

# Tourist's Environmentally Responsible behavior with a Focus on Water-energy-food Nexus Awareness: Evidence from College Students

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**Abstract.** Environmental issues caused by unsustainable tourism have increased fast, resulting in greater attention to tourists' behavior contributing to ecotourism. With college students as the research object, this study explored the effects of values on tourist's environmentally responsible behavior (TERB) by introducing the newly proposed water-energy-food nexus awareness into the Value-Belief-Norm (VBN) theory. Valid five-part questionnaires were analyzed from 799 Sichuan University students that included demographics, the New Ecological Paradigm (NEP) scale, water-energy nexus awareness, water-food awareness and TERB. The correlation and regression analyses found that the biospheric and altruistic values orientations supported the NEP, but egoistic values did not, that water-energy nexus awareness and water-food nexus awareness were positively affected by the NEP and openness-to-change, and that openness-to-change, NEP, water-energy nexus awareness and water-food nexus awareness all had a positive effect on most TERB items except anti-waste ones. The potential role of CGBs to prevent college students from saving water, energy, and food when travelling was also highlighted. Caution should be exercised when accepting results about causality. **Keywords:** Ecotourism, Sustainable development, Behavioral research, Water-energy-food nexus.

## 1 Introduction

The overall increase in travel in the last couple decades has resulted in both direct and indirect adverse environmental effects. Environment damage and degradation of natural resources, such as greenhouse gas emissions, the loss of biodiversity and water shortages, can be found in many tourist destinations; and the issue of excessive non-recyclable waste arose swiftly at the same time [1]. The negative environmental outcomes can harm tourism development in turn; for example, the sea level rise caused by climate change leads to flooding and erosion, which severely threatens global coastal destinations [2].

Therefore, there has been an increased focus on ecotourism and the role of tourists in it. Consequently, several theories have been developed to learn tourists' environmentally responsible behavior (TERB), such as Value-Belief-Norm (VBN) theory, the Theory of Planned behavior (TPB), the Technology Acceptance Model (TAM), and Special Interest tourism

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(SIT)[3]. However, there have been few studies on the differences between pro-environmental behavior in daily life and TERB or inner relationships among tourists' decisions. Meanwhile, young travellers between 18 to 30 years old have become one of the fastest-growing tourism groups; as part of this group, college students with active minds, more opportunities to encounter innovative ideas and the ability to accept something new, have become assignable in tourism market [4]. Hence, it is always a topic in ecotourism research to learn about the travel behavior of college students.

Values determine the extent to which people behave responsibly towards the environment in the short-to-medium and in the long term. Though it may be more difficult to encourage TERB by changing tourist values, being more directly exposed to social issues and allowed to make independent decisions, college students might be more likely to change their values and environmentally unfriendly travel behaviors[5]. Furthermore, according to the theory of generational replacement, college students with some ecological education are the future consumers, tourists and policymakers. They, therefore, could be instrumental in making long-term differences [6]. With this in mind, therefore, it is important to understand the values being held by college students to determine how these values affect TERB.

VBN theory suggesting that values influence people's norms by one's general and specific beliefs is widely used in explaining human behavior [7]. Previous pro-environmental behavioral research has tended to examine the egoistic, altruistic value and biospheric values extracted from Schwartz's universal motivational value types by Stern et al. [8]. Studies have found that students with stronger altruistic and biospheric values were more willing to implement pro-environmental behaviors [9]. As innovation plays a significant role in environmental protection nowadays and college students are often willing to engage in something new, it is possible that openness-to-change, which was included in the initial Schwartz's values theory, may have an effect as well.

In the last decade, not only policy makers but also scholars from various fields including environmental research have focused on the trade-offs between water and energy, water and food and energy and food and proposed the water-energy-food nexus, which was defined as follows[10]. Water purification and transport require energy and energy production requires water for cooling. Farmers also need water for irrigation but the excessive use of pesticides and fertilizers during food production can indirectly cause water pollution and water shortages. The energy-food nexus is related to the energy needed to manufacture pesticides and fertilizers and dispose of food waste, while other foods can be easily converted into bioenergy.[11]

Though there has been some research into the water-energy-food nexus, most has focused on the scientific and technical nexus when seeking to determine the complex connections between the three elements and has tended to focus on specific situations to allow for comprehensive analyses of the challenges and to provide policy guidance. The development of the water-energy-food nexus can be divided into two distinct phases: before and after the Bonn 2011 Conference. In the first phase, research focused mainly on the relationships between only two of the three elements and especially on water and energy as the background to food production [12]. Even though the water-energy-food nexus concept was formally proposed in 2008, there were few studies that treated the three elements equally within the framework, with most researchers being more concerned about adapting to climate change, increasing agricultural production, or ensuring resource security[13]. After the Bonn 2011 Conference, however, a water-energy-food nexus resource integration platform was developed by the German government, which changed the focus of the associated research[14]. For example, UNAP-AP evaluated the status of the water-energy-food nexus in the Asia-Pacific region and a water-energy-food nexus project from the perspective of investment and risk management was initiated by the Research Institute for Humanity and Nature (RIHN) in Japan [15]. Using

qualitative and quantitative methods, research on the water-energy-food nexus began to put more emphasis on the combination of theory and practice.

