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## ATTITUDES AND BEHAVIOR FOR SUSTAINABLE TEAM PERFORMANCE

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ATTITUDES AND BEHAVIOR FOR SUSTAINABLE  
TEAM PERFORMANCE

BY

MD. HASAN SHAHRIAR SIMANTO

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF  
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2018

MASTER OF SCIENCE IN SYSTEMS ENGINEERING  
OF  
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## **ABSTRACT**

As climate change in conjunction with the fourth wave of industrialization necessitates the world to move toward a sustainable future, research needs to focus on the intertwined connection between team work and sustainability. Currently, it is unknown whether teams that are successful at accomplishing sustainability-related tasks have different team composition than the teams who are not. This research explored the composition of teams performing sustainability-related tasks in regard to the individuals' pro-environmental attitude, individuals' self-reported pro-environmental behavior, individuals' pro-environmental identity and team cohesion. Data was collected on real-world teams at the U.S. Department of Energy Solar Decathlon, which is a biennial, international competition to inspire collegiate students and faculty to design, build, and operate energy-efficient solar-powered homes. Established tools were used to measure individuals' pro-environmental attitude (NEP scale), individuals' self-reported pro-environmental behavior (PEB scale), individuals' pro-environmental self-identity (PESID scale), and team cohesion (TC scale). Regression models suggest that neither pro-environmental attitude, nor pro-environmental behavior, nor pro-environmental self-identity were a significant predictor for team performance on a sustainability-related project. Team cohesion's standard deviation was a significant predictor of team performance on a sustainability-related project; indicating that the convergence of individuals' perceptions of the overall team working together toward achieving this particular project directly aligned with a successful outcome. Furthermore, a posteriori explorations identified a difference in team composition between sustainability-related project performance and overall team performance.

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Last but not the least, I would like to thank my family for always believing in me and supporting me throughout my academic career.

## **PREFACE**

The basis for this research originally stemmed from my passion for sustainability. I'm really grateful for my major professor for introducing me to the sector of human factors in regards to sustainability.

This thesis was prepared using manuscript format.

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# MANUSCRIPT

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## **Attitudes and Behavior For Sustainable Team Performance**

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## INTRODUCTION

The fourth industrial revolution has triggered an overwhelming change in every aspect of the world, especially with economic and social systems (Schwab, 2017). In this rapidly transforming world, where stakes are high for every decision made, collaboration and connectivity is more important than ever and will continue to be so throughout the 21st century. Moreover, failure to make the correct decisions with respect to climate change and global sustainability could turn out catastrophic. Therefore, climate change in conjunction with the fourth wave of industrialization necessitates the world to move toward a sustainable future. Regardless of system level or domain specific issues, transformations toward sustainability require collaboration and teamwork as keys to success in a globalized network. Furthermore, research should focus on the interconnectedness between team work and sustainability.

In order to move toward a sustainable future, a comprehensive concept of sustainability is mandatory. Nonetheless, sustainability is complex but based on a simple idea of creating and maintaining conditions so that humans and nature can exist in productive harmony to support present and future generations. In other words, sustainability is the “possibility that human and other forms of life will flourish on the planet forever” (Ehrenfeld, 2008). Despite rigorous methods to define sustainability (Basiago, 1995), the term can be confusing and subject to misinterpretation. Sustainability became a global conversation topic when it was defined by the Brundtland report, commissioned by the General Assembly of the United Nations (UN)

in 1984: “Humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs”. Even though the Brundtland Report is still one of the most recognized attempts to define sustainability, the report defined sustainable development rather than sustainability. Brown et al. (1987) took an approach to break down all of the essential elements defining global sustainability based on different themes. Later, Hawken et al. (1999) looked at different facets of sustainability (i.e., economic and environmental) and proposed the idea of natural capitalism, a whole systems approach, to achieve sustainability. Sustainability was separated into three factors (i.e., environmental, economic, social)—“the three pillars of sustainability”—a framework adopted by the 2005 UN World Summit. Colloquially, these three factors are known as Planet, Profit and People. However, in recent years, the focus of sustainability has concentrated on more specific perspectives, such as corporate sustainability, social sustainability, sustainability in information systems, systems perspectives of sustainability, sustainable engineering, and biological sustainability (Graedel & Allenby, 2010; Abraham, 2005; Morse, 2010). The definition has expanded to now encompass the UN Sustainable Development Goals. A set of 17 goals (poverty, zero hunger, clean water and sanitation, climate action, etc.) was adopted by countries to end poverty, protect the planet and ensure prosperity for all. However, defining sustainability is not the same as achieving sustainability. In order to achieve sustainability, a systems approach is necessary due to incalculable interdependencies required to accommodate all aspects of sustainability (Zink, 2014). Moreover, according to Docherty et al. (2009), “only people and groups who operate sustainably are able to

grasp, prioritize, and work toward ecological sustainability”. Furthermore, to discuss sustainability from a human factors perspective, looking at the team-level of systems should be as important as those at the individual-level.

Since the use of teams within organizations has increased remarkably, understanding teams (i.e., team composition and performance) working in these systems in order to achieve sustainability is crucial. It is, therefore, essential to access and analyze team composition (Macht & Nembhard, 2015) and how it relates to sustainability-related projects. Considering the size of the problem, there is minimal team-level research on the relationships between environmental attitudes, environmental behaviors, and the links to generalizable team performance; not to mention, the divergent perspectives on what drives high team performance. The team composition of a sustainability related team project, regardless of scale, has yet to be explored, especially in the context of pro-environmental attitude and pro-environmental performance. Currently, it is unknown in the literature if there are any significant differences between the composition of the teams performing regular projects versus sustainability-related projects. Teams’ performance on sustainability-related projects plays an influential role toward the holistic approach of more sustainable systems on all levels and scales. Hence, research is needed to shed light on the relationship between team performance and a team’s propensity toward sustainability. The goal of this study is to explore whether there is a relationship between an individual’s perspective on sustainability, aggregated to a team level, and their team’s outcome on a sustainability-oriented project. The outcomes of this research will contribute to the literature on

whether teams that are required to achieve sustainable outcomes have different compositions (i.e., pro-environmental attitude, pro-environmental behavior, team cohesion) for high-team performance.

## REVIEW OF LITERATURE

The following literature review focuses on the team composition metrics in regard to an individuals' perspective on sustainability. The individual-level metrics explored were: the individuals' pro-environmental attitude, individuals' self-reported pro-environmental behavior, individuals' pro-environmental identity and team cohesion. The exploration of the ubiquitous team cohesion will be connected to examine how these teams performed beyond sustainability-centered metrics, with a more holistic approach to collaborative teamwork.

### **New Ecological Paradigm**

There are quite a few environmental attitude (EA) measures available in the literature, the three most commonly used being: the Ecology scale (Maloney & Ward, 1973; Maloney et al., 1975), the Environmental Concern scale (Weigel & Weigel, 1978), and the New Ecological Paradigm (NEP) scale (Dunlap & Van Liere, 1978; Dunlap et al., 2000; Hawcroft & Milfont, 2010). The latter of these three measures, the New Environmental Paradigm (NEP) scale (Dunlap & Van Liere, 1978) was revised and renamed as the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000), and

has become the most widely used measure of pro-environmental attitude (Harraway et al., 2012; Hawcroft & Milfont, 2010).

Since the introduction of the revised NEP scale, NEP on an individual level has been used in various domains, such as: higher education (Harraway et al., 2012; Karpudewan et al., 2012; Jowett et al., 2014), agriculture (Chua et al., 2016), recreation and tourism (Kil et al., 2014), home energy audit settings (Sprehn, 2014), psychology and economics (Clark et al., 2003), ecological economics (Choi & Fielding, 2013), electric vehicle adoption (Jansson et al., 2017), and species diversity and species conservation (Hunter & Rinner, 2004; Liordos et al., 2017). The NEP scale has been used mainly for two purposes: (1) to measure the change of environmental attitude, and (2) to explore the relationship between other psychological measures and behaviors. NEP has been proven to successfully capture ecological worldview and monitor changes of ecological worldviews due to different educational programs (e.g., classes) in order to evaluate the effectiveness of programs (Harraway et al., 2012; Jowett et al., 2014; Karpudewan et al., 2012). Chua et al. (2016) examined the relationships among value orientations, NEP, and pro-environmental personal norm (the moral obligation to protect the environment) in the agricultural context. The study found that NEP mediated the relationship between biospheric value (value concerned about the underlying human consideration on the environment when decision making) and pro-environmental personal norm, as well as the relationship between altruistic value and pro-environmental personal norm (Chua et al., 2016). Kil et al. (2014) examined the relationship between environmental attitudes, outdoor recreation motivations, and

environmentally responsible behaviors. They concluded that the environmental attitudes of nature-based hikers had a significant influence on their self-reported environmentally responsible behaviors, thus, suggesting a positive association between environmental attitudes and behaviors. To clarify the relationship between individual differences and decision-making, particularly in a home energy audit setting, Sprehn (2014) analyzed a detailed model consisting of cognitive style, personality, and NEP, and found that a positive shift in ecological paradigm increased the possibility of considering home energy reports useful. In the ecological economics context, Choi & Fielding (2013) investigated the relationship between environmental attitudes and the behavioral intention involving endangered species. They confirmed findings of environmental attitudes as a significant motivator for conservation values, particularly involving endangered species. However, it is not necessary to see a relationship between attitude and behavior. Jansson et al. (2017) analyzed the influence of norms (personal and social), ecological attitudes, and interpersonal influence in the form of opinion leading and opinion seeking on Electric Vehicle (EV) adoption. According to Jansson et al. (2017), adherence to the NEP was not significantly related to EV adoption. Furthermore, Gatersleben et al. (2002) conducted two large-scale field studies among representative samples of Dutch households and concluded that respondents who indicate that they behave more environmentally (behaviors according to psychological studies) do not necessarily use less energy (actual environmental impact). Whitmarsh (2009), based on a postal recruitment study, found that the reasons behind actions taken to conserve energy were unconnected to the environment. Whitmarsh (2009) also concluded the actions which are easier to perform are more likely to be linked to pro-environmental



attitude. On the other hand, actions that require sacrifice tend to link to circumstances. Therefore, generally the literature is conflicted in this particular genre even at an individual-level and can be quite conditional based on various levels of situations.

Young et al. (2013), additionally, conducted a multi-disciplinary literature review on organizational-based behavior incentives focusing on the research that looked at the actual performance. While most of the researchers looked at individual-level behavior, Young et al. (2013) considered a group-level actual behavior review and concluded that attitude change is not necessarily a prerequisite for behavior change in the workplace.

While the NEP scale is widely accepted and extensively utilized in psychology (Hawcroft & Milfont, 2010), the relationship between NEP and task performance behavior has yet to be thoroughly explored. The study by Sprehn (2014) required participants to review energy audit reports to identify their cognitive style, but this was at an individual-level task, not a team-level task. Although the literature review conducted by Young et al. (2013) focused on the actual pro-environmental behavior, most of the studies reviewed were focused at the group-level. Moreover, no direct link has been established between NEP and actual performance on a sustainability-related task. The main goal of this study is to explore the relationship between NEP, aggregated to the team-level using standard arithmetical methods, and the team performance of a sustainability-related project. Even though groups are oriented differently than teams, Young et al., (2013) is the closest indication that NEP does not relate to performance. Thus, the following supposition regarding NEP will be considered:

Hypothesis 1: Individual pro-environmental attitude, aggregated to the team-level, is not related to the team-level's actual performance on a sustainability-related project.

