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# Economix

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Tuyen Tiet

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Economix - UMR 7235 Bâtiment Maurice Allais  
Université Paris Nanterre 200, Avenue de la République  
92001 Nanterre Cedex

Site Web : [economix.fr](http://economix.fr)  
Contact : [secreteriat@economix.fr](mailto:secreteriat@economix.fr)  
Twitter : @EconomixU



 Université  
Paris Nanterre

# Social incentive factors in interventions promoting sustainable behaviors: A meta-analysis

Phu Nguyen-Van<sup>a,c</sup>      Anne Stenger<sup>b</sup>

Tuyen Tiet<sup>b,d\*</sup>

<sup>a</sup>*EconomiX, CNRS, UPL, University of Paris Nanterre, France*

<sup>b</sup>*BETA, INRAE, University of Strasbourg, France*

<sup>c</sup>*TIMAS, Thang Long University, Vietnam*

<sup>d</sup>*University of Management and Technology, Vietnam*

## Abstract

Based on a meta-analysis, this paper highlights the strength and relevance of several social incentive factors concerning pro-environmental behaviors, including social influence, network factors (like network size, network connection and leadership), trust in others, and trust in institutions. Firstly, our results suggest that social influence is necessary for the emergence of pro-environmental behaviors. More specifically, an internal social influence (i.e., motivating people to change their perceptions and attitudes) is essential to promote pro-environmental behaviors. Secondly, network connection encourages pro-environmental behaviors, meaning that the effectiveness of a conservation policy can be improved if connections among individuals are increased. Finally, trust in institutions can dictate individual behaviors to shape policy design and generate desired policy outcomes.

**Keywords:** Meta-analysis; Network; Pro-environmental behavior; Social influence; Social incentive; Trust.

**JEL codes:** D91; Q50.

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\* *Corresponding author.* Address: BETA, 61 avenue de la Forêt Noire, F-67085 Strasbourg Cedex, France, E-mail: ttietong@unistra.fr

## Résumé

Sur la base d'une méta-analyse, cet article met en évidence la pertinence de plusieurs facteurs d'incitations sociales concernant les comportements pro-environnementaux, notamment l'influence sociale, les facteurs de réseau (comme la taille du réseau, les connexions au sein d'un réseaux et le leadership), la confiance envers les autres et la confiance dans les institutions. Nos résultats suggèrent que l'influence sociale est nécessaire à l'émergence des comportements pro-environnementaux. Plus précisément, une influence sociale interne (c'est-à-dire celle qui motive les gens à changer leurs perceptions et leurs attitudes) est essentielle pour promouvoir les comportements pro-environnementaux. Les connexions au sein d'un réseau encouragent aussi les comportements pro-environnementaux, ce qui signifie que l'efficacité d'une politique de conservation peut être améliorée si les connexions entre les individus sont accrues. Enfin, la confiance dans les institutions peut dicter les comportements individuels donnant ainsi à des résultats souhaités.

# 1 Introduction

It has been highlighted in the literature that individuals could be incentivized to mitigate environmental issues (e.g., climate change, biodiversity conservation, etc.) via using monetary incentives. As an example, monetary incentives have been successfully implemented to motivate people to protect their living environment, e.g., providing payments based on the quantity of recycled waste or the amount of electricity reduced [Tucker et al. \(1998\)](#); [Thøgersen and Olander \(2003\)](#); [Elinder et al. \(2017\)](#). However, the effectiveness of monetary policies is questionable. Firstly, they are costly to implement [Asensio and Delmas \(2015\)](#). For example, the Pigovian tax or cap-and-trade emission requires relatively high administrative and monitoring costs to be successfully implemented. Secondly, the effect of monetary policies is not always sustainable in the long run [Ashenmiller \(2011\)](#); [Lefebvre and Stenger \(2020\)](#). Several studies have shown that environmental conservation programs cannot be easily achieved if they fail to motivate people in terms of environmental sustainability: Will people continue to conserve energy if they know that they will not receive any more payments for their efforts in the future [Allcott and Rogers \(2014\)](#); [Zaval \(2016\)](#)? Thus, the crowding-out effect of an environmental policy is also essential and needs to be taken into account [Cardenas et al. \(2000\)](#); [Werfel \(2017\)](#). Thirdly, people’s motives can also be good drivers of pro-environmental behaviors [Thøgersen \(2013\)](#). While policymakers mainly focus on how to effectively use monetary incentives to encourage individuals or industries to protect the environment, social incentives (i.e., non-monetary incentives) are also useful tools to mitigate individuals’ negative impacts on the environment [Thøgersen \(2013\)](#); [Bolderdijk et al. \(2013\)](#).

Several studies have indicated that people engage in pro-environmental (pro-social) behaviors because of individual social incentives, such as social norms or intrinsic/extrinsic motivations, namely “social influence” [Abrahamse and Steg \(2013\)](#); [Dietz \(2015\)](#). Social influence refers to how individuals alter their attitudes and behaviors in response to the demands of their social environment (e.g., an expectation of others, conformity or altruism, etc.) [Cialdini \(2007\)](#); [Turner \(1991\)](#); [Cialdini and Goldstein \(2004\)](#). For instance, providing energy consumption feedback or environmental messages is an effective way to encourage households’ energy conservation [Allcott and Rogers \(2014\)](#). In this case, if an individual consumes less electricity while others do not, he or she would gain not only a benefit from saving energy but an image

reward by comparison with his or her neighbors as well (e.g., the best in the neighborhood) [Griskevicius et al. \(2010\)](#); [Van Horen et al. \(2018\)](#).

Some of the existing literature also qualifies social influence as internal influences (e.g., altruism, intrinsic motivation or other-regarding preferences) and external influences (e.g., social norms or extrinsic motivation) [Harpine \(2015\)](#); [Simpson and Willer \(2015\)](#). According to the theory of planned behavior (TPB), *external influence factors* are defined as social pressure or social norms that affect individual intentions to perform a target behavior. In contrast, the existing literature has suggested that attitude and personal norms are internal motives that could explain pro-environmental behaviors through intrinsic motivations [Ajzen et al. \(1991\)](#); [Bénabou and Tirole \(2006\)](#); [Schultz et al. \(2007\)](#). For instance, it is essential to alter or strengthen citizens' beliefs and perceptions about environmental protection to motivate them to take actions to mitigate climate change.

However, focusing on individual social incentives when addressing environmental issues may raise several problems. As for monetary contribution, for example, an individual who takes actions to alleviate his or her sense of obligation to help improve environmental quality may not take any further actions when he or she realizes that others do not cooperate (i.e., a single action bias). Furthermore, for most environmental issues (e.g., biodiversity, deforestation, energy, etc.), it is important to have many individuals, most often within the same area, adhering to a conservation program in order to reach a necessary threshold (i.e., the proportion of individuals in the network) above which a positive program effect can arise [Gouu \(1993\)](#). Thus, in addition to social influence, network factors and individual trust can also be used to promote “collective pro-environmental behaviors”, which are behaviors taken together by a group of individuals and including society as a whole (i.e., collective actions) to achieve an environmental target [Gouu \(1993\)](#); [Van Laerhoven \(2010\)](#).

In today's world of social relationships, everyone is linked to a social network (e.g., the limited network of family, friends, relatives, neighbors, co-workers and even acquaintances). Since individuals are linked to each other, other individual behaviors could be an important factor that can be used to motivate a person to perform a specific action [Thaler and Sunstein \(2008\)](#). For example, people are more likely to adopt behaviors that are approved by others in order to cultivate or maintain close social relationships with others [Cialdini and Goldstein \(2004\)](#).

Some studies have shown that people who have been motivated by strong social influences may require pressure from their network to live up to their intentions [de Graaf et al. \(2004\)](#). Different network structures (characterized by different network size, network connection or degree of connection, and leadership) may have different impacts on individual contributions to a collective good [Gouu \(1993\)](#). In their study, the authors showed that a volunteer who is centrally located in a sparse network (i.e., network with a low degree of connection) has a more significant impact on others' contributions than the one who is centrally located in a dense and less centralized network [Gouu \(1993\)](#).

Besides network factors, individual trust is an important concept since trust is applicable to the relationship between people [Lewis and Weigert \(1985\)](#); [Cochard et al. \(2004\)](#). Higher levels of trust (social and/or institutional) help ensure stronger social connections, which could indeed strengthen individual pro-environmental actions. Pro-environmental actions cannot be sustained if there is neither trust among individuals (i.e., trust in others) nor trust toward the institutions (e.g., government or leaders). Therefore, policymakers should also pay attention to social factors, such as network factors and trust, to motivate individual as well as collective actions to achieve an environmental target [Ng et al. \(2013\)](#).

Several studies have provided descriptive reviews of this area of research, focusing on how information strategies influence energy conservation [Delmas et al. \(2013\)](#); [Karlin et al. \(2015\)](#), how social influence approaches can be used to encourage resource conservation [Abrahamse and Steg \(2013\)](#); [Farrow et al. \(2017\)](#), presenting comparative studies of household energy conservation [Abrahamse et al. \(2005\)](#), analyzing determinants and outcomes of belief in climate change [Hornsey et al. \(2016\)](#), testing behavioral inventions on climate change mitigation [Nisa et al. \(2019\)](#), and examining the evidence of spillover in pro-environmental behavior [Maki et al. \(2019\)](#). Although numerous studies have been conducted to assess the effects of social incentives on pro-environmental behavior, the latter are, however, often studied separately (see [Summary survey table for meta-analysis of pro-environmental behavior](#), Supporting Information). In addition, the effectiveness of social incentives that promote pro-environmental behavior has not yet been sufficiently investigated in the literature.

While a previous meta-analysis study focused on the crucial role of social influence on resource conservation [Abrahamse and Steg \(2013\)](#), our study covers other social incentives

(network and trust). Our proposed categorization of social incentives is supported by the fact that besides social influence (i.e., internal and external influence), network factors (i.e., network size, network connection and leadership) and trust (i.e., trust in others and trust in institutions) are important concepts that could strengthen social norms and thus shape individual behaviors in a desirable manner, as previously discussed. We contribute to the literature by addressing all these groups of social incentives together to answer the following question: Which social incentives are more effective in encouraging pro-environmental behavior? In response to this question, we conducted a meta-analysis to provide an empirical insight into these seven groups of social incentives. Note that meta-analysis is a well-known statistical technique that helps combine the results of multiple scientific studies, establish an evidence-based practice, and resolve uncertain research outcomes [Gurevitch et al. \(2018\)](#). We took the impact of the aggregation level into account by organizing the seven social incentive groups into three higher aggregated social groups (i.e., social influences, network and trust) and investigated their relative relevance with respect to the metadata. The purpose is to quantify the strength and relevance of social incentives regarding pro-environmental behavior and give some policy recommendations.

The rest of the paper proceeds as follows. In Section 2, we describe the meta-analysis results. Section 3 is devoted to discussions and a conclusion. Section 4 describes data collection, descriptive statistics and the methodology used. In this section, heterogeneity and publication bias problems are also checked to warrant the robustness of the analysis. Since heterogeneity probably exists between studies, the meta-regression model is adapted to take this heterogeneity into account.

## 2 Materials and methods

### 2.1 Data collection

The dataset in our study was built using the Web of Science, Google Scholar, PubMed, SagePub, and ScienceDirect databases and some other relevant journal websites. A PRISMA flow diagram of data collection is presented in Fig 1. We used keywords to search for related pro-environmental behavior and social incentives: “pro-environmental behaviors”, “sustainable behaviors”, “envi-



