

National Culture, Economic Development, Population Growth and Environmental Performance: The Mediating Role of Education

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ABSTRACT. Literature on ethical behavior has paid little attention to the mechanism between macro-environmental variables and environmental performance. This study aims at constructing a model to examine the relationships which link cultural values, population growth, economic development, and environmental performance by incorporating the mediating role of education. The multiple linear regression model was employed to test the hypotheses on a 3-year-pooled sample of 51 countries. Empirical results conclude that national culture, economic development, and population growth would significantly influence environmental performance directly. In addition, through the mediating effect of education, population growth and national culture would significantly affect environmental performance indirectly. These findings provide theoretical and managerial implications for constructing the mechanism of cultural values and ethical behavior in general and environmental management in particular.

KEY WORDS: national culture, environmental performance, education, cross-cultural, ethical behavior

Introduction

Previous studies on environmental performance have showed economic development (e.g., Husted, 2005; Mendelsohn, 1994) and demographic growth (e.g., Burns et al., 1994; Husted, 2005) are important predictors of environmental degradation of a country. Beyond economic and demographic dimensions, Vitell et al. (1993) highlighted the influence of national culture on ethical decision-making and proposed a conceptual model discussing the effects of

cultural values on ethical decision-making, as based on the typology of Hofstede (1980).

Utilizing the propositions of Vitell et al. (1993), Husted (2005) verified the hypothesized correlated relationship between national culture and environmental performance. Notably, Husted (2005) is one of the few studies to discuss the main effect of national culture on moral behavior at the analytical level of a country among the abundant empirical researches of culture's consequences for the past two decades. What Husted (2005) contributed helps us figure out the logic concerning how national culture affects environmental outcome of a country: although the relationship between them seems like fatalism – we could not change our environmental behaviors since our national culture has been predetermined.

Reviewing 180 studies adopting Hofstede's national culture framework, Bradley et al. (2006) made recommendations for researchers who will use Hofstede's framework in the future. One of the proposed recommendations is to include theoretically relevant contextual moderators and mediators. In fact, Carrol and Gannon (1997) has proposed an integrated model of culture and ethical behaviors showing parenting, socialization, education, and religion would be the primary mechanisms of cultural transmission.

Compared with more empirical studies focused on contextual moderating effects (e.g., Husted, 1999, 2000, 2005), few studies have been concerned with if there is a mediating role between cultural values and their consequences (e.g., Kirkman and Shapiro, 2001; Van Dyne et al., 2000). This disregard not only reflects the theoretical gap of national culture but also hinders our understanding of how

environmental management practices could stop the environmental degradation across countries. Similarly, although scholars have argued and proved that economic development and population growth are important factors of determining the level of the environmental performance (e.g., Gnyawali, 1996; Grafton and Knowles, 2004; Husted, 2005), yet few studies have ever tried further to find the possible mechanism between them. Nevertheless, the work of Carrol and Gannon (1997) may provide important clues for constructing a mediated model among macro-environmental variables.

Given its theoretical significance and practical relevance, the mechanism linking cultural values, economic development, population growth, and environmental outcomes deserves systematic and in-depth analysis. In particular, we argue education would be one of the bridges to connect those macro-environmental variables according to Carrol and Gannon (1997). Specifically, this study attempts to answer the following two research questions: (1) what factors determine the environmental performance of a country and (2) is education a mediating variable which connects demographic, socioeconomic variables, and environmental performance? In the following section, we first review the literature to develop a set of hypotheses, through a vector of geographic factors, and then test the hypotheses on a 3-year pooled sample of 51 countries. Finally, we discuss the findings and conclude the article by suggesting new directions for future studies.

Literature review and hypothesis construction

Based on Hofstede's (1980) framework, many studies have shown culture has *main* associations between cultural values and societal outcomes, as well as cultural values being a *moderator* at the analytical levels of individual, group, and country. Most previous studies were conducted at the individual and country level, and only few studies were conducted at the group level. At the country level, research issues have mainly included organization behavior, human resource management, international business studies, alliance formation, innovation and research and development, and finally societal outcomes (Bradley et al., 2006), while only relatively few

studies have focused on the ethical behaviors (e.g., Husted, 1999, 2000, 2005).

Adopting the revised model proposed by Hunt and Vitell (1992), Vitell et al. (1993) provided a conceptual framework to examine how culture influences one's perceptions and ethical decision-making in business. In order to accomplish the task, they first used the cultural typology proposed by Hofstede (1980) but subsequently developed specific propositions relating Hofstede's cultural dimensions to informal and formal codes of behavior, the perception of ethical problems, the perception of the consequences of behavior, and the evaluation of the relative importance of stakeholders. The pioneering effort of Vitell et al. (1993) has thus filled up the significant gap in the conceptualization of business ethics relative to different influences.

Mainly on the basis of Vitell et al. (1993), Bryan W. Husted has performed a stream of empirical studies on the association between cultural values and un/ethical behaviors such as corruption, software piracy, and environmental sustainability. Through the empirical results of Husted (1999, 2000, 2005), some propositions about the relationships between cultural values and ethical behaviors have been confirmed. Briefly, Husted (1999, 2000, 2005) has paid more attention to the main and interacting effects of cultural factors, whereas he did not try to explore the mechanism of connecting cultural variables and those ethical outcomes. Furthermore, since Husted (1999, 2000, 2005) adopted cross-sectional research design, the hypothesized relationships between cultural values and outcomes would be unstable at different observing time points.¹

In addition to the discussion about the association between national culture and environmental performance, previous studies have also demonstrated that economic development and population growth are crucial predictors of environmental performance. For example, one cross-country survey on the relationship between social capital and environmental performance found that measures of population density and per capita income are shown to have a significantly negative and a significantly positive effect on several measures of environmental performance (Grafton and Knowles, 2004). The same argument was also proposed by Husted (2005), and he further emphasized the moderating effects of macro-environmental variables. According to mentioned

above, scholars tend to put more concern with the direct effects and moderating effects of geographic factors, while neglecting to construct a mediated model to predict the difference of environmental performance across countries.