### **Pro-environmental Behavior**

In addition to attitudes, individuals' behavior is also worth exploring while evaluating team performance. There are numerous models of human behavior, as well as behavior changing strategies, to ensure positive environmental impact. Shu et al. (2017) summarized two main groups of strategies in the literature, while looking at ways to reduce resource consumption during the use phase of products: (1) antecedent versus consequence strategies, and (2) informational versus structural strategies. Antecedent strategies target factors that precede behavior, whereas consequence strategies aim to change consequences after behavior. On the other hand, informational strategies are defined as changing internal knowledge to norms without impacting the external environment or context for decision-making (Shu et al., 2017). Structural strategies include availability of products and services, legal regulation, and financial incentives (Steg and Vlek, 2009). Antecedent versus consequence energy-conservation strategies were categorized by Abrahamse et al. (2005) in a meta-analysis evaluating the effectiveness of interventions aiming to encourage households to reduce energy consumption. Furthermore, informational versus structural strategies were distinguished by Steg and Vlek (2009) in a review on the contribution and potential of environmental psychology for understanding and promoting pro-environmental

behavior. Psychologists have also developed models of human behavior that aim to identify factors affecting behavior and to explain the processes of behavior change.

One of the most commonly used models is the Value-Belief-Norm (VBN) Theory of Environmentalism by Stern (2000). The VBN approach offers a good account of the causes of the general tendency toward pro-environmental behavior. However, Stern (2000) concluded that a general theory on environmentally significant behavior lies far in the distance, hence, suggested a framework with multiple propositions (a statement or assertion that expresses a judgment or opinion) that can increase theoretical coherence. Among other propositions, the VBN framework includes the empirical proposition that attitudinal causes have the highest predictive power to predict behaviors that are less constrained by context or personal capabilities. This proposition was later supported by other studies that failed to find relationships between attitude and pro-environmental behaviors (Whitmarsh, 2009). Moreover, the environmental impact of any individual's behavior is small and has an environmentally significant impact at the aggregation level, when many people independently do the same things (Stern, 2000). Thus, how an individual's behavior is reflected in teams—at a larger, intermediary level impact—requires exploration.

Unlike studies to understand the relationship between pro-environmental attitude and self-reported pro-environmental behavior, very few studies have been conducted on the pro-environmental behavior and group level (Young et al., 2013) pro-environmental performance. Oftentimes, self-reported performance has been considered as a substitute

for actual performance due to the difficulties associated with measuring actual performance (Whitmarsh, 2009; Whitmarsh & O'Neill, 2010). Therefore, in this present study, both an actual team performance, along with self-reported performance aggregated to team-level, will be explored. The relationship between individuals' pro-environmental attitude and the self-reported pro-environmental behavior, aggregated to a team-level, will be analyzed. Furthermore, the relationship between individuals' pro-environmental behavior, aggregated to a team-level, and the actual team performance on a sustainable project will be explored. Additionally, the relationship between attitude and self-reported behavior at the individual-level will also be analyzed and compared with available literature. Thus, the following hypothesis regarding pro-environmental behavior will be considered:

Hypothesis 2a: Individual pro-environmental attitude is not related with individual self-reported pro-environmental behavior.

Hypothesis 2b: Individual pro-environmental attitude is not related with individual self-reported aggregated pro-environmental behavior, both (attitude, and behavior) aggregated at the team-level.

Hypothesis 2c: Individual pro-environmental behavior, aggregated to the team-level, is not related with the team-level's actual performance on a sustainability-related project.

### **Pro-environmental Self Identity**

Self-identity serves the purpose to differentiate oneself from others as well as to conform to the values, beliefs, and behaviors of social groups to which one belongs (Christensen et al., 2004; Whitmarsh & O'Neill, 2010). Self-identity has been used to improve the predictive power of intention and behavior models in various sectors with substantial independent effect (Sparks & Shepherd, 1992; Cook, Kerr, & Moore, 2002; Charng et al., 1988). Some studies have focused on the relationship between environmental behavior and identity. Van der Werff, Steg, & Keizer (2013) studied the relationship between biospheric values (value concerned about the underlying human consideration of the environment when decision making) and environmental self-identity and how both are related to environmental preferences, intentions, and behavior. Results indicated that biospheric values were related to preferences, intentions, and behavior via one's environmental self-identity. Gatersleben, Murtagh, & Abrahamse (2014) conducted a study using data from three studies on UK residents to examine the role of values and identities in explaining individual pro-environmental behaviors. Results showed that self-identity played a mediating role in the link between values and behaviors. Mannetti, Pierro, & Livi (2004) looked at a more specific pro-environmental behavior (i.e., household recycling) to understand the relation between intention and variables derived from theory of planned behavior, as well as self-identity theory. Analysis based on structural equation modeling showed that personal identity contributes significantly and independently to the explanation of intentions to recycle. Therefore, pro-environmental self-identity variables are important to include in a model trying to predict pro-environmental behavior. However, incorporation of self-identity

variables in a model that looks at the team-level performance on a sustainability-related project instead of individual-level is currently unknown. Thus, the following hypotheses regarding pro-environmental self-identity will be explored in this research:

Hypothesis 3a: Individual pro-environmental self-identity is related with individual self-reported pro-environmental behavior.

Hypothesis 3b: Individual pro-environmental self-identity is related with individual self-reported pro-environmental behavior, both (identity, and behavior) aggregated at the team-level.

Hypothesis 3c: Individual pro-environmental self-identity, aggregated to the team-level, is related with the team-level's actual performance on a sustainability-related project.

### **Team Cohesion**

Salas, Estrada, & Vessey (2015) extensively summarized that the researchers from diverse fields such as organizational sciences (e.g., Mach, Dolan, & Tzafrir, 2010), public health (e.g., Zelner et al., 2012), sociology (e.g., Portes & Vickstrom, 2011), clinical psychology (e.g., Lerner, McLeod, & Mikami, 2013), and sports psychology (e.g., Callow, Smith, Hardy, Arthur, & Hardy, 2009) have used cohesion and related the construct to important outcomes within their specific fields.

Although some of the studies used team cohesion as an important factor to consider for team performance (Mach, Dolan, & Tzafrir, 2010), most other studies focused on the factors affecting cohesion itself (Callow et al., 2009; Portes & Vickstrom, 2011). Furthermore, there is limited to no research on the impact of team cohesion on team performance in sustainability-related projects. Salas et al. (2015) conducted a meta-analysis on team cohesion and re-iterated that team cohesion is essential for team effectiveness and performance, and more future research on real world large-scale teams is necessary. Therefore, team cohesion is considered as a factor in this present study. Team cohesion will be considered at the aggregated team-level to understand its impact on team performance in a sustainable-project. The following hypothesis regarding team cohesion will be explored:

Hypothesis 4: The individual self-reported cohesion, aggregated to the team-level, is related with the team-level's actual performance on a sustainability-related project.

## METHODOLOGY

The goal of this study is to explore whether there is a relationship between an individual's propensity for sustainability and an individual's environmental behaviors, aggregated to a team level, and their team's outcome on a sustainability-oriented engineering project. The research was conducted in a field setting. The field setting data was collected at the U.S. Department of Energy Solar Decathlon with participating

teams. A scientifically validated measure of individual preference for the environment and sustainability, New Ecological Paradigm (NEP) Scale, was used to collect data. In addition to the NEP scale, other validated measures were collected and analyzed in the field: (1) identifying individuals' environmental actions, pro-environmental Behavior (PEB) Scale, (2) pro-environmental self-identity scale (PESID), a validated measure of individual pro-environmental identification, and (4) team cohesion (TC) scale, a validated measure of team cohesiveness. Each of these measures were looked at with relationship to each other at both the individual- and team-level and their relationship to team performance on a sustainability-oriented project.

### **Teams & Task**

The U.S. Department of Energy Solar Decathlon is a biennial, international competition to inspire collegiate students and faculty to design, build, and operate energy-efficient solar-powered homes. Since this research is focused on understanding team composition for a sustainable outcome, the Solar Decathlon is suitable to study individual team members, as well as their team performance. Because the Solar Decathlon requires teams to create solar powered homes and promotes clean energy, it can also serve the purpose of a sustainable project.

The U.S. Department of Energy Solar Decathlon 2017 consists of 10 contests: architecture contest (juried), water contest (juried), market potential contest (juried), health and comfort contest (juried), engineering contest (juried), appliances contest (measured), communication contest (juried), home life contest (measured), innovation



contest (juried), and energy contest (measured). These decathlon contests are subjectively measured by industry experts (juried) in seven out of the ten contests and objectively measured via house performance data (measured) in the remaining three contests. Team performance for this project will be classified as the total team performance score for all contests and the one team performance score on sustainability. One specific contest out of the ten contests, the innovation contest (juried), has a sub-category named ‘sustainability’. Each team is evaluated on the sustainability sub-category based on the following three criteria:

(1) How well does the team integrate sustainable design, detail, product, and performance decisions into the competition prototype house?

(2) To what extent does the team holistically integrate passive strategies, materials selection, life cycle, and local strategies to maximize sustainability?

(3) To what extent do the innovations have immediate and long-term environmental, social, cultural, and commercial potential?

Since the innovation contest is subjectively measured, the jury rated teams on each criteria using the following categorical evaluation: eclipses (contest criteria 91% – 100% of available points), exceeds (contest criteria 81% – 90% of available points), equals (contest criteria 61% – 80% of available points), and approaches (contest criteria 0% – 60% of available points). A scale for the sustainability sub-category is created by assigning four points to the eclipses rating, three to exceeds, two to equals, and one to approaches for each criteria. This ratings to point conversion creates a sustainability

scale (highest being 12 and lowest being 3) which is used for the team performance on sustainability score.

For the U.S. based university teams, at the individual-level, more than 90% of the sample student population active in the 2017 Solar Decathlon are STEM majors. With respect to age, 73.63% of the students are between 19-25 years whereas 23.08% of the students are between 26-32 years. There are 31 graduate students (M.S. [25] and Ph.D. [06]), and 60 undergraduate students (5th year Senior [12], Senior [30], Junior [10], Sophomore [05], Freshman [03]). Based on those who were present in Denver, Colorado in Fall 2017, there are two teams of 13, two teams of 10, two teams of 7, one team of 14, and one team of 8, and one team of 9.

## **Measurement Tools**

### ***New Ecological Paradigm***

The New Ecological Paradigm (NEP) is a 15-item self-reported survey that examinees answer using a 5-Likert scale of strongly disagree (1) to strongly agree (5). The positive and negative balance of the 15-items was maintained in such a way that agreement with the eight odd-numbered items and disagreement with the seven even-numbered items indicate pro-NEP responses. The NEP scale can be treated as either a unidimensional scale (i.e., overall NEP [NEP<sub>O</sub>]) or as a multidimensional scale with its five correlated subsets (i.e., the Reality of Limits to Growth [item number 1, 6, and 11], Anti-Anthropocentrism [item number 2, 7, and 12], the Fragility of Nature's Balance [item number 3, 8, and 13], Rejection of Exemptionalism [item number 4, 9, and 14],

and the Possibility of an Eco-crisis [item number 5, 10, and 15]) (Dunlap et al., 2000). The overall NEP is measured by the average of the ratings of all the 15 items (highest overall NEP score being 5). Similarly, each multidimensional scale of NEP is measured by the average of the rating of all the corresponding items (highest multidimensional NEP score being 5).

Although NEP is a widely used measure for environmental attitudes, the dimensionality of NEP scale is critical. Amburgey & Thoman (2012), using confirmatory factor analysis (CFA), questioned whether NEP should be treated as (a) one scale, (b) a set of independent scales, or (c) a set of correlated subscales. The study recommended that future NEP research should use CFA to accurately represent the five interrelated facets structure. If CFA is unavailable, treating the scale as five correlated subscales is preferred over treating the NEP as a singular score (Amburgey & Thoman, 2012). However, Dunlap et al. (2000) also mentioned that it is possible to have a different number of NEP dimensions based on the nature of the sample population. Though Dunlap et al. (2000) assumed that NEP is best represented as a correlated scale of five facets, the multi-structured NEP scale has been used in very few research studies (Sprehn, 2014; Davis & Stroink, 2016). Thus only a unidimensional, overall scale of NEP was tested by the only research that referred to pro-environmental attitude-team performance on academic settings (Simanto & Macht, 2017). Simanto & Macht (2017) also tested the confirmatory factor analysis (CFA) approach recommended by Amburgey & Thoman (2012) and concluded that an increased number of participants could improve CFA model fit.