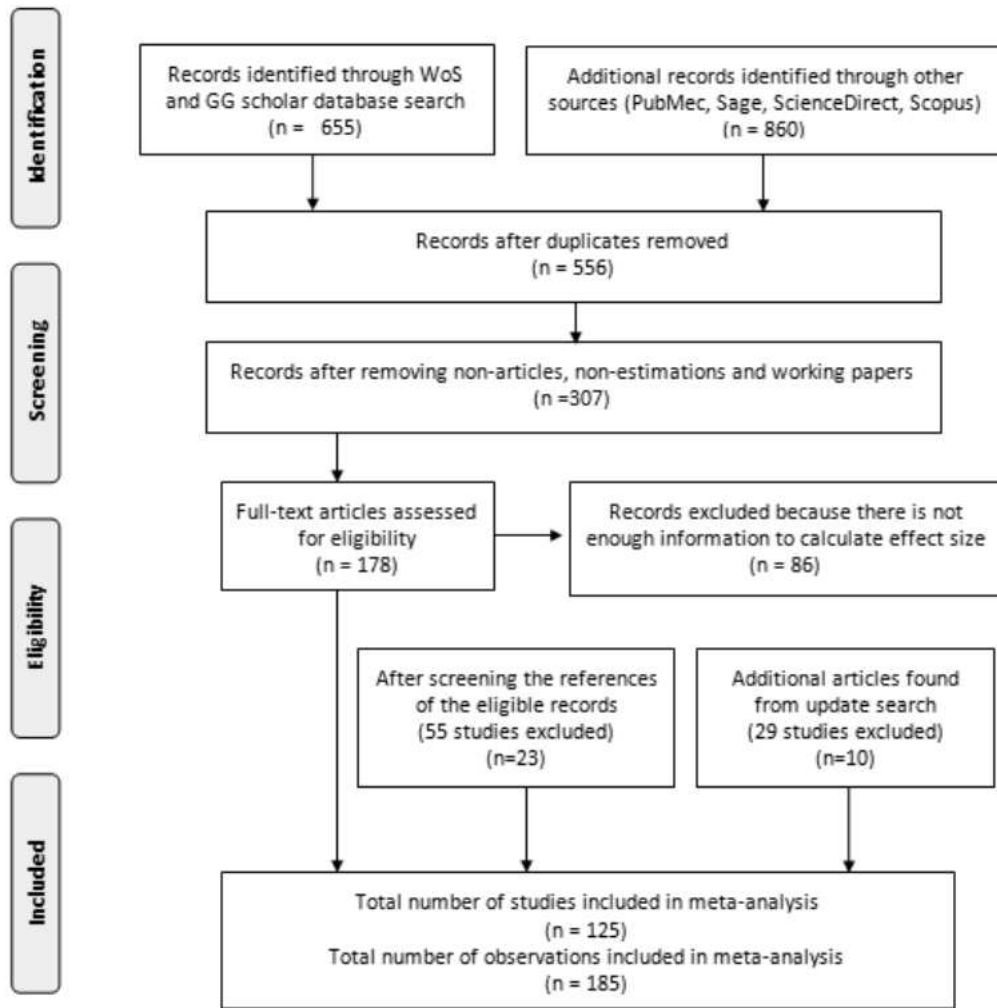
ronmental conservation”, “green behaviors”, “social incentives”, “social intervention”, “social influence”, “social interaction”, “norms”, “nudges”, “networks”, “network structures”, “group size”, “network size”, “network connections”, “network density”, “leader”, “leadership”, “social expectation”, “social comparison”, “peer influence”, “trust”, “social trust”, “institutional trust”, “trust in others” or “trust in government” and all possible combinations of these keywords (All information about these keywords and search strategy for the Web of Science database is presented in Table 1). We also took both the UK and US English into account when performing our keyword searches (e.g., behaviors and behaviours.) and with/without plurals and Boolean operators (OR, AND, \*). With these systematic keyword searches, we collected all the published and unpublished works (1,515 papers). We then did the abstract analysis and excluded all duplicated studies, working papers, books, papers without estimation results and papers with only simulation results. We then put all these papers into our meta-analysis dataset (307 papers). We eliminated all the papers that did not provide enough information to calculate standard errors of effect size (i.e., t-values, p-values, confidence intervals or significance levels). After this step, we obtained 92 eligible studies. We continued screening the references of these eligible studies and found an additional 23 eligible records (in 55 relevant studies).

An additional update search was conducted in January-February 2020, with an additional ten eligible studies found (among 29 relevant studies). We eventually ended up with 125 studies in the last step. These 125 studies led to 185 observations in our meta-analysis data (in some papers, the authors used more than one social variable to examine the impacts on pro-environmental behaviors). The description of study characteristics is provided in [Study characteristics](#) (Supporting Information). The entire dataset is summarized in [Summary survey table for meta-analysis of pro-environmental behavior](#) (Supporting Information), and the descriptive statistics in Table 2 and [Descriptive statistics](#) (Supporting Information).

## 2.2 Dependent variable

Pro-environmental behavior is defined as “behavior that consciously seeks to minimize the negative impact of one’s actions on the natural and built world” [Kollmuss and Agyeman \(2002\)](#). Pro-environmental behavior in our meta-analysis is measured across 13 different types of pro-environmental behaviors identified from the literature (including pro-environmental behaviors,

Figure 1: PRISMA flow diagram of data collection.



pro-environmental intentions, energy consumption, energy conservation, water consumption, water conservation, recycling, environmental conservation, environmental program, environmental groups, green consumption, resource extraction, and workplace pro-environmental behaviors). The definitions of dependent variables are provided in [Definitions of dependent variable](#) (Supporting Information). The detailed descriptive statistics of 13 different types of pro-environmental behaviors are reported in [Descriptive statistics](#) (Supporting Information). We observed that social incentives are more efficient in promoting pro-environmental intention and green consumption but less efficient in encouraging resource conservation.

The effect sizes are the estimated coefficients in the selected studies. The standard errors of the effect sizes are the standard errors of the coefficient estimates. When a paper did not report the standard errors, we calculated them using the corresponding reported t-statistic, the (two-

Table 1: Keywords and online search strategy.

Group	Keywords	
1	"pro-environmental behaviors" OR "pro-environmental behaviours"	
2	"sustainable behaviors" OR "sustainable behaviours"	
3	"environmental conservation" OR "green behaviors" OR green behaviours	
A	"social incentives" OR "social intervention" OR nudges OR social comparison"	
B	"personal norms" OR attitudes OR "intrinsic motivation"	
C	"social norms" OR "social expectation" OR "social interaction" OR "peer influence" OR "social influence"	
D	"networks" OR "network structures" OR "group size" OR "network size" OR "network connections" OR "network density" OR "leader" OR "leadership"	
E	"trust" OR "social trust" OR "institutional trust" OR "trust in others" OR "trust in government"	

Data source	Search strategy	Numbers of studies	Numbers of potentially relevant studies	Extend search with Google Scholar and other sources (duplicates removed)	Searches updated (Performed on 25th February 2020)		
					Numbers of additional studies	Numbers of potentially relevant studies	Numbers of potentially relevant studies
Web of Science	"1" OR "2" OR "3"	2241			149		
	"1" AND ("A" OR "B" OR "C" OR "D" OR "E")	276			54		
	"2" AND ("A" OR "B" OR "C" OR "D" OR "E")	67		280	12		
	"3" AND ("A" OR "B" OR "C" OR "D" OR "E")	206			14		
Total		2790	276 (2790 - 2514)	556 (276 + 280)	229		89 (229 - 140)
Total after removing non-estimation, non-article and working papers				307			29
Total after removing articles that do not have enough information to calculate effect size				115			10

Notes: Numbers of potentially relevant studies is total numbers of studies after removing duplicates and not related to pro-environmental behaviors.

sided) p-value, the confidence interval or the significance level. For papers that only reported insignificant results, we computed the standard errors at a 50% significance level [Abrahamse and Steg \(2013\)](#); [Rosenthal \(1991\)](#). In order to account for heterogeneity in effect sizes across studies, we performed weighted meta-regression (see details in Meta-regression section). In order to account for heterogeneity in effect sizes across studies, we performed weighted meta-regression (see details in Meta-regression section). In order to summarize and compare the results from various studies, in addition to the effect sizes included in the weighted regressions, we also used the partial correlation coefficients (PCCs) that are often used in meta-analysis in order to make different comparable studies which are based on different units of measurement [Doucouliagos and Ulubaşoğlu \(2008\)](#); [Efendic et al. \(2011\)](#). The PCC can be calculated by the t-statistic of the reported regression estimate  $t_{ij}$  and the regression degrees of freedom  $df_{ij}$ :  $PCC_{ij} = \frac{t_{ij}}{\sqrt{t_{ij}^2 + df_{ij}}}$ , where  $i$  is the observation  $i$  in the study  $j$  [Greene \(2003\)](#). The standard errors of the PCC are calculated using the formula:  $SE_{pcc_{ij}} = \frac{PCC_{ij}}{t_{ij}}$ . We did not explore the possibility of using the standardized effect sizes to compare the magnitudes of variable coefficients because it leads to a reduction in the number of observations due to missing data on standard deviations of dependent variables and regressors.

## 2.3 Predictor variables

We identified seven different groups of social incentives that can enhance pro-environmental behavior: social influence (including internal and external influence); network factors (including network size, network connection and leadership); and trust (including trust in others and institutions). The detailed definitions of these seven social dummies are given in [Definitions of predictor variables](#) (Supporting Information). The diagram of these seven groups of social incentives is presented in [The diagram of these seven groups of social incentives](#). (Supporting Information).

In our study, we consider *external social influence* as external motives (e.g., extrinsic motivation, the expectation of others or social norms) that help motivate people to behave toward the environment. In contrast, *internal social influence* is defined as internal motives (e.g., attitudes, personal norms or intrinsic motivation) that could encourage people to take actions to protect the environment. It should be noted that “social comparative feedback” is an external factor that could internally motivate individuals by generating self-evaluation (i.e., individuals evaluate themselves). Self-enhancement could also encourage people to act and sustain their behaviors over time [Festinger \(1954\)](#); [Frey and Meier \(2004\)](#); [Van Der Linden \(2015\)](#). In other words, competitive behaviors drive self-evaluation, and the necessity of such an evaluation is based on the comparison with other people [Festinger \(1954\)](#). On the other hand, since people observe social behaviors (i.e., social norms) through comparative feedback, they could change their behaviors to fit in with a group (i.e., conformity or internalization) or take the social beliefs as their personal beliefs (i.e., group or belief polarization). Nevertheless, “social comparative feedback is an external factor as it provides information treatment (i.e., feedback information) to individuals in the treatment group, leading us to consider “social comparative feedback as an external social influence in our meta-analysis. We have the following hypotheses:

**H1a:** The presence of internal social influence could positively impact pro-environmental behaviors.

**H1b:** The presence of external social influence could positively impact pro-environmental behaviors.

Concerning network, each individual is represented by a social unit (or node). Social units are linked together through social relationships such as friendship or acquaintanceship [Wasser-](#)

man and Faust (1994). *Network connection* is the degree of connection or the relationship between individuals and others, including friends, neighbors, environmentalists and environmental organizations. A strong network connection comes from the solid ties or interactions among individuals inside the network (i.e., a dense network), which is equivalent to what is referred to as the “good sense of community”. The latter means that individuals frequently interact with each other and that they care more about their community. Several empirical studies have shown that the “good sense of community” can directly shape individuals’ behaviors and force them to care more about environmental issues Nepal et al. (2007a); Tesfaye et al. (2012a); Videras et al. (2012). *Network size* captures the number of friends, neighbors or co-workers involved in pro-environmental actions or environmental associations that individuals participate in. *Leadership* captures the presence of environmental leaders that can influence individuals pro-environmental behaviors. We have the following hypotheses:

**H2a:** A stronger network connection (i.e., higher frequency of interactions) has a positive impact on pro-environmental behaviors.

**H2b:** A larger network size (i.e., more individuals in a network) has a positive impact on pro-environmental behaviors.

**H2c:** The presence of leadership could help promote pro-environmental behaviors.

Finally, *trust in institutions* is defined as individuals’ trust in government, institutions, or leaders. *Trust in others* is defined as a social trust or individuals’ trust in friends, neighbors and family. We have the following hypotheses:

**H3a:** A higher trust in institutions could positively impact pro-environmental behaviors.

**H3b:** A higher trust in others could positively impact pro-environmental behaviors.

The correlation matrix of these seven social incentives, provided in [Correlation matrix of seven social incentive dummies](#) (Supporting Information), indicates that the multicollinearity problem is not present in the data. The descriptive statistics are given in Table 2 and [Descriptive statistics](#) (Supporting Information) for more detailed descriptive statistics. The descriptive statistics suggest that internal social influence appears to be more effective than other social incentives in encouraging pro-environmental behavior. Table 2 also shows that the two social incentives commonly studied in the existing literature are internal and external social influence, which accounted for about 60% of the observations. Meanwhile, the less commonly used social

incentive factor is network size, with 4.92% of the observations.

## 2.4 Control variables

In order to address the issue of geographical difference or other factors correlated with geographical regions (i.e., regional heterogeneity), we first controlled for the difference between regions (including America, Asia & Pacific, Europe, and Middle East & Africa) and also studies that were conducted on multiple countries. The list of countries is provided in [Study characteristics](#) (Supporting Information). Secondly, we accounted for the heterogeneity across different specifications regarding control variables (demographic characteristics, education, income, etc.). Thirdly, we included data collection methods used in the studies, such as experiment, direct contact, indirect contact and census data. Fourthly, we also controlled the types of targeted populations to capture the differences among households, demographic-related populations (students, teachers, children or residents), agriculture-related, employed, and other population groups. Finally, we included the study's publication year to capture the time trend of pro-environmental behavior estimates since we observed an increase in effect size (PCC) of the reported pro-environmental behavior across publication year (see [Plot of PCC vs. publication year](#), Supporting Information). Descriptive statistics of the control variables are reported in Table 2 and [Descriptive statistics](#) (Supporting Information), respectively.

According to the results of the study's characteristics reported in [Study characteristics](#) (Supporting Information), we observed that most of the selected studies were done in America, with 37 studies in all. However, a smaller number of studies were conducted in the Middle East and African countries. On average, only 62 papers in our study controlled for demographic variables (including household size, age or gender), and only 40 papers controlled for education and income variables (including participants' education levels and income or wages). Most of our studies were conducted using direct contact (including face-to-face interviews, telephone interviews and questionnaires). The most common population used to investigate pro-environmental behavior was households, with 65 studies in all. A smaller number of studies targeted agriculture-related populations such as farmers, fishers or forest users.

Table 2: A brief summary of the descriptive statistics.