One of few studies – Carrol and Gannon (1997) – developed a comprehensive model of the influence of culture on the ethical behaviors among managers. The origins of culture including history, resource, and geography determine the national cultures which are reflected on managerial values, belief, and practices. Through the primary (parenting, socialization, education, and religion) and secondary (laws, human resource management systems, and organizational culture) mechanisms of cultural transmission, the modal values and beliefs of managers as well as their subsequent ethical behaviors are affected. The model of Carrol and Gannon (1997) may provide an important clue to construct a mediated model which begins with national culture, and then education to environmental performance.

After reviewing literature-related ethical behaviors, we have found education has been regarded and included as a critical antecedent of ethical behavior. For example, scholars have used education to predict the rate of software piracy across nations (e.g., Andrés, 2006a, b; Depken and Simmons, 2004; Marron and Steel, 2000). The other examples are Grafton and Knowles (2004) and Park et al. (2007), which used education to predict the level of environmental performance. There are two points needed to mention. First, the empirical findings are not very consistent to show that education is an effective factor to determine ethical behavior. Second, extant studies did not further explore the possibility of education being the bridge to connect socioeconomic variables with ethical behavior. Hence, we think there is still room for discussing the role of education plays based on sounder theoretical foundations and improvement of measurement.

Based on the framework of Carrol and Gannon (1997), we are interested in exploring the relationships between macro-environmental variables and environmental performance. First, we will discuss how education plays a mediating role connecting macro-environmental variables, such as national culture, economic development, and population growth, and the environmental performance of a country. This part is the main theme of the

present article. Second, the direct effect of macro-environmental variables on environmental performance is also being investigated. We will pay more attention to the influence of economic development and population growth on environmental performance. In particular, the non-linear effect of population growth on the environmental performance will be elaborated in the following section. Due to insufficient empirical studies and inconsistent conclusions,² we put less concern on the direct effect of national culture on environmental performance. To the best of our knowledge, there are only three recent studies dealt with this issue, most of which deduce the relationship between national culture and environmental performance by the definitions of the four cultural dimensions. Husted (2005) found that individualism, power distance, and masculinity are significant predictors of environmental performance, while the other two studies Park et al. (2007) and Ringov and Zollo (2007) indicated that only power distance and masculinity could explain the difference of environmental performance across countries.

Cultural values and educational level

National culture is defined as ‘the values, beliefs and assumptions learned in early childhood that distinguish one group of people from another’ (Newman and Nollen, 1996). Carrol and Gannon (1997) proposed an eclectic model, in which national culture value will transmit the modal value and belief to the managers and thus subsequent ethical behaviors through primary and secondary transmission mechanisms. The primary transmission system includes parenting, socialization, education, and religion, and the secondary transmission system covers laws, human resource management systems, and organizational culture.

In this study, we employed a similar approach by investigating the impact of Hofstede’s national culture framework on education attainment rates and national environmental management. Specific to our research context, we believe that national culture could also be applied to national environmental performance via educational level improvement. Therefore, we infer that these four cultural dimensions may affect a nation’s environmental

performance through the mediating effect of education. In the following subsections, we will elaborate on the ways that four cultural dimensions could contribute to the educational level and environmental management performance of a country.

Individualism–collectivism

This cultural dimension examines to what extent the degree of the society is individual or collective in relation to achievement and interpersonal relationships. High individualism indicates the importance of the individual in the society, and personal rights tend to be very influential within these societies. Low individualism typifies a society that is more collectivist in nature. These societies would exhibit close ties between individuals, extended families, and collectives where everyone takes responsibility for fellow members of their group (Hofstede, 1991).

In an individualist society, the organization would emphasize individual work performance; in a collectivist society, organization would prefer to adopt the work group type to execute tasks. Consequently, people in individualist cultures need to have better educational backgrounds enabling fulfillment of tasks alone. For example, education seems to be valued in the United States if it leads to short-term success, i.e., there is a clear relationship between going to school and obtaining a job (Carrol and Gannon, 1997).

Hypothesis 1-1 The higher the level of individualism of a country, the higher the educational level of the country.

Power distance

This dimension examines the degree of equality and inequality among people in a society. At one end of the continuum, a high power distance indicates that inequalities of wealth and power are openly tolerated within the society. These societies could follow a caste system that limits significant upward mobility of its citizens. At the other end of the continuum, a low power distance indicates the society de-emphasizes the differences between citizens' power and wealth. In such countries, equality and opportunity for everyone is stressed more than in high power distance countries (Hofstede, 1991).

Citizens in low power distance countries are more likely to have equal rights and wealth to be enrolled

in school and thus have higher education. It is reasonable to expect that people in low power distance cultures are more likely to have higher education than people in higher power distance cultures. On the contrary, people in high power distance cultures have lower levels of education.

Hypothesis 1-2 The higher the level of power distance of a country, the lower the educational level of the country.

Uncertainty avoidance

Research has shown that people in high uncertainty avoidance cultures have a strong resistance to change (e.g., Kale and Barnes, 1992), while people in low uncertainty avoidance cultures do not fear the future and exhibit lower change resistance (e.g., Kale, 1991; Nakata and Sivakumar, 1996; Ueno and Sekaran, 1992). Presumably, this is because change often involves uncertainties.