As NEP is an individual measure and team performance is a team measure, NEP scores need to be aggregated to a team level measure. Individual team members' NEP scores were aggregated to generate statistics for the team as a whole. Each team obtained two metrics for each NEP score: mean and standard deviation. Standard arithmetical statistical equations were used to calculate aggregated mean and standard deviation.

### ***Pro-environmental Behavior***

While finding ways to change environmentally important behaviors, Stern (2000) looked at environmental intent and environmental impact distinctions and introduced the Value-Belief-Norm (VBN) theory after thoroughly reviewing the definitions, classifications and concerns of pro-environmental behaviors. People may act in ways that are pro environmental in intent, however, sometimes, that in fact have little or no positive environmental impact (Stern, 2000). Furthermore, based on a recent study led by DEFRA (2008a), twelve headline behaviors within four domains including both low and high impact environmental actions were identified (Whitmarsh & O'Neill, 2010). For example, "domestic energy/water" behavior domain with four headline behaviors: installing insulation products, better energy management and usage, installing domestic microgeneration through renewables, and more responsible water usage. However, due to the broadness of those headline behaviors, Whitmarsh & O'Neill (2010) disaggregated these activities where appropriate and created separate items that refer more specifically to those headline behaviors. Additionally, 24 items out of those created items that refer to headline behaviors were used to develop a pro-environmental

behavior (PEB) scale ( $\alpha = 0.92$ ) (Whitmarsh & O'Neill, 2010). Since our study sample was of multi-level college/university students, items such as “*When was the last time you bought or built an energy-efficient home?*” were excluded and 17 items out of the 24-item PEB scale were used based on the relevance to the age range of the sample. These items ask respondents to indicate how often they take different actions. The PEB scale used in this study is a 4-Likert scale of never (i.e., 1), occasionally (i.e., 2), often (i.e., 3), and always (i.e., 4). The summation of points from each items is considered to be an overall individual PEB score. Therefore, the PEB scale used here has a score between 17 and 68 (highest being 68).

Since, PEB is an individual measure and team performance is a team measure, PEB scores also need to be aggregated to a team level before examining the relation between self-reported PEB and actual team performance. Each team obtained two metrics for PEB score: mean, and standard deviation.

### ***Pro-environmental Self Identity***

A pro-environmental self-identity (PESID) scale, developed using measures adapted from previous research (Cook et al., 2002; Sparks & Shepherd, 1992) will be used in this research. Four items: “I think of myself as an environmentally-friendly consumer”, “I think of myself as someone who is very concerned with environmental issues”, “I would be embarrassed to be seen as having an environmentally-friendly lifestyle” (scoring reversed), and “I would not want my family or friends to think of me as someone who is concerned about environmental issues” (scoring reversed) – were

measured on a 5-Likert agreement scale of strongly disagree (1) to strongly agree (5) and formed a reliable scale ( $\alpha = 0.7$ ) (Whitmarsh & O'Neill, 2010). The positive and negative balance of the 4-items was maintained in such a way that agreement with the two items and disagreement with the other two items indicate pro-environmental self-identity responses. The average of the 4-item points is considered as an overall individual PESID score. Therefore, the PESID scale used here has a continuous score between 1 and 5 (average of 4-item points, highest being 5).

Since, PESID is an individual measure and team performance is a team measure, PESID scores need to be aggregated to a team level before examining the relation between PESID and team performance (both aggregated team level self-reported PEB and actual team performance). Each team obtained two metrics for PESID score: mean, and standard deviation.

### ***Team Cohesion***

Throughout the decades, multiple researchers have debated in pursuit of a coherent definition of the team cohesion. Even though traditionally cohesion was regarded as a unidimensional construct, to enrich the theory of cohesiveness, a multidimensional construct was suggested (Mullen and Copper, 1994). Carless & De Paola (2000) adopted the multidimensional view of cohesiveness and established a metric of team cohesion using a 10-item, 9-likert scale that loads onto three factors: (a) task cohesion, the extent to which the team is united and committed to achieving the work task; (b) social cohesion, the degree to which team members like socializing together; and (c) individual

attraction to the group, the extent to which individual team members are attracted to the group. In a recent study, Salas et al. (2015) reviewed the literature of team cohesion to help researchers find consistent, reliable, and significant cohesion-to-performance relationships and made suggestions on dimensionality and team-level analysis. Based on the fact that there is still no one optimal approved method for collecting team cohesion, the Carless & De Paola (2000) method will be used because it abides by the fundamental principles presented by Salas et al. (2015).

Team Cohesion (TC) is a 10-item self-reported survey and examinees answer using a 9-Likert scale of strongly disagree (e.g., 1) to strongly agree (e.g., 9) (Carless & De Paola, 2000). However, recent research has shown that the cohesion-performance relationship was larger when measures used 5-Likert or 7-Likert scale (Salas, Vessey, & Landon, 2017). For this research, a 5-point Likert scale will be used for the team cohesion items to ensure better outcome and maintain consistency with the other measurements. The positive and negative balance of the 10-items was maintained in such a way that agreement with the four items and disagreement with the other 6 items indicate positive team cohesion responses. Therefore, the Team Cohesion (TC) scale used here has a score between 1 and 5 (the average of all 10-item points, with the highest being 5).

Unlike NEP, PEB, and PESID, it has long been unclear whether team cohesion is an individual or team measure (Casey-Campbell & Martens, 2009). In a meta-analysis, Salas et al. (2015) mentioned that authors of 37% of studies on team cohesion

considered team cohesion as a team measure whereas 14% concluded it was a multi-level measure. Moreover, 40% of the study failed to clarify the conceptualization. Fortunately, there was an agreement that team cohesion should not be solely considered as an individual measure (Salas, Grossman, Hughes, & Coultas, 2015). Since analytical strategies seem to favor team-level measure as aggregation of team cohesion frequently yielded significant results (Salas, Grossman, Hughes, & Coultas, 2015), TC is considered as a team measure in this study. Therefore, TC scores need to be aggregated to a team level using standard aggregation methods. Each team obtained two metrics for TC score: mean, and standard deviation.

Due to technical error in the data collection process, 16 out of the 91 individuals' team cohesion data were recorded as 7-Likert scale (strongly disagree, disagree, somewhat disagree, neutral, somewhat agree, agree, and strongly agree) and the rest of the 75 individuals' as 5-Likert scale. To convert the 7-Likert data to 5-Likert data, all the somewhat disagree responses were considered as between disagree and neutral of the 5-Likert scale.

### ***Internal Consistency***

The internal consistency reliability was analyzed, using the Cronbach alpha test, for the scales used in the data collection on this specific sample. The overall NEP scale has an alpha of 0.76, the PEB scale has an alpha of 0.84, the PESID has an alpha of 0.61, and the TC has an alpha of 0.76. Apart from the PESID scale, internal consistency for other unidimensional scales measured by alpha are relatively higher and acceptable.



With further investigation, the items of PESID revealed a pattern where positively asked questions had a higher correlation ( $r = 0.45$ ;  $p < 0.001$ ) with the other positively asked question. A similar but opposite trend was also true where reversed coded questions were statistically significantly correlated ( $r = 0.69$ ;  $p < 0.001$ ). Therefore, highly correlated items are grouped together to create two separate factors for the PESID measure: PESID<sub>P</sub> (i.e., positively coded questions) and PESID<sub>R</sub> (i.e., reversed coded questions), along with one single measure of PESID overall (PESID<sub>O</sub>).

As recommended by Amburgey & Thoman (2012), a CFA was used to verify the hypothesized five factors of NEP (Dunlap, Van Liere, Mertig & Jones, 2000). A CFA was executed at the individual-level using the *lavaan* package in R (Beaujean, 2013; O'Rourke & Hatcher, 2013; Rosseel, 2012). The CFA results are considered statistically significant if  $p$ -values are less than 0.05 for the Chi-Square test and the goodness-of-fit indices are met: the absolute index (Standardized Root Mean Square residual [SRMR]  $\leq 0.09$ ), parsimony index (Root Mean Square Error of Approximation [RMSEA]  $< 0.10$  and RMSEA CI90), and incremental index (Comparative Fit Index [CFI]  $\geq 0.90$ ) (O'Rourke & Hatcher, 2013). After running CFA on NEP data, the model did not converge. Therefore, an Exploratory Factor Analysis (EFA) was executed using the promax rotation to explore the dimensionality of the NEP scale using the *psych* package in R. A few of the NEP items were eliminated (NEP1, NEP2, NEP11, and NEP13) due to conflicting factor loading and very high uniqueness. Based on the eigenvalue greater than 1 criterion (Kaiser, 1974), a three factor model emerged in the EFA, and the three factors together accounted for a total of 41% of the variance.

**Table 1: Exploratory factor analysis loading on NEP three factor model**

	Factor 1	Factor 2	Factor 3
NEP3: When humans interfere with nature it often produces disastrous consequences	<b>0.53</b>		
NEP5: Humans are severely abusing the environment	<b>0.57</b>		
NEP15: If things continue on their present course, we will soon experience a major ecological catastrophe	<b>0.94</b>		
NEP9: Despite our special abilities, humans are still subject to the laws of nature		<b>0.51</b>	
NEP10: The so-called "ecological crisis" facing humankind has been greatly exaggerated (R)		<b>0.50</b>	
NEP12: Humans were meant to rule over the rest of nature (R)		<b>0.57</b>	
NEP7: Plants and animals have as much right as humans to exist		<b>0.50</b>	
NEP14: Humans will eventually learn enough about how nature works to be able to control it (R)			<b>0.43</b>
NEP4: Human ingenuity will ensure that we do not make the earth unlivable (R)			<b>0.50</b>

NEP6: The earth has plenty of natural resources if we just learn how to develop them (R)			<b>0.60</b>
NEP8: The balance of nature is strong enough to cope with the impacts of modern industrial nations (R)			<b>0.49</b>
Alpha Coefficients	0.75	0.65	0.59

Note: R=reverse coded. Factor loadings less than 0.40 were removed.

Table 1 represents the factor loadings of the three factor model of NEP. The mean item complexity index of this three factor model is 1.50. However, the alpha coefficients for these factors based on the sample size is not high. Therefore, it can be assumed there is not a strong consistency of the NEP multi-dimensionality for this specific sample. However, along with the unidimensional NEP score ( $NEP_O$ ), these new three factors ( $NEP_{F1}$ ,  $NEP_{F2}$ ,  $NEP_{F3}$ ) are also considered for future analysis. The first factor,  $NEP_{F1}$ , represents the perception of repercussions of actions.  $NEP_{F2}$ , the second factor, represents the order (or the tension) between human versus nature. And the third factor,  $NEP_{F3}$ , represents the resilience (both from the humans and nature's perspective).

To investigate the dimensionality of the Team Cohesion (TC) scale, a similar approach using EFA and CFA are taken. However, after running a CFA model on the TC data, the model did not converge. Therefore, an EFA is considered to check for dimensionality using promax rotation. Based on the eigenvalue greater than 1 criterion (Kaiser, 1974), a three factor model emerged in the EFA, and the three factors together

accounted for a total of 48% of the variance. A three factor EFA model on the TC data is represented in Table 2.

**Table 2: Exploratory factor analysis loading on TC three factor model**

	Task Cohesion (TKC)	Social Cohesion (SLC)	Individual Attraction to the group (IAG)
TC1: Our team is united in trying to reach its goals for performance	<b>0.59</b>		
TC2: I'm unhappy with my team's level of commitment to the task (R)	<b>0.58</b>		
TC3: Our team members have conflicting aspirations for the team's performance (R)	<b>0.66</b>		
TC4: This team does not give me enough opportunities to improve my personal performance (R)	<b>0.38</b>		
TC5: Our team would like to spend time together outside of work hours		<b>0.29</b>	0.42
TC6: Members of our team do not stick together outside of work time (R)		<b>0.84</b>	
TC7: Our team members rarely party together (R)		<b>0.61</b>	
TC8: Members of our team would rather go out on their own than get together as a team (R)		<b>0.63</b>	
TC9: For me this team is one of the most important social groups to which I belong			<b>0.72</b>
TC10: Some of my best friends are in this team			<b>0.81</b>
Alpha coefficients	0.64	0.74	0.74

Note: R=reverse coded. Factor loadings less than 0.40 were removed.