However, the water-energy-food nexus was rarely discussed in social science until Portney et al. [10], who pointed out that the public cognition of the water-energy, water-food, and energy-food nexus could encourage public support for environmental policies, which provided a new idea for human pro-environmental behavior research but did not connect the awareness of nexus with developed theories. As basic ecological education is now given to college students, this paper examines whether awareness of the water-food-energy nexus can explain their personal TERB rather than only explain their environmentally friendly intentions.

This research, therefore, introduces water-energy-food awareness into VBN theory to fill the theoretical gap between water-energy-food nexus awareness and the widely adopted human behavioral theories to explore how values influence college students TERB about water, energy, food and so on through the water-energy-food nexus awareness. Hence, besides testing the relationships already suggested in many previous studies, this research also seeks to confirm the following hypotheses:

*Hypothesis 1.* Openness-to-change positively and significantly influences general environmental beliefs.

*Hypothesis 2.* Openness-to-change positively and significantly influences the awareness of the water-energy-food nexus.

*Hypothesis 3.* General environmental beliefs positively and significantly influence the awareness of the water-energy-food nexus.

*Hypothesis 4.* Openness-to-change positively and significantly influences TERB.

*Hypothesis 5.* The water-energy-food nexus awareness positively and significantly influences TERB.

Our paper consists of 5 parts. Following the introduction part, we elaborate on the methods that we use in this paper. In chapter 3, we talk about the results based on our data and analysis. In chapter 4, we have a discussion on what we have found. Last but not least, we make conclusions at the end of this paper.

## **2 Methods**

### **2.1 Respondents and Procedure**

During March 15-25, 2022, a random sample of 1200 Sichuan University (SCU) undergraduates from four disciplines; Liberal Arts, Science, Engineering and Medical Science; were selected from the SCU registrar's office. All 1200 students were sent email invitations that included a short description of the study, information about confidentiality and contact people. Two reminder emails were then sent to those who did not respond. Finally, 1103 students responded to the email indicating their willingness to participate in the survey and 934 completed the paper questionnaires with a response rate of 84.68%. After removing the invalid questionnaires whose answering time was less than 6 minutes or whose values were missed, a total of 799 valid questionnaires were used in the analysis, with an effective rate of 85.54%. The profile data is as follows. (table 1)

### **2.2 Measures**

The questionnaire consisted of five parts. The first part focused on the basic demographics; gender, grade and region; the second part focused on environmental values; the third part was

**Table 1.** Participant profile data

|               | Gender |        | Grade    |           |        |        | Region |             |
|---------------|--------|--------|----------|-----------|--------|--------|--------|-------------|
|               | Male   | Female | Freshmen | Sophomore | Junior | Senior | City   | Countryside |
| Sample size   | 399    | 400    | 213      | 212       | 204    | 170    | 513    | 286         |
| Percentage(%) | 49.94  | 50.06  | 26.66    | 26.53     | 25.53  | 21.28  | 64.21  | 35.79       |

**Table 2.** Variables reliability statistics in formal survey

| Variable                     | Cronbach's $\alpha$ | Number of items |
|------------------------------|---------------------|-----------------|
| Egoistic value               | 0.840               | 4               |
| Altruistic value             | 0.834               | 4               |
| Biospheric value             | 0.946               | 4               |
| Openness-to-change           | 0.748               | 4               |
| NEP                          | 0.827               | 15              |
| Water-energy nexus awareness | 0.657               | 4               |
| Water-food nexus awareness   | 0.676               | 5               |

the NEP scale; the fourth part had items measuring personal awareness of the water-energy-food nexus and the final part measured TERB. Therefore, the questionnaire had 47 questions, the details of which are in the following section.

(1) Values and NEP

The environmental values scale had two parts. The first part had 12 questions adopted from the environmental values scale compiled by Hsu [16]. Based on Stern's value theory, it included three environmental "value orientations": egoistic, altruistic and biospheric. 12 items were assessed by a 5-point Likert type scale. The Cronbach's alphas were 0.840 for the egoistic values, 0.834 for the altruistic values, 0.946 for the biospheric values and 0.748 for the openness-to-change, which were considered reasonable (table 2).

