

# A Reexamination of How National Culture Influences Environmental Performance: Based on Neo-Configurational Perspective

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## Research Article

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# Abstract

The inconsistencies and conflicts in the relationship between national culture and environmental performance imply the need for more fine-grained research. Our study advanced existing research by identifying the configurational effect of the six cultural dimensions that lead to high or low environmental performance with the support of the fuzzy-set Qualitative Comparative Analysis (fsQCA). Our results demonstrate that there is no national recognized as a necessary condition for high environmental performance, but high power distance and collectivism are identified as necessary conditions for low environmental performance. And we also summarize four configurations leading to high environmental performance and one configuration leading to low environmental performance. This study contributes to the field of cultural factors and environmental performance from the perspective of method and content.

## 1. Introduction

Current rapid economic growth provokes a series of negative consequences in the environment (e.g., global warming, haze, water contamination, soil desertification), which hampers sustainable development (Givens et al., 2019; Sarkodie et al., 2020; Wang et al., 2020), and provokes a series of thought on the environmental ethic (Singh et al., 2019). According to the World Health Organization (World Health, 2019), avoidable environmental problems lead to a quarter of deaths and diseases in the world. Facing these environmental threats, governments around the world are clearly duty-bound to take measures to deal with them. So far, many countries have adopted environmental performance as an important metric to measure progress towards the achievement of sustainable development (Punyatoya, 2014; Guijarro, 2019). That requires policymakers to be devoted to environmental ethics through environmental regulation, pollution control policies, and their implementation in day-today operations to reduce the environmental impact of economic activity (Singh et al., 2019).

However, it must be recognized that there are huge disparities in environmental performance between countries, which will against the improvement of global environmental governance. A large number of scholars have investigated many factors influencing environmental performance (e.g., Rahman, 2017; Adom et al., 2018; Lohwasser et al., 2020; Makhloufi et al., 2021; Peng et al., 2021). Recently, some studies began to focus on the broader socio-cultural factors, which have significant importance on the public incentive and ethical decision-making to protect the environment (Park et al., 2007; Halkos & Zisiadou, 2018). Especially, the environmental ethics having a grave impact on environmental performance is inseparable from culture (Peng & Lin, 2009). For example, people within collectivistic or uncertainty avoidance contexts would present more ethically oriented environmental behaviors (Petruzzella et al., 2017). So, many studies have provided valuable research conclusions about the relationship between national culture and environmental performance, including Husted (2005), Park et al. (2007), Peng and Lin (2009), Vachon (2010), Onel and Mukherjee (2014), Lahuerta-Otera and González-Bravo (2018), Kumar et al. (2019), and Dangelico et al. (2020). The relevant conclusions are shown in Table 1.

[Insert Table 1 about here]

According to Table 1, it is obvious that there are still no consensus and even equivocal in the practical conclusions about the effect of independent cultural dimensions on environmental performance (Song et al., 2018). And it is not too difficult to spot the sources of this large divergence from three perspectives. First, these studies have lost sight of the fact about the original multifaceted notion of Hofstede's cultural framework. That is, it would behoove researchers to regard this culture framework as distinctive complex patterns of interrelated dimensions, with the perspective of combination, not isolation (Beugelsdijk et al., 2017; Tekic & Tekic, 2021). This exactly explains why Efrat (2014) found that uncertainty avoidance made a negative effect on national innovation performance if considered alone, but became positive effect when combined with individualism or masculinity. Second, despite the complexity inherent in the cultural framework, variance-based approaches (e.g., regression analysis or structural equation modeling) are still broadly adopted to explore the effect of national culture on environmental performance. It is widely acknowledged that these variance-based methods are appropriate to examine the changes of outcomes with antecedent conditions (de Guinea & Webster, 2017), but they are based on the logic of linear additive independent effects, in which the influence of the independent variables are considered discretely (Douglas et al., 2020). Accordingly, these research methods constrain a deeper exploration to the interplay of national cultural dimensions that lead to a focal outcome (Wilden et al., 2016). Third, although Hofstede (2010) built the culture framework including six dimensions, little research has been designed to investigate the effect of all six dimensions at the same time, let alone on environmental performance. Consequently, it is urgent to explore how the interaction and combination of the six dimensions of national culture influence environmental performance by adopting another effective approach.

Given that, we hold that adopting the fuzzy-set qualitative comparative analysis (fsQCA) based on the neo-configurational theory (Misangyi et al., 2017), can be an antidote to the above problems. So, this research is designed to address the existing research gaps by employing a sample of 72 countries and regions to systematically demonstrate multiple configurations of national cultural dimensions, by which different countries exhibit a high or low level of environmental performance. And the data of this research mainly comes from two widely used and accepted databases, that is, Hofstede et al. (2010) for national cultural dimensions and the 2020 Environmental Performance Index for environmental performance, to achieve the above object.