	Definition	Mean	SD
<b>Dependent variables</b>			
PCC	Partial correlation coefficient.	0.136	0.151
Coefficient	Effect size coefficient.	1.682	16.392
<b>Predictor variables</b>			
SEpcc	Standard error of the partial correlation coefficient.	0.053	0.043
SE	Standard error of the effect size coefficient.	0.827	5.767
<i>Social influence factors</i>			
Internal social influence	=1 if there is the presence of internal influence, such as personal norms, attitudes or intrinsic motivation.	0.297	0.458
External social influence	=1 if there is the presence of external social influence, such as norms, peer influence, environmental information treatments, or comparative feedback treatments..	0.297	0.458
<i>Network factors</i>			
Network size	=1 if there is the presence of environmental network (group) size or friend (neighbor or work) group size.	0.049	0.216
Network connection	=1 if there is the presence of network (social, neighborhood, community or environmental group) ties.	0.103	0.305
Leadership	=1 if there is the presence of a group leader or leadership support in pro-environmental behaviors.	0.065	0.248
<i>Trust</i>			
Trust in institutions	=1 if there is the presence of individual trust in institutions (government, leaders or public/environmental institutions).	0.076	0.266
Trust in others	=1 if there is the presence of individual trust in others (family, friends, neighbors or community).	0.114	0.319
<b>Control variables</b>			
<i>Differences between geographical regions</i>			
America	=1 if study was conducted in the Americas.	0.248	0.433
Asia & Pacific	=1 if study was conducted in Asia and the Pacific.	0.300	0.459
Europe	=1 if study was conducted in Europe.	0.300	0.459
MEA	=1 if study was conducted in the Middle East and Africa.	0.043	0.205
Multiple countries	=1 if study was conducted in more than one country.	0.103	0.305
<i>Difference in model specifications</i>			
Presence of demographic control	=1 if study was controlled for household size, age or gender.	0.502	0.501
Presence of education control	=1 if study was controlled for participants' education level.	0.327	0.470
Presence of income control	=1 if study was controlled for household income, wages or country GDP.	0.360	0.481
<i>Types of data collection method</i>			
Experiment	=1 if study was conducted using field experiment or laboratory experiment.	0.120	0.326
Direct contact	=1 if study was conducted using face-to-face interview, telephone interview or questionnaires.	0.453	0.499
Indirect contact	=1 if study was conducted using online survey or mail (email) survey.	0.311	0.464
Census data	=1 if study was conducted using census data.	0.114	0.319
<i>Types of population</i>			
Employed	=1 if study's population is employers or employees.	0.097	0.297
Demographic-related	=1 if study's population is students, teachers, children or residents.	0.200	0.401
Household	=1 if study's population is households.	0.502	0.501
Agriculture-related	=1 if study's population is farmers, fishers or forest users.	0.081	0.273
Others	=1 if study's population is car-drivers, internet users, investors, landowners, tourists or countries.	0.118	0.324
Publication year	Study's publication year.	22.808	5.263

Notes: The detailed definitions of dependent and explanatory variables are provided in Table 1. The detailed descriptive statistics is given in the S5 Table (in Supporting Information).

## 2.5 Publication bias

Fig 2 shows the funnel plot with the regression residuals compared to their corresponding standard errors. This graph is used to assess the publication bias [Patterson et al. \(2003\)](#); [Sterne and Egger \(2001\)](#). The latter corresponds to a type of bias that refers to the distortion of empirical data representation on a subject [Sterling \(1959\)](#). For instance, empirical data is distorted because reviewers of scientific journals tend to accept studies with significant positive effects rather than negative or insignificant ones. In the absence of a publication bias, we would expect that the majority of the observations would fall inside of the pseudo-confidence region with bounds  $\hat{\alpha} \pm 1.96SE$ , where  $\hat{\alpha}$  is the estimated effect of the mixed-effects model and  $SE$  is the corresponding standard error value [Sterne and Egger \(2001\)](#). Egger's regression test for funnel plot asymmetry:  $z\text{-stats} = 3.256$ ,  $p = 0.001$  suggests that asymmetry presents in the funnel plot [Egger et al. \(1997\)](#), implying that positive estimates may be preferably selected for publication. We should therefore focus on the formal methods of detection of and correction for publication bias. According to the literature, we should regress the estimated effect size on its standard error [Stanley and Doucouliagos \(2010\)](#):

$$PCC_{ij} = \beta_0 + \beta_1 SEpcc_{ij} + \epsilon_{ij}, \quad (1)$$

where the coefficient  $\beta_0$  denotes the overall (average) effect size and  $\beta_1$  measures the magnitude of the publication bias.

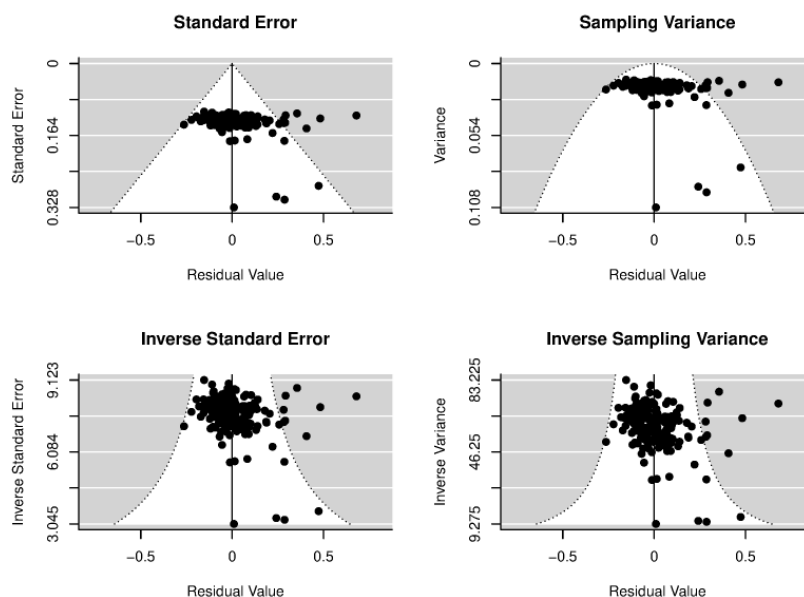
Equation (1) is probably heteroskedastic because of, for example, different measurements between studies and dependence of estimates within a study due to multiple estimates per study. Thus, we apply the weighted least squares to the following multivariate mixed-effect model with the weights defined by the standard errors of the effect size ( $1/SEpcc_{ij}$ ) [Stanley \(2008\)](#); [Doucouliagos and Stanley \(2009\)](#):

$$\frac{PCC_{ij}}{SEpcc_{ij}} = \beta_1 + \beta_0 \frac{1}{SEpcc_{ij}} + \alpha_j \frac{1}{SEpcc_{ij}} + \frac{\epsilon_{ij}}{SEpcc_{ij}}, \quad (2)$$

where  $\alpha_j$  is the study-level random effect and  $\mu_{ij} \equiv \frac{\epsilon_{ij}}{SEpcc_{ij}}$  is the estimate-level disturbances.



Figure 2: Funnel plot for publication bias.



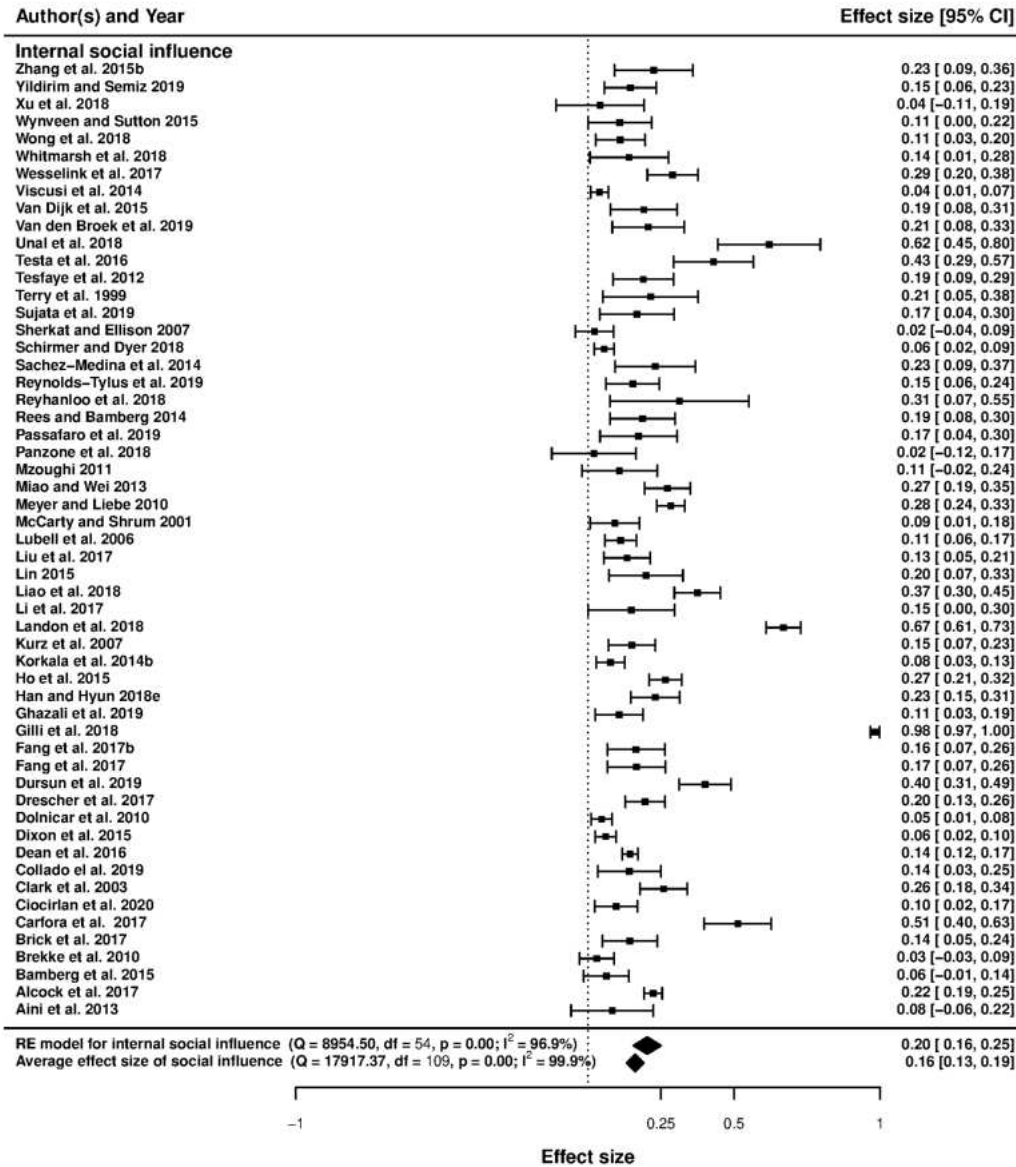
Estimation results of Equation (2) are provided in [Test for publication bias](#). (Supporting Information). The results suggest that the null hypothesis  $\beta_1 = 0$  is rejected at the 10% significance level, meaning that there is some evidence of funnel asymmetry. The positive constant suggests that publication selection is favorable to positive effects. This result is also in line with the results of Egger’s regression test.

## 2.6 Forest plots and heterogeneity

Figs 3-6 display the forest plots of effect sizes and their precision. The forest plot illustrates the results of several studies with horizontal lines showing the confidence interval for each study and a mark to show the point estimate. It provides a visual presentation of the amount of variation between the results of the studies, as well as an estimate of the overall result of all the studies together [Freiman et al. \(1978\)](#). Studies are divided into seven sub-groups of social incentives, i.e., internal social factor (Fig 3), external social factor (Fig 4), network factors including network size, network connection and leadership (Fig 5) and trust, including trust in others and trust in institutions (Fig 6). The overall effect size of each sub-group (indicated by a diamond) is also at the bottom of each study subset.