The Chinese version of the New Ecological Paradigm (NEP) scale revised by Liu [17] was adopted to measure the respondents' general concern about the environment. The NEP Scale was designed to be used for general environmental topics to avoid becoming dated and to measure ecocentric belief system; that is, humans are just one component of nature; as opposed to an anthropocentric belief system; that is, humans are independent of and superior to other organisms in nature; and has been the most widely used measure to investigate environmental issues. The NEP scale has two dimensions: the "new ecological paradigm" and "dominant social paradigm", with a total of 15 items measured on a Likert type scale ranging from 1 "fully disagree" to 5 "fully agree"; the "dominant social paradigm" was scored in reverse order. The Cronbach's alpha was 0.827 (table 2).

(2) Water-Energy-Food Nexus Awareness

In the pre-research, the scale used in Portney et al.'s research to elicit explicit water-energy-food nexus awareness was adopted after being translated into Chinese. The initial scale had three subscales: 11 questions on water-energy nexus awareness, six questions on water-food nexus awareness, and four questions on energy-food nexus awareness.

According to the pre-research results, the Cronbach's alpha of the water-energy-food nexus awareness was polarized, and in particular, the Cronbach's alpha of the energy-food nexus awareness was only 0.006, which was consistent with the results in Portney et al.'s research. These results indicated that further research on the energy-food nexus awareness measure was still required. Therefore, we decided to select only "water-energy" and the "water-food" nexus awareness both of which had better Cronbach's  $\alpha$ .

The small Cronbach's  $\alpha$  of "water-energy" nexus awareness also indicated that some of the items in the scale might be invalid. Thus, from the results of a focus-group discussion with the respondents in the pre-research period and information about the main power generation methods in China, we removed items WE5 to WE11 and WF3. Therefore, the final scale used in the research had four questions on water-energy nexus awareness and five questions on water-food nexus awareness, with the pre-research Cronbach's  $\alpha$  for the four-item water-energy nexus awareness scale being 0.642, and the Cronbach's  $\alpha$  for the five-item water-food nexus awareness scale being 0.649.

A Likert five-point scoring method was used for all questions except those for the judgment of right and wrong; 1="unimportant/harmless/unconcerned", 2="somewhat important/slightly harmful/somewhat concerned", 3="uncertain or unclear/harmful/concerned", 4="more important/very harmful/very concerned", 5= "very important/extremely harmful/extremely concerned". In the "True or False" questions, 1= "wrong", 2= "uncertain or unclear", and 3= "correct". The Cronbach's  $\alpha$  for the water-energy nexus awareness scale was 0.657, and the Cronbach's  $\alpha$  for the water-food nexus awareness scale was 0.676 (table 2).

### (3) TERB

As it was not necessary to tie TERB to specific products or services, the questions about tourist behavior associated with water, energy and food had two dimensions; "wasting resources" and "polluting the environment (directly/indirectly)". Moreover, as free disposable goods are generally provided to customers in the traditional service models for both hotels and restaurants, there was one question about the "use of disposable goods", which was not directly related to water, energy or food. The specific items were as follows:

Initial T1: Feel freer to use water at the hotel than at home.

Initial T2: Throw garbage into water bodies such as lakes and rivers during sightseeing.

Initial T3: Order too much food and do not pack leftovers.

Initial T4: Prefer organic food or dining at organic restaurants.

Initial T5: Keep lights, air conditioners and other electrical equipment running when leaving the residence.

Initial T6: Prefer low-energy-consumption transportation (walking, riding a shared bicycle, taking a bus, etc.).

Initial T7: Avoid using disposables (toothbrushes, tableware, plastic bags, etc.).

Respondents completed the TERB Scale on a scale ranging from 1 "never do so" to 5 "often do so", while the question focused on harm to the environment (Initial T1, T3 and T5) were scored in reverse order. Therefore, in the following analysis, the higher scores for TERB items indicated that the respondents implemented more frequent TERB.

## 2.3 Data Analysis

This study tentatively introduced the water-energy-food nexus awareness as a specific environmental belief into the classic VBN theory. The data statistics software Stata15.0 and SPSS25.0 were employed to analyze the correlations between the values, the general environmental beliefs (NEP), the specific environmental beliefs (water-energy nexus awareness and water-food nexus awareness) and the TERB. Next, the VBN theory was tested using regression analyses, with each variable in the causal chain being regressed onto the preceding variable in the causal chain. As this paper was exploratory, the results of regressions should be taken cautiously.