Therefore, it is reasonable to expect that people in high uncertainty avoidance cultures prefer to have a stable career compared with people in low uncertainty avoidance cultures. Consequently, people in high uncertainty avoidance cultures have higher needs for education.

Hypothesis 1-3 The higher the level of uncertainty avoidance of a country, the higher the educational level of the country.

Masculinity–femininity

This dimension focuses on the degree the society reinforces, or does not reinforce, the traditional masculine work role model of male achievement. This is shown by the level of inequality between males and females. In a country with high masculinity, there is a higher degree of gender differentiation. In these societies, the male controls a significant portion of the society and power structure, with females being dominated by males. At the other end of the continuum, a low masculinity country has a small level of differentiation and discrimination between genders; females are treated equally to males in all aspects of the society in these communities (Heffernan and Farrell, 2005).

According to the above perspective, we infer that in masculine societies males aiming to consolidate

their power structure and competition with others will need to obtain more knowledge to reinforce their ability. In such circumstances, a female's educational level would be lower than a male's. Therefore, the citizen's average education enrollments in a masculine country would be lower than for a feminine country.

Hypothesis 1-4 The higher the level of masculinity of a country, the lower the educational level of the country.

Economic development and educational level

The improvement of economic development could allow the government to have sufficient budget to offer related educational construction; moreover, the increase of gross national product (GNP) per capita could enhance the people's ability to assume education-related expenses (Chang, 2004). Therefore, economic development would enhance a people's capability regarding education attainment and further strive for higher socioeconomic status (Rubinson and Ralph, 1984). On the contrary, a low socioeconomic status would diminish the student's chances of university enrollment (Sewell and Hauser, 1976). According to the findings of Meyer (1977), there is a significant relationship between GNP per capita and school enrollment rate.

Hypothesis 2 The higher the level of economic development of a country, the higher the educational level of the country.

Population growth and educational level

Classical demographic transition theory predicts that fertility decline will occur naturally as associated with socioeconomic development. The mass schooling by the state would change the family economy by raising the costs of children because of the many costs directly or indirectly associated with school attendance. Thus, Caldwell (1980) argued that the onset of the fertility transition in developing countries would be linked with the achievement of "mass formal schooling."

From another perspective, previous scholars indicated that education, or literacy, has been found to be the strongest inverse correlation of the crude birth rate in macro-level socioeconomic regressions (Charles and Ruder, 1977; Ronald, 1973). The hypothesized relationship has been borne out by many empirical studies in contemporary developed and developing countries (Harvey, 1979). In other words, the negative relationship between education and fertility implies that a high level of education is associated with both low level of fertility and early fertility decline (Van de Walle, 1980). Based on the above discussion, we infer the third hypothesis as follows.

Hypothesis 3 The higher the population growth rate of a country, the lower the educational level of the country.

Educational level and environmental performance

Prior studies have shown a positive relationship exists between the level of education and moral judgment (Bebeau, 1994; Rest, 1986). Individuals who take courses in ethics tend to have higher levels of moral sensitivity (Ofstun, 1986). Research by Bebeau (1994) on ethical sensitivity in the field of dentistry indicated that individuals in professional areas that require higher education (dentist versus hygienist) incline to demonstrate higher levels of ethical sensitivity. Using a cognitive mapping technique, Swenson-Lepper (2005) found that level of education is positively correlated with moral sensitivity. Examining major factors influencing consumers' intention to buy advertised green products, Chan (2004) argued that consumers' educational level is a significant determinant of green purchase intention. This finding echoes those of previous environmental research; in the environmental literature, education has consistently been shown to be an important demographic factor that positively affects environmental consciousness (Arbuthnot and Lingg, 1975).

At the country level, Grafton and Knowles (2004) explored the relationship between social capital and environmental performance. In this study, they used average years of schooling (AYS) of the population

aged 25 or older to be the proxy of social capacity which is one of the dimensions of social capital. Environmental performance was measured by eight different kinds of indexes.³ Using cross-country data from a sample of low, middle, and high-income countries, empirical results surprisingly showed that AYS could not effectively predict the degree of any kind of indexes of environmental performance.⁴ They inferred this finding could be attributed that the state of the environment is dominated by economic and demographic factors. Another reason we surmise is that the higher education proxy such as tertiary education may be more appropriate to reflect the influence of education on ethical behaviors.

Carrol and Gannon (1997) argued the primary mechanism of cultural transmission will affect the modal values and beliefs of managers as well as their subsequent ethical behaviors. Since education is one of the critical components of the primary mechanism of cultural transmission, we expect that business executives with higher educational level would have more appropriate environmental managerial behavior.

Hypothesis 4 The higher the educational level of a country, the higher the social and institutional capacity of the country for environmental performance.

Economic development and environmental performance

From the perspective of suppliers, MNCs in developed and developing countries, aiming to minimize the costs of production and enhance their competitiveness, might have slack resources to perform environmental management (Berry and Rondinelli, 1998); from the perspective of consumers, Henriques and Sadosky (1999) indicated that a firm's formulation of its environmental plan is positively influenced by pressure from customers, shareholders, government regulations, neighborhood, and community groups. The public has put increasing pressure on governments to enact environmental regulations and legal restrictions that mitigate the adverse effects of pollution (Berry and Rondinelli, 1998).

