).

Long-Term Orientation vs. Short-Term Orientation (LT/ST): According to Hofstede:

“ This dimension describes how every society has to maintain some links with its own past while dealing with the challenges of the present and future, and societies prioritize these two existential goals differently” (Hofstede et. al 2022).

Indulgence vs. Restraint (I/R):

“This dimension is defined as the extent to which people try to control their desires and impulses, based on the way they were raised. Relatively weak control is called "Indulgence" and relatively strong control is called "Restraint". Cultures can, therefore, be described as Indulgent or Restrained” (Hofstede et. al 2022).

Masculinity vs. Femininity (M/F):

“The Masculinity side of this dimension represents a preference in society for achievement, heroism, assertiveness, and material rewards for success. Society at large is more competitive. Its opposite, Femininity, stands for a preference for cooperation, modesty, caring for the weak, and quality of life. Society at large is more consensus-oriented” (Hofstede et. al 2022).

2.3 Culture and its Relation to EPI:

There is literature support to back up the claim that cultural values affect the environmental performance of a country. An interesting insight into how cultural values can be related to environmental performance can be seen from (Katz et al., 2001) who concluded that higher levels of individualism typically mean greater care or awareness for broader social issues such as the environment. In contrast, a more collectivist-leaning society has a greater emphasis on your immediate social circles and local community, and therefore, perhaps less emphasis on the broader impact of something such as the environment (Katz et al., 2001).

Another insight into the effect that culture has on environmental performance can be seen from Husted (2005). This paper investigated the relationship that Hofstede’s cultural dimensions have with environmental sustainability and the institutional capacity of a country to address the environment. Overall, the findings from this paper were that countries that were deemed to be high in individualism, low levels of power distance, and lower levels of masculinity, and higher levels of economic development have greater institutional capacity to address environmental sustainability (Husted 2005). An interesting finding from this paper is also how certain countries can be low in levels of economic development, yet still have a strong institutional capability to address environmental sustainability. A research paper from 2013 (Onel, Mukherjee 2013) offers an insight into this as this explores the relationship that Hofstede’s cultural dimensions and environmental performance utilizing the 2010 Yale EPI. Their findings from this study also show that there is a strong positive correlation between environmental performance and I/C (Onel, Mukherjee 2013).

The cultural dimension of individualism and its relationship with environmental concern/support for environmental action seen in various countries is the focus of a 2016 paper by Eom et. al (2016). Their findings highlight that a country’s I/C score transcends the effects that other cultural dimensions and GDP have on environmental concerns. They found that national-level individualism was a significant predictor of the strength of the association between personal environmental concern and environmental-behavior intentions, above and beyond the effects of other national-level cultural orientations and plausible national-level variables, such as gross domestic product. They also concluded that the results also suggest that person- and national-level individualism exert independent influences on the link between environmental concern and pro environmental action and concern for the environment (Eom et. al 2016).

Another interesting insight into the matter regarding this subject can also be seen from a 2020 research paper (Dangelico et. al 2020) that investigates the effect that national culture has on environmental performance with this study utilizing the 2014 EPI. This paper suggests that due to the values of individualistic societies, there is a greater likelihood of environmental groups (i.e. non-profits, clubs, etc.). Individualistic societies will be far more likely to have such groups compared to collectivist societies, hence the greater likelihood of an individualistic society having the means at an institutional level to focus on environmental improvement (Dangelico et. al 2020). To further expand on the significance of I/C with regards to environmental performance, (Dangelico et. al 2020) provides further insight from their results. Their findings found that I/C had a statistically significant impact ($p < 0.01$) on EPI, along with finding a significant impacts LT/ST and PD on EPI. Also, using 2019 EPI data, Vu (2023) found that countries with higher individualism scores tend to have better environmental policy performance which was observed to also impact climate change policy adoption.

A research paper from Kumar et. al (2019) have found a country’s power distance, long-term orientation, individualism, and uncertainty avoidance to correlate with EPI in a given year. Specifically, they found low power distance to result in higher EPI scores, while higher long-term orientation, individualism, and uncertainty avoidance, as well as gross domestic product had higher EPI scores.

Overall, there are some differences in findings from the various researchers when exploring the

relationship between culture and environmental performance in a given year, however, a significant impact of individualism on EPI appears to be relatively consistently. However, none of the research found in the literature review addressed the growth of environmental performance over a significant period of time.