Table 2 represents the factor loadings of the three factor model of TC. The TC5-item seems to load highly on two factors even though according to the literature it should

load highly on social cohesion. Since, almost every item is following the loading pattern suggested in the literature, the decision to use item TC5 as a social cohesion item, as originally specified, is taken. Furthermore, the alpha coefficients for these factors based on the sample size is not very high. Therefore, it can be assumed that there is not strong consistency for TC multi-dimensionality for this specific sample. Both the unidimensional TC score (TC<sub>O</sub>) and these three confirmed factors in the literature (TC<sub>TKC</sub>, TC<sub>SLC</sub>, TC<sub>IAG</sub>) are also considered for further analysis.

### **Analysis**

Two statistical method, correlation, and regression, are used in corresponding steps. In the first step, individual level correlations are determined. Since the response variable's (PEB) distribution is normal (Shapiro-Wilk test,  $p > 0.05$ ), regression analysis was conducted to test individual-level hypothesis. In the second step, team-level correlations are determined, and regression analysis was also used to test team-level hypothesis. More statistically robust techniques, such as structural equation modeling, were not used based on the team sample size of nine U.S. college/university-based teams.

## **RESULTS & DISCUSSIONS**

The results of the analysis will be discussed in two steps: individual-level and team-level following the initial descriptive statistics. Each step (individual-level and team-

level) will start a correlation matrix and followed by regression analysis. Table 3 represents descriptive statistics of the individual measures.

**Table 3: Descriptive Statistics**

	M	SD	Variance	Skewness	Kurtosis
PEB	46.17582	7.544819	56.9243	0.1837426	2.800121
NEP <sub>O</sub>	3.671795	0.4324185	0.1869858	-0.01804894	2.59408
NEP <sub>F1</sub>	4.117216	0.6370721	0.4058608	-0.5389611	2.792435
NEP <sub>F2</sub>	4.115385	0.6024345	0.3629274	-0.4316162	2.596089
NEP <sub>F3</sub>	2.964286	0.6724452	0.4521825	0.2872498	2.700708
PESID	4.197802	0.5509039	0.3034951	-0.7292386	3.370952
PESID <sub>P</sub>	3.934066	0.6110501	0.3733822	-0.003765414	2.607013
PESID <sub>R</sub>	4.461538	0.8951436	0.8012821	-1.951757	6.279912
TC <sub>O</sub>	3.784615	0.5868793	0.3444274	-0.8683321	3.87324
TC <sub>TKC</sub>	4.071429	0.6836744	0.4674107	-0.705292	3.190513
TC <sub>SLC</sub>	3.728022	0.6725246	0.4522894	-0.4018411	3.213859
TC <sub>IAG</sub>	3.324176	1.072701	1.150687	-0.3553114	2.321612

Note: N = 91. M = mean. SD = standard deviation

Table 3 shows the descriptive statistics with the means, standard deviations, variances, skewness, and kurtosis of the individual level measures. The means column shows that the factors of each measurement have means somewhat close to their overall measurement. However, the standard deviation for one of the team cohesion factors, individuals' attraction to the group, is relatively high. Thus, the spread of the responses on individuals' attraction to the group was higher compared to other measures of team

cohesion. The skewness column shows a few interesting events as well. For example,  $NEP_{F1}$ , the factor that represents the perception of repercussions of actions is moderately negatively skewed. Similarly, the pro-environmental identity score on negatively asked items ( $PESID_R$ ) is highly negatively skewed, which means most of the respondents answers fall in the same place of the distribution with a relatively higher mean score. Furthermore, both the overall team cohesion and task cohesion, one of the factors of team cohesion, are moderately negatively skewed. This means that both population distributions have a similar score. The kurtosis column has a really high value for the pro-environmental identity score on negatively asked items ( $PESID_R$ ). The peak of this distribution is really high which means that when answering negatively asked questions, most of the respondents had higher scores on pro-environmental self-identity ( $M = 4.461538$ ).

## **Individual Level**

### *Correlations*

A correlation table of individual-level measures is presented in Table 4. Individual-level correlations are determined through the Spearman's correlation test ( $\rho$ ) since all the variables apart from PEB and  $NEP_O$  were not normally distributed. From Table 4, it is clear that apart from team cohesion each of the individual factors per metric slightly struggles to relate to each other. NEP overall and its factors are highly correlated excluding  $NEP_{F3}$  and  $NEP_{F1}$ . The same is true for  $PESID_O$  and its' two different groups of  $PESID_P$  and  $PESID_R$  are not correlated ( $r = 0.20$ ) and are not statistically significant;

this means that these factors of positive pro-environmental self-identity does not relate to reverse-coded pro-environmental self-identity.

**Table 4: Individual-level Correlation Matrix**

	1	2	3	4	5	6	7	8	9	10	11	12
PEB	1											
NEP <sub>O</sub>	0.20	1										
NEP <sub>F1</sub>	<b>0.35***</b>	<b>0.65***</b>	1									
NEP <sub>F2</sub>	0.14	<b>0.75***</b>	<b>0.48***</b>	1								
NEP <sub>F3</sub>	-0.04	<b>0.68***</b>	0.18	<b>0.38***</b>	1							
PESID <sub>O</sub>	0.12	<b>0.47***</b>	<b>0.29**</b>	<b>0.41***</b>	<b>0.27*</b>	1						
PESID <sub>P</sub>	<b>0.29**</b>	<b>0.28**</b>	<b>0.35***</b>	<b>0.22*</b>	-0.01	<b>0.69***</b>	1					
PESID <sub>R</sub>	0.00	<b>0.46***</b>	0.19	<b>0.39***</b>	<b>0.37***</b>	<b>0.80***</b>	0.20	1				
TC <sub>O</sub>	0.09	0.09	0.19	0.02	-0.09	0.17	0.14	0.13	1			
TC <sub>TKC</sub>	0.16	0.11	0.19	0.12	-0.04	<b>0.23*</b>	0.19	0.12	<b>0.69***</b>	1		
TC <sub>SLC</sub>	0.00	0.05	0.11	0.03	-0.05	0.01	-0.06	0.04	<b>0.80***</b>	<b>0.30**</b>	1	
TC <sub>IAG</sub>	0.07	-0.04	0.09	-0.20	-0.19	0.06	0.18	0.00	<b>0.72***</b>	<b>0.23**</b>	<b>0.50***</b>	1

Note: N = 91. (\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ )

NEP<sub>O</sub> does not correlate with PEB; thus, implying that individual attitude does not relate to individual behavior. Actually, no overall measurement (i.e., NEP<sub>O</sub>, PESID<sub>O</sub>, or TC<sub>O</sub>) correlates with statistical significance to behavior via PEB. However, that is not the case for relating PEB to factors, such as NEP<sub>F1</sub> and PESID<sub>P</sub>. However, NEP<sub>F1</sub> significantly correlates ( $p < 0.001$ ) with PEB even though the correlation coefficient is relatively weak ( $r = 0.35$ ). PESID<sub>P</sub>, the positively framed factor of PESID, has a weak, positive significant relationship with PEB ( $r = 0.29$ ;  $p < 0.01$ ); meaning, although statistically significant, it is unlikely going to consistently relate pro-environmental self-identity to pro-environment behavior.



In addition, PESID<sub>O</sub> is significantly correlated with NEP<sub>O</sub>, as well as the factors of NEP (Table 4). The only two correlations not statistically significant are NEP<sub>F3</sub> with PESID<sub>P</sub> ( $r = -0.01$ ) and NEP<sub>F1</sub> with PESID<sub>R</sub> ( $r = 0.19$ ). Although, the correlations vary from 0.22 to 0.47, they are all relatively weak correlations. Yet, there does appear to be a relationship between pro-environmental self-identity and pro-environmental attitude.

### ***Regression***

To further investigate the relationship between PEB and the factors of both NEP and PESID based on correlation from Table 4, three different regression models were used for predicting PEB. Only the significant models are represented here. Table 5 represents the ANOVA table for regression analysis to predict PEB from NEP<sub>F1</sub> variable.

**Table 5: ANOVA table for regression analysis to predict PEB from NEP<sub>F1</sub>**

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	519.8	519.78	10.05	0.002**
NEP <sub>F1</sub>	1	519.8	519.78	10.05	0.002**
Error	89	4603.4	51.72		
Total	90	5123.2			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model to predict PEB from NEP<sub>F1</sub> (coefficient +3.772,  $p = 0.002$ ) was significant ( $p = 0.002$ ) with a y-intercept of 30.64 ( $p < 0.001$ ), however, the prediction power was very low ( $R^2 = 0.101$ ;  $R_{adj}^2 = 0.094$ ). *Hypothesis 2a* predicted that individual pro-environmental attitude is not related with individual self-reported

behavior. *Hypothesis 2a* is supported when NEP is considered as a unidimensional construct since the model to predict PEB from  $NEP_O$  had marginal significance ( $p = 0.05$ ) and low prediction power ( $R_{adj}^2 = 0.02$ ). Yet, it is not supported when NEP is considered as a multidimensional construct. A significant positive relationship between  $NEP_{F1}$  (the facet that represent the perception of repercussions of actions) and PEB is found to be true, even though the prediction power is low. In other words, the attitude that represents the perception of repercussions of actions could predict pro-environmental behavior. Thus, *Hypothesis 2a* is conditional based on the level of dimensionality examined.

Table 6 represents the ANOVA table for regression analysis to predict PEB from both  $PESID_P$  and  $PESID_R$  variables. The regression model to predict PEB from both  $PESID_P$  and  $PESID_R$  is significant with a y-intercept of 40.44 ( $p < 0.001$ ). This model has low prediction power ( $R^2 = 0.124$ ;  $R_{adj}^2 = 0.105$ ) as well but does support that PESID represents over 10% of pro-environmental behavior. *Hypothesis 3a* predicts the relationship between individual pro-environmental self-identity and individual self-reported pro-environmental behavior; thus, supporting *Hypothesis 3a*. A significant positive relationship between  $PESID_P$  (coefficient +3.54,  $p < 0.01$ ) and PEB is found, along with a significant negative relationship between  $PESID_R$  (coefficient -1.832,  $p < 0.05$ ) and PEB. This relationship means the higher the pro-environmental self-identity in positively asked items, the higher the PEB. Conversely, the lower the pro-environmental self-identity in reversed coded items, the higher the PEB.

**Table 6: ANOVA table for regression analysis to predict PEB from PESID<sub>P</sub> and PESID<sub>R</sub>**

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	2	639.2	319.58	6.27	0.003**
PESID <sub>P</sub>	1	419.4	419.42	8.23	0.005**
PESID <sub>R</sub>	1	241.8	241.81	4.75	0.032*
Error	88	4484.0	50.95		
Total	90	5123.2			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Furthermore, another model incorporating all statistically significant correlations (i.e., PESID<sub>P</sub>, PESID<sub>R</sub>, and NEP<sub>F1</sub>) to PEB was used to predict behavior. Table 7 represents the ANOVA table for regression analysis to predict PEB from the NEP<sub>F1</sub>, PESID<sub>P</sub>, and PESID<sub>R</sub> variables.