Under pressure from supply and demand sides, poor countries are less likely to invest in scientific

research or environmental enforcement; furthermore, the social and institutional capacity (SIC) for environmental performance is likely to be lower. In contrast, people in wealthier countries are better informed and able to make greater demands on corporations for socially and environmentally responsible performance (Gnyawali, 1996; Husted, 2005). According to the above argument, we infer Hypothesis 5 as follows:

Hypothesis 5 The higher the level of economic development of a country, the higher the social and institutional capacity of the country for environmental performance.

Population growth and environmental performance

Population growth is often attributed to as an influencing factor of environmental degradation (Brundtland et al., 1987; Burns et al., 1994). Previous studies indicate that a negative relationship exists between population growth and environmental performance (e.g., Husted, 2005), while in the present study we infer that there might be an inverted U-shape relationship between them by arguing that there are two major contrasting forces to determine the level of environmental performance. For governments, one of two kinds of pressure they face is from the sense of environmental protection perceived by civilians, which prevents governments from adopting large-scale exploitation of natural resource, while the other kind of pressure is associated with the consideration of food production sufficiency which might coerce governments to deplete more nature resource.

When the population growth rate is in the low-medium growth stage, the sense of environmental protection perceived by civilians is getting stronger with population growth. Lager populations encourage greater specialization and increased investments in knowledge (Becker et al., 1999), which is beneficiary to environmental performance. During this stage, the positive effects on environmental performance both from the sense of environmental protection and food production productivity would curb governments to consume more nature resource;

when the population growth rate is continually increasing, larger and denser populations will force governments to distort markets with subsidies and to relax environmental enforcement, thus diminishing the nation's social and institutional capabilities to respond to environmental degradation (Husted, 2005). Although the sense of environmental protection perceived by civilians is still high, it may be overwhelmed by the consideration of food production sufficiency. Malthus's 1798 Principle of Population which mentions that there is an unbalance growth between population and food production can help explain why governments may sacrifice environment performance for producing more food during high population growth stage.

Hypothesis 6 There is an inverted U-shape relationship between the rate of population growth and the social and institutional capacity of a country for environmental performance.

Methodology

Conceptual model

On the basis of the section of literature review and hypothesis construction, the framework of this research is illustrated in Figure 1. In this study, we try to explore the relationships among socioeconomics, cultural variables, and environmental performance. We investigate the relationship between

economic development, population growth, and education in advance and then explore the associations between education, economic development, population growth, and environmental performance. In addition, in order to examine if the proposed model is ideal, this study uses a fully mediated model (Figure 2) and a partially mediated model (Figure 3) as our competing models.

Sample

The research sources were from three international surveys: the Hofstede culture study, the World Bank, and the World Economic Forum. The data of cultural dimensions were obtained from the Hofstede study (1997). The data of environmental performance was taken from the Global Leaders of Tomorrow Environmental Task Force of the World Economic Forum. The data of GNP per capita, population growth rate, and enrollment rate were collected from the World Bank.

We first obtained country-level data of environmental performance from the Environmental Sustainability Index (ESI) report (2001, 2002, and 2005) and then excluded those countries not included in Hofstede's (1997) country list. Finally, we collected two samples under different education levels. One sample has 153 observing points (51 countries for 3 years = 153) under secondary education level, and the other one has 144 observing points (48 countries for 3 years = 144) under tertiary educational level.

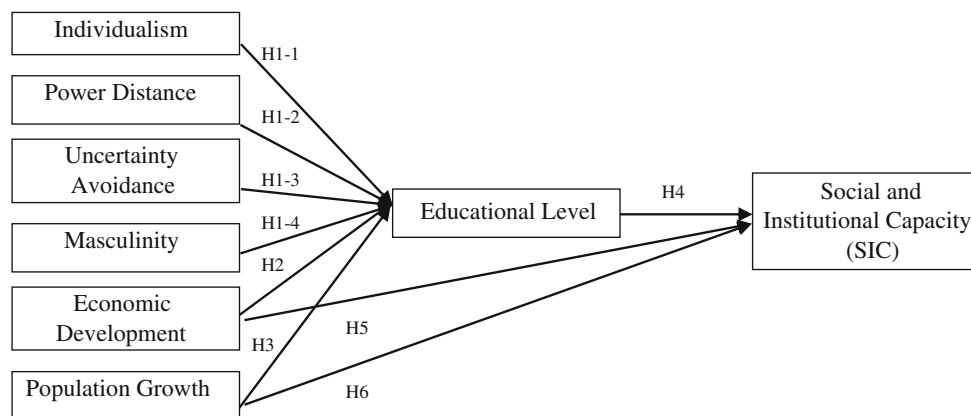


Figure 1. The proposed model – Model 1.

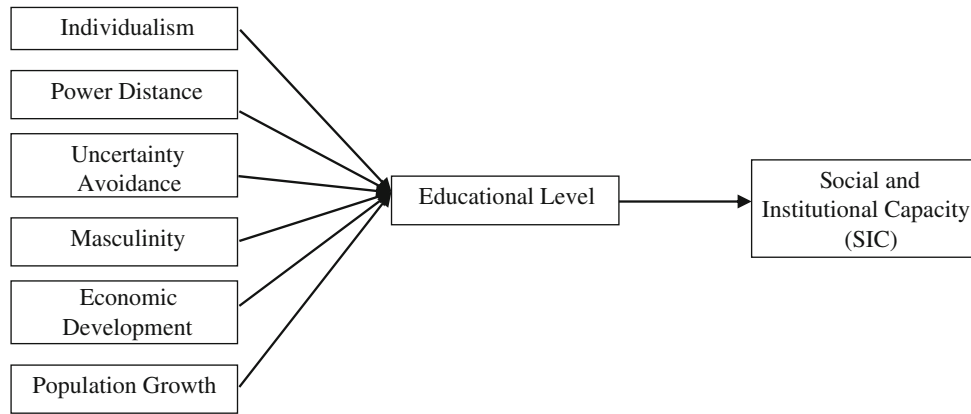


Figure 2. The fully mediated model – Model 2.