To the best of our knowledge, this is the first paper to apply the QCA method to investigate the combinatory influences of national culture on environmental performance. This research advances the understanding of drivers of environmental performance from the perspective of the national culture and extends existing literature in several ways through the application of the QCA. Firstly, the QCA does not regard each antecedent condition as an independent dimension that acts independently on the outcome condition, but tests the combined effects of all antecedent conditions (Ragin, 2008; Rihoux & Ragin, 2008). Secondly, the QCA is based on causal equifinality, which implies that there are multiple combinations of antecedent conditions that have the same effect on the outcome condition (Fiss, 2011;

Pappas & Woodside, 2021). That is to say, there may be more than one combination of national cultural dimensions leading to high environmental performance or low environmental performance. Finally, compared with traditional regression analysis which can only deal with symmetric data relationships, the QCA can well address causal asymmetry (Fiss, 2011; Schneider & Wagemann, 2012; Douglas et al., 2020). For our study, this implies that the combination of the national cultural dimension of low environmental performance does not represent the mirror image of the combination of the national cultural dimension of high environmental performance. To sum up, this research can give us the whole picture of the relationship between culture and environmental performance.

We structure this research as follows. We present the theoretical background of the study in section 2. Section 3 reports the methodology we adopt in this research, namely fsQCA, and the data collection. Then, we show the results of necessity analysis and sufficiency analysis. Lastly, we summarize the theoretical and practical implications of the research as well as its limitations.

## **2. Theoretical Background**

### **2.1 The Concept of National Culture**

National culture is usually defined as “the collective programming of the mind which distinguishes the members of one human group from another” (Hofstede & Hofstede, 1984). Consistent with previous literature, this research takes national culture to consist of the shared knowledge, beliefs, values, and goals that guide human activity (Milton, 1997; Hofstede, 2001). Naturally, the different sets of beliefs, values, attitudes, and morals which are embedded in the national culture will guide all aspects of the social operation (North, 1991)

Researchers have paid close attention to developing dimensions of national culture, providing various relevant frameworks created by some well-known research projects. It includes these concepts developed by Schwartz Values Survey (Schwartz, 1992), World Values Survey (WVS) (Inglehart, 1997), or, Globe Leadership and Organization Behavior Effectiveness (GLOBE) (House et al., 2004). However, the framework of national culture developed by Professor Hofstede (Hofstede & Hofstede, 1984; Hofstede et al., 2010) has been widely adopted in academic literature due to “its clarity, parsimony, originality, and universality” (Kumar et al., 2019), even though it has drawn serious criticism because of simplifying culture into several dimensions and ignoring within-country cultural heterogeneity (House et al., 2004). Considered as a practical and valid instrument to quantifying national culture, Hofstede’s cultural framework is still the most widely cited to date (Bearden et al., 2006). Therefore, the research analyses the complex causal relationship between national culture and environmental performance according to the following six dimensions: power distance, individualism verse collectivism, masculinity verse femininity, uncertainty avoidance, as well as two subsequently added dimensions—Long-term orientation versus short-term orientation and indulgence verse restriction (Hofstede & Hofstede, 1984; Hofstede et al., 2010).

## 2.2 National Cultural dimensions and Environmental Performance

Previous research considering national culture and its effects on various outcomes at the country-level have mainly focused on innovation performance (Shane, 1993; Tsegaye et al., 2019), entrepreneurship (Davidsson, 1995; Hayton et al., 2002; Valliere, 2019), and economic growth (Johnson & Lenartowicz, 1998; Tabellini, 2010; Castellani, 2019). In this study, the main attention would be paid to the influence of national culture on environmental performance. According to Park et al. (2007), the attitude, willpower, capacity to protect the environment vary from country to country, which is significantly influenced by cultural factors. It is easier to create a high degree of environmental performance if the culture of countries makes their people more aware of the environmental conditions. Additionally, once damaging, these countries with high environmental awareness are more capable and quicker to restore the environment (Onel & Mukherjee, 2014). Following the pioneering research of Husted (2005), previous studies (Husted, 2005; Park et al., 2007; Peng and Lin, 2009; Vachon, 2010; Onel and Mukherjee, 2014; Lahuerta-Otera and González-Bravo, 2018; Kumar et al., 2019; Dangelico et al., 2020) provide an apparently theoretical assumption focusing on the relationship between independent cultural dimensions and environmental performance.