**Table 7: ANOVA table for regression analysis to predict PEB from NEP<sub>F1</sub>, PESID<sub>P</sub>, and PESID<sub>R</sub>**

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	3	980.9	326.96	6.87	0.000***
NEP <sub>F1</sub>	1	341.7	341.72	7.18	0.009**
PESID <sub>P</sub>	1	193.0	192.97	4.05	0.047*
PESID <sub>R</sub>	1	275.6	275.60	5.79	0.018*
Error	87	4142.3	47.61		
Total	90	5123.2			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The model to predict PEB from NEP<sub>F1</sub> (coefficient +3.217,  $p < 0.01$ ), PESID<sub>P</sub> (coefficient +2.517,  $p < 0.05$ ), and PESID<sub>R</sub> (coefficient +2.517,  $p < 0.05$ ) was significant ( $p = 0.000$ ) with a y-intercept of 31.77 ( $p < 0.001$ ) and slightly better prediction power ( $R^2 = 0.191$ ;  $R_{adj}^2 = 0.163$ ). Therefore, the combined model (see Table 7) showed a better prediction capability while predicting PEB.

The individual level correlation table and regression analysis show that unidimensional NEP is not related to self-reported PEB, similar to other findings (Whitmarsh & O'Neill, 2010; Jansson et al., 2017; Whitmarsh, 2009). However, only one factor of NEP,  $NEP_{F1}$ , was able to increase the prediction power when combined with PESID to predict PEB (even though the overall prediction power was cumulatively around 17%). On the other hand, pro-environmental self-identity, grouped into two categories, were also a significant predictor for behavior. This PESID-PEB relationship is also supported by literature (Whitmarsh & O'Neill, 2010). In summary, *Hypothesis 2a*, which predicted no relationship between individual attitude and behavior, was supported when attitude was unidimensional. However, when treated as a multidimensional construct, attitude-behavior relationship was significant and did not support *Hypothesis 2a*. Supposition 3a predicted that there is a relationship between pro-environmental self-identity and pro-environmental behavior. Supposition 3a was supported when identity was treated as two groups of positively and reversed coded items. Moreover, a significant model with better predictive power was found to predict pro-environmental behavior when a multidimensional attitude variable and two identity variables (grouped as positively and reversed coded items) were considered as predictor variables.

## **Team Level**

### ***Correlations***

Correlation tables of team level measures is presented in Table 8 and Table 9. Team-level correlations are determined through the Pearson's correlation test since all the variables apart from Final Score (FS) were normally distributed. Correlation tables show that team performance in the form of Final Score (FS) of the Solar Decathlon 2017 is not correlated with other forms of team performances. However, the Innovation Contest (IC) score is strongly correlated ( $r = 0.94, p < 0.001$ ) with the Sustainability Score (SUS) since SUS is a subset of IC. From Table 8, it is also clear that FS significantly correlates with  $NEP_{FI\_AVG}$  ( $r = 0.81, p < 0.01$ ),  $PESID_{O\_STD}$  ( $r = 0.68, p < 0.05$ ),  $TC_{O\_AVG}$  ( $r = 0.87, p < 0.01$ ),  $TC_{TKC\_STD}$  ( $r = -0.81, p < 0.01$ ),  $TC_{SLC\_AVG}$  ( $r = 0.77, p < 0.05$ ), and  $TC_{IAG\_AVG}$  ( $r = 0.73, p < 0.05$ ).

Moreover, IC significantly correlates with  $PESID_{R\_AVG}$  ( $r = -0.68, p < 0.05$ ),  $TC_{O\_STD}$  ( $r = -0.87, p = 0.01$ ), and  $TC_{IAG\_AVG}$  ( $r = 0.81, p < 0.10$ ). However, SUS only correlates with  $TC_{O\_STD}$  ( $r = -0.86, p < 0.01$ ) and  $TC_{IAG\_AVG}$  ( $r = 0.86, p < 0.01$ ). Since IC and SS are highly correlated, it is also visible that both are significantly correlated with  $TC_{O\_STD}$  and  $TC_{IAG\_AVG}$ . From Table 8, it is clear that none of the aggregated pro-environmental attitude variables were significantly related to aggregated self-reported pro-environmental behavior except for the NEP factor that represents the order (or tension) between human verses nature. The correlation coefficient between  $NEPF2\_AVG$  and  $PEBAVG$  is  $r = 0.69$  ( $p < 0.05$ ). Since the correlation coefficient is positive, that means, the higher the attitude that represents the tension (or order) between

**Table 8: Team level correlation matrix**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FS	1													
IC	0.62	1												
SUS	0.49	<b>0.94***</b>	1											
NEP <sub>O_AVG</sub>	0.47	-0.29	-0.50	1										
NEP <sub>O_STD</sub>	0.34	0.03	-0.24	0.45	1									
NEP <sub>F1_AVG</sub>	<b>0.81**</b>	0.13	-0.05	<b>0.74*</b>	0.26	1								
NEP <sub>F1_STD</sub>	0.21	0.34	0.12	0.01	<b>0.81**</b>	-0.01	1							
NEP <sub>F2_AVG</sub>	0.32	-0.48	-0.66	<b>0.77*</b>	0.27	<b>0.72*</b>	-0.13	1						
NEP <sub>F2_STD</sub>	-0.12	0.28	0.11	-0.22	0.48	-0.30	<b>0.68*</b>	-0.39	1					
NEP <sub>F3_AVG</sub>	-0.22	-0.39	-0.50	0.49	0.14	-0.05	-0.12	0.08	0.24	1				
NEP <sub>F3_STD</sub>	0.31	-0.14	-0.31	<b>0.76*</b>	0.65	0.44	0.51	0.49	0.08	0.29	1			
PEB <sub>AVG</sub>	-0.11	-0.53	-0.55	0.44	0.13	0.32	0.10	<b>0.69*</b>	-0.25	-0.04	0.60	1		
PEB <sub>STD</sub>	0.43	0.41	0.26	0.02	0.28	0.31	0.47	0.26	0.21	-0.37	0.11	0.25	1	
PESID <sub>O_AVG</sub>	-0.25	-0.47	-0.52	-0.03	0.33	-0.01	0.12	0.14	0.02	-0.17	-0.01	0.09	-0.37	1
PESID <sub>O_STD</sub>	<b>0.68*</b>	0.50	0.47	0.44	0.14	0.53	0.20	0.11	-0.21	-0.10	0.60	0.15	0.09	-0.40
PESID <sub>P_AVG</sub>	0.18	0.02	-0.09	0.04	0.50	0.23	0.52	0.08	0.03	-0.47	0.35	0.23	-0.05	<b>0.73*</b>
PESID <sub>P_STD</sub>	0.65	0.46	0.39	0.51	0.01	0.56	-0.08	0.07	0.00	0.34	0.36	-0.17	-0.10	-0.48
PESID <sub>R_AVG</sub>	-0.58	<b>-0.68*</b>	-0.62	-0.10	-0.18	-0.31	-0.49	0.09	-0.02	0.36	-0.47	-0.16	-0.45	0.47
PESID <sub>R_STD</sub>	0.58	0.44	0.43	0.34	0.25	0.41	0.38	0.14	-0.17	-0.27	<b>0.67*</b>	0.33	0.25	-0.35
TC <sub>O_AVG</sub>	<b>0.87**</b>	0.45	0.31	0.59	0.47	<b>0.73*</b>	0.21	0.35	0.16	0.12	0.38	-0.18	0.24	-0.17
TC <sub>O_STD</sub>	-0.60	<b>-0.87**</b>	<b>-0.86**</b>	0.06	0.05	<b>-0.87**</b>	-0.11	0.45	-0.16	0.05	0.02	0.60	-0.04	0.56
TC <sub>TRC_AVG</sub>	0.47	-0.26	-0.52	<b>0.88**</b>	0.50	<b>0.78*</b>	0.04	<b>0.72*</b>	-0.02	0.46	0.54	0.27	0.00	0.23
TC <sub>TRC_STD</sub>	<b>-0.81**</b>	-0.43	-0.34	-0.61	-0.08	<b>-0.68*</b>	0.16	-0.23	0.29	-0.23	-0.29	0.23	-0.04	0.45
TC <sub>SLC_AVG</sub>	<b>0.77*</b>	0.46	0.33	0.52	0.32	0.61	0.07	0.25	0.20	0.28	0.22	-0.32	0.22	-0.37
TC <sub>SLC_STD</sub>	-0.29	-0.29	-0.23	-0.15	-0.40	-0.08	-0.28	0.29	-0.32	-0.18	-0.28	0.44	0.51	-0.27
TC <sub>IAG_AVG</sub>	<b>0.73*</b>	<b>0.81**</b>	<b>0.86**</b>	-0.07	0.29	0.28	0.40	-0.16	0.17	-0.52	0.12	-0.33	0.31	-0.19
TC <sub>IAG_STD</sub>	0.52	-0.20	-0.42	0.72	0.28	<b>0.84**</b>	-0.17	<b>0.75*</b>	-0.21	0.22	0.21	0.19	0.15	0.23

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	15	16	17	18	19	20	21	22	23	24	25	26	27
PESID <sub>O_STD</sub>	1												
PESID <sub>P_AVG</sub>	0.22	1											
PESID <sub>P_STD</sub>	<b>0.75*</b>	-0.17	1										
PESID <sub>R_AVG</sub>	<b>-0.86**</b>	-0.26	-0.46	1									
PESID <sub>R_STD</sub>	<b>0.94***</b>	0.33	0.50	<b>-0.92***</b>	1								
TC <sub>O_AVG</sub>	0.52	0.06	<b>0.73*</b>	-0.31	0.37	1							
TC <sub>O_STD</sub>	-0.64	0.15	<b>-0.75*</b>	0.59	-0.48	-0.56	1						
TC <sub>TRC_AVG</sub>	0.20	0.16	0.45	0.12	0.05	<b>0.67*</b>	0.12	1					
TC <sub>TRC_STD</sub>	<b>-0.70*</b>	0.19	<b>-0.86**</b>	0.40	-0.46	<b>-0.77*</b>	0.66	-0.51	1				
TC <sub>SLC_AVG</sub>	0.41	-0.24	<b>0.76*</b>	-0.21	0.22	<b>0.95**</b>	-0.61	0.59	<b>-0.79*</b>	1			
TC <sub>SLC_STD</sub>	-0.39	-0.41	-0.50	0.14	-0.25	-0.50	0.53	-0.25	0.33	-0.40	1		
TC <sub>IAG_AVG</sub>	0.59	0.30	0.42	-0.65	0.61	0.64	<b>-0.75*</b>	-0.07	-0.42	0.53	-0.50	1	
TC <sub>IAG_STD</sub>	0.04	0.08	0.30	0.22	-0.12	0.60	0.18	<b>0.90***</b>	-0.48	0.55	0.01	-0.08	1

Since the correlation coefficient is positive, that means, the higher the attitude that represents the tension (or order) between the human verses nature score within teams, the higher the teams self-reported aggregated pro-environmental behavior.

The correlation coefficient between  $NEP_{F2\_AVG}$  and  $PEB_{AVG}$  is  $r = 0.69$  ( $p < 0.05$ ). Since the correlation coefficient is positive, that means, the higher the attitude that represents the tension (or order) between the human verses nature score within teams, the higher the teams self-reported aggregated pro-environmental behavior.