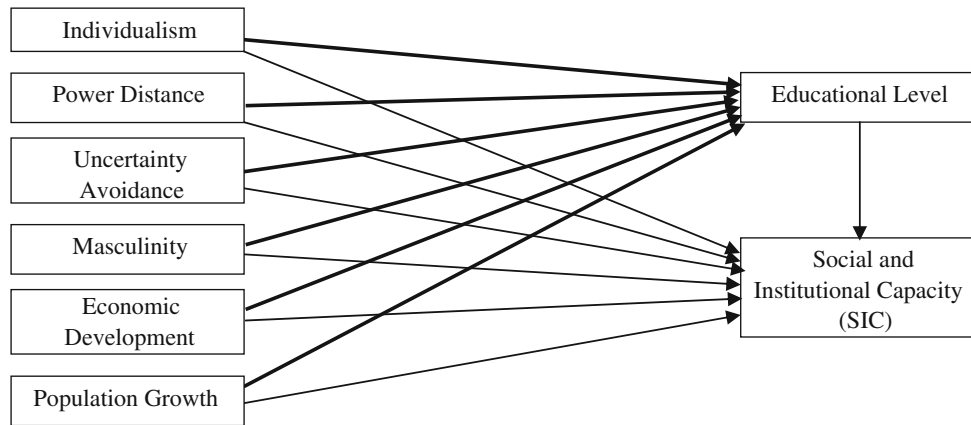


Figure 3. The partially mediated model – Model 3.

Measures

Dependent variable

Environmental performance was measured by the Social and Institutional Capacity (SIC) for environmental sustainability provided by the Environmental Sustainability Index (ESI). The ESI was developed by the Global Leaders of Tomorrow Environmental Task Force of the World Economic Forum. It represents a measure of sustainable development at the country level for 122 countries based on five main dimensions of performance, including SIC for environmental sustainability (Global Leaders, 2001, 2002, 2005). Husted (2005) also adopted SIC to be the proxy of environmental performance.

Independent variables

Economic development Economic development was measured by using World Bank data for years

2001, 2002, and 2005 on GNP per capita. Purchasing power parity estimates of GNP per capita were used since these estimates reflect differences in the cost of living from one country to another. The estimates are derived by using a currency’s purchasing power parity, instead of its exchange rate, which may be under or over value.

Population growth rate World Bank data for years 2001, 2002, and 2005 were also used to measure the rate of population growth in a country.

Cultural variables The cultural variables of power distance, individualism, masculinity, and uncertainty avoidance were measured using data published by Hofstede (1997) for 46 countries and three regions. In addition, this study includes cultural data for five other countries that were not part of Hofstede’s original study (Brouthers and Brouthers, 2001).

Mediating variable

In this study, we used the rate of students enrolled in school as the proxy of educational level of a country. Although indicators of educational level also include average attendance, total school days, educational expenditures, etc., previous longitudinal studies have found that these other series behave much like enrollments (Ralph and Rubinson, 1980; Walters and Rubinson, 1983). Moreover, the enrollment series are the only ones available on an annual basis.

According to the classification of the United Nations Educational, Scientific, and Culture Organizations (UNESCO), education is separated by primary, secondary, and tertiary three levels. Owing to the non-normal distribution of the enrollment of primary educational level, we exclude the primary educational level and adopt the secondary and tertiary educational levels as the proxies of education. In terms of the definition of gross enrollment rate, secondary is the number of pupils (total, male, female) enrolled in secondary education, regardless of age, expressed as a percentage of the population

(total, male, female) in the theoretical age group for secondary education. Secondary enrollments are the number of students enrolled in public secondary schools, grades 9 through 12; tertiary is the number of pupils (total, male, female) enrolled in tertiary, regardless of age, expressed as a percentage of the population (total, male, female) of the 5-year age group following on from the secondary school leaving age (UNESCO, 2006).

The findings of the empirical survey*Data analysis*

Table I shows the descriptive statistics and correlation matrix for the variables of pooled cross-national data for years 2001, 2002, and 2005.⁵ There are significant correlations among dependent variable – SIC – and independent variables including economic development, population growth, individualism, and power distance. Coincidentally, we found

TABLE I
Descriptive statistics and correlations – pooled cross-national data

Variable	Mean	SD	1	2	3	4	5	6	7
1. SIC	60.65 (60.11)	17.85 (17.56)	–						
2. Economic development	14032.16 (14202.01)	13078.82 (13169.99)	0.80** (0.79**)						
3. Population growth	1.05 (1.08)	0.92 (0.91)	–0.40** (–0.44**)	–0.37** (–0.39**)					
4. Education ^a	92.03 (43.60)	28.26 (22.71)	0.70** (0.74**)	0.59** (0.72**)	–0.56** (–0.51**)				
5. Individualism	45.93 (46.26)	25.13 (25.13)	0.70** (0.70**)	0.73** (0.72**)	–0.45** (–0.44**)	0.74** (0.63**)			
6. Power distance	53.38 (53.38)	22.86 (23.13)	–0.60** (–0.60**)	–0.54** (–0.53**)	0.50** (0.48**)	–0.51** (–0.49**)	–0.62** (–0.60**)		
7. Uncertainty avoidance	67.05 (66.92)	22.49 (23.15)	–0.15 (–0.14)	–0.19* (–0.19*)	–0.08 (–0.07)	–0.12 (–0.03)	–0.42** (–0.43**)	0.20* (0.21*)	
8. Masculinity	50.07 (49.67)	18.79 (19.08)	–0.15 (–0.18*)	–0.04 (–0.06)	–0.01 (–0.02)	–0.08 (–0.14)	0.07 (0.08)	0.06 (0.06)	0.03 (0.03)

* $p < 0.05$; ** $p < 0.01$, two-tailed test. The raw data are collected in years 2001, 2002, and 2005.