*(1) Power distance and environmental performance.* As the first cultural dimension, power distance indicates the degree to which the least influential members of organizations and institutions expect and accept the power to be unequally distributed (Hofstede et al., 2010). The intension of this cultural dimension is to analyze the way people feel about the distribution of power rather than to measure it. Countries having comparatively large power distance are characterized by a well-defined hierarchy, where subordinates are expected to take orders from their superiors without questioning and have strong respect to the authority (Williams & Zinkin, 2008). Dangelico et al. (2020) stress that the key pillars of societies of the high level of power distance is centralization of power, hierarchy, and resistance to the change of power distribution. In this kind of society, the subordinates in high authoritarian would rather receive orders from their leaders than participate in the decision-making process. Therefore, creativity and innovation would be not encouraged in high-power-distance countries, which cause low capability to innovate (Burns, 1994; Katz et al., 2001; Husted, 2005), and it is certainly including the low willingness and ability of innovation on environmental protection. Furthermore, the great respect to the authority bringing about a weak social debate capacity for better environmental conditions usually leads to weaker responsiveness of the private sector to social issues, like environmental ones (Husted, 2005; Katz et al., 2001; Onel & Mukherjee, 2014). Alternatively, in low power distance societies, it is much easier to openly discuss environmental issues and come up with environmental solutions. Moreover, citizens living in these countries are more prone to have similar rights and wealth to take a supportive behavior to programs of environmental improvement (Husted, 2005; Peng & Lin, 2009). Hence, the lower level of power distance can lead to higher environmental performance.

(2) *Individualism and environmental performance.* Individualism is the second cultural dimension, having caused extensive concern in cross-cultural studies compared with other cultural dimensions (Chen et al., 2009; Taylor & Wilson, 2012). Individualism means the preference for a loosely-knit social framework in which people primarily meet their own needs and the needs of their immediate families. For comparison, collectivism means the preference for a tightly-knit social framework in which individuals assume to be loyal are closely connected through some groups (Ringov et al., 2007; Hofstede et al., 2010). In individualistic societies, individuals' freedom to act, personal decision-making, personal initiative, and personal effort are supported and rewarded. In this case, it's common that interest groups formed by like-minded people frequently play a key role in social issues like environmental problems. As Husted (2005) suggested, the widespread presence of environmental interest groups aimed at improving the surrounding environment is more likely in individualistic society rather than in collective society, since the values of individualistic society are more conducive to the emergence of environment groups. Hence, individualism is considered to be an antecedent of high environmental performance.

(3) *Masculinity and environmental performance.* Masculinity is the third cultural dimension, concerning a society's preference for masculine values such as power, ambition, assertiveness, materialism, and orientation toward achievement (Hofstede et al., 2010). Contrary to the view of masculinity, femininity represents a society's preference for feminine values such as cooperation, modesty, tolerance, and ethics. In countries with a high degree of masculinity, the higher attention to material wealth rather than the quality of life indicates private sectors are less willing to improve their environmental performance and even are ready to destroy the natural environment to make more profits (Palmer et al., 1995; Hofstede, 2001). Furthermore, paying particular emphasis on material success and competition in masculine societies is averse to breeding the pro-environmental behaviors of cooperation and helping (Tice & Baumeister, 1985; Ringov et al., 2007). Hence, femininity is seen as an antecedent of high environmental performance.

(4) *Uncertainty avoidance and environmental performance.* The fourth cultural dimension, uncertainty avoidance, represents the extent of subjective fear of society towards uncertainty and ambiguity (Hofstede, 1984, 2001). In countries with high levels of uncertainty avoidance, individuals are prone to stay away from unknown situations and they have a strong resistance to change (Kale & Barnes, 1992). That is, uncertainty-avoiding societies are fairly routine and less innovative, in which people will make effective decisions to reduce uncertainty and risk connected with environmental problems. Alternatively, in societies having low uncertainty avoidance, individuals frequently do not have great emphasis on risks and are more capable to deal with an uncertain situation. Accordingly, these societies are characterized by low resistance to change (Kale, 1991). Since the deterioration of the living environment could bring about unknown situations, individuals living in high uncertainty-avoiding societies desire to have pleasant and healthy environmental conditions to avoid uncertainty and risk. Hence, high uncertainty avoidance may help to generate high environmental performance.