2.4 Gross Domestic Product relationship with EPI:

The control variable that was used in the model was GDP per capita (PPP). This was sourced from the 2023 IMF data mapper and is measured in international dollars (IMF 2023). To quote the WHO, “GDP per capita, purchasing power parity (current international \$) - This is the GDP divided by the midyear population, where GDP is the total value of goods and services for final use produced by resident producers in an economy, regardless of the allocation to domestic and foreign claims” (WHO 2006).

An interesting feature of how GDP per capita relates to environmental performance is the Environmental Kuznets Curve (EKC) hypothesis (Stern 2018). This hypothesis suggests that as a country begins to develop, environmental performance weakens as environmental concerns take a backseat to economic development, but as a country reaches a certain point and becomes more developed, environmental performance strengthens so that at higher levels of income, environmental performance improves (Stern 2018). There is evidence to suggest wealthier countries perform far better on their EPI scores than do less-wealthy countries (Wolf et al. 2022), with the top EPI ranked countries having respective GDP per capita above \$50,000 (IMF 2023). Wolf, et al. (2022) also found that some of the lowest ranked countries are also the countries which are still in the process of rapidly increasing their industrialization, such as India and Vietnam. Also of note is the observation that Zimbabwe as a relatively poor country, which is shrinking economically (World Bank 2022), actually performs better on its EPI score than Vietnam or India (Wolf et al. 2022).

Another research study that supports the claim that developed countries have better environmental performance is Kumar et al. (2019), who found EPI to be strongly positively correlated with GDP (0.62) and strongly negatively correlated with population growth (-0.57). Their results also suggest that developed countries pay more attention to environmental performance and conclude that developed countries should invest in technological development to establish and maintain a sustainable environment.

3. Research Questions

Since our literature review, as indicated above, found studies addressing only a single year’s data for each country, which was calculated and ranked in the Environmental Performance Index (EPI), we have not found previous research to suggest to us with confidence that these results apply also to growth rates in EPI over a significant period of time (10 years). Therefore, the following research questions were utilized for this study.

RQ1: To what degree, if any, do each of the national cultural dimensions explain the ten-year growth rates of national environmental performance as measured by the EPI 10-year growth rate data?

RQ2: To what degree, if any, does the addition of the GDP measure significantly increase the research model’s explanatory power with regards to the EPI 10-year growth rate.

Necessary Condition Analysis

Dul (2016) suggests necessary condition analysis (NCA) as a method describing necessary conditions within a dataset that “may provide new insights that are normally not discovered with traditional approaches” (p. 15) and suggests NCA and multiple regressions are complementary analytical tools. Dul sees multiple regression as spotting determinants that may explain variances in the outcomes, while NCA may spot critical or necessary determinants that can prevent an outcome from occurring. Therefore, an independent variable may be seen as a necessary for a condition to occur, but not substantive enough to explain significant amounts of variance in the outcome; while other independent variables may explain significant (substantive) amounts of outcome variance, while not being necessary for the outcome to occur. There was no research studies found in the literature, using the above research variables, which utilize the NCA approach. Therefore, the next research question is:

RQ3: What cultural and GDP research model variables, if any, may be considered as necessary conditions for EPI 10-year growth?

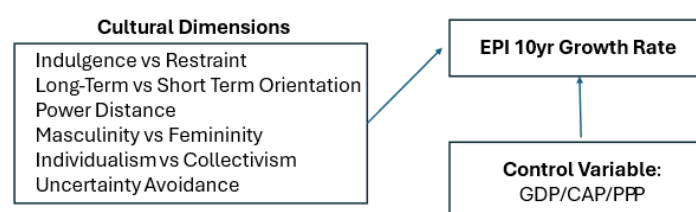


Figure 1 below is the conceptual view of the research model:

4. Methodology

The national culture dimensions and data were taken from Hofstede, et.al (2010). A total of six cultural dimensions were used, including what is still the newest Hofstede dimension labeled “indulgence vs. restraint” (IVR).

The source that was used to measure environmental performance and growth was 2022 Yale University’s EPI – change in 10-year growth rate ranking (Wolf et. al 2022). The 2022 EPI was created by the Yale University Center for Environmental Law and Policy, Center for International Earth Science Information Network Earth Institute of Columbia University, and additional support from the McCall MacBain Foundation of Canada. The index for 2022 included 180 countries, and for this project, 69 were used in the sample, as these were the number that were available matches each of this model’s research variables. EPI’s 10-year growth rate represents the difference in one-year scores between 2013 and 2022. The overall yearly EPI score for a country used 40 performance indicators across 11 categories. (Wolf et. al 2022). The source for GDP per capita (PPP) was the International Monetary Fund which provides GDP per capita (PPP) in international dollars published in 2023 (IMF, 2023).