^aThe upper correlation coefficients of variables are under secondary educational level. The sample size is 153 (51 countries for 3 years = 153); the lower ones are under tertiary educational level. The sample size is 144 (48 countries for 3 years = 144).

education is also significantly associated with economic development, population growth, individualism, and power distance.

There is further a high correlation between power distance and individualism as seen in Husted (2005) and also acknowledged by Hofstede (1997), which notes that this relationship would disappear if economic development is held constant. Since economic development is included in the model, there should be little concern about this correlation.

Statistical results

We construct two sets of models under the mediating variable set up on secondary education (Table III) and tertiary education (Table IV) levels, respectively.

Secondary education

Hypotheses 1, 2, and 3 predicted that cultural variables, economic development, and population growth would be significantly related to education level. In the first step, we regressed education level

on the control variables. Next, four cultural variables, economic development, and population growth were added. As predicted, cultural variables except power distance were significantly related to education level in the Model 1 of Table II. Hypothesis 1 was supported. Economic development has no significant effect on educational level. Hypothesis 2 was not supported. A significant negative relationship exists between population growth and education level. The result for population growth was accordance with Hypothesis 3.

Adopting the procedure suggested by Baron and Kenny (1986), we tested the mediating effect of education on environmental performance. To test for mediation, we estimated the three following regression equations: first, regressing the mediator (education) on the independent variables (cultural values, economic development, and population growth); second, regressing the dependent variable (SIC) on the independent variables; third, regressing the dependent variable on both the independent variable and the mediator. We further checked the coefficient change of all independent variables to know whether it is a fully or partially mediated model.

TABLE II
Sample: secondary education

Variable	Expected sign	Model 1 Dependent: secondary education (SECEDU)		Model 2 Dependent: SIC		Model 3 Dependent: SIC				
		Coefficients	VIF	Coefficients	VIF	Coefficients	VIF			
<i>Control variables</i>										
2002		-0.10	-0.10**	1.33	-0.13*	-0.11**	1.33	-0.13*	-0.08**	1.38
2005		-0.09	-0.13***	1.43	0.09	-0.02	1.43	0.09	0.02	1.50
<i>Predict variables</i>										
IDV	H1-1 (+)		0.68***	3.56		0.23***	3.61		0.07	4.95
PDI	H1-2 (+)		0.05	1.88		-0.23***	1.98		-0.23***	1.98
UAI	H1-3 (+)		0.15***	1.45		0.11**	1.45		0.07*	1.53
MAS	H1-4 (-)		-0.14***	1.05		-0.14***	1.05		-0.10***	1.11
GNP	H2 (+), H5 (+)		0.03	2.51		0.47***	2.57		0.47***	2.58
PEO	H3 (+)		-0.26***	1.65		0.40***	6.24		0.38***	6.25
PEO ²	H6 (-)					-0.45***	5.87		-0.36***	6.31
SECEDU	H4 (+)								0.25***	3.24
F change		0.83	47.50***		2.77**	60.45***		2.77**	58.67***	
Adjusted R ²		-0.00	0.65***		0.02**	0.74***		0.02**	0.76***	
ΔR^2		0.01	0.66***		0.04**	0.72***		0.04**	0.74***	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, one-tailed test; all regression coefficients are standardized.

The results of Model 1 of Table II supported the first condition. Model 2 of Table II indicated all independent variables (cultural values, economic development, and population growth) are significantly related to the dependent variable (SIC). Hence, the second condition was supported. Notably, an inverted U-type relationship was found between population growth and SIC. Next, educational level was added in the Model 3 of Table II; the results remained the same as Model 2 of Table II except that individualism lost its explanatory power on SIC. In addition, the mediator (education level) is significantly positive to the dependent variable (SIC). Thus, Hypothesis 4 was supported. Hypotheses 5 and 6 were supported as well. The third condition was supported. Since the explanatory power of independent variables did not vanish after incorporating educational level in the Model 3 of Table II, we inferred that education only has partially mediating effect on SIC. In sum, the competing Model 3 is preferred to the proposed model.

Tertiary education

The results of Table III based on tertiary education are similar to those of Table II. Two different findings are needed to mention between them. First, Model 1 of Table III shows economic development is significantly positively to education level, which was not found in the Model 1 of Table II. Second, Model 3 of Table III shows all independent variables maintain their explanatory power over SIC after incorporating the education level. Thus, we inferred education has also partially mediated effect on SIC.