(5) *Long-term orientation and environmental performance.* As the fifth cultural dimension, Long-term orientation means a society's preference for future-oriented values, such as thrift, self-discipline, and

persistence, while short-term orientation, its opposite, refers to a society's preference for past- and present-oriented perspective, respecting for tradition and fulfilling social obligation (Hofstede et al., 2010). Since solving environmental sustainability requires a long-term perspective, societies characterized by long-term are more likely to reinforce environment protection investment than short-term orientation societies (Mamman & Saffu, 1998). Alternatively, societies concerned with the short-term will prioritize present over future benefits, so individuals in these societies are reluctant to adopt policies oriented to sustainability and environmental innovation. Hence, long-term orientation is seen as an antecedent condition of high environmental performance.

*(6) Indulgence and environmental performance.* Indulgence is the final cultural dimension of Hofstede's framework. It refers to a society's preference for meeting the immediate needs and personal desires of its members (Hofstede et al., 2010). Alternatively, restriction refers to a society's preference for limiting the satisfaction of natural human desires. This dimension is newly added, so it is least tested in Hofstede's cultural framework. Only a tiny minority studied have explored the impact of indulgence on the country's environmental performance. Managers of private sectors in indulgent societies with fewer restrictions with regard to spending limits are encouraged to invest in environmental protection. Furthermore, since indulgence exerts a positive influence on innovation outputs, employees in these private sectors have more time and interest to innovate, which can positively affect the environmental performance of private sectors (Prim et al., 2017). Hence, indulgence is seen as an antecedent condition of high environmental performance.

## **2.3 National culture and environmental performance: neo-configurational perspective**

Although considerable empirical researches have been conducted to explore the relationship of independent cultural dimensions and environmental performance, there is still no unanimous conclusion or consensus on this matter (Song et al., 2018). Specifically, the most consistent and positive relationships with environmental performance were found for low power distance and high individualism (Peng & Lin, 2009; Vachon, 2010; Lahuerta-Otero & González-Bravo, 2018; Kumar et al., 2019). The effect of uncertainty avoidance is ambiguous, including positive (Peng & Lin, 2009; Onel & Mukherjee, 2014), negative (Vachon, 2010), and non-significant (Lahuerta-Otero & González-Bravo, 2018; Dangelico et al., 2020). Moreover, the influence of masculinity on environmental performance is mixed, with most of them suggesting no relationships whether it is in the country sample or the company sample (Vachon, 2010). In light of the existing divergent studies, although it seems reasonable to conclude that certain cultural dimensions do affect environmental performance, we must consider these findings with caution. Clearly, the existing fixed research paradigm employing traditional quantitative methods, which makes the studies about the relationship between culture and environmental performance to a large extent stagnant and makes no substantive breakthrough. So, it is necessary to gain a deeper investigation of the connection between national culture and environmental performance with the new theoretical perspective and method.

In this study, our primary purpose is to employ the fsQCA based on the neo-configurational theory to investigate the complex interplay of all cultural dimensions and their combined effect on environmental performance. This set-theoretic technique allows us to grasp environmental performance by shifting from examining isolated net effects to exploring combined effects of culture on environmental performance. Specifically, based on the multiple conjunctural causations, equifinality, and causal asymmetry of the neo-configurational perspective, we believe that this research can examine the following proposition.

First, in neo-configurational theorizing, the attentions lie on understanding how or why multiple attributes combine into distinct configurations to generate a phenomenon. By fragmenting culture into independent dimensions, previous research generally neglects the fact that different dimensions of national culture mutually permeated and blends can generate a new effect. For example, in exploring the effect of culture on national innovation performance, uncertainty avoidance can reduce national innovation performance if considered alone, but this negative effect would turn into be positive in combination with individualism or masculinity (Efrat, 2014). According to the primary notion of Hofstede's cultural framework (Hofstede & Hofstede, 1984), national culture represents complex patterns that are based on a distinctive combination of interrelated dimensions, instead of a list of unrelated isolated dimensions (Beugelsdijk et al., 2017). Therefore, national cultural dimensions need to be reconsidered in a holistic perspective as configurations-combinations of influence conditions for further research (Misangyi et al., 2017). With this knowledge, we propose that:

### **Proposition 1**

High or low environmental performance should be influenced by combinations of multiple cultural dimensions, rather than a single cultural dimension on its own.

Second, the configurational theory with the intrinsic principle of equifinality, recognizes that complex causal explanations usually involve more than one configuration of attributes leading to the local outcome (Misangyi et al., 2017; Furnari et al., 2020), and multiple combinations of antecedent conditions are equally effective (Fiss, 2011; Woodside, 2013). This exactly proves the truth of an old saying "all roads lead to Rome". Therefore, different combinations of national cultural dimensions can be sufficient to explain the level of environmental performance. With this knowledge, we propose that:

### **Proposition 2**

Multiple combinations of culture dimensions are similarly connected with high and low environmental performance.