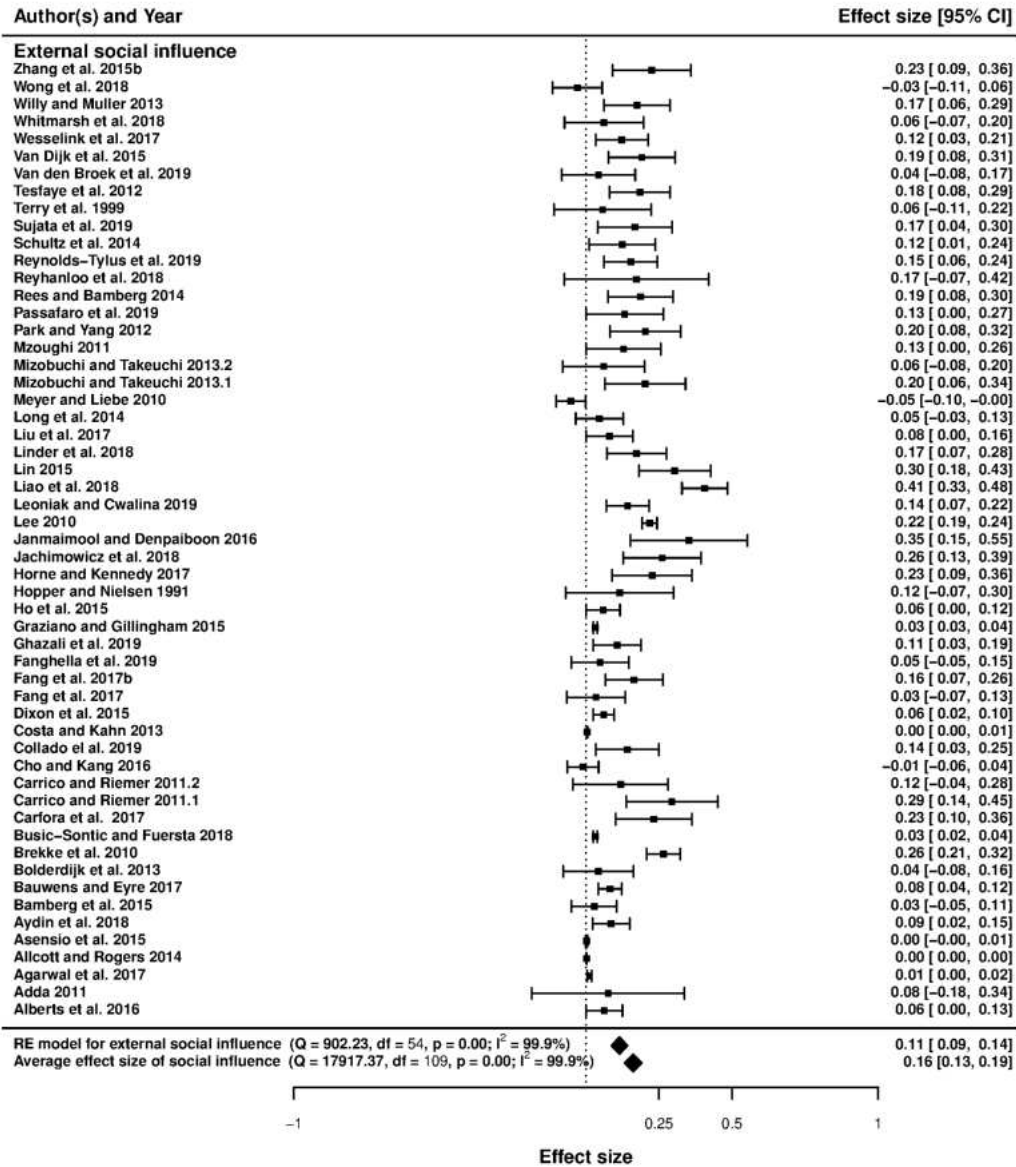
The overall effect size of all studies is first calculated by fitting a random-effect model ( $\beta = 0.132, 95\%CI = [0.107, 0.157]$ ). When the between-study variance is non-zero, the random-

Figure 3: Forest plot of internal social influence.



effect model for meta-analysis is a well-known approach to account for heterogeneity among studies. The random effect model is fitted using the restricted maximum likelihood, which is the most recommendable property Viechtbauer (2005). The random effect model is as follows:  $PCC_{ij} = \beta + \alpha_j + \epsilon_{ij}$ , where  $\alpha_j$  is the study-specific random effect;  $\epsilon_{ij}$  is the error term;  $\beta$  is the overall effect size. The regression is weighted by a weight equal to  $1/(\tau^2 + v_i)$ , where  $v_i$  is individual variance and  $\tau^2$  is between-study variance, typically preferred to as the amount of heterogeneity Kalaian and Raudenbush (1996). This suggests that social incentives are generally good at encouraging pro-environmental behavior. The Cochran  $Q$ -statistic for heterogeneity,

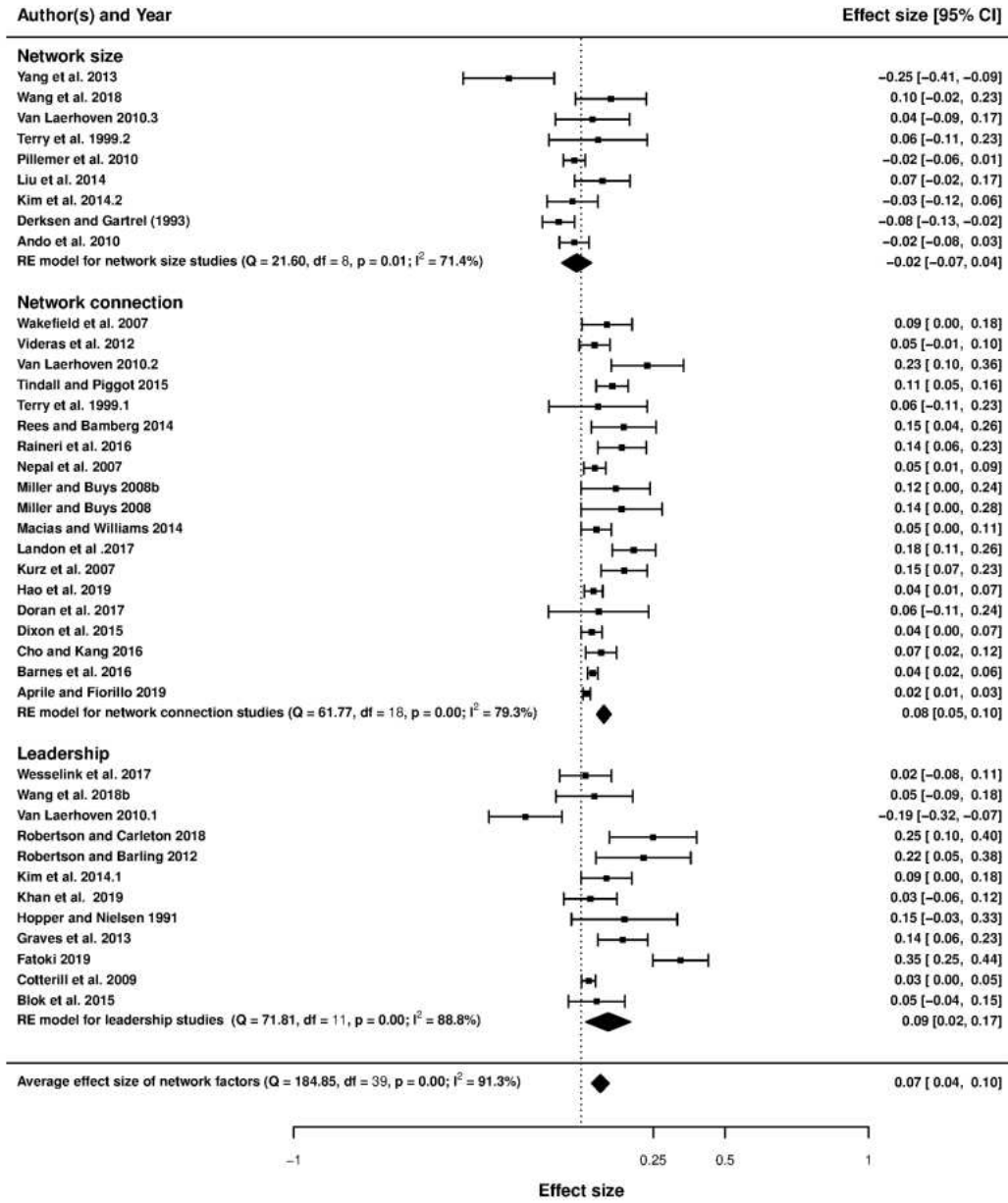
Figure 4: Forest plot of external social influence.



which is the weighted deviations related to the summary effect size, is also calculated [Cochran \(1954\)](#). The  $Q$ -test statistic  $Q(df = 184) = 18867.97$  with  $p < 0.001$  suggests that heterogeneity exists in our meta-analysis (statistically significant between-study variance).

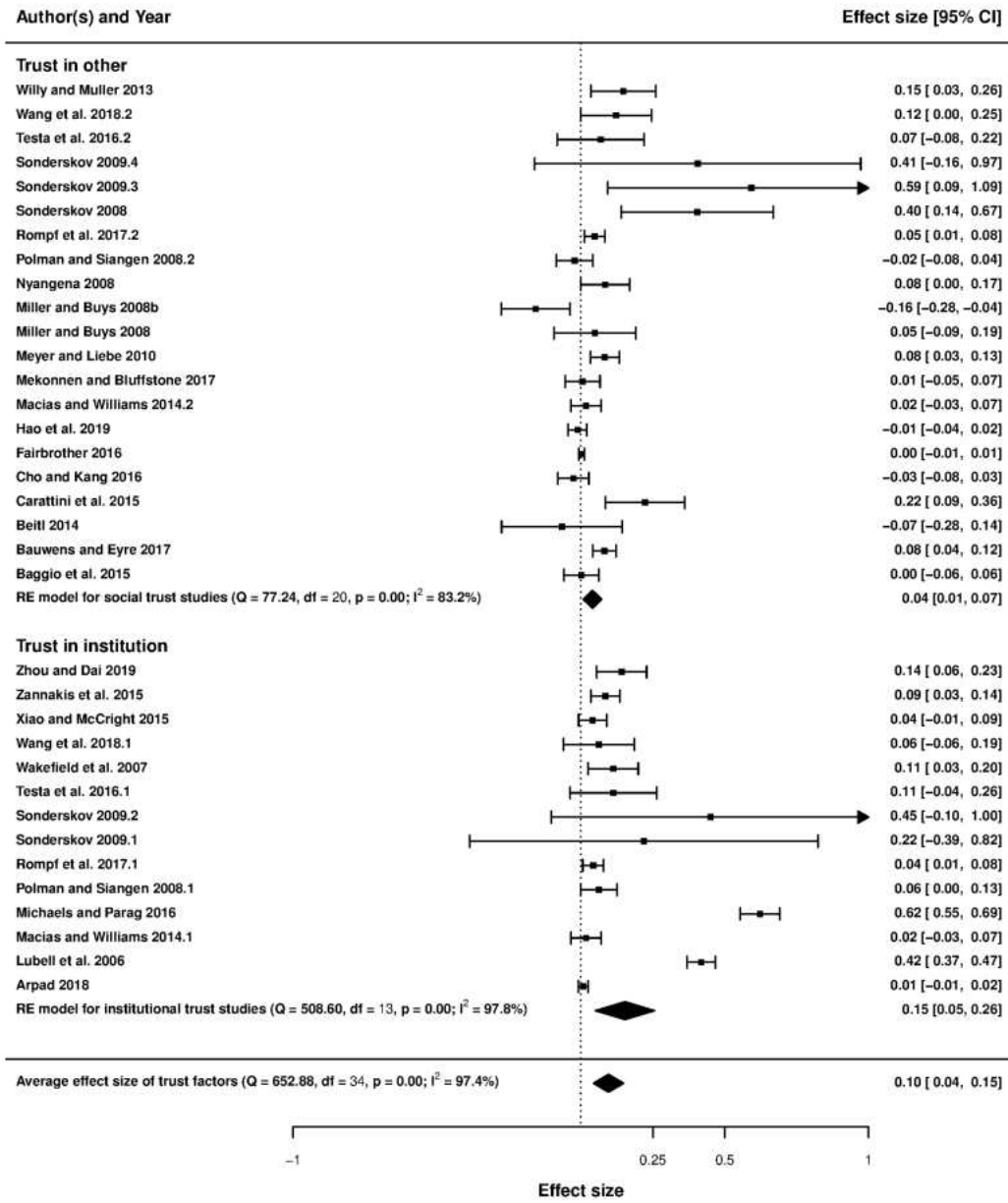
In addition to the heterogeneity of study effect sizes, we applied the moderator analysis with several control variables: differences between regions, differences in specification (presence of demographic, education and income variables), data collection methods (field experiment, direct and indirect method, and census data), types of population (households, employed, agriculture-related, etc.) and publication year ( $Q$ -test for moderator:  $QM(df = 16) = 40.66, p < 0.001$ ).

Figure 5: Forest plot of network factors.



We also fit the mixed effect model with restricted maximum likelihood and with the Cochran  $Q$ -stat = 7568.11,  $df=168$ ,  $p < 0.001$  (the mixed-effect model is  $PCC_{ij} = \beta_0 + \beta_1 SE_{pcc} + \sum_{l=1}^L \delta_l Z_{ijl} + \alpha_j + \varepsilon_{ij}$ , where  $\delta_l$  is the fixed slope,  $\alpha_j$  is the study-specific random effect,  $\varepsilon_{ij}$  is the error term and  $\beta_1$  is the publication bias).

Figure 6: Forest plot of trust factors.