**Table 3.** Correlation statistics for values, NEP and the demographic variables

| Demographic variables | Egoistic value | Altruistic value | Biospheric value | Openness-to-change | NEP      |
|-----------------------|----------------|------------------|------------------|--------------------|----------|
| Gender                | -0.086*        | 0.228***         | 0.216***         | 0.007              | 0.459*** |
| Region                | -0.007         | 0.088*           | 0.042            | -0.120***          | 0.131*** |

Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

**Table 4.** Multiple regression analyses to test the relationships between the values, the demographic variables and the NEP

| Dependent variable | Independent variable | Coefficient( $\beta$ ) | Standard error | P     | R2    | Adj. R2 |
|--------------------|----------------------|------------------------|----------------|-------|-------|---------|
| NEP                | Egoistic value       | -0.310***              | 0.082          | 0.000 | 0.332 | 0.326   |
|                    | Altruistic value     | 0.476***               | 0.104          | 0.000 |       |         |
|                    | Biospheric value     | 0.502***               | 0.102          | 0.000 |       |         |
|                    | Openness-to-change   | 0.023                  | 0.090          | 0.797 |       |         |
|                    | Region               | 1.547**                | 0.549          | 0.005 |       |         |
|                    | Gender               | 6.441***               | 0.540          | 0.000 |       |         |

### 3 Results

#### 3.1 The Relationship between Demographic Variables and Values and NEP

The relationships between the demographic variables and the values in the four dimensions and between the demographic variables and the NEP were reported for the two variables (table 3).

The results for the relationship between gender and values indicated that female altruistic and biospheric values were higher than male altruistic values and biospheric values. However, the gender difference in egoistic values and openness-to-change was not significant. The relationship between gender and NEP also indicated that the female general environmental belief level was higher than the male general environmental belief level.

The correlation analysis indicated that the hometown (city or countryside) of the respondents was not significantly correlated with the four values dimensions; however, for the NEP, the results indicated that the general environmental belief level of rural college students was slightly higher than that of urban students.

#### 3.2 The Effects of Values on NEP, WEF Nexus Awareness and TERB

To start with, the causality from the values to the NEP was analyzed. As shown in the (table 4), the demographic variables and the values were found to significantly contribute to the variance in the NEP, as the  $R^2 = 0.332$ ,  $P < 0.001$ . Respondents who scored high on the egoistic values were less aware of the general environment than respondents who scored low ( $\beta = -0.310$ ,  $P < 0.001$ ). Both biospheric and altruistic value orientations were found to have a positive effect on the NEP and significantly contributed to this model, which was in line with previous research. Openness-to-change was found to have an insignificant effect on NEP ( $P > 0.05$ ), which meant that H1 was not supported.

The relationship between values and awareness of the water-energy and water-food nexus was then explored. In the correlation analyses, the relationships between openness-to-change and water-energy nexus awareness and water-food nexus awareness were observed to have a significant positive correlation ( $r_1 = 0.136$ ,  $r_2 = 0.137$ ,  $p < 0.001$ ). Regression analysis was then conducted to measure whether openness-to-change promoted the formation of water-energy nexus awareness and water-food nexus awareness, respectively (table 5), from which it was found that openness-to-change had a significant positive effect on the two awareness types but with only small coefficients, which indicated that while H2 was supported, the

**Table 5.** OLS multivariate regression results showing the relationships between demographic variables, openness-to-change, NEP, water-Energy Nexus Awareness, water-Food Nexus Awareness and TERB