Third, another inherent principle of the configurational theory is causal asymmetry, which means that a condition or a combination of antecedent conditions that explains the presence of an outcome may differ from the conditions that lead to the absence of the same outcome (Fiss, 2011; Greckhamer et al., 2018). For example, high power distance can give rise to a low level of environmental performance, while the low

power distance may not lead to a high level of environmental performance, typically due to the interplay with other cultural dimensions. With this knowledge, we propose that:

### **Proposition 3**

Cultural configurations leading to high and low environment performance are distinctive and asymmetrical.

## **3. Methodology And Data**

To explore the impact of the combination of culture profiles on environmental performance, we adopt Quantitative Comparative Analysis (QCA). Ragin (2008) held that, traditional quantitative research methods, such as structural equation modeling or multiple regression analysis, can merely explain the simple linear relationship but obviously lacks the ability to cope with the complexity of cause and effect. While case study, as a qualitative method, is often influenced by subjectivity of the researcher and lacks universality. Therefore, Ragin (2008) pioneered the QCA method, which transcends the boundary of quantitative and qualitative analysis and integrates the advantages of qualitative and quantitative analysis.

Based on set theory and Boolean algebra, QCA allows us to simplify the complex causal relationships into causal configuration, each of which represents a unique combination of the configurational elements that are considered to jointly determine the specific outcome. In this way, this study uses QCA to address the complex interplay of the culture profiles dimensions, instead of an independently single variable, representing QCA condition sets, and their combined influence on low and high EPI, representing QCA outcome sets in this study. Furthermore, fsQCA, one of three mature QCA techniques, is able to use continuous scale variables (Greckhamer et al., 2018). For this reason, we adopt fsQCA in this study.

To measure the environmental performance of countries and regions, we use a comprehensive environmental quality index, i.e., the Environmental Performance Index (EPI), as the outcome condition in the present study. Specifically, we adopt the 2020 EPI, introduced by Yale University and Columbia University. The EPI is calculated for 180 countries on 20 indicators combined into 9 categories in two overarching objectives including protection of human health and maintaining ecosystem vitality. Consistent with the prior studies, we measure national culture on the basis of the newly updated cultural dimension scores, which are obtained from Hofstede's website ([www. geert-hofstede.com](http://www.geert-hofstede.com)). Given the linkage between all six cultural dimensions and environmental performance, all six cultural dimensions are involved in the QCA process.

Our sample was generated beginning from all countries for which the EPI data are available. Then, those countries for which data about all the cultural dimensions were not available are excluded. We get a sample consisted of 72 countries and regions by this process.

## **4. Results**

## 4.1 Calibration

Calibration is a fundamental process in fsQCA (Duşa, 2019). Our study adopts the direct method of calibration (Rihoux & Ragin, 2008), which requires us to set three main quantitative anchors to constitute a fuzzy set. These three quantitative anchors are the threshold for full membership, the crossover point, and the threshold for non-membership. In our study, as both antecedent condition—Hofstede’s cultural dimension and outcome condition—environmental performance index range from 0 to 100, we set 50 as the crossover point. Meanwhile, 75 (median of 50 and 100) and 25 (median of 0 and 50) are set to “full in” and “fully out”. However, to avoid the case ambiguity caused by the use of the 50 points as crossover point, we use the score equal to 50.001 as the crossover point in calibration process. Table 2 displays the calibration thresholds for all antecedent conditions and the outcome condition as well as the descriptive statistics.

[Insert Table 2 about here]

## 4.2 Analysis of necessity

Before creating the truth table, a crucial step of fsQCA, it is indispensable to carry out an analysis of the necessity for each condition. To identify whether any of the six national culture dimensions are necessary for high or low EPI, we conduct necessity analysis to tests whether the antecedent condition is always present (absent) where the outcome condition is present (absent). Schneider and Wagemann (2012) argue that if the consistency of an antecedent condition exceeds the threshold of 0.9, it should be regarded as a necessary condition.

Table 3 shows the result of the analysis of the necessary conditions. As reported in the table, each consistency does not exceed the threshold of 0.9 where the outcome condition is high EPI, so there is no cultural dimension recognized as a necessary condition for high EPI. Conversely, the consistency of power distance (PDI) and collectivism (IDV) exceeds 0.9, which means high power distance and collectivism are identified as necessary conditions for low EPI.