## 2.7 Meta-regression model

We adopted the meta-regression analysis method to further shed light on the ‘black box’ of our meta-analysis results [Havranek and Irsova \(2011\)](#); [Stanley and Jarrell \(1989\)](#). We used the following meta-regression model (where  $i = 1, 2, \dots, N$  and  $j = 1, 2, \dots, M$  stand for observations and studies, respectively):

$$y_{ij} = \beta_0 + \beta_1 x_{ij} + \sum_{k=1}^K \gamma_k SD_{ijk} + \sum_{l=1}^L \delta_l Z_{ijl} + \alpha_j + \varepsilon_{ij}, \quad (3)$$

where  $y_{ij}$  is either the effect size coefficient ( $Coeff_{ij}$ ) or the partial correlation coefficient ( $PCC_{ij}$ ) of observation  $i$  and study  $j$ . Note that  $x_{ij}$ , included here to account for the publication bias, corresponds to the standard error of  $Coeff_{ij}$  ( $SE$ ) or the standard error of  $PCC_{ij}$  ( $SEpcc$ ) depending on the considered regression. A positive (negative) value of  $\beta_1$  implies a positive (negative) publication bias.  $SD_{ijk}$  are the social incentives dummies including internal social influence, external social influence, network size, network connection, leadership, trust in others and trust in institutions (there are  $K=7$  social incentives dummies, network size being the base category).  $Z_{ijl}$  is a vector of study-level characteristics ( $L=18$  control variables). In Equation (3), the meta-regression coefficients  $\delta_l$  represent the bias related to  $L$  variables including differences between geographical regions, model specifications (demographic, education and income factors), types of study (field experiment or laboratory experiment, etc.), types of population and publication year. A positive (negative) value of  $\delta_l$  implies a positive (negative) bias. Finally,  $\varepsilon_{ij}$  is the meta-regression model error. Note that because of the presence of predictor variable dummies and control variable dummies, the intercept of the meta-regression above ( $\beta_0$ ) cannot help to separately identify the overall effect size and the values of the base categories of these groups of dummies.

Because most of the primary literature uses different data sets, different dependent variables, different types of data collection methods and different sample sizes, it is reasonable to suspect that the meta-regression error is likely to be heteroskedastic (see [Plot of partial correlation coefficient vs. squared root of study's sample size](#). in Supporting Information for the plot of partial correlation coefficient vs. squared root of study's sample size). We therefore estimated the model using weighted least squares (WLS) with weights given by  $1/e_i$  ( $e_i$  is the observation  $i$ 's standard errors). When the individual standard error is unknown, the model is estimated using weighted least squares (WLS) with weights given by  $1/\sqrt{N_i}$  where  $N_i$  is the study's sample size. When the individual standard error  $e_i$  is known, the heteroskedasticity can also be corrected by weighted least square regression with weights given by  $1/e_i$  [Stanley and Jarrell \(1989\)](#); [Wolf \(1986\)](#).

In summary, we performed the following two regressions with two different dependent variables (*PCC* or *Coeff*): (1) WLS with weights given by  $1/e_i$ ; and (2) the mixed-effect model with weights given by  $1/(\tau^2 + v_i)$ , where  $v_i$  is individual variance and  $\tau^2$  is between-study variance, typically preferred as to the amount of heterogeneity [Kalaian and Raudenbush \(1996\)](#). Standard errors are calculated using bootstrap with 2000 replications. The estimation results are provided in [Table 2](#) and result with all control variables in [Meta regression results](#) (Supporting Information).

Finally, to investigate the impact of the aggregation level of social incentive factors, we organized the seven social incentive groups into three higher aggregated social groups (i.e., social influences, network and trust). We fit the same model in [Equation \(3\)](#) using these three social incentives dummies (the network group being the base category). To compare our model of seven social incentives dummies (column 4, [Table 3](#)) with that of three social incentives dummies (column 6), we applied the Wald test with the null hypothesis of the equality between the coefficients of internal and external social influence dummies, equality between coefficients of network connection, leadership and network size (i.e., the regression intercept), and equality between trust in institutions and trust in others dummies. The Wald test statistic  $\chi^2(4) = 17.35$  with  $p = 0.0016$  suggests that the model with seven social incentives dummies is preferable. The computed statistic of an alternative test (likelihood ratio test) is  $\chi^2(4) = 16.62$  with  $p = 0.002$ , also suggesting that the unrestricted model (i.e., model with seven social incentives dummies) is preferable. Consequently, our proposed model with seven social incentives dummies is better than those with three higher-aggregated social incentives dummies. Moreover, in order to compare the magnitude of the impacts of the seven social incentives dummies for our model, we calculated the corresponding standardized coefficients:

$$\tilde{\gamma}_k = \hat{\gamma}_k \frac{s(SD_{ijk})}{s(PCC_{ij})}, \quad (4)$$

where  $\hat{\gamma}_k$  is the estimated coefficient of predictor  $k$ ,  $s(SD_{ijk})$  and  $s(PCC_{ij})$  are the sample standard deviation of the predictor  $k$  and the dependent variable (*PCC*), respectively. Standardized coefficients for other control variables are similarly defined. The standardized coefficients are reported in [Table 3](#) (column 5).



### 3 Results

Based on the existing literature, as mentioned above, we divided our discussions about the emergence of pro-environmental actions into seven groups of social incentives: internal and external social influence, network factors (network size, network connection, and leadership) and trust (trust in others and trust in institutions) [Bekkers and Schuyt \(2008\)](#); [Simpson and Willer \(2015\)](#). This result leads to seven social incentive dummies used in the meta-regression (network size being the base category). The forest plots in [Figs 3-6](#) show that internal and external social influence, trust in institutions and network connection are key significant factors that could be used to encourage pro-environmental behavior. Our summarized results ([Table 3](#), column 4, where the mixed-effect model is applied using partial correlation coefficients) suggest that the effect of internal and external social influence, network connection and trust in institutions on pro-environmental behavior are positive and statistically significant, meaning that Hypotheses H1a, H1b, H2a and H3a are validated. On the contrary, leadership and trust in others do not significantly affect pro-environmental behavior, meaning that Hypotheses H2c and H3b are not validated. The standardized coefficients (column 5) suggest that internal social influence is the most effective social incentive (since its value is the highest), followed by external social influence, network connection and trust in institutions.

#### Social influence

Our meta-regression results in [Table 3](#) show that there is a positive and significant impact of external social influence on pro-environmental behaviors at a 10% significance level. The forest plot in [Fig 4](#) suggests that the overall effect of external social influence is positive, even if some studies have reported negative results. This result means that the presence of external social influence is overall in favor of encouraging pro-environmental behaviors. For instance, several studies suggested that individuals who gain insights about environmental issues and receive recognition from their peers through “social comparative feedback” (e.g., household energy consumption report) could change and develop more environmentally-oriented behaviors because of the self-evaluation/-enhancement process [Festinger \(1954\)](#); [Robelia et al. \(2011\)](#). Therefore, external social influence is a factor that could positively impact pro-environmental behaviors.



Table 3: A brief summary of the meta regression results.

Variables	Coef		PCC			
	Weighted least squares	Mixed-effect model	Weighted least squares	Mixed-effect model, seven social incentives	Standardized coefficient of Model (4)	Mixed-effect model, three social incentives
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Social influence</b>						0.058*** (0.017)
Internal social influence	0.230 (0.144)	0.262*** (0.068)	0.167*** (0.062)	0.154*** (0.043)	0.8454	
External social influence	0.104 (0.143)	0.158** (0.069)	0.062 (0.062)	0.085* (0.045)	0.4680	
<b>Network factors</b>						
Leadership	0.046 (0.196)	0.125 (0.087)	0.061 (0.078)	0.053 (0.057)	0.1479	
Network connection	0.089 (0.167)	0.174** (0.077)	0.025 (0.065)	0.091** (0.045)	0.3444	
<b>Trust</b>						-0.004 (0.029)
Trust in institutions	0.208 (0.191)	0.229*** (0.082)	0.091 (0.069)	0.110* (0.062)	0.3445	
Trust in others	0.045 (0.157)	0.074 (0.079)	-0.029 (0.066)	0.030 (0.047)	0.1133	
<b>Control variables</b>						
<i>Difference between regions</i> (Europe as baseline)						
MEA	0.174 (0.176)	0.138* (0.078)	0.148** (0.070)	0.119** (0.062)	0.2901	0.103* (0.066)
Presence of demographic variables	-0.203*** (0.073)	-0.072* (0.064)	-0.110*** (0.028)	-0.076** (0.034)	-0.4571	-0.074** (0.035)
SE (or SEpcc)	1.951*** (0.134)	1.234*** (0.179)	0.899** (0.455)	1.123*** (0.381)		1.101*** (0.373)
Intercept	-10.010 (9.938) -8.383 (12.144)	-11.941* (6.248) -12.099* (6.263)	-3.458 (5.445) -3.245 (5.689)	-5.542 (3.597) -5.861 (3.593)		-6.606 (5.330) -6.606 (5.330)
Observations	185	185	185	185		185
Studies	125	125	125	125		125

Notes: Meta-regressions with effect size coefficient or partial correlation coefficient as dependent variables. All the columns are obtained from regressions using seven social incentive groups (network size as the base category), except the last one that is based on the regression using three higher-aggregated social incentive groups (network as the base category). Full estimation results with all control variables are given in the S7 Table in Supporting Information.

Weighted least squares are estimated with weights equal to  $1/SE$  (or  $1/SE_{pcc}$ ). In the multivariate mixed-effect model, the weight is calculated using  $1/(\tau^2 + v_i)$ , where  $v_i$  is individual variance and  $\tau^2$  is between study-variance or typically called the amount of heterogeneity.

The Wald test of Model in column 4 vs. Model in column 6 is  $\chi^2(4) = 17.35$  with  $p = 0.0016$ , suggesting that Model in column 4 is preferable.

Bootstrap standard errors with 2000 replications are in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

However, in some cases, external social influence could discourage environmental conservation. For instance, one study revealed that comparison feedback might perform poorly in encouraging environmental conservation (e.g., soil conservation) because terracing is a demanding soil conservation practice and farmers have a low perception of environmental issues [Willy and Holm-Müller \(2013\)](#). Thus, if there is a relatively low individual perception of an environmental issue, external social influence may also fail to promote pro-environmental behaviors. In another example, when asking people how much they are willing to contribute to environmental conservation, individuals will report lower conservation efforts if they know that their profiles and results are invisible to others. People may act collectively but regardless of the demand of the social situation if they know that others cannot observe their actions [Lee et al. \(2016\)](#);

Brick et al. (2017). For example, if a community could not observe forest owners' behaviors and if there were no regulator to monitor them, then forest owners would collectively choose deforestation, even with strong social expectations (social norms) that forest conservation is essential for society Ledyard (1995); Korhonen et al. (2013).

Regarding the forest plot in Fig 3, most of the studies in the literature suggest a positive effect of internal social influence on pro-environmental behaviors. In addition to the forest plot, our meta-regression results in Table 3 suggest that internal social influence has a positive and significant effect on pro-environmental behaviors. The standardized coefficients reported in Table 3 (column 5) indicate that the internal social influences that motivate people to change their perceptions and attitudes are significant to promote pro-environmental behaviors (the standardized coefficient is 0.8454 while that of external influence is 0.4680). Thus, internal social motives that help guide people to change their perceptions and attitudes toward a sustainable behavior could be more efficient than the external social influence Turner (1991); Cialdini and Goldstein (2004); Harpine (2015). For instance, one study has suggested that altering individuals' perceptions by providing different visual attention to climate information (e.g., global temperature change) could reinforce their beliefs and motivations to take actions to mitigate climate change Hartter et al. (2012); Luo and Zhao (2019).

### 3.1 Network factors

Our results suggest that the effect of network connection is relatively strong, with the standardized coefficient equals 0.344 (see the results in Table 3). In one study, the authors showed that network has an indirect impact on ecological health because it helps to share information and knowledge across individuals and to promote cooperation among members of the network Barnes et al. (2016). On the other hand, individuals are less likely to take a conservation action because they fear that their neighbors may free-ride on their efforts, such as restoring soil functions or investing in fertility improvements Wollni and Andersson (2014); Di Falco et al. (2020). Thus, a stronger network connection (i.e., a denser network), the main characteristic of network structure, is an effective social incentive to enhance environmental behavioral changes.

Several studies have indicated that larger network size is responsible for weaker network connection or less social interaction because individuals in a society or group only make con-

tact or frequently interact with others living close to them [Derksen and Gartrell \(1993\)](#); [Yau \(2010\)](#); [Yang et al. \(2013\)](#). Our forest plot (Fig 5) suggests that network size does not affect pro-environmental behaviors. Meta-regression results also support this finding by indicating that other groups of social incentives positively affect pro-environmental behaviors compared to network size (as the base category). It should be noted that the effect of network size corresponds to the regression intercept. The latter also corresponds to the overall effect size in the meta-regression. Moreover, it represents the effect of the base category for other groups of dummies (more precisely, census data among types of data collection methods and Europe among geographical regions). Consequently, we cannot separately identify the overall effect size, the effect of network size, and the effect of the base category for other dummy groups. A simple meta-regression without variables of interest (i.e., social incentives) and any control variable gives a very rough estimation of the overall effect size (see [Test for publication bias.](#), also corresponding to a test for publication bias). When this meta-regression model is augmented by social incentive dummies (see Table 3, columns 1' and 3' using effect size coefficient and partial correlation coefficient as dependent variables, respectively), the intercept may become (significantly or not) negative. This is because the intercept also includes the effect of the base category of social incentives (i.e., network size). Hence, increasing network size will not result in a better environmental outcome, *ceteris paribus*. By comparing this result with the network connection, we would expect that if an increase in the network size is accompanied by an increased degree of connection between individuals, the adverse effect of network size can be more than offset by the positive effect of connections between individuals, leading to a pro-environmental action. In other words, when requiring this combination of network size and network connection, the point of vigilance must be to observe the necessary condition of an increase in the connection.