Regarding aggregated pro-environmental self-identity variables relating to other team level variables,  $PESID_{O\_STD}$  is positively correlated with the final score of the competition ( $r = 0.68$ ,  $p < 0.05$ ). This means the higher the standard deviation of the overall self-identity score within teams, the higher the overall team performance in the competition. Again,  $PESID_{R\_AVG}$  is negatively related to the innovation contest of the competition ( $r = -0.68$ ,  $p < 0.05$ ). This means, the higher the self-identity score in the reversed coded items, the lower the team performance on the innovation contest. Furthermore,  $PESID_{R\_STD}$  is positively related to  $NEP_{F3\_STD}$  ( $r = 0.67$ ,  $p < 0.05$ ), meaning, the lower the standard deviation of self-identity in reversed coded items within teams, the lower the standard deviation of the attitude factor that represents the resilience (both from the humans and natures perspective) with teams. The overall identity standard deviation variable ( $PESID_{O\_STD}$ ) was negatively correlated ( $r = -0.70$ ,  $p < 0.05$ ) with the multidimensional team cohesion variable, task cohesion standard deviation ( $TC_{TKC\_STD}$ ), which means, the lower the standard deviation of overall identity

within teams, the higher the standard deviation of task cohesion within teams. Furthermore,  $PESID_{P\_STD}$  is positively related to  $TC_{O\_AVG}$  ( $r = 0.73, p < 0.05$ ), which means, the higher the standard deviation of identity on positively asked items within teams, the higher the overall team cohesion of the teams. Again,  $PESID_{P\_STD}$  is negatively related to  $TC_{O\_STD}$  ( $r = -0.75, p < 0.05$ ), which means, the higher the standard deviation of identity on positively asked items within teams, the lower the overall team cohesion of the teams. Similarly,  $PESID_{FI\_STD}$  is negatively related to  $TC_{TKC\_STD}$  ( $r = -0.86, p < 0.01$ ), which means, the higher the standard deviation of identity on positively asked items within teams, the lower the standard deviation on task cohesion of the teams. Also,  $PESID_{FI\_STD}$  is positively related to  $TC_{SLC\_AVG}$  ( $r = 0.76, p < 0.05$ ), which means, the higher the standard deviation of identity on positively asked items within teams, the higher the social cohesion of the teams.

In regard to attitude-cohesion aggregated variable relationships,  $NEP_{O\_AVG}$  is highly related ( $r = 0.88, p < 0.01$ ) to  $TC_{TKC\_AVG}$ , meaning, the higher the overall pro-environmental attitude of the teams, the higher the task cohesion.  $NEP_{FI\_AVG}$  is positively related to  $TC_{O\_AVG}$  ( $r = 0.73, p < 0.05$ ), which means, the higher the overall team cohesion of the teams, the higher the perception of repercussions of actions (NEP factor). Again,  $NEP_{FI\_AVG}$  is positively related to  $TC_{TKC\_AVG}$  ( $r = 0.78, p < 0.05$ ), which means, the higher the task cohesion of the teams, the higher the perception of repercussions of actions. Furthermore,  $NEP_{FI\_AVG}$  is positively related to  $TC_{IAG\_STD}$  ( $r = 0.84, p < 0.01$ ), which means, the higher the standard deviation of individual attraction to the group cohesion of the teams, the higher the perception of repercussions of actions.



However,  $NEP_{F1\_AVG}$  is negatively related to  $TC_{TKC\_STD}$  ( $r = -0.68, p < 0.05$ ), which means, the higher the standard deviation of task cohesion of the teams, the lower the perception of repercussions of actions. On the other hand,  $NEP_{F2\_AVG}$  is positively related to  $TC_{TKC\_AVG}$  ( $r = 0.72, p < 0.05$ ), which means, the higher the individual attraction to the group cohesion of the teams, the higher the attitude that represents order (or tension) between human verses nature. Again,  $NEP_{F2\_AVG}$  is positively related to  $TC_{IAG\_STD}$  ( $r = 0.75, p < 0.05$ ), which means, the higher the standard deviation of individual attraction to the group cohesion within the teams, the higher the attitude that represents order (or tension) between human verses nature.

### ***Regression***

*Hypothesis 1* predicted that the individuals' pro-environmental attitude, aggregated to team level, is not related to the team performance on a sustainability-related project. Individuals' pro-environmental attitude, measured by NEP, has 8 different aggregated variables. Two aggregated variables for  $NEP_O$ , average and standard deviation, and two variables for each of the three factors of NEP found via exploratory factor analysis ( $NEP_{F1}$ ,  $NEP_{F2}$ ,  $NEP_{F3}$ ).

All the regression models to predict the team performance on a sustainability-related project measured by the sustainability score (SUS) score from NEP variables are not statistically significant at  $p$ -value = 0.05. In other words, none of the aggregated NEP (both unidimensional and multidimensional) variables were significantly related to the sustainability score (SUS). Therefore, *Hypothesis 1* is supported that the

individuals' pro-environmental attitude, aggregated to team level, is not related to the team performance on a sustainability-related project. Though there is numerous literature supporting the fact that environmental attitude does not relate to environmental behavior, there is none focusing on environmental attitude, aggregated to team level, and its relationship with actual team performance on a sustainability-related project. This study, therefore, contributes to the literature by supporting the hypothesis that pro-environmental attitude does not relate to the team performance on a sustainability-related project.

*Hypothesis 2b* predicts that individual pro-environmental attitude is not related with individual self-reported aggregated pro-environmental behavior, both aggregated at the team-level. Moreover, individuals' pro-environmental attitude, measured by NEP, has 8 different aggregated variables (both at unidimensional and multidimensional level).

All the regression models but one to predict the self-reported aggregated pro-environmental behavior measured by  $PEB_{AVG}$  score from NEP variables are not statistically significant at  $p\text{-value} = 0.05$ . In other words, none of the aggregated NEP variables were related to self-reported aggregated pro-environmental behavior measured by  $PEB_{AVG}$  apart from the  $NEP_{F2\_AVG}$ . Table 9 represents the ANOVA table for regression analysis to predict  $PEB_{AVG}$  from  $NEP_{F2\_AVG}$  variable.

**Table 9: ANOVA table for regression analysis to predict  $PEB_{AVG}$  from  $NEP_{F2\_AVG}$**

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	35.25	35.254	6.52	0.038*
$NEP_{F2\_AVG}$	1	35.25	35.254	6.52	0.038*
Error	7	37.84	5.406		
Total	8	73.09			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model (see Table 9) to predict  $PEB_{AVG}$  from  $NEP_{F2\_AVG}$  (coefficient 14.74,  $p = 0.038$ ) was significant ( $p = 0.038$ ) with a y-intercept of -14.5 ( $p = 0.564$ ), and the prediction power was relatively high ( $R^2 = 0.482$ ;  $R_{adj}^2 = 0.408$ ). The positive coefficient of  $NEP_{F2\_AVG}$  means the higher the attitude representing the order (or tension) between human and nature, the higher the self-reported pro-environmental average score of the teams. The model has a relatively high predicting power where 40.8% variation is due to the predictor variable  $NEP_{F2\_AVG}$ . Therefore, *Hypothesis 2b* is supported at the unidimensional level of attitude, measured by NEP, but is not supported by the multidimensional level.

*Hypothesis 2c* predicts that individual pro-environmental behavior, aggregated to the team-level, is not related with the team-level's actual performance on a sustainability-related project. To test this hypothesis, a regression model was used to predict the actual team performance on a sustainability-related project, measured by SUS, from individuals' pro-environmental behavior, measured by  $PEB_{AVG}$ . The regression model to predict SUS from  $PEB_{AVG}$  (coefficient -0.672,  $p = 0.160$ ) was not significant ( $p = 0.160$ ) with a y-intercept of 33.8 ( $p = 0.096$ ), and the prediction power was relatively low ( $R^2 = 0.299$ ;  $R_{adj}^2 = 0.182$ ). Therefore, the regression model supports

*Hypothesis 2c.* This means that individuals' team level self-reported pro-environmental behavior does not relate to their actual team performance on a sustainability-related project. Though there are literature on individual level pro-environmental behavior not relating to actual performance (e.g. home energy usage), the relationship between self-reported aggregated pro-environmental behavior and actual team performance in a sustainability-related project has not been explored before. Therefore, this study, by supporting *Hypothesis 2c*, contributes to the literature.

*Hypothesis 3b* predicts that the individual pro-environmental self-identity is related with individual self-reported pro-environmental behavior, both aggregated at the team-level. Individual pro-environmental self-identity, measured by PESID, has six aggregated team-level variables. To test *Hypothesis 3b*, linear regression models to predict  $PEB_{AVG}$  from each of the aggregated PESID variables were used.

All the regression models to predict the self-reported aggregated pro-environmental behavior, measured by  $PEB_{AVG}$  score, from PESID variables are not statistically significant at  $p$ -value = 0.05. In other words, none of the individual pro-environmental self-identity variables is related to individual self-reported pro-environmental behavior, both aggregated at the team-level. Therefore, these regression models do not support *Hypothesis 3b*. Therefore, although related at individual level, pro-environmental self identity, aggregated to team level, was not related to team-level self-reported pro-environmental behavior.

*Hypothesis 3c* predicts that individual pro-environmental self-identity, aggregated to the team-level, is related with the team-level's actual performance on a sustainability-related project. To test *Hypothesis 3b*, linear regression models to predict the sustainability score (SUS) from each of the aggregated PESID variables were used.

All the regression model to predict the actual team performance on a sustainability-related project, measured by the sustainability score (SUS), from PESID variables are not statistically significant at  $p$ -value = 0.05. In other words, none of the aggregated individual pro-environmental self-identity variables was significantly related to the actual team performance on a sustainability-related project. Therefore, the results do not support *Hypothesis 3c*. Since the incorporation of self-identity variables in a model that looks at the team-level performance on a sustainability-related project has not been explored before, this study contributes to the literature by not supporting *Hypothesis 3c*.

*Hypothesis 4* predicts that individual self-reported cohesion, aggregated to the team-level, is related with the team-level's actual performance on a sustainability-related project. Individual self-reported cohesion, measured by TC, has eight aggregated team-level variables. To test the *Hypothesis 4*, linear regression models to predict SUS from each of the aggregated TC variables were used (both unidimensional and multidimensional).

All the regressions models but two to predict the actual team performance on a sustainability-related project, measured by the sustainability score (SUS), from TC

variables are not statistically significant at  $p$ -value = 0.05. In other words, no other aggregated TC variables, apart from  $TC_{O\_STD}$  and  $TC_{IAG\_AVG}$ , were related to the actual performance on a sustainability-related project. Table 10 represents the ANOVA table for regression analysis to predict SUS from  $TC_{O\_STD}$  variable.

**Table 10: ANOVA table for regression analysis to predict SUS from  $TC_{O\_STD}$**

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	79.02	79.016	16.43	0.007**
$TC_{O\_STD}$	1	79.02	79.016	16.43	0.007**
Error	6	28.86	4.810		
Total	7	107.88			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model (see Table 10) shows that the model is significant ( $p < 0.01$ ) having a negative  $TC_{O\_STD}$  coefficient (-34.26,  $p < 0.01$ ) with a y-intercept of 26.03 ( $p < 0.01$ ), and a higher predictive power ( $R^2 = 0.732$ ;  $R_{adj}^2 = 0.687$ ) where 68.8% variation in the model is due to the predictor variable. This means that the unidimensional aggregated team cohesion measure, standard deviation, was negatively related to the sustainability score. Therefore, the lower the standard deviation (in other words, the lower the diversity) of overall team cohesion within teams, the higher the teams scored in sustainability score, and thus, the higher actual team performance on a sustainability-related project. Consequently, *Hypothesis 4* is supported for unidimensional team cohesion for standard deviation aggregation method. Furthermore, Table 11 represents the ANOVA table for regression analysis to predict SS from  $TC_{IAG\_AVG}$  variable.

**Table 11: ANOVA table for regression analysis to predict SUS from**

**TC<sub>IAG\_AVG</sub>**

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	79.25	79.252	16.61	0.007**
TC <sub>IAG_AVG</sub>	1	79.25	79.252	16.61	0.007**
Error	6	28.62	4.771		
Total	7	107.87			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model (see Table 11) shows that the model is significant ( $p < 0.01$ ) having a positive TC<sub>IAG\_AVG</sub> coefficient (+6.09,  $p < 0.01$ ), with a y-intercept of -12.99 ( $p < 0.05$ ) and a high predictive power ( $R^2 = 0.734$ ;  $R_{adj}^2 = 0.690$ ) where 69.04% variation in the model is due to the predictor variable. This means that, multidimensional aggregated team cohesion measure, individual attraction to the group score average, was positively related to the sustainability score. Therefore, the higher the average score of individual attraction to the group within teams, the higher the teams scored in the sustainability score, and thus, the higher actual team performance on a sustainability-related project. Consequently, *Hypothesis 4* is also supported at multidimensional team cohesion variable, individual attraction to the group, for average aggregation method.