[Insert Table 3 about here]

## 4.3 Analysis of sufficiency

After calibrating the raw data and conducting the analysis of necessity, we establish the truth table to assign each case to one of these truth table rows on the basis of Boolean algebra (Schneider & Wagemann, 2010). In the next step, we simplify these configurations by logical minimization and reduce the initial truth table by specifying the frequency value and consistency threshold. We analyze sufficiency following the established fsQCA default rule by adopting a frequency value $>1$ , a consistency threshold $>0.75$ , and a proportional reduction in inconsistency (PRI) $>0.7$ . We assume that the presence and the absence of each condition would affect the outcome on account of the lack of concrete theory or literature.

The qualitative comparative analysis of fuzzy sets usually generates three types of solutions: complex solution, parsimonious solution, and intermediate solution. A complex solution does not incorporate any logical reminders, and conversely, a parsimonious solution incorporates all of the logical reminders, while the intermediate solution merely involves logical reminders in accordance with theory or literature. As a result, the intermediate solution is closest to theoretical reality (Rihoux & Ragin, 2008). Consequently, we following the previous studies, focus on the intermediate solution for the interpretation of the final combination. A more comprehensive and detailed view of the findings can be obtained by combining the parsimonious solution and the intermediate solution. Causal conditions can be divided into the core condition and the peripheral condition. The former, existing a key meaning to the interpretation of the causality, coexist in the intermediate solution and the parsimonious solution, comparatively; the latter, no existing a key influence to the interpretation of the causality, merely appears in the intermediate solution (Fiss, 2011). Following the study of Ragin (2008), we also use the black circles (“●”) to represent the presence of a condition, and white circles (“○”) to represent its absence. Moreover, large circles indicate core conditions, and relatively small circles refer to peripheral conditions. Blank spaces in a solution indicate a “don’t care” situation in which this causal condition may be either present or absent.

The analysis of sufficiency generated five solutions, four configurations leading to high EPI and one configuration leading to low EPI. The findings are shown in detail in Table 4.

#### ***4.3.1 Cultural profiles – Antecedents of high environmental performance***

The result shows that four casual recipes are associated with high EPI. The overall solution has a consistency level of 0.999, revealing that the degree to which the configurations led to high EPI is high. On the other hand, the coverage of the overall solution is 0.469, which indicates that almost 46% of the cases with a high level of EPI showed these four combinations of causal conditions. In addition, Table 4 also shows one casual recipe associated with low EPI. The solution consistency is 0.976 and coverage is 0.196. All five configurations demonstrate a high degree of consistency, and further, the coverage of each configuration provides evidence of its relative empirical importance. Therefore, the explanatory solution of high EPI consists of four different but equifinal configurations which are sufficient for leading to high EPI. The presence of solution 1 (1a and 1b) and 2 (2a and 2b) imply the existence of second-order in this study (Fiss, 2011). The following section describes each configuration specifically.

Solution 1a and Solution 1b, as a set of neutral permutations, have the same core conditions, namely, low power distance and individualism. Specifically, in solution 1a, indulgence appears as the peripheral condition. Masculinity, uncertainty avoidance, and long-term orientation appear as conditions of indifference; in other words, both masculinity and femininity, high and low uncertainty avoidance, as well as long-term and short-term orientation, may be integrative dimensions that are related to high EPI. This solution includes the USA, Denmark, Australia, the UK, etc. In solution 1b, uncertainty avoidance and long-term orientation both appear as peripheral conditions. Masculinity and indulgence are conditions of indifference. This solution includes Hungary, Estonia, Latvia, Germany, etc. Solution 1(1a and 1b) is essentially in accordance with the point of view about previous culture studies, which emphasize the

importance of low power distance and individualism in generating high environmental performance. Low power distance means distribution of power, in which individuals are more likely to take part in the decision-making process and are more engaged in world issues, such as the environment; Individualism means autonomy, independence, and freedom. Emphasizing low power distance and individualism as its core conditions, solution 1 stresses their equal importance in generating the combined effect on high EPI.

Solution 2a and Solution 2b have the same core conditions, namely, individualism and indulgence. Specifically, in solution 2a, high certainty avoidance appears as the peripheral condition. Power distance, masculinity, and long-term orientation appear as conditions of indifference. This solution includes Finland, Malta, Iceland, Norway, etc. In solution 2b, masculinity, uncertainty avoidance, and long-term orientation appear as the peripheral condition. Power distance appears as a condition of indifference. This solution includes Austria, Luxembourg, Belgium, etc. Solution 2(2a and 2b) partially concurs with the point of view from previous cultural research which investigated the effects of independent cultural dimensions on EPI. Namely, this solution emphasizes the great importance of individualism and indulgence. In societies characterized by individualism and indulgence, individuals are more encouraged to make the environmental investment with a high degree of personal initiative and fewer constraints.