In order to have a sustainable network, the presence of a good leader appears to be necessary. This leader is responsible for providing information and keeping people connected. For example, some studies showed that a “block leadership” approach treatment has a positive impact on the recycling rate of households because a leader plays a vital role in sustaining a connection and providing needed information to households within the leader’s network [Burn \(1991\)](#); [Hopper and Nielsen \(1991\)](#). Block leaders are defined as volunteers who help inform people in their

groups about a specific issue. However, the coefficient of leadership in our meta-analysis regression is statistically insignificant compared to the network size (see Table 3). This result is not surprising because, among the positively significant results of leadership, some studies reported the positively small and even negative impact of leadership on pro-environmental behaviors (see the forest plot in Fig 5). For example, one study indicated that the presence of a leader in groups that have the autonomy to craft governance rules for their environmental resource could encourage the groups collective actions toward resource conservation but discourage resource conservation when groups are subject to rules imposed by others [Van Laerhoven \(2010\)](#). A detailed analysis of the autonomy to craft governance rules would be interesting but is beyond the scope of this paper. Thus, it would be interesting for future studies to take it into account when studying the impact of leadership on pro-environmental behaviors. We also re-estimated the model by excluding one paper that reported a negative impact of leadership and obtained the same results. We can be confident that an outlier is not present in our data.

### 3.2 Trust

Our meta-analysis results (Table 3) show that trust in institutions is a driver of pro-environmental behaviors. A lack of trust in government can lead to a negative individual perception of an institutional design/government program and prevent the individual from participating in it. For example, a well-designed agri-environmental contract cannot completely replace a farmer's trust in government institutions [Polman and Slangen \(2008\)](#). The existing literature has also suggested that the rate of participation in an environmental program can be increased by motivating people and by maintaining and developing institutional trustworthiness [Sønderskov \(2009\)](#); [Xiao and McCright \(2015\)](#).

Regarding the forest plot in Fig 6, trust in others has an overall positive effect on pro-environmental behaviors. Similar to trust in institutions, maintaining trustworthiness between individuals has a positive impact on behavioral changes, as shown by numerous studies [Yan et al. \(2018\)](#). However, our meta-regression results cannot confirm the significant impact of trust in others on pro-environmental behaviors (see Table 3). Some of the existing literature suggests that trust in others may fail to motivate new attitudes about environmental issues and pollution [Hao et al. \(2019\)](#). In their study, the authors argued that a higher level of trust

within a close network could cultivate a sense of comfort and security and thus makes people less likely to respond to less immediate and indirectly observable environmental issues. One study indicated that trust in others performing resource conservation behaviors might have a low impact on resource extraction because of the subtractability property of the common resource (i.e., consuming an additional common resource would decrease the available resources for others) [Beitl \(2014a\)](#). As a result, because of the resource constraint, individuals who trust in others performing resource conservation feel that they have no choice but to harvest whatever the environment provides.

## 4 Robustness checks

Regarding the robustness of our estimation results, we classified pro-environmental behaviors into three different groups, including environmental conservation, environmental consumption and general pro-environmental behaviors. The detailed classification of the dependent variable is reported in [Classifications of dependent variable](#) (Supporting Information). Indeed, conservation efforts are more likely to have positive spillovers on others (i.e., positive externalities) and also more likely to be observed by others (i.e., visibility or observability) than consumption efforts (e.g., eating green). We observe that the social incentive factors play a crucial role in promoting environmental conservation rather than environmental consumption and general pro-environmental behaviors (the estimation results are reported in [Mixed-effect meta regression results with subgroups of dependent variable](#), Supporting Information).

Alternatively, we checked the robustness by classifying the observed pro-environmental behaviors into two different groups, including high dependency (i.e., pro-environmental behaviors that highly depend on the critical contribution of others to ensure their successes) and low dependency, which is otherwise the pro-environmental behaviors that less likely depend on the critical contribution of others to ensure their success. The detailed definitions of these two classifications are reported in [Classifications of dependent variable](#) (Supporting Information). Indeed, similar to public good contributions, some kinds of pro-environmental behaviors like recycling or workplace pro-environmental behaviors require the contributions of many other fellow citizens to ensure their success. For instance, individuals are more likely to contribute to a public good if they observe that others also contribute [Frey and Meier \(2004\)](#); [Berger \(2017\)](#).

Estimation results reported in [Mixed-effect meta regression results with subgroups of dependent variable](#) (Supporting Information) suggests that social incentive factors play a significant role only when pro-environmental behaviors highly depend on the contribution of others.

## 5 Discussions and conclusions

Our results suggest that policymakers should focus on at least three issues to promote pro-environmental behaviors in society. Firstly, we found that internal social influence is the most important social incentive that positively affects pro-environmental behaviors. This result means that internal social influence that motivates people to change their perceptions and attitudes is extremely important and necessary to promote pro-environmental behaviors. In addition to internal social influence, our results suggest that external social influence also positively impacts pro-environmental behaviors but is less effective than internal influences. This result aligns with the existing literature that holds that internal social motives are better than external ones because they guide people into changing their behaviors. In contrast, external influences can drive people to perform a specific action through compliance and identification, but it is not enough to motivate them to change their perceptions and attitudes toward a sustainable behavior [Turner \(1991\)](#); [Cialdini and Goldstein \(2004\)](#); [Harpine \(2015\)](#). This finding implies that the impacts of an environmental policy can be under-estimated if policymakers do not include social influence in their decisions regarding environmental issues. Therefore, based on our meta-analysis results, effective environmental policies should focus on strengthening individuals' personal norms by fostering environmental awareness and the sense of obligation toward eco-friendly behaviors (e.g., improving green education and providing environmental information).

Secondly, since network is a valuable source of knowledge and information for individuals, the effectiveness of a conservation policy can be improved only if connections or interactions among individuals are increased. This result does not support an existing conjecture [De Young et al. \(1995\)](#), which hypothesizes that increasing interactions between individuals in a large structure can be harmful to collective conservation behaviors. One example validating our results relates to pecuniary and non-pecuniary mechanisms in a spatial coordination game [Banerjee \(2017\)](#), consisting of giving agglomeration bonuses to people who interact in an enlarged network. It

was shown that these bonuses could enhance coordination towards environmental conservation programs. In addition to the agglomeration bonus that encourages people to collaborate in a network to achieve an environmental target (i.e., collective actions), policymakers could also try to establish conditions under which individuals could share their knowledge to better drive them toward more sustainable behaviors (e.g., a favorable regulatory framework for environmental associations/groups).

Finally, we found that trust in institutions (e.g., governments, institutions or leaders) is needed to ensure a positive impact on pro-environmental behaviors. It is important because citizens trust in government can dictate individual behaviors to shape policy design and generate desired policy outcomes. For instance, trust in institutions could reduce the risk of free-riding and opportunistic behaviors as citizens would be willing to sacrifice some immediate personal benefits (e.g., by contributing to common goods) if they have positive expectations of the long-term outcomes of the governments policies [Irwin \(2009\)](#). Examples of making institutions more inclusive, transparent, receptive and efficient at the local and national levels include increased transparency, improved communication and interaction with populations [Polman and Slangen \(2008\)](#); [Zannakis et al. \(2015\)](#) (e.g., participatory democracy and citizen convention).

This study quantified the strength and relevance of seven groups of social incentives of pro-environmental behaviors, which constitutes our main contribution to this study. One issue which has not been fully addressed is the impact of a countrys cultural differences on pro-environmental behaviors. Our meta-regression partially addressed this issue by using geographical regions and study-specific effects. The coefficient of MEA (i.e., Middle East & Africa) is positive and significant (although at the 10% significance level only), supporting a relatively higher effect compared to Europe (as the base category). However, we admit that our approach cannot satisfactorily address the differences in national cultures. This issue is important enough to be investigated in-depth in a future study, in which the general characteristic of a national culture can be captured by using Hofstedes values, for example, and adopting a previously proven approach [Morren and Grinstein \(2016\)](#).

## Data and code availability

The data and statistical codes (in R software) used in this study are available from the authors upon request.

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## Supporting information

Fig S1: The diagram of these seven groups of social incentives.

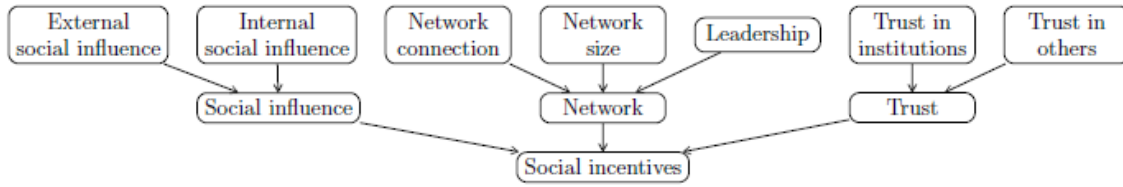
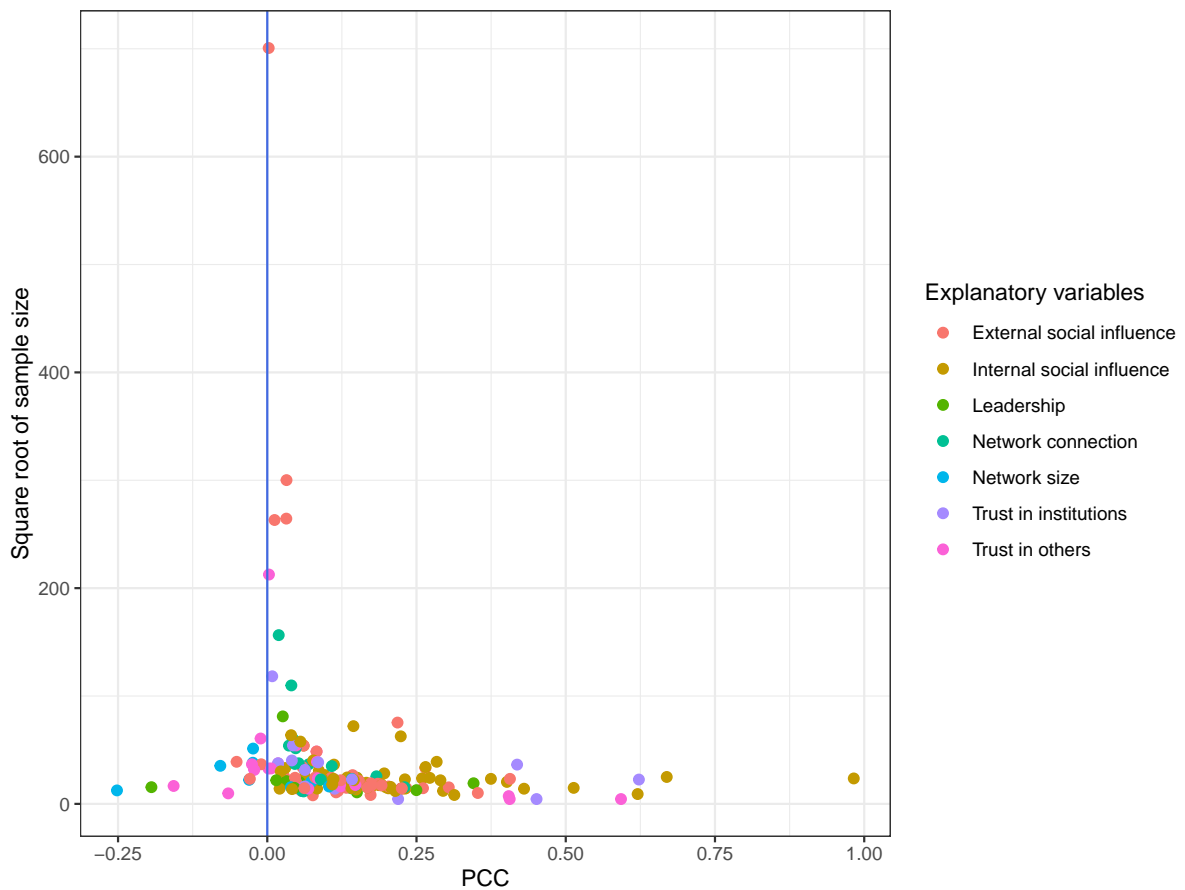
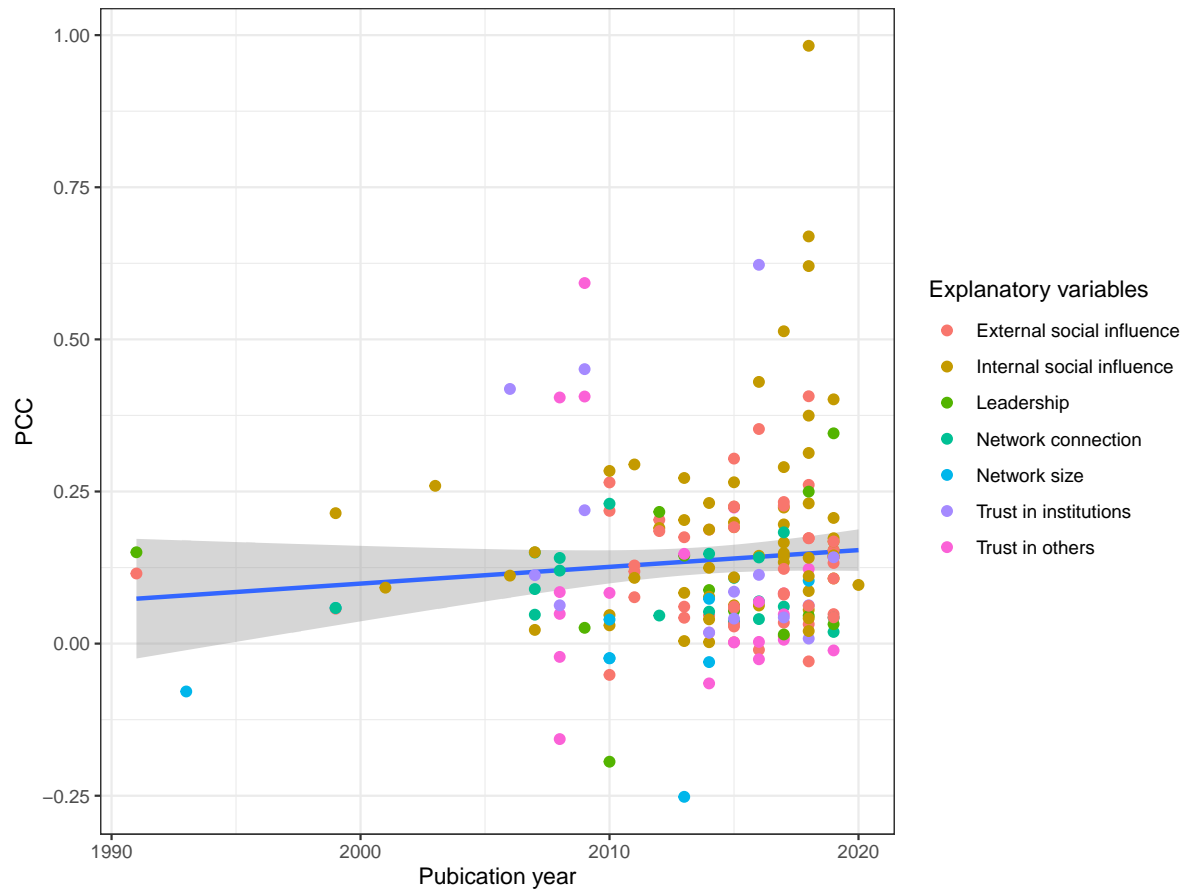