|                                    | Water-energy nexus awareness | Water-food nexus awareness | T2: Do not throw garbage into water | T3: Order properly or pack leftovers | T4: Prefer organic food/restaurants | T6: Prefer green transportation | T7: Avoid using disposables |
|------------------------------------|------------------------------|----------------------------|-------------------------------------|--------------------------------------|-------------------------------------|---------------------------------|-----------------------------|
| Openness-to-change                 | 0.007*<br>(0.003)            | 0.008*<br>(0.003)          | 0.006<br>(0.007)                    | 0.027*<br>(0.013)                    | 0.017<br>(0.011)                    | 0.033**<br>(0.012)              | 0.048***<br>(0.012)         |
| NEP                                | 0.007***<br>(0.001)          | 0.005***<br>(0.001)        | 0.015***<br>(0.003)                 | 0.015**<br>(0.005)                   | 0.008<br>(0.004)                    | 0.009<br>(0.005)                | 0.025***<br>(0.005)         |
| Water-Energy Nexus Awareness Index | —<br>(0.033)                 | 0.321***<br>(0.033)        | 0.836***<br>(0.079)                 | 0.398**<br>(0.149)                   | 0.395**<br>(0.132)                  | 1.202***<br>(0.140)             | 0.795***<br>(0.138)         |
| Water-Food Nexus Awareness Index   | 0.336***<br>(0.034)          | —                          | 0.194*<br>(0.081)                   | 0.649***<br>(0.153)                  | 1.971***<br>(0.135)                 | 0.255<br>(0.143)                | 0.788***<br>(0.141)         |
| Gender                             | 0.021<br>(0.020)             | -0.030<br>(0.019)          | 0.219***<br>(0.044)                 | 0.167*<br>(0.084)                    | 0.008<br>(0.074)                    | 0.305**<br>(0.078)              | 0.135<br>(0.077)            |
| Region                             | -0.022<br>(0.019)            | 0.042*<br>(0.018)          | -0.040<br>(0.042)                   | -0.056<br>(0.079)                    | -0.209**<br>(0.070)                 | 0.188*<br>(0.074)               | -0.003<br>(0.073)           |
| Observations                       | 799                          | 799                        | 799                                 | 799                                  | 799                                 | 799                             | 799                         |
| R2                                 | 0.215                        | 0.190                      | 0.320                               | 0.111                                | 0.312                               | 0.207                           | 0.247                       |
| Adj. R2                            | 0.210                        | 0.185                      | 0.315                               | 0.105                                | 0.307                               | 0.201                           | 0.241                       |

Note: \* p<0.05 \*\* p<0.01 \*\*\* p<0.001

effect was only slight. Thus, any conclusions that openness-to-change positively influenced both the water-energy nexus awareness and water-food nexus awareness should be made with caution.

The relationship between openness-to-change and TERB was then examined. As can be seen in Table 6, positive highly significant relationships were found between openness-to-change and most of the TERB items, but there was only a small correlation coefficient. The relationships between openness-to-change and T1 and T5 were exceptional. Open values inversely were found to be related to T1 (do not waste more water in hotels than at home) and had only a slight positive but insignificant correlation with T5 (turn off the electrical equipment when leaving the residence) at an insignificant level. Five regression analyses were conducted on the other five TERB items; T2, T3, T4, T6 and T7; from which it was found that openness-to-change had a significant positive effect on T3, T6 and T7 (table 5); that is, college students who were more open to change were more likely to order the proper amount of food or pack up the leftovers, prefer green transportation and use fewer disposables when travelling. As reported, there was no adequate evidence to support H4, and we leave potential reasons to the discussion.

### 3.3 The Effects of NEP on WEF Nexus Awareness and TERB

The correlation analysis showed that the general environmental belief (NEP) and water-energy nexus and water-food nexus awareness were positively significantly correlated ( $p < 0.001$ ). Two regressions for water-energy nexus awareness and water-food nexus awareness with the NEP as the independent variables were then conducted, and the R-squares for both found to be about 0.2, which indicated that the regression fitting effects were acceptable (table 5). The results showed that NEP had a significant positive effect on both water-energy nexus awareness and water-food nexus awareness, but the effect was not strong; therefore, it was concluded that H3 was supported.

As can be seen in Table 6, NEP was positively correlated with the most TERB items except T1 at a highly significant level ( $p < 0.001$ ), which indicated that NEP had a strong correlation with TERB. From the regression on the five TERB items, it was concluded that the NEP had significant positive effects on three of the TERB items; T2, T3 and T7; but the positive effects on T4 and T6 were not significant (table 5). Hence, it was surmised that college student tourists who were more concerned about the environment would use fewer disposables, have less food waste and would not pollute water by littering.



**Table 6.** Correlation statistics for openness-to-change, NEP, WEF Nexus Awareness and TERB

| Variables  | Openness-to-change | NEP      | Water-energy<br>nexus awareness | Water-food nexus awareness |
|--|--------------------|----------|---------------------------------|----------------------------|
| T1: Do not waste more water in hotels              | -0.065             | 0.012    | -0.091*                         | -0.032                     |
| T2: Do not throw garbage into water                | 0.098**            | 0.404*** | 0.473***                        | 0.282***                   |
| T3: Order properly or pack leftovers               | 0.120***           | 0.234*** | 0.225***                        | 0.245***                   |
| T4: Prefer organic food/restaurants                | 0.140***           | 0.218*** | 0.315***                        | 0.534***                   |
| T5: Turn off the electrical equipment when leaving | 0.012              | 0.149*** | 0.066                           | 0.034                      |
| T6: Prefer green travel                            | 0.136***           | 0.268*** | 0.392***                        | 0.233***                   |
| T7: Avoid using disposables                        | 0.196***           | 0.350*** | 0.361***                        | 0.346***                   |