Direct and indirect effects of education

Tables IV and V demonstrate the analysis of direct and indirect effects of main variables on environmental performance (SIC). Overall, economic development is the most powerful independent variable explaining the 47% and 43% correlation of environmental performance across countries in Tables IV and V, respectively. In particular, we have

TABLE III
Sample: tertiary education

Variable	Expected sign	Model 1 Dependent: tertiary education (TEREDU)		Model 2 Dependent: SIC		Model 3 Dependent: SIC				
		Coefficients	VIF	Coefficients	VIF	Coefficients	VIF			
<i>Control variables</i>										
2002		0.04	0.01	1.39	-0.09	-0.12***	1.43	-0.09	-0.12***	1.43
2005		0.08	-0.05	1.48	0.10	-0.02	1.51	0.10	-0.01	1.53
<i>Predict variables</i>										
IDV	H1-1 (+)		0.27***	3.50		0.27***	3.56		0.24***	3.73
PDI	H1-2 (+)		-0.01	1.81		-0.22***	1.92		-0.21***	1.93
UAI	H1-3 (+)		0.17***	1.45		0.13***	1.45		0.10**	1.54
MAS	H1-4 (-)		-0.14***	1.07		-0.17***	1.07		-0.15***	1.12
GNP	H2 (+), H5 (+)		0.48***	2.55		0.43***	2.59		0.35***	3.18
PEO	H3 (+)		-0.20***	1.60		0.32***	6.29		0.31***	6.32
PEO ²	H6 (-)					-0.42***	6.10		-0.37***	6.40
TEREDU	H4 (+)								0.16**	2.86
F change		0.36	38.41***		2.07*	60.38***		2.07**	55.29***	
Adjusted R ²		-0.01	0.61***		0.02*	0.75***		0.02**	0.76***	
ΔR^2		0.01	0.63***		0.03*	0.74***		0.03**	0.75***	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, one-tailed test; all regression coefficients are standardized.

TABLE IV
The analysis of direct effect and indirect effect on SIC (secondary education)

	Individualism	Power distance	Uncertainty avoidance	Masculinity	Educational level	Economic development	Population growth
Direct effect	n.s.	-0.23	0.07	-0.14	0.25	0.47	0.38 - 0.36 = 0.02
Indirect effect	0.68 × 0.25 = 0.17	n.s.	0.15 × 0.25 = 0.04	-0.14 × 0.25 = -0.04	n.a.	n.s.	-0.26 × 0.25 = -0.07
Total effect	0.17	-0.23	0.11	-0.18	0.25	0.47	0.09

TABLE V
The analysis of direct effect and indirect effect on SIC (tertiary education)

	Individualism	Power distance	Uncertainty avoidance	Masculinity	Educational level	Economic development	Population growth
Direct effect	0.24	-0.21	0.10	-0.15	0.16	0.35	0.31-0.37 = -0.06
Indirect effect	0.27 × 0.16 = 0.04	n.s.	0.17 × 0.16 = 0.03	-0.14 × 0.16 = -0.02	n.a.	0.48 × 0.16 = 0.08	-0.20 × 0.16 = -0.03
Total effect	0.28	-0.21	0.13	-0.17	0.16	0.43	-0.09

to point out that all culture variables have significant effects on environmental performance through direct effect and/or indirect effect. Among the cultural variables, uncertainty avoidance is the least effective one by accounting for 11% and 13% correlation of environmental performance across countries, as shown in Table IV and Table V respectively.

Discussion and conclusion

While previous studies have made significant advances in using cultural value variables to predict managerial behaviors, these studies are often focused on the main effect or moderating effect of cultural variables. This article makes a contribution by constructing a mediated model which fills up the theoretical gap in national culture issues. We have found that education of a country would be a bridge to connect cultural values and environmental behavior. The conclusions drew from this study echoes the suggestion of Bradely et al. (2006), which recommended adding theoretically contextual-mediated factors

into the national culture framework. Besides, the conceptual framework proposed by Carrol and Gannon (1997) is partially confirmed by our empirical study which adopts Husted (2005) as our research foundation.

With an empirical application to 3 years pooled cross-national data of 51 countries, results indicate that national culture, economic development, population growth, and education would influence environmental performance directly. Through the mediating effect of education, population growth and culture variables would indirectly affect environmental performance. Comparing the proposed model with the two competing models, we found empirical results favoring the competing model in which macro-environmental variables have direct and indirect effects on environmental performance simultaneously. In contrast to the findings of previous research on ethical behavior (e.g., Andrés, 2006a, b), the present study demonstrates education does play an important role on environmental performance. Notably, the inferential relationships associated with education are robust under both secondary and tertiary educational levels.

In this study, we have found that all cultural variables have significant effects on environmental performance by direct effect and/or indirect effect. This result again confirms that national culture values are good predictors of managerial behavior (e.g., Andrés, 2006a, b; Husted, 1999, 2000, 2005). As most scholars have paid more attention to the main effect and moderating effect of cultural values, our contribution can be beneficial with counterbalancing the academic development of national culture issues. Consequently, researchers could refer to Carrol and Gannon (1997) to propose more possible mediators to connect national culture and ethical behavior.

Although not developing hypotheses related the direct effect of national culture on environmental performance, we have found that power distance and masculinity are more effective and consistent predictors of environmental performance based on the subsample analyses (as shown in Tables II and III). Comparing our finding with those of Husted (2005), Park et al. (2007), and Ringov and Zollo (2007), we suggest that further studies on the relationship between national culture and environmental performance could pay more attention to the two cultural variables—power distance and masculinity.

In respect to the relationship between economic development and education, the empirical finding shows that economic development would not affect educational level significantly when education is measured by secondary enrollment rate. It may be secondary education is classified as compulsory education in our research sample, most of which are developing and developed countries. Therefore, it would not be an economic burden for citizens. In other words, the level of GNP per capita would not cause a significant change in secondary enrollment rate. While using tertiary enrollment rate as the proxy of education, we found it would result in a significant relationship between economic development and educational level (as shown in Table III).

Interestingly, there is an inverted U-shape relationship between population growth and environmental performance. In addition, population growth also has impact on environmental performance through the mediating effect of education. As we have known, prior studies seldom discuss the non-linear effect of population growth. The findings may shed some light on the effect of demographic variables on environmental performance.