Fig S2: Plot of partial correlation coefficient vs. squared root of study's sample size.



S3 Fig. Plot of partial correlation coefficient vs. publication year. The line and the shaded area represent the linear fit and the corresponding 95% confidence interval, respectively.

**Fig S3:** Plot of partial correlation coefficient vs. publication year. The line and the shaded area represent the linear fit and the corresponding 95% confidence interval, respectively.



**Table S1:** Study characteristics.

Study characteristics	Number of observations	Number of papers
Publication period		
1991-2005	9	5
2006-2010	33	19
2010-2015	58	41
2016-2020	85	62
Data collection method		
Field experiment	19	17
Laboratory experiment	3	3
Face-to-face interview	27	16
Telephone interview	6	3
Online survey	35	22
Mail survey	22	16
Questionnaires	52	36
Census data	21	12
Country by regions		
America		
Canada	5	4
Mexico	1	1
US	38	30
Bolivia	1	1
Ecuador	1	1
Asia & Pacific		
Australia	11	6
China	19	13
Hong Kong	1	1
Japan	2	1
Malaysia	5	3
Nepal	1	1
New Zealand	1	1
Singapore	2	1
South Korea	6	3
Taiwan	8	4
Thailand	1	1
Europe		
Belgium	2	1
Finland	1	1
France	2	1
Germany	6	3
Ireland	2	1
Italy	9	5
Netherlands	9	6
Norway	3	2
Poland	1	1
Spain	3	2
Sweden	1	1
Switzerland	5	2
Turkey	2	2
UK	9	8
Middle East and Africa (MEA)		
Ethiopia	3	2
Israel	1	1
Kenya	3	2
South Africa	1	1
Multiple countries		
Africa, America, Asia	3	1
Europe	9	4
Germany and Japan	1	1
UK, Europe, North Africa	1	1
UK, US, Denmark, and Sweden	2	1
US, Canada	1	1
US, Europe, South Africa, Asia	1	1
US, UK, Romania, Italy	1	1

**Table S2:** Correlation matrix of seven social incentive dummies.

	External social influence	Internal social influence	Trust in institutions	Trust in others	Network size	Network connection	Leadership
External social influence	1.00						
Internal social influence	-0.09 (0.232)	1.00					
Trust in institutions	-0.07 (0.353)	-0.03 (0.638)	1.00				
Trust in others	-0.08 (0.273)	-0.04 (0.579)	-0.03 (0.667)	1.00			
Network size	0.03 (0.727)	0.01 (0.859)	0.01 (0.891)	0.01 (0.871)	1.00		
Network connection	-0.13 (0.079)	-0.07 (0.375)	-0.05 (0.491)	-0.06 (0.416)	0.02 (0.795)	1.00	
Leadership	-0.07 (0.363)	-0.03 (0.645)	-0.03 (0.721)	-0.03 (0.673)	0.01 (0.892)	-0.05 (0.500)	1.00

Notes: The  $p$ -value of the Pearson correlation coefficient is in parentheses. The Pearson correlation coefficient suggests that there is no multicollinearity in our seven social incentive dummies.

**Table S3:** Definitions of dependent variable.

Variables used in collected studies	Variables used in our study	
Household/individual/self-reported/climate-change pro-environmental actions (behaviors). (Private) environmental actions (behaviors). Collective environmental actions (behaviors).	Pro-environmental behavior	
Pro-environmental/behavioral intentions. Environmental efficiency intention. Intention to engage in pro-environmental actions/waste sorting. Intention to reduce car-travel/environmental problems/climate issues.	Pro-environmental intentions	
Percentage change in total energy consumption. Monthly/weekly/daily energy consumption.	Energy consumption <sup>a</sup>	
Self-reported energy conservation/electricity reduction. Energy-saving behaviors/intentions. Use acceptable techniques to conserve energy/installing new solar PV system.	Energy conservation	
Monthly/weekly water use.	Water consumption <sup>a</sup>	
Sustainable water consumption behavior/water conservation. Water-sensitive gardening (car washing) behavior/using recycled (desalinated) water. Soil and water conservation investment.	Water conservation	
Frequency of recycling. Household waste collected/proportion of waste recycled. Number of items recycled. Intention to perform household recycling/recycling intention/waste separation intention.	Recycling	Pro-environmental behaviors
Number of trees planted on private land/intention to participate in tree planting. Estimated CO2 emission saving. Restriction of intensive practices/adopt organic farming/reduce pesticide use. Regularly engaging in resource/forest monitoring. Soil conservation.	Environmental conservation	
Participation in a solar program. Contribution to a tree planting project (conservation program/environmental protection). Intention to participate in environmental activities.	Environmental programs	
Participation in environmental group (cooperatives).	Environmental groups	
Climate friendly food consumption/green purchasing behaviors.	Green consumption	
Shark bycatch/fishing behaviors.	Resource extraction <sup>a</sup>	
Workplace pro-environmental behaviors. Employee green behavior/organizational environmental behavior.	Workplace environmental behaviors	

Notes: <sup>a</sup> Reverse coded.



**Table S4:** Definitions of predictor variables.

Variables used in collected studies	Variables used in our study	
Attitude toward pro-environmental behaviors. Fear of social sanctioning/neighbors-judge. “Green to be seen” (visibility) effect. Personal norm/self-identity/environmental identity. Intrinsic motivation/normative motives/willingness to sacrifice for the environment.	Internal social influence	
Information treatment (about other behaviors/environmental messages/environmental movies) Household (energy/electricity/water) consumption report (feedback)/group-level feedback/comparative feedback. Social norms/descriptive norms/subjective norms/injunctive norms/community norms. Installation base (number of solar PV installation in the neighborhood). Peer educator treatment/peer influence. Second-order normative belief.	External social influence	Social influence factors
Eco-network (number of environmentally-minded friends)/number of friends engaged in household recycling. Structural social capital/social network (number of environmental associations participated in). Work group size (number of employees in the work group)/group size/number of users in a forest group.	Network size	
Network ties to environmental group/environmentalists/belonging to a strong tied network. Bonding social capital (frequency of meetings with friends and relatives)/neighborhood connection/group identification. Community ties/sense of community/community attachment. Frequency of engaging in environmental cooperative activities.	Network connection	Network factors
Leadership support (in pro-environmental actions). Block-leadership approach treatment. Leader’s voluntary green workplace behaviors/green transformational leadership/leader’s behaviors. Presence of a group leader.	Leadership	
Interpersonal trust/generalized trust/social trust. Feeling of trust and safety/most people can be trusted. Trust index/level of trustworthiness/level of trust in family and friends.	Trust in others	Trust
Government trust/institutional trust/political trust. Level of trust in public institutions. Trust in government/trust institution in general. Belief in government competence.	Trust in institutions	

Notes: <sup>a</sup> Reverse coded.

**Table S5: Descriptive statistics.**

Study characteristics	Observations	Mean	Std.Dev	Min	Max	Percent of observations	Number of papers
<b>Overall effect size (PCC)</b>	185	0.136	0.151	-0.251	0.982	100	125
<i>Effect size categorized by type of pro-environmental behaviors</i>							
Pro-environmental behaviors	20	0.148	0.247	-0.025	0.982	10.93	14
Pro-environmental intentions	29	0.174	0.156	-0.157	0.620	14.75	18
Energy consumption	9	0.089	0.106	0.002	0.294	4.92	8
Energy conservation	20	0.147	0.165	0.018	0.623	10.93	12
Water consumption	2	0.154	0.041	0.125	0.183	1.09	2
Water conservation	7	0.095	0.046	0.046	0.145	3.83	6
Recycling	31	0.141	0.136	-0.078	0.593	16.93	20
Environmental conservation	23	0.087	0.129	-0.252	0.313	12.57	14
Environmental programs	13	0.146	0.120	-0.051	0.353	7.10	10
Environmental groups	5	0.132	0.154	0.028	0.405	2.73	3
Green consumption	10	0.177	0.156	-0.029	0.451	5.46	6
Resource extraction	2	-0.012	0.074	-0.065	0.040	1.09	2
Workplace pro-environmental behaviors	14	0.136	0.108	-0.030	0.346	7.65	11
<i>Effect size categorized by predictor variables</i>							
<b>Social influence factors</b>							
Internal social influence	55	0.204	0.173	0.021	0.982	29.7	55
External social influence	55	0.124	0.099	-0.051	0.407	29.7	53
<b>Network factors</b>							
Network size	9	-0.014	0.107	-0.252	0.103	4.86	9
Network connection	19	0.093	0.058	0.019	0.230	10.3	19
Leadership	12	0.097	0.138	-0.194	0.346	6.59	12
<b>Trust</b>							
Trust in institutions	14	0.171	0.190	0.008	0.623	7.57	13
Trust in others	21	0.098	0.177	-0.157	0.593	11.4	20
<b>Control variables</b>							
<i>Differences between geographical regions</i>							
America	185	0.248	0.433	0	1	24.86	37
Asia & Pacific	185	0.300	0.459	0	1	30.05	35
Europe	185	0.300	0.459	0	1	30.05	36
MEA	185	0.043	0.205	0	1	4.37	6
Multiple countries	185	0.103	0.305	0	1	10.38	11
<i>Difference in model specifications</i>							
Presence of demographic control	185	0.502	0.501	0	1	50.27	62
Presence of education control	185	0.327	0.470	0	1	32.78	41
Presence of income control	185	0.360	0.481	0	1	36.06	42
<i>Types of data collection method</i>							
Experiment	185	0.120	0.326	0	1	12.02	20
Direct contact	185	0.453	0.499	0	1	45.35	55
Indirect contact	185	0.311	0.464	0	1	31.14	38
Census data	185	0.114	0.319	0	1	11.47	12
<i>Types of population</i>							
Employed	185	0.097	0.297	0	1	9.73	13
Demographic-related	185	0.200	0.401	0	1	20.00	25
Household	185	0.502	0.501	0	1	50.27	65
Agriculture-related	185	0.081	0.273	0	1	8.11	8
Others	185	0.118	0.324	0	1	11.89	14
Publication year	185	22.808	5.263	0	29	100	125

**Table S6: Test for publication bias.**

Variables	Coefficient
Intercept	0.027 (0.063)
$SE_{pcc}$	2.064* (1.186)
Observations	185
Studies	125

Notes: Meta-regression based on multivariate mixed-effect model with  $PCC$  as dependent variable and weights =  $1/SE_{pcc}$ .