Note: \* p<0.05 \*\* p<0.01 \*\*\* p<0.001

### 3.4 The Effects of WEF Nexus Awareness on TERB

The correlation analysis found that the correlation coefficient between water-energy nexus awareness and water-food nexus awareness was close to 0.4, which was greater than the correlation coefficient between the NEP and the two awareness types. The results of the correlation analysis (table 6) for the relationships between TERB and water-energy nexus awareness and water-food nexus awareness indicated that the two awareness types were correlated with different aspects of the TERB at differing degrees. First, focusing on the anti-waste TERB items associated with water, food and energy (T1, T3 and T5), water-energy nexus awareness and water-food nexus awareness were both positively and significantly related to T3 ( $\beta=0.225, p<0.001$ ) but not to T1 or T5. Second, with regard to the anti-pollution TERB items; T2, T4 and T6; the two awareness types were both positively and significantly correlated to them ( $p<0.001$ ), with the relationship with T4 being the strongest ( $r_1=0.315, r_2=0.534$ ). Finally, the water-energy nexus awareness and water-food nexus awareness were also both positively and significantly correlated with T7, the TERB item being not directly related to water, energy or food ( $r_1=0.361, r_2=0.346, p<0.001$ ).

In the regression results for the five TERB items (table 5), the R-square for both the T2 and T4 regressions exceeded 0.3, indicating that the two regression fitting effects are good. The R-square of the T6 and T7 regressions both surpassed 0.2, indicating that the two regression equation fitting effects were acceptable. However, the R-square for the anti-waste TERB (T3) regression was only slightly greater than 0.1, indicating that the effects of all the independent variables; water-energy nexus awareness, water-food nexus awareness and the NEP; were not obvious. Overall, however, the regression results were basically consistent with the correlation measurement conclusions that both water-energy nexus awareness and the water-food nexus awareness had positive effects on all TERB items except those related to anti-waste. In other words, if the college students had high water-energy or water-food nexus awareness, they would seldom pollute the water by littering garbage or using disposables just for convenience and would more often choose organic food and green transportation; therefore, H5 was not firmly supported and will be discussed in next section.

## 4 Discussion

### 4.1 Specific Environmental Knowledge and the Openness-to-change Affect WEF Nexus Awareness

The fact that the NEP explained less than 20% of water-energy nexus awareness and water-food nexus awareness was not expected. One of the reasons for these results may have been because of the lack of policy issues about any of the two food-energy-water nexus elements in Sichuan Province. The initial scale of the Water-food-energy Nexus Index scale was designed to assess public nexus awareness in the USA in which there were controversial hydraulic



fracturing practices and government policies that had begun to draw people's attention to the scientific and technical aspects of the nexus. However, as there had been no public events related to any two nexus elements at the same time in the respondents' living environment, this could explain the low water-energy and water-food nexus awareness in the college students, which weakened the positive effect of the NEP.

It is possible that specific knowledge about water, energy and food plays a greater role in the formation of water-food and water-energy nexus awareness. In early research, Hines et al. [18] stated that knowledge and education were important predictors of environmental awareness. Recent studies have also concluded that people with higher education levels were more concerned about the environment [19]. As the respondents in this research were college students, it was expected that their capacity to acquire knowledge would not hinder the formation of environmental beliefs. Besides general knowledge, some research has found that specific knowledge can be helpful in developing specific environmental beliefs. In particular, it has been found that consumers with greater knowledge about renewable energy tended to believe that biofuels would help improve the environment. In general, compared to the NEP, specific knowledge could more influence specific beliefs.

Openness-to-change was found to have a positive correlation with water-food nexus and water-energy nexus awareness and positively influenced two beliefs. Students more open to change were more likely to be aware of the water-energy and water-food nexus by acquiring more knowledge about the three elements. It was noted that younger generations who had a greater openness-to-change were more willing to accept innovative knowledge and ideas. Therefore, people with higher education should be more aware of the nexus in environmental protection and have greater knowledge of environmental issues. In accordance with Vicentemolina et al. [3], people are able to learn more about the environment through traditional media (such as TV or newspaper), the internet, and social interactions (with families or friends etc.). College students with high levels of openness-to-change usually have active minds and good social skills so that they can make full use of these platforms to acquire information, which gives them more chances to encounter new ideas about the environment or even the water-energy-food nexus. As a result, they can gain insights into new knowledge in a variety of ways and finally accept it thoroughly. Generally speaking, the more open a college student is, the more they are to the water-energy and water-food nexus, possibly because of greater exposure to specific knowledge.