Managerial implications

Environmental performance can be economically attractive for both firms and countries under certain circumstances (Porter and van der Linde, 1995). According to our empirical results, we have found that national culture, economic development, and population growth would both directly and indirectly through the mediating effect of education affect the level of environmental performance. There are several managerial implications for governments and firms could be drawn from the present study.

For governments

Environmental scholars argued higher education institutions (HEIs) occupy a unique position in that they educate and mold the next generation of society's decision-makers (Walton et al., 2000); therefore, "formal education should be recognized as critical for achieving environmental and ethical awareness, values, attitudes, skills and behavior" (DoE/DfEE, 1996; Lemons, 1995).

Given that national culture is relatively stable, in order to upgrade environmental performance, government policy makers could enhance their economic development and set up a mild population growth rate, both of which are positive to the promotion of educational level and further lifts up the level of environmental performance. Moreover, higher economic development and mild population growth also have direct positive influence on environmental performance.

From a longitudinal view, the association between economic development and education may be reciprocal: a sound education system not only enhances environmental performance but also increases the economic development of a country. For governments, investment in human capital can receive twofold benefits as the above mentioned.

For business

We propose two managerial implications for business: strategies for market selection in the short term and enablers for green capability building in the long term.

When firms decide to launch the internationalization strategy to pursue growth, the location choice becomes the first decision issue of international

market expansion. The frequent mistake firms may make is to formulate international marketing strategies only based on their home country contexts, while omitting huge difference may exist across borders. According to our empirical conclusions, firms possessing competitive advantage based on green management could choose those countries with macro-environmental attributes nurturing higher environmental performance. In specific, countries with economic development and lower population growth are preferred to enter. Moreover, firms are encouraged to select those countries perhaps with high individualism, low power distance, high uncertainty avoidance, and low masculinity. On the contrary, firms without green competitiveness should avoid commit much resource to enter those countries with higher environmental performance.

In the long term, through properly designed environmental standards can trigger innovations that lower the total cost of a product or improve their value (Hart, 1995). Ultimately, this enhanced resource productivity makes companies more competitive (Porter and van der Linde, 1995). In this study, we propose some possible enablers for building up the firm's green capability. First, support from top management (the metaphor from economic development of our framework). Top management support will reflect the firm's resource commitment to construct the green capability. When subsidiaries own more resource, they would be more willingly and able to adopt green management to respond to local responsiveness pressure (Peng and Lin, 2008). It is in particular important when MNCs are implementing global and environmental standards across business units (Epstein and Roy, 1998).

Second, the corporate culture facilitating the strategy based on green management (the hint from national culture of our framework). To fulfill this purpose, firms could modify their organizational designs and incentive systems to change the extant corporate culture gradually. Two cultural dimensions relevant to concentration of authority are power distance and individualism (Harrison et al., 1994; Hofstede, 1980). Thus, firms could put more emphasis on individual centered decision-making (the parallel of individualism) and adopt more decentralized design (the parallel of low power distance). Furthermore, firms should show less preference for performance-contingent rewards, which is

expected for a culture lower in masculinity and higher in uncertainty avoidance (Chow et al., 1999). Finally, continuing communication and training on environmental management (the hint from education of our framework). It is crucial to enhance the employees' understanding of the mission and the goal of environmental protection and sustainable development and hence cultivate them to be skilled workers in environmental management practice.

Limitations and directions for future research

Considering the robustness of research outcomes, we use 3 years pooled cross-national data to test hypotheses. Owing to the database of Hofstede (1997), only 51 countries data were collected. In addition, the ESI report by Global Leaders just offered the 3 years data of 2001, 2002, and 2005, which might not be very perfect for longitudinal data to test hypotheses. Hence, the generalization of our conclusions obtained from this study should be conservatively interpreted.

Recently, developed or developing countries in the world have flourished a bandwagon of local environmentalism. For example, developing countries establish numerous environmental regulations and laws in order to establish the legal status of the state government concerning environmental management. This emphasizes the role of local government, communities, and individuals in environmental and ecological protection (Gilbert et al., 1992). However, a complete environmental management regulation system is just a necessary condition. The effectiveness of environmental management needs to rely on the enforcement of environmental regulations. Strict environmental regulations do not inevitably hinder competitiveness against foreign rivals; they may even enhance competitiveness (Porter and van der Linde, 1995). Besides, higher environmental standards can trigger innovation and upgrading of technologies, making companies more efficient. According to the above arguments, we infer that the implementation of environmental regulations and the development of environmental technologies are two of the critical factors in enhancing the environmental performance of a country.

This study has put more emphasis on exploring the mediating effect of education between cultural

values and environmental performance. We suggest future studies can refer the PEST framework which covers political, economic, societal, and technological environments (Porter, 1980) to extend our framework to predict environmental performance across countries.

Notes

¹ We found that the relationships between national culture and environmental performance are not stable when 2001, 2002, and 2005 data were, respectively, applied to test the model constructed by Husted (2005).

² We mainly compared the findings of Husted (2005), Park et al. (2007), and Ringov and Zollo (2007). In addition, we used extra data to test the robustness of the relationship between national culture and environmental performance based on Husted (2005) (see the details in Footnote 1).

³ Eight indexes included are ESI, SYS, STR, GLO, SYSA, SYSW, SO₂, and TSP in Grafton and Knowles (2004).

⁴ Andrés (2006a, b) also used AYS to predict the software piracy across countries. The findings indicated that education might not be a good predictor of un/ethical behavior.

⁵ The correlation matrix of years 2001, 2002, and 2005 are not presented here due to the similarity with the pooled cross-sectional one.

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