Data analyses including descriptive statistics, correlations, hierarchical regressions were completed using Excel and SPSS. In addition, following the recommendations of Dul (2016), Necessary Condition Analysis was also completed using the software available from Erasmus Research Institute of Management. Additionally, using SPSS, a number of other analyses were completed, including variance inflationary factor analyses, as well as an analysis of potential significant moderation and/or mediation, as appropriate, between model variables.

5. Results

Variable	Mean	STD	N
10 Year Change EPI Score	5.249	6.1945	69
I/R	48.22	21.857	69
LT/ST	43.93	22.926	69
PD	60.42	21.753	69
M/F	47.80	18.945	69
I/C	43.22	23.233	69
UA	66.41	22.429	69
GDP CAP/PPP	40.40	28.974	69

Table 1: Descriptive Statistics

Note: GDP/CAP/PPP in thousands

Table 1 highlights some of the key characteristics of the data. Of particular note is the wide range of data with, for example, the 10-year change in EPI Score with a mean of 5.25 and a Standard Deviation of 6.19, and GDP also indicating a wide range with a GDP/CAP/PPP mean of 40.4 and a standard deviation of 28.97.

Pearson Correlation	EPI 10yr Growth	I/R	LT/ST	PD	M/F	I/C	UA	GDP CAP/PPP
EPI 10yr Growth	1.000	.166	.171	-.228	-.110	.335	-.015	.300
I/R	.166	1.000	-.420	-.295	-.098	.244	-.159	.217
LT/ST	.171	-.420	1.000	-.001	.216	.198	.031	.334
PD	-.228	-.295	-.001	1.000	.113	-.658	.144	-.539
M/F	-.110	-.098	.216	.113	1.000	.166	.012	.021
I/C	.335	.244	.198	-.658	.166	1.000	-.223	.597
UA	-.015	-.159	.031	.144	.012	-.223	1.000	-.205
GDP CAP/PPP	.300	.217	.334	-.539	.021	.597	-.205	1.000

Table 2: Correlations

Note: **Bold** indicates $p < .05$

Table 2 summarizes variable correlations. Some interesting significant ($p < .05$) simple correlations of note with EPI 10-year growth include the cultural values of Power Distance (PD) and Individuality and Collectivism (I/C), as well as EPI’s simple correlation with the measure of GDP (GDP/CAP/PPP).

	Model 1 Std. Beta	Model 2 Std. Beta	Model 3 Std. Beta
PD	0.061	0.081	-
I/C	0.366**	0.315**	0.287**
M/F	-0.204*	-0.20*	-0.186
UA	0.076	0.082	-
LT/ST	0.225*	0.198*	0.124
I/R	0.189	0.174	-
EPI 10yr Growth	DEP.	DEP.	DEP.
GDP/Cap/ppp	-	0.073	0.091
R-Squared	0.19	0.192	0.165
Adj. R-Squared	0.111	0.100	0.113
Delta R-Squared	-	0.002	0.027
F-Value	2.419*	2.075	3.168**

Table 3: Hierarchical Regression

Note: *p<1.0; **p<.05

Table 3 indicates a 3-step hierarchical regression with Model 1 (Step 1) addressing the impacts of the six national cultural dimensions in the EPI 10yr. Growth. This model step suggests the variable “Individuality” (significant positive for I/C) to be a statistically significant predictor ($p<.05$) of EPI 10yr. Growth; also, greater “Femininity” (negative sign for M/F) is significant at ($p<.1$), and that greater “Long-term Orientation” (positive sign for LT/ST) is a significant predictor ($p<.1$) of EPI 10yr. Growth. It should be noted that the $p<.1$ level of significance is recognized in the first two model steps given the sample size/variable-number relationship. Model 2 (Step 2) adds the GDP/CAP/PPP variable to the research model and finds it not to be a significant predictor of EPI 10-yr. Growth, while previous (Model 1) significant variables remain significant. Finally, Model 3 (Step 3) eliminates the three non-significant determinant variables in order to minimize potential overlaps between variables, and leaves GDP in the model as the control variable. With Model 3 having only 4 determinant variables remaining, potential problems with sample size are minimized. In this final third step, Individuality is the only significant variable ($p<.05$) and with an explanatory R-square of 16.5% and model statistical significance ($p<.05$) as seen by the F-value.