## **4.2 Other Specific Beliefs for the NEP Influences on TERB**

The R-square was not found to be very high in the multiple regression when the water-energy-food nexus awareness was the dependent variable and NEP was the main independent variable, however, the NEP was found to significantly influence most TERB items. It has been suggested that there are other specific beliefs through which NEP can have an effect on someone's environmentally responsible behaviors, such as, the awareness of consequences (AC), the ascription of responsibility (AR) and the belief that specific actions can make a difference. AC refers to an individual's awareness of the adverse consequences of performing or not performing a specific behavior and AR refers to the sense of responsibility of performing or not performing a specific behavior. Therefore, besides the water-energy-food nexus awareness, there were several specific beliefs found to be mediators between the NEP and TERB.

## **4.3 CGBs Hinder the Occurrence of TERB**

Unexpectedly, NEP, water-food and water-energy nexus awareness, and openness-to-change were not found to be significantly related to T1 and T5, and the R-square for T3 in the regres-

sion was lower than for other TERB items even though there was a significant positive correlation, which indicated that beliefs and openness-to-change were less effective in explaining anti-waste TERB based on VBN theory. Previous research has also found that college student tourists might not put environmental conservation high on their priority lists. It is possible that the compensatory green beliefs (CGBs) play an important role in the process. In line with our research, CGBs have been mainly used to explain conflicts and contradictions between an individual's current or past behaviors rather than future behavioral intentions .

CGBs were derived from the “compensatory beliefs” in health research and were developed to explain the inconsistencies in people's environmentally responsible behaviors. Psychologists Patrik et al. [20] recently concluded that CGBs were a type of the balancing heuristic that make people act against their intentions of doing something good when faced with climate change. Hope et al. [21] considered the nature of CGBs cumulative and holistic, which is opposite to the idea that CGBs have the feature where specific compensatory actions are pitted against one another in an earlier attempt to measure CGBs. Nonetheless, both views can help in understanding why college students tend to have greater waste when travelling and also why it is difficult for VBN theory to fully explain it. The VBN's lack of effectiveness in this study can be divided into two dimensions. First, NEP, awareness of water-food and water-energy nexus and openness-to-change are possibly less powerful in explaining environmentally responsible behavior when travelling than in daily life, and second, they are less powerful in explaining anti-waste TERB than anti-pollution TERB.

Firstly, to some extent, the endorsement and use of CGBs depend on how moral someone feels it is to take a certain action. Unlike other behaviors, TERB can be seen as a “grey zone” for moral judgments. The “minimum” and “maximal” moral standards may relate more to the fact that some forms of compensation appear to be more acceptable than others, with travel behaviors being judged using the latter. In other words, people may be committed to environmentally responsible behavior in their daily lives, and may not be so responsible or even feel bad about it when travelling.

Secondly, as water, energy and food waste does not seem to directly harm the environment and the negative effect is not directly evident, it is easier for tourists to make use of CGBs to rationalize their waste. According to Rabiau et al. [22], it is more likely that compensatory beliefs occur when the behavior is “moderately” tempting. Moreover, present research has also found that CGBs are often used as a strategy to reduce the guilt of not being as responsible for the environment as one should be.

Thirdly, the inconvenience of practice is one of the main reasons students avoid TERB and use CGBs. Hope et al. [21] pointed out that it was more possible for respondents to endorse CGBs if pro-environmental behavior would require greater costs. Further, tourists often prefer activities that can bring them direct value rather than restrict their travel experiences or make them suffer the inconvenience. Particularly, when considering whether to “pack the leftovers”, the tourist preference for convenience would overrule TERB; that is, fewer tourists would be willing to pack leftovers if they had to take the food all the way back to the hotel and heat it up by themselves the next day.

In addition, numerous researchers also suggested that tourists often waste more when away from home in a hotel as they are pursuing luxury, which can also result in CGBs. Some studies have focused on the differences between pro-environmental behaviors in hotels and at home from the perspective of recycling and reuse [23]. To explain why tourists seldom take environmental factors into account, Carr [24] suggested that behavior at home was driven by the residual culture while the tourism culture was the driving force when on holiday. Therefore, it was easy for college student tourists to accept CGBs and waste more water or energy in hotels and order too much at restaurants.

There were some potential explanations for the results in section 3. The lack of policy issues and specific knowledge could have led to the insignificant causal relationships between NEP and water-energy-food nexus awareness. However, openness-to-change was found to assist college students to acquire greater knowledge regarding the connections between water, energy and food. Besides water-food and water-energy nexus awareness, NEP was able to positively influence TERB via AC, AR and the belief that one's action makes a difference. Last but not least, due to lower morality and a preference for convenience and luxury, CGBs could make it harder to practice TERB, which would lead college student tourists to waste more water, energy and food when travelling.