In summary, *Hypothesis 4* is supported for both unidimensional and multidimensional team cohesion. That is, the individual self-reported cohesion, aggregated to the team-level, is related with the team-level's actual performance on a sustainability-related project. Although team cohesion has been considered as an important factor for team performance in other sectors, the relationship between team cohesion and sustainability-related projects has not been explored before. Therefore,

this study contributes to the literature as team cohesion was found to be a significant predictor for performance in a sustainability-related project.

### *A Posteriori*

Apart from the hypothesis related to team cohesion, *a posteriori* relationship was found based on the team level correlation table (see Table 8) between final score of the Solar Decathlon 2017 and overall team cohesion aggregation variable, TC<sub>O\_AVG</sub>. Table 12 represents the ANOVA table for regression analysis to predict FS from the TC<sub>O\_AVG</sub> variable.

**Table 12: ANOVA table for regression analysis to predict FS from TC<sub>O\_AVG</sub>**

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	48269	48269	21.49	0.002**
TC <sub>O_AVG</sub>	1	48269	48269	21.49	0.002**
Error	7	15724	2246		
Total	8	63992			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model (see Table 12) shows that the model is significant ( $p < 0.01$ ) having positive TC<sub>O\_AVG</sub> coefficient (+271.1,  $p < 0.01$ ), with a y-intercept of -294.5 ( $p < 0.05$ ) and a high predictive power ( $R^2 = 0.754$ ;  $R_{adj}^2 = 0.719$ ) where 71.9% variation in the model is due to the predictor variable. This means that, unidimensional aggregated team cohesion measure, overall team cohesion average, was positively related to the final score. Therefore, the higher the average score of overall team cohesion within teams, the higher the teams performed in the overall Solar Decathlon 2017 competition.



Another *a posteriori* relationship was found based on the team level correlation table (see Table 8) between the final score of the Solar Decathlon 2017 and multidimensional team cohesion aggregation variable,  $TC_{TKC\_STD}$ . Table 13 represents the ANOVA table for regression analysis to predict FS from the  $TC_{TKC\_STD}$  variable.

**Table 13: ANOVA table for regression analysis to predict FS from  $TC_{TKC\_STD}$**

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	42049	42049	13.41	0.008**
$TC_{TKC\_STD}$	1	42049	42049	13.41	0.008**
Error	7	21944	3135		
Total	8	63992			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model (see Table 13) shows that the model is significant ( $p < 0.01$ ) having negative  $TC_{TKC\_STD}$  coefficient (-483.0,  $p < 0.01$ ), with a y-intercept of 1040 ( $p < 0.001$ ) and a high predictive power ( $R^2 = 0.657$ ;  $R_{adj}^2 = 0.608$ ) where 60.8% variation in the model is due to the predictor variable. This means that, multidimensional aggregated team cohesion measure, task cohesion standard deviation, was negatively related to the final score. Therefore, the lower the standard deviation (in other words, the lower the diversity) of task cohesion within teams, the higher the teams performed in overall Solar Decathlon 2017 competition.

Another *a posteriori* relationship was found based on the team level correlation table (see Table 8) between the final score of the Solar Decathlon 2017 and multidimensional team cohesion aggregation variable,  $TC_{SLC\_AVG}$ . Table 14 represents the ANOVA table for regression analysis to predict FS from the  $TC_{SLC\_AVG}$  variable.

**Table 14: ANOVA table for regression analysis to predict FS from TC<sub>SLC\_AVG</sub>**

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	38396	38396	10.50	0.014*
TC <sub>SLC_AVG</sub>	1	38396	38396	10.50	0.014*
Error	7	25597	3657		
Total	8	63992			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model (see Table 14) shows that the model is significant ( $p < 0.01$ ) having positive TC<sub>SLC\_AVG</sub> coefficient (+190.2,  $p < 0.05$ ), with a y-intercept of 28.0 ( $p < 0.10$ ) and a high predictive power ( $R^2 = 0.600$ ;  $R_{adj}^2 = 0.541$ ) where 54.19% variation in the model is due to the predictor variable. This means that, multidimensional aggregated team cohesion measure, task cohesion average, was positively related to the final score. Therefore, the higher the average score of task cohesion within teams, the higher the teams performed in overall Solar Decathlon 2017 competition.

A similar *a posteriori* relationship was found based on the team level correlation table (see Table 8) between final score of the Solar Decathlon 2017 and multidimensional team cohesion aggregation variable, TC<sub>IAG\_AVG</sub>. The regression model to predict FS from TC<sub>IAG\_AVG</sub> (coefficient +115.3,  $p < 0.05$ ) was not significant ( $p < 0.05$ ) with a y-intercept of 352 ( $p < 0.05$ ), and the prediction power was low ( $R^2 = 0.529$ ;  $R_{adj}^2 = 0.462$ ). This means that, the multidimensional aggregated team cohesion measure, individual attraction to the group score average, was positively related to the final. Therefore, the higher the average score of individual attraction to the group within teams, the higher the teams performed in overall Solar Decathlon 2017 competition.

In summary, according to Salas et al. (2015), while adopting multidimensional team cohesion, priority should be given to social and task cohesion items because of their capability to demonstrate significant relationships. Contrary to the literature, results in this study found a significant relationship between the sustainability score and average individual attraction to the group score. However, while predicting the overall team performance in the Solar Decathlon 2017 competition, task cohesion ( $TC_{TKC\_STD}$ ), social cohesion ( $TC_{SLC\_AVG}$ ), and individual attraction to the group cohesion ( $TC_{IAG\_AVG}$ ) aggregation variables were significantly related along with the overall team cohesion ( $TC_{O\_AVG}$ ) measure. Furthermore, while predicting the final score of the Solar Decathlon, the unidimensional aggregated team cohesion variable, mean, was positively related, which means the higher the average of the team cohesion scores the better the team performed in the overall competition. Conversely, in the case of performance in the sustainability score, the lower the unidimensional aggregated team cohesion variable, standard deviation, the better the teams performed.

Apart from hypothesis related to pro-environmental attitude, *a posteriori* relationship was found based on the team level correlation table (see Table 8) between the final score of the Solar Decathlon 2017 and the multidimensional attitude aggregated variable, the perception of repercussions of actions average ( $NEP_{FI\_AVG}$ ). Table 15 represents the ANOVA table for regression analysis to predict FS from the  $NEP_{FI\_AVG}$  variable.

**Table 15: ANOVA table for regression analysis to predict FS from NEP<sub>FI\_AVG</sub>**

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-value	P-value
Regression	1	41491	41490.7	12.91	0.009**
NEP <sub>FI_AVG</sub>	1	41491	41490.7	12.91	0.009**
Error	7	22501.7	3214.5		
Total	8	63992.4			

Significance code: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

The regression model (see Table 15) shows that the model is significant ( $p < 0.01$ ) having positive NEP<sub>FI\_AVG</sub> coefficient (+262.6,  $p < 0.01$ ), with a y-intercept of -362.9 ( $p < 0.10$ ) and a high predictive power ( $R^2 = 0.648$ ;  $R_{adj}^2 = 0.598$ ) where 59.8% variation in the model is due to the predictor variable. This means that, multidimensional aggregated attitude measure, the perception of repercussions of actions average, was positively related to the final score. Therefore, the higher the average score of the perception of repercussions of actions within teams, the higher the teams performed in overall Solar Decathlon 2017 competition.

Another significant correlational relationship ( $r = 0.88$ ,  $p < 0.01$ ) based on the team level correlation table (see Table 8) was found between average score on task cohesion (TC<sub>TKC\_AVG</sub>) and average score on overall attitude (NEP<sub>O\_AVG</sub>). This means that, the higher the task cohesion of the teams, the higher the overall pro-environmental attitude.

## CONCLUSION

The goal of this study was to explore the composition of teams performing sustainability-related tasks in regard to the individuals' pro-environmental attitude, individuals' self-reported pro-environmental behavior, individuals' pro-environmental identity and team cohesion. The main research question asked was whether individuals' pro-environmental attitude, aggregated to a team level, relates to the team performance on a sustainability-related project. The results in this study demonstrate that pro-environmental attitude, measured by the NEP scale, does not relate to team performance on a sustainability-related project. Another research question explored in this study was whether the individual pro-environmental attitude relates with individual self-reported pro-environmental behavior, both aggregated at the team-level. The results demonstrate that individual pro-environmental attitude, at a unidimensional-level, does not relate with individual self-reported aggregated pro-environmental behavior, both aggregated at the team-level. However, at a multidimensional attitude, attitude that represents the order (or tension) between human versus nature, relates to self-reported pro-environmental behavior, when both aggregated at the team-level. Furthermore, this study also answered whether self-reported pro-environmental behavior, aggregated to the team-level, relates to the actual team performance on a sustainability-related project. Results show that the self-reported pro-environmental behavior, aggregated to the team-level, does not relate to the actual team performance on a sustainability-related project. This study also explored whether individuals' pro-environmental self-identity,

aggregated to the team-level, relates to the both self-reported aggregated team performance as well as actual team performance on a sustainability-related project. Results show that even though at the individual-level a pro-environmental identity-behavior relationship exists (significant but weak), at team level, pro-environmental self-identity does not relate to team performance (self-reported or actual performance). Moreover, another research question, referring to collaboration and teamwork, asked whether the individual self-reported cohesion, aggregated to the team-level, is related with the team-level's actual performance on a sustainability-related project. Results in this study demonstrate that both at a unidimensional and at the multidimensional level, team cohesion was a significant predictor for actual performance on a sustainability-related project.

This study, like any other study, has its limitations. The results of this study is only relevant to the architectural, engineering, and construction (AEC) domain. In order to expand the conclusions of this study to other domains, apart from the AEC domain, additional rigorous experimentation is needed. Future work should focus on team performance in different domains, as well as diving farther into the AEC domain. Moreover, this study only focused on the teams from the U.S. in the Solar Decathlon. Future expansions of the work could also focus on a cross-culture, cross-country experiment in order to expand the applicability of these research conclusions. Furthermore, psychometric scales, like team cohesion, was considered as a static construct in this study when, truly, they are dynamic constructs. Since the US Department of Energy Solar Decathlon is almost a two-year long project and team

cohesion can change over time, in order to measure team cohesion more accurately, data should have been strategically sampled multiple times during the timeline of the project. Again, this study only used quantitative methods; whereas an incorporation of qualitative methods such as interviews would help to understand more about the other possible factors influencing team performance.

Last, but certainly not the least, the sample size used in this study was low. Nine participating teams were used in the analysis, and due to the low sample size, more rigorous statistical methods (e.g., structural equation modeling) could not be used which analyze all these metrics simultaneously in a larger, more comprehensive model. However, sample size is a common challenge in research related to teams due to the resources necessary to conduct a study with increased sample size. Due to this work's exploratory nature, the value of the work is not diminished based on sample size because they are real-life, naturalistic teams used. In order to quantify this in terms of real, commercial buildings within the AEC domain, tracking and understanding one team for a single project alone can take up to two-to-five years. Therefore, nine teams of this nature is acceptable within the AEC domain.

The implications of the results of this study are multifaceted. This study is one of the first attempts to understand the environmental attitude and team performance on a sustainability-related project. Incorporation of attitude, self-reported behavior, self-identity, and team cohesion to understand team performance on a sustainability-related project by studying real-world teams has not been done before. Not only does this study

contribute to the literature by shedding light on the composition of teams performing a sustainability-related task, but also opens future research directions. The methodology used in this study provides a unique opportunity to compare measures of self-reported behavior, as well as actual performance on real-world teams. Moreover, it explored whether measures that relate to actual performance on a sustainability-related project also relate the same (or different) way to other forms of actual performance in the same team setting. For example, one of the most significant findings of this research is how the overall team cohesion was related to the actual performance on a sustainability-related project and the actual performance on the overall competition. Teams with higher overall team cohesion performed better on overall competition. Conversely, teams with lower standard deviation of overall team cohesion within the team (in other words, teams of lower diversity of cohesion within team) performed better on a sustainability-related project. Given the limitations, this study certainly helps to better understand the composition of teams performing sustainability-related projects, as these teams that will be responsible for tackling the challenges required for a sustainable world.