The full model (all variables) was also tested for potential moderation which found no statistically significant moderation between variables including each of the independent variables and the control variable (GDP). Also, potential mediation analysis was conducted using Mc Gill University’s *Indirect Effect P-Value Calculator*. Analysis using each of the six cultural variables found no evidence of statistically significant mediation in this research model. SPSS also tested for Variance Inflationary Factor (VIF) between all research model variables. Hair, et al. (2006) indicated that VIF is an “Indicator of the effect that other independent variables have on the standard error of a regression coefficient.” (p.176) We found all VIF scores ranging between 1.1 and 2.2 which are well below the 5.0 “caution” level suggested by Hair, et al. (2006), suggesting the results can be interpreted as seen.

Variables	Small Effect	Medium Effect*	Large Effect*
	$0 < d < 0.1$	$0.1 < d < 0.3$	$0.3 < d < 0.5$
I/R		0.25*	
LT/ST		0.19*	
PD		0.12*	
M/F	0.09		
I/C		0.21*	
UA		0.17*	
GDP		0.17*	

*Indicates a significant effect on EPI Growth 10yr.

Table 4: NCA Size Effect Results (EPI Growth 10yr.)

Table 4 shows the results of a Necessary Condition Analysis (NCA). Dul (2016) argues that traditional approaches, such as multiple regression, may not spot all possible determinant variables that on average may contribute to the outcome in multiple regression analysis (“outcome” being the determinants that play a role in producing large regression coefficients). He sees NCA to potentially spot “necessary” or critical determinants that may *prevent* an outcome (in this case EPI 10 yr. Growth) from occurring. Dul (2016), Falk and Biesanz (2016), and Gortz et al. (2013), among others, have found NCA medium and large size effects of between 0.1 and 0.5 as

suggesting a significant necessary condition relationship – at some level the determinants with these size effects are necessary for an outcome under study to occur.

6. Discussion & Conclusion

The purpose of this paper was to explore the potential relationships that national culture has on the 10-yr change in EPI scores for the 69 countries in this sample, as well as, how GDP per capita (PPP) may affect those research model relationships. Given the relatively limited information regarding culture and environmental performance growth, we hope this study's findings will add to the discussion of why and how some countries can progress in their environmental performance over a significant number of years, while others do not. Given the nature of today's climate change, and its global impact on our environment, it is important that the subject of a country's environmental activity is carefully examined.

These results suggest that culture does make a difference, with Necessary Condition Analysis suggesting positive 10-year environmental performance growth patterns in a country are influenced by specific national cultural dimensions and GDP. In the absence of significant moderation and mediation effects within this research model, the hierarchical regression findings from this study suggests that national culture does have an impact on 10-year change in EPI scores - particularly the cultural dimension of Individualism (I/C). Specifically, the results of this study suggest that at some level, each of the national cultural dimensions (with the possible exception of Masculinity/ Femininity), along with an economy's healthy gross domestic product, help create the human behavior environment in which environmental performance growth can take place. In addition, these results suggest that the cultural dimension of Individuality also adds significantly to the actual positive environmental performance growth rate itself.

Overall, these results have possible implications for researchers by suggesting the potential importance of culture and GDP in their environmental performance research models. These results also have potential implications for organizational and governmental strategy development, which may improve their country's environmental performance through strategies and actions that strengthen appropriate culturally related behaviors. A possible example of such strategic action may be the development of individual initiatives that improve environmental performance, e.g. through offering appropriate encouragement and incentives at the individual level – which may also help to strengthen cultural individualism.

7. Limitations & Future Research

A potential limitation is related to sample size. Despite what may be considered as reasonable standard deviations in the data, the sample size that was used was relatively limited with only 69 countries utilized due to country data availability. For future research, adding more countries may allow a more in-depth look into this subject. Another limitation is that “environmental performance” as measured in the EPI, is also an incredibly broad term that covers a wide variety of topics that range from biodiversity, air quality, etc.

Future research may find it beneficial to do a more in-depth look into potential additional economic factors and how that has an effect on changes in EPI over a significant period of time. Given the suggestion in this research that gross domestic product per capita using purchasing power parity (GDP/CAP/PPP) is a “necessary condition”, it might be worthwhile to investigate other economic factors such as FDI (Foreign Direct Investment), number of startups by country (i.e. entrepreneurship by country), and taxation, etc. Another antecedent variable of EPI 10-year growth rate that may be worth exploring is a nation's population size and growth rate, as suggested by Kumar et al. (2019) and Dangelico et al. (2020). It may also be of interest for future research to focus on specific areas within the EPI, such as biodiversity, air quality, waste management etc

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