#### ***4.3.2 Cultural profiles – Antecedents of low environmental performance***

The result also shows that one causal recipe is associated with low environmental performance. The level of consistency is 0.976. It points out the fact that the combination of high power distance, collectivism, masculinity, low uncertainty avoidance, short-term orientation, and restriction brings about a low level of environmental performance. This solution includes the Philippines, Malaysia, Mozambique, and Dominican, etc. This result concurs with the point of view from previous cultural studies, which identified high power distance, collectivism, and short-term orientation as inhibitors of environmental performance. As the only core condition leading to low environmental performance, restriction is considered to having an essential meaning.

[Insert Table 4 about here]

#### **4.4 Robustness tests**

The robustness test of QCA needs to stay true to fundamental principles and nature of set-theoretic methods instead of copying the robustness test of qualitative analysis. Following the recommendations of Schneider and Wagemann (2012), we conduct three robustness checks for our sufficiency analysis. Firstly, we modify the consistency threshold from the former value of 0.75 to 0.8 adopted in the fsQCA procedure. The solutions are completely unchanged. Secondly, we rerun our sufficiency analysis with a higher proportional reduction in the inconsistency of  $\text{PRI} \geq 0.75$ . The solutions are unchanged and parameters of fit remain similar. Finally, following the suggestion of Fiss (2011), we recalibrate the data of the outcome by setting the fully-in and fully-out cutoff points at the 95th percentile (80.585) and the 5th percentile (32.200), with the crossover point set to the median (57.650). However, to avoid the case ambiguity problem, we increase the crossover point by 0.001 and use the score equal to 57.651. Solution

1a, Solution 1b, and Solution 2b remain completely unchanged, while Solution 2a is absent from the sufficiency analysis. All of these modifications confirm the robustness of our original results.

## 5. Discussion And Conclusion

The inconsistencies and conflicts in the relationship between national culture and environmental performance imply the need for more fine-grained research. Our study advanced this research by identifying the configurational effect of the six cultural dimensions that lead to high or low environmental performance. The fsQCA method, based on multiple conjunctural causation, casual equifinality, and causal asymmetry, is used for this purpose because it has proved suitable for capturing the complex interplay of the antecedent conditions and their impact on a specific outcome condition from a neo-configurational perspective. Our results show that there is no national cultural dimension recognized as a necessary condition for high environmental performance, but high power distance and collectivism are identified as necessary conditions for low environmental performance. And we summarize four configurations leading to high environmental performance and one configuration leading to low environmental performance.

Theoretically, we conduct a beneficial supplement to existing environmental studies based on neo-configurational theory, by providing new insight into how the complex interplay of the six cultural dimensions allows countries to achieve high or low levels of environmental performance. Even though culture has been proved to be a significant determinant for environmental performance (Park et al., 2007), the current literature remains very limited and mixed (Kumar et al., 2019), especially they narrowly consider the effect of cultural dimensions independently and fail to examine the combined effect. In this work, we consider all cultural dimensions developed by Hofstede et al. (2010), and present that an appropriate combination of cultural dimensions—rather than a single dimension alone—can provide environmental performance improvements, and detect the modes about how the different dimensions interact with one another within Hofstede's cultural framework which has not been thoroughly explored. And with the fsQCA technic, we go beyond previous research on the net effect of antecedents to dig deeper into the data to reveal finer-grained detail about the complexity of environmental issues. Therefore, our results provide systemic and holistic views of the relationship between national culture and environmental performance, which particularly contributes to improving our understanding of how national cultural factors complexly interplay and combine to influence environmental performance.

In addition, our research based on the country-level analysis might also help to provide practical implications for policymakers who aim to improve the environmental performance of their country. First, to date, policymakers concentrate mainly on formal factors affecting environmental performance and make relevant physical policies such as the usage of new clean energy, the development of environmentally friendly technology. In addition to these formal institutions, our results indicated that culture also has important consequences for the environment. Of course, the cultural values are not easy to be deliberately modified, and may only change gradually over a long period. But we still should enlarge the propagation and education, foster a culture of environmental protecting culture and create an

enabling environment for the enhancement of the construction of environmental ideology and faith. At the same time, policymakers still can learn from countries with high environmental performance within their cultural areas, rather than simply rigid replicating the most environmentally friendly countries' practices and policies around the world. Second, previous studies tend to see the cultural factors in isolation and ignore the nature of the interplay of the cultural dimensions. While our results with the configurational approach can guide policymakers to understand how to get high level of environmental performance through strategies that appropriately combine various cultural dimensions. For example, the combination of a low level of power distance and individualism may improve environmental performance.