## 5 Conclusions

With college students as the research object, this study focused on tourists' environmentally responsible behavior. Based on the VBN theory, the study creatively explored a specific path from values to TERB. The assessment and regression analyses found that college student TERB as regards water, energy, food and using disposables was significantly influenced by their water-energy-food nexus awareness, the NEP and indirectly by their values.

For the effects of values on environmental awareness, it was found that holding both biospheric and altruistic values orientation were positively related to NEP, while holding egoistic value was not. It was also found that water-energy nexus awareness and water-food nexus awareness were positively affected by the NEP and openness-to-change. The NEP, water-energy nexus awareness, and water-food nexus awareness were found to have positive effects on all TERB items except anti-waste ones.

As some of the data analysis results were surprising, this study also examined the specific formation mechanism for water-energy nexus awareness and water-food nexus awareness as well as the causes and obstacles to TERB, from which it was concluded that measures should be taken to further promote anti-waste TERB. It is suggested that restaurants and hotels should remind customers to order food properly while offering free package services and non-disposable or recyclable items. Comprehensive environmental education from tourism management should also be offered to tourists to remind them to be environmentally responsible consistently.

As there has been little research on water-energy-food nexus awareness, the possible causalities found in this study should be viewed with caution. Further investigations are required to measure energy-food nexus awareness and introduce water-energy-food nexus awareness into developed theories.

## References

- [1] B. Hausas, K. Yagoubi, *American Economic Review* **76**, 84 (2005)
- [2] F. Shi, D. Weaver, Y. Zhao, M.F. Huang, C. Tang, Y. Liu, *Tourism Management* **70**, 59 (2019)
- [3] M.A. Vicente-Molina, A. Fernández-Sáinz, J. Izagirre-Olaizola, *Journal of Cleaner Production* **61**, 130 (2013)
- [4] J. Thøgersen, F. Ölander, *Journal of economic psychology* **23**, 605 (2002)
- [5] P.G. Harris, *Environment and behavior* **38**, 5 (2006)
- [6] I. Vermeir, W. Verbeke, *Journal of Agricultural and Environmental ethics* **19**, 169 (2006)
- [7] P.W. Schultz, S. Oskamp, *Social psychology quarterly* pp. 375–383 (1996)
- [8] P.C. Stern, T. Dietz, T. Abel, G.A. Guagnano, L. Kalof, *Human ecology review* pp. 81–97 (1999)

- [9] M. Grubb, D. Ulph, *Oxford Review of Economic Policy* **18**, 92 (2002)
- [10] K.E. Portney, B. Hannibal, C. Goldsmith, P. McGee, X. Liu, A. Vedlitz, *Environment and Behavior* **50**, 375 (2018)
- [11] P. Hellegers, D. Zilberman, P. Steduto, P. McCornick, *Water Policy* **10**, 1 (2008)
- [12] H. Hoff, SEI: Stockholm Environment Institute (2011)
- [13] M. Gulati, I. Jacobs, A. Jooste, D. Naidoo, S. Fakir, *Aquatic Procedia* **1**, 150 (2013)
- [14] J. Lazarus, *Water Resources Impact* **12**, 12 (2010)
- [15] A. Endo, I. Tsurita, K. Burnett, P.M. Orenco, *Journal of Hydrology: Regional Studies* **11**, 20 (2017)
- [16] H. C, Master's thesis, National Cheng Kung University, Tainan (2008)
- [17] L. X, Master's thesis, Beijing Forestry University, Beijing (2012)
- [18] J.M. Hines, H.R. Hungerford, A.N. Tomera, *The Journal of environmental education* **18**, 1 (1987)
- [19] D. RE Cotton, I. Alcock, *Studies in Higher Education* **38**, 1457 (2013)
- [20] T. Kessler, J. Neumann, A. Mummendey, A. Berthold, T. Schubert, S. Waldzus, *Personality and Social Psychology Bulletin* **36**, 1213 (2010)
- [21] A.L. Hope, C.R. Jones, T.L. Webb, M.T. Watson, D. Kaklamanou, *Environment and behavior* **50**, 401 (2018)
- [22] M. Rabia, B. Knäuper, P. Miquelon, *British journal of health psychology* **11**, 139 (2006)
- [23] S. Wearing, S. Cynn, J. Ponting, M. McDonald, *Journal of Ecotourism* **1**, 133 (2002)
- [24] N. Carr, *Annals of Tourism Research* **29**, 972 (2002)