## APPENDICES

### New Ecological Paradigm (NEP) scale items

<i>How much do you agree or disagree with the following statements?</i>	Item No.	Item Type
We are approaching the limit of the number of people the earth can support.	NEP1	
Humans have the right to modify the natural environment to suit their needs.	NEP2	R
When humans interfere with nature it often produces disastrous consequences.	NEP3	
Human ingenuity will ensure that we do not make the earth unlivable.	NEP4	R
Humans are severely abusing the environment.	NEP5	
The earth has plenty of natural resources if we just learn how to develop them.	NEP6	R
Plants and animals have as much right as humans to exist.	NEP7	
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	NEP8	R
Despite our special abilities, humans are still subject to the laws of nature.	NEP9	
The so-called "ecological crisis" facing humankind has been greatly exaggerated.	NEP10	R
The earth is like a spaceship with very limited room and resources.	NEP11	
Humans were meant to rule over the rest of nature.	NEP12	R
The balance of nature is very delicate and easily upset.	NEP13	
Humans will eventually learn enough about how nature works to be able to control it.	NEP14	R
If things continue on their present course, we will soon experience a major ecological catastrophe.	NEP15	

### **Five (05) hypothesized facets of NEP**

*the reality of limits to growth* (1, 6, 11)

*antianthropocentrism* (2, 7, 12)

*the fragility of nature's balance* (3, 8, 13)

*rejection of exemptionalism* (4, 9, 14)

*the possibility of an ecocrisis* (5, 10, 15)

## Pro-environmental Behavior (PEB) scale items

<i>Please indicate how often you take each action</i>	Item No.
Turn off lights you are not using.	PEB1
Drive economically (e.g., braking or accelerating gently).	PEB2
Walk, cycle or take public transport for short journeys (i.e., trips of less than 3 miles).	PEB3
Use an alternative to traveling (e.g., shopping online).	PEB4
Share a car journey with someone else.	PEB5
Cut down on the amount you fly.	PEB6
Buy environmentally-friendly products.	PEB7
Eat food which is organic, locally-grown or in season.	PEB8
Avoid eating meat.	PEB9
Buy products with less packaging.	PEB10
Recycle.	PEB11
Reuse or repair items instead of throwing them away.	PEB12
Compost your kitchen waste.	PEB13
Save water by taking shorter showers.	PEB14
Turn off the tap while you brush your teeth.	PEB15
Write to your MP about an environmental issue.	PEB16
Take part in a protest about an environmental issue.	PEB17

PEB items were on four different response options:

*Never*

*Occasionally*

*Often*

*Always*

## Pro-environmental Self Identity (PESID) scale items

<i>How much do you agree or disagree with the following statements?</i>	Item No.	Item Type
I think of myself as an environmentally-friendly consumer.	PESID1	
I think of myself as someone who is very concerned with environmental issues.	PESID2	
I would be embarrassed to be seen as having an environmentally-friendly lifestyle.	PESID3	R
I would not want my family or friends to think of me as someone who is concerned about environmental issues.	PESID4	R

## Team Cohesion (TC) scale items

<i>How much do you agree or disagree with the following statements?</i>	Item No.	Item Type
Our team is united in trying to reach its goals for performance.	TC1	
I'm unhappy with my team's level of commitment to the task.	TC2	R
Our team members have conflicting aspirations for the team's performance.	TC3	R
This team does not give me enough opportunities to improve my personal performance.	TC4	R
Our team would like to spend time together outside of work hours.	TC5	
Members of our team do not stick together outside of work time.	TC6	R
Our team members rarely party together.	TC7	R
Members of our team would rather go out on their own than get together as a team.	TC8	R
For me this team is one of the most important social groups to which I belong.	TC9	
Some of my best friends are in this team.	TC10	

## Facets mentioned in Carless & De Paola (2000) on Revised Scale of Cohesion

*Task Cohesion (1, 2, 3, 4)*

*Social Cohesion (5, 6, 7, 8)*

*Individual Attraction to the Group (9, 10)*

## **IRB Consent Form**

Dear Participant,

The purpose of this study is to determine the level of interest, knowledge, behavior, and teamwork on a sustainability focused project-outcome, such as the Solar Decathlon. The objectives of this research is to better understand how teams behave and perform on a sustainability-driven project. Whether you are an industry professional or student, teamwork is vital to completing any assignment or project. The intent of this survey/interview is to obtain a better understanding of the participant's perspective attitudes, behavior on overall team cohesion and performance.

There are two procedures that could occur during the study based on your association with your Solar Decathlon team: survey and/or interview. If you decide to take part in this study, as a team member, your participation will involve filling out a questionnaire pertaining to your level of interest, knowledge, behavior, and teamwork in and toward sustainability. The electronic responses will be linked to a SurveyMonkey account to which only the PI and the key personnel researchers will have access. If you decide to take part in this study, as a team leader(s) and faculty advisor(s), you will be asked to take the electronic survey and audio recorded during an interview. The survey takes 6-8mins and the interview takes 10-20mins.

YOU MUST BE AT LEAST 18 YEARS of age or older and be a faculty advisor(s), team leader(s), or team member of the 2017 Solar Decathlon to be in this research project.

The possible risks or discomforts of the study are minimal. They do not extend beyond those you would experience in everyday life.

Although there are no direct benefits of the study, your answers will help to understand the team's propensity for sustainability attitudes and behaviors, team cohesion, and their predictive success in the Solar Decathlon.

Your participation in this research is confidential. Only the person in charge, and his/her assistants, will know your identity. The data will be stored and secured in a locked/password protected file. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared. Scientific reports will be based on group data and will not identify you or any individual as being in this project. If you are a student, agreement to participate in the study will not affect any grade in any class anyway nor your participation or outcome from the Solar Decathlon.

You can ask questions about this research, contact Hasan Simanto ([simanto@uri.edu](mailto:simanto@uri.edu)) or Dr. Gretchen Macht ([macht@uri.edu](mailto:macht@uri.edu) and 401.874.2243) with questions. You can also call this number if you have complaints or concerns about this research. If you have other concerns about this study or if you have questions about your rights as a research participant, you may contact the University of Rhode Island's Vice President for Research and Economic Development, 70 Lower College Road, Suite 2, URI, Kingston,

RI, (401) 874-4328. You may also call this number if you cannot reach the research team or wish to talk to someone else.

Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

You are at least 18 years of age or older to consent to take part in this research study. You have read the consent form and your questions have been answered to your satisfaction. If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below. Your filling out the survey implies your consent to participate in this study.

Thank you,

Hasan Simanto & Dr. Gretchen Macht

## Survey Screenshots

\* 1. What is your Team Name?

\* 2. What College/University are you from?

\* 3. What is your Major?

Major 1

Major 2 (if applicable)

\* 4. What is your academic standing?

- Freshman (0 - 32 credits)
- Sophomore (33 - 64 credits)
- Junior (65 - 96 credits)
- Senior (97 - 128 credits)
- 5th year Senior (>128 credits)
- M.S.
- Ph.D.

\* 5. What year were you born?

\* 6. What experience do you have working in Industry? (apart from the Solar Decathlon)

- Internships
- Jobs
- Research Assistant
- Co-opt

\* 7. Is this your first time participating in the Solar Decathlon?

- Yes.
- No.

If no, please label the SolarD year, team, and in what role:

\* 8. What is your role on the Solar Decathlon team?

\* 9. How long were you involved in your Solar Decathlon project team? (In terms of months)

\* 10. Why did you participate in the Solar Decathlon? (Check all that apply)

- Career Development (Network, Resume builder, Experience, Credit, ect.)
- Special Interest (Sustainability, Climate, Environment)
- Special Influence (Peers, Professors, Clubs, Class)
- Other (please specify)

\* 11. What stage did you enter the competition? (choose most appropriate)

- RFP (Proposal, Funds, Preparing)
- Architectural Design
- Engineering Design
- Planning and Coordination
- Construction Activities
- Transportation
- Competition



\* 12. What percentage of your time was spent on a weekly basis on: (*all options combined should equal 100%*)

Class/ School	<input type="text"/>
Work (excluding Solar Decathlon)	<input type="text"/>
Social	<input type="text"/>
Solar Decathlon	<input type="text"/>

\* 13. What percentage of your time did you focused on: (*all options combined should equal 100%*)

RFP	<input type="text"/>
Architectural Design	<input type="text"/>
Engineering Design	<input type="text"/>
Planning and Coordination	<input type="text"/>
Construction Activities	<input type="text"/>
Transportation	<input type="text"/>
Competition	<input type="text"/>

\* 14. Did your team focus on Sustainability?

- YES  
 NO

\* 15. How much do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Disagree Somewhat	Neither agree nor disagree	Agree Somewhat	Agree	Strongly Agree
Our team is united in trying to reach its goals for performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'm unhappy with my team's level of commitment to the task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our team members have conflicting aspirations for the team's performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This team does not give me enough opportunities to improve my personal performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our team would like to spend time together outside of work hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Members of our team do not stick together outside of work time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our team members rarely party together	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Members of our team would rather go out on their own than get together as a team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For me this team is one of the most important social groups to which I belong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Some of my best friends are in this team	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 16. How much do you agree or disagree with the following statements?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
We are approaching the limit of the number of people the earth can support.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans have the right to modify the natural environment to suit their needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When humans interfere with nature it often produces disastrous consequences.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Human ingenuity will ensure that we do <i>not</i> make the earth unliveable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans are severely abusing the environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The earth has plenty of natural resources if we just learn how to develop them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plants and animals have as much right as humans to exist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Despite our special abilities, humans are still subject to the laws of nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The so-called "ecological crisis" facing humankind has been greatly exaggerated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The earth is like a spaceship with very limited room and resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans were meant to rule over the rest of nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The balance of nature is very delicate and easily upset.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Humans will eventually learn enough about how nature works to be able to control it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If things continue on their present course, we will soon experience a major ecological catastrophe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 17. Please indicate how often you take each action

	Never	Occasionally	Often	Always
Turn off lights you're not using	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drive economically (e.g., braking or accelerating gently)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walk, cycle or take public transport for short journeys (i.e., trips of less than 3 miles)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use an alternative to travelling (e.g., shopping online)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share a car journey with someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cut down on the amount you fly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buy environmentally-friendly products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eat food which is organic, locally-grown or in season	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoid eating meat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buy products with less packaging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recycle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reuse or repair items instead of throwing them away	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compost your kitchen waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Save water by taking shorter showers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Turn off the tap while you brush your teeth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Write to your MP about an environmental issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take part in a protest about an environmental issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 18. How much do you agree or disagree with the following statements?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think of myself as an environmentally-friendly consumer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of myself as someone who is very concerned with environmental issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would be embarrassed to be seen as having an environmentally-friendly lifestyle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not want my family or friends to think of me as someone who is concerned about environmental issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 19. Please indicate the last time you took this action (if at all)

	Never	5 or more years ago	1-3 years ago	In the last year
Installed insulation products in your home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bought or built an energy-efficient home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Installed a more efficient heating system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Installed a renewable energy system (e.g., solar panels, wind turbine) in your home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Changed to a 'green' energy tariff for your home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bought a low-emission vehicle (e.g., hybrid, electric, biofuel, less than 1.4 L engine)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bought a product to save water (e.g., water but, water 'hippo', low-flush toilet)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. If you want us to reach out to you for any possible clarification of your answers, please provide your email address below:

Thank you for your time and participation in this study. We wish you all the best in the 2017 Solar Decathlon.

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