## 6. Limitations And Future Research

This research naturally has some limitations but also indicates potential avenues for future research. The first limitation is that we do not integrate the temporal effect, that is, the dynamic changes of EPI are not considered. Future studies could use more longitudinal information to analyze temporal effects. The second limitation is that we merely investigate the influence of national culture—an informal institution—on environmental performance. More in-depth research, examining how cultural factors and other formal institutions (e.g., institutional quality, level of economic development) interact to influence environmental performance, should be the focus of future research.

## Declarations

**Author contribution** Ting Xu (Draft writing, analysis, data interpretation, and editing), Di Chen (Draft writing, methodology, analysis, writing, and editing), Zhike Lv (Supervision, and editing).

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# Tables

**Table 1** Empirical research testing national cultural' effect on environment performance

Source	Measure	Method	PDI	IDV	MAS	UAI	LTO	IVR
Dangelico et al. (2020)	EPI	Regression		+			+	+
	Environmental Health			+		+	+	+
	Ecosystem vitality				+			+
Kumar et al. (2019)	EPI	SEM and cluster analysis	-	+		+	+	
Lahuerta-Otero and González-Bravo (2018)	Seven indicators of EPI	MDS and Regression	-	+	-		+/-	x
Onel and Mukherjee (2014)	Environmental Health	Regression		+		+	x	x
Vachon (2010)	Green corporatism	Regression	-	+		-	x	x
	Environmental innovation	Regression		+		-	x	x
Peng and Lin (2009)	SIC	Regression	-	+	-	+	x	x
Park et al. (2007)	ESI	Regression	-		-		x	x
Husted (2005)	SIC	Regression	-	+	-		x	x

Notes: (-) indicates a negative significant effect of the cultural dimension on the country's performance. (+) indicates a positive significant effect of the cultural dimension on the country's performance. An empty cell means that the effect of the cultural dimension on the country's performance is not significant. (x) shows that the effect of this cultural dimension has not been investigated in this study. 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; SEM: structural equation model; MDS: multidimensional scaling analysis.

**Table 2** Fuzzy-set membership calibrations and descriptive statistics.

Sets		Fuzzy set calibrations			Descriptive statistics			
		Fully out	Crossover	Fully in	Mean	SD	Min	Max
Outcome	EPI	25.00	50.00	75.00	58.11	15.64	27.60	82.50
Conditions	PDI	25.00	50.00	75.00	60.35	20.33	11.00	100.00
	IND	25.00	50.00	75.00	43.71	22.81	12.00	91.00
	MAS	25.00	50.00	75.00	48.51	19.65	5.00	100.00
	UAI	25.00	50.00	75.00	66.11	21.45	8.00	100.00
	LTO	25.00	50.00	75.00	45.92	23.69	7.00	100.00
	IVR	25.00	50.00	75.00	46.77	23.00	0.00	100.00

**Table 3** fsQCA results – analysis of necessity

Condition	Outcome condition: HIGH EPI		Outcome condition: LOW EPI	
	Consistency	Coverage	Consistency	Coverage
PDI	0.622	0.602	<b>0.971</b>	0.517
¬PDI	0.510	0.978	0.270	0.269
IDV	0.594	0.965	0.253	0.215
¬IDV	0.518	0.551	<b>0.956</b>	0.560
MAS	0.573	0.772	0.667	0.488
¬MAS	0.621	0.765	0.691	0.457
UAI	0.806	0.715	0.782	0.376
¬UAI	0.301	0.704	0.421	0.524
LTO	0.553	0.819	0.440	0.348
¬LTO	0.561	0.637	0.776	0.480
IVR	0.567	0.810	0.504	0.389
¬IVR	0.573	0.670	0.758	0.477

**Table 4** fsQCA results – analysis of sufficiency

Configuration	HIGH EPI				LOW EPI
	1a	1b	2a	2b	3
Power distance	●	●			●
Individualism	●	●	●	●	●
Masculinity			●	●	●
Uncertainty Avoidance		●	●	●	●
Long-Term Orientation		●	●	●	●
Indulgence	●		●	●	●
Consistency	0.998	1	1	1	0.976
Raw coverage	0.343	0.236	0.163	0.145	0.196
Unique coverage	0.135	0.09	0.007	0.014	0.196
Solution coverage	0.469				0.196
Solution consistency	0.999				0.976