Standard errors are in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

**Table S7: Meta regression results.**

Variables	Coef			PCC				
	Weighted least squares	Weighted least squares	Mixed-effect model	Weighted least squares	Weighted least squares	Mixed-effect model, seven social incentives	Standardized coefficient of model (4)	Mixed-effect model, three social incentives
	(1')	(1)	(2)	(3')	(3)	(4)	(5)	(6)
<b>Social influence</b>								0.058*** (0.017)
Internal social influence	0.296** (0.126)	0.230 (0.144)	0.262*** (0.068)	0.264*** (0.064)	0.167*** (0.062)	0.154*** (0.043)	0.8454	
External social influence	0.160 (0.126)	0.104 (0.143)	0.158** (0.069)	0.085 (0.062)	0.062 (0.062)	0.085* (0.045)	0.4680	
<b>Network factors</b>								
Leadership	0.109 (0.178)	0.046 (0.196)	0.125 (0.087)	0.093 (0.081)	0.061 (0.078)	0.053 (0.057)	0.1479	
Network connection	0.161 (0.149)	0.089 (0.167)	0.174** (0.077)	0.104 (0.068)	0.025 (0.065)	0.091** (0.045)	0.3444	
<b>Trust</b>								-0.004 (0.029)
Trust in institutions	0.284* (0.170)	0.208 (0.191)	0.229*** (0.082)	0.152** (0.073)	0.091 (0.069)	0.110* (0.062)	0.3445	
Trust in others	0.100 (0.132)	0.045 (0.157)	0.074 (0.079)	0.067 (0.069)	-0.029 (0.066)	0.030 (0.047)	0.1133	
<b>Control variables</b>								
<i>Difference between regions (Europe as baseline)</i>								
America		-0.072 (0.073)	-0.017 (0.038)		-0.049* (0.029)	-0.026* (0.032)	-0.1364	-0.021 (0.026)
Asia & Pacific		-0.028 (0.087)	-0.058 (0.042)		-0.031 (0.035)	-0.038 (0.034)	-0.2153	-0.050** (0.026)
MEA		0.174 (0.176)	0.138* (0.078)		0.148** (0.070)	0.119** (0.062)	0.2901	0.103* (0.066)
Multiple countries		-0.111 (0.142)	-0.034 (0.063)		-0.080* (0.046)	-0.010* (0.051)	-0.0343	-0.023 (0.036)
<i>Difference in specification</i>								
Presence of demographic variables		-0.203*** (0.073)	-0.072* (0.064)		-0.110*** (0.028)	-0.076** (0.034)	-0.4571	-0.074** (0.035)
Presence of education variables		0.083 (0.068)	0.054 (0.040)		0.081*** (0.026)	0.052 (0.033)	0.2988	0.054* (0.033)
Presence of income variables		0.171** (0.069)	0.026 (0.042)		0.101*** (0.027)	0.035 (0.034)	0.2014	0.041 (0.041)
<i>Types of data collection method (census data as baseline)</i>								
Experimental design		-0.006 (0.114)	-0.042 (0.070)		0.004 (0.033)	-0.004 (0.051)	-0.0155	-0.039 (0.030)
Direct contact		-0.030 (0.108)	0.030 (0.057)		0.013 (0.037)	0.028 (0.045)	0.1671	0.033 (0.034)
Indirect contact		0.023 (0.094)	0.011 (0.053)		0.108*** (0.035)	0.063 (0.043)	0.3506	0.066** (0.036)
<i>Types of targeted population (Household as baseline)</i>								
Employed		-0.010 (0.111)	-0.024 (0.056)		-0.028 (0.058)	-0.028 (0.048)	-0.0999	-0.035 (0.028)
Demographic-related		-0.009 (0.085)	-0.030 (0.042)		0.001 (0.035)	-0.028 (0.035)	-0.1396	-0.026 (0.024)
Agriculture-related		0.038 (0.154)	0.010 (0.067)		0.023 (0.050)	-0.046 (0.050)	-0.1531	-0.053* (0.032)
Others		-0.002 (0.104)	0.030 (0.052)		-0.006 (0.051)	0.010 (0.046)	0.0349	0.008 (0.055)
Publication year		0.004 (0.006)	0.006* (0.003)		0.001 (0.003)	0.003 (0.003)	0.1740	0.003* (0.002)
SE (or SEpcc)	1.948*** (0.133)	1.951*** (0.134)	1.234*** (0.179)	1.280*** (0.399)	0.899** (0.455)	1.123*** (0.381)		1.101*** (0.373)
Intercept	-0.121 (0.119)	-8.383 (12.144)	-12.099* (6.263)	-0.071 (0.062)	-3.245 (5.689)	-5.861 (3.593)		-6.606 (5.330)
Observations	185	185	185	185	185	185		185
Studies	125	125	125	125	125	125		125
Adjusted $R^2$	0.545	0.552	-	0.303	0.442	-		-
F Statistic (df=162)	32.45***	11.3***	-	12.43***	7.62***	-		-
Test of moderators (df=22)	-	-	109.17***	-	-	65.34***		48.78***
Test for residual heterogeneity (df=162)	-	-	4440.16***	-	-	5266.77***		6481.45***

Notes: Meta-regressions with effect size coefficient or partial correlation coefficient as dependent variables. All the columns are obtained from regressions using seven social incentive groups (network size as the base category), except the last one that is based on the regression using three higher-aggregated social incentive groups (network as the base category). Weighted least squares are estimated with weights equals to  $1/SE$  (or  $1/SE_{pcc}$ ). In the multivariate mixed-effect model, the weight is calculated using  $1/(\tau^2 + v_i)$ , where  $v_i$  is individual variance and  $\tau^2$  is between-study variance, typically refer to as the amount of heterogeneity (Kalaian and Raudenbush, 1996).

The Wald test of Model in column 4 vs. Model in column 6 is  $\chi^2(4) = 17.35$  with  $p = 0.0016$ , suggesting that Model in column 4 is preferable.

Bootstrap standard errors with 2000 replications are in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

**Table S8:** Classifications of dependent variable.

Groups of dependent variable	Classifications
Environmental conservation. Water conservation. Energy conservation. Resource extraction.	Environmental conservation
Energy consumption <sup>a</sup> . Water consumption <sup>a</sup> . Recycling. Green consumption.	Environmental consumption
Pro-environmental behaviors. Pro-environmental intentions. Environmental groups. Environmental programs. Workplace pro-environmental behaviors.	General pro-environmental behaviors
Recycling. Environmental programs. Environmental groups. Environmental conservation. Resource extraction. Workplace pro-environmental behaviors.	High dependency
Pro-environmental behaviors. Pro-environmental intentions. Energy consumption. Water consumption. Energy conservation. Water conservation. Green consumption.	Low dependency

Notes: <sup>a</sup> Reverse coded.

**Table S9:** Mixed-effect meta regression results with subgroups of dependent variable.

	Environmental conservation	Environmental consumption	General pro-environmental behaviors	High dependency	Low dependency
<b>Variables</b>	(1)	(2)	(3)	(4)	(5)
<b>Social influence</b>					
Internal social influence	0.192** (0.076)	0.100 (0.099)	0.138 (0.097)	0.192*** (0.051)	0.047 (0.131)
External social influence	0.139* (0.076)	0.097 (0.096)	0.039 (0.098)	0.159*** (0.053)	-0.022 (0.131)
<b>Network factors</b>					
Leadership	-0.245** (0.096)	0.142 (0.114)	0.060 (0.097)	0.109* (0.057)	-0.055 (0.209)
Network connection	0.142** (0.067)	0.056 (0.115)	0.058 (0.106)	0.131** (0.059)	-0.022 (0.132)
<b>Trust</b>					
Trust in institutions	0.086 (0.068)	0.041 (0.184)	0.141 (0.111)	0.101 (0.068)	0.040 (0.137)
Trust in others	0.050 (0.067)	0.091 (0.177)	-0.039 (0.107)	0.101* (0.057)	-0.118 (0.133)
<b>Control variables</b>					
<i>Difference between regions (Europe as baseline)</i>					
America	-0.055 (0.090)	0.024 (0.044)	-0.086 (0.064)	0.024 (0.036)	-0.083 (0.061)
Asia & Pacific	-0.025 (0.118)	-0.023 (0.057)	-0.089 (0.069)	0.040 (0.036)	-0.123** (0.063)
MEA	0.158 (0.134)	-	0.127 (0.182)	0.096* (0.054)	0.233 (0.152)
Multiple countries	0.075 (0.121)	-	-0.052 (0.098)	0.066 (0.060)	-0.128 (0.091)
<i>Difference in specification</i>					
Presence of demographic variables	0.044 (0.086)	0.094 (0.116)	-0.159** (0.065)	-0.036 (0.045)	-0.103 (0.065)
Presence of education variables	-0.017 (0.080)	0.042 (0.103)	0.064 (0.067)	0.059 (0.046)	0.026 (0.057)
Presence of income variables	0.036 (0.078)	-0.091 (0.071)	0.080 (0.076)	0.018 (0.040)	0.105 (0.069)
<i>Types of data collection method (census data as baseline)</i>					
Experimental design	-0.009 (0.126)	-0.033 (0.120)	-0.019 (0.172)	-0.032 (0.066)	0.035 (0.081)
Direct contact	-0.018 (0.106)	0.059 (0.120)	0.092 (0.097)	0.002 (0.056)	0.095 (0.074)
Indirect contact	0.149 (0.117)	0.033 (0.093)	0.124 (0.098)	0.041 (0.050)	0.119 (0.079)
<i>Types of targeted population (Household as baseline)</i>					
Employed	-0.077 (0.171)	-0.052 (0.097)	-0.067 (0.084)	0.012 (0.052)	-0.054 (0.104)
Demographic-related	-0.008 (0.108)	0.011 (0.056)	-0.108 (0.071)	-0.005 (0.052)	-0.065 (0.055)
Agriculture-related	-0.051 (0.089)	-	-0.036 (0.174)	-0.035 (0.040)	-
Others	-0.191 (0.140)	0.026 (0.102)	0.012 (0.080)	-0.010 (0.056)	0.073 (0.079)
Publication year	0.012 (0.008)	0.003 (0.003)	0.001 (0.007)	0.001 (0.003)	0.006 (0.007)
SE (or SEpcc)	0.635 (1.138)	1.904** (0.776)	1.175 (1.126)	1.022** (0.498)	0.939 (0.763)
Intercept	-24.47 (17.398)	-7.727 (7.010)	-1.320 (13.760)	-1.548 (5.202)	-11.547 (13.845)
Observations	52	52	81	88	97
Studies	34	35	56	60	66
Test of moderators	38.95**	26.85	36.19**	42.17***	44.22***
Test for residual heterogeneity	220.72***	182.40***	1489.09***	353.96***	2823.22***

Notes: Meta-regressions with partial correlation coefficient as dependent variables. All the columns are obtained from regressions using seven social incentive groups (network size as the base category).

Weighted least squares are estimated with weights equals to  $1/SE$  (or  $1/SEpcc$ ). In the multivariate mixed-effect model, the weight is calculated using  $1/(\tau^2 + v_i)$ , where  $v_i$  is individual variance and  $\tau^2$  is between-study variance, typically refer to as the amount of heterogeneity (Kalaian and Raudenbush, 1996).

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

**Table S10: Summary survey table for meta-analysis of pro-environmental behavior.**

Author(Year)	Country	Method	Description	Pro-environmental behavior	Intervention/measurement	Target group	Number of observations
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Internal social influence</b>							
Aini et al. (2013) <a href="#">Aini et al. (2013)</a>	Malaysia	Questionnaires	Authors investigated the relative acceptability of technical adoption and behavioral change to energy-saving transport measures in response to climate change.	Acceptability-technical energy-efficient car”, etc.) (3 items)	Attitude towards energy conservation (“I am willing to make personal sacrifices for the sake of conserving energy”, etc.) (4 items)	Employees	201
Alcock et al. (2017) <a href="#">Alcock et al. (2017)</a>	UK	Census data	Authors investigated whether people with pro-environmental value orientations and concerns about the risks of climate change, and those who engage in more pro-environmental household behaviors, would also be more likely to abstain from such voluntary air travel, or at least to fly less far.	Household pro-environmental actions (“conserving energy in their homes, doing recycling”, etc.) (in category)	Pro-environmental attitude	Households	3,923
Bamberg et al. (2015) <a href="#">Bamberg et al. (2015)</a>	Germany	Face-to-face interview	The author studied the effect of subjective norms, which is when individuals think that their active actions and regular participation are supported by people who are important, on the intention to participate in climate action.	Participation intention in environmental group (in category)	Attitude toward participation (“how do you judge the personal consequences of an active and regular participation in a local environmental group?”)	Students	652
Brekke et al. (2010) <a href="#">Brekke et al. (2010)</a>	Norway	Questionnaires	Authors investigated how fear of social sanctioning could affect recycling behavior. The standard error is calculated using the t-stats reported in the paper.	Probability of recycling glass (in dummy (0 or 1))	Fear of social sanctioning	Households	1,104
Brick et al. (2017) <a href="#">Brick et al. (2017)</a>	US	Online survey	Authors studied how environmental identity and social visibility could lead to pro-environmental behavior, which is measured by the frequency of performing pro-environmental behaviors.	Self-reported recurring pro-environmental behavior (frequency of performing pro-environmental behaviors, including air travel, meat and dairy consumption, water conservation and recycling)	“Green to be seen” effect: the interaction between the environmental identity (seeing one-self as pro-environmentalist) and the visibility (one action is visible by others)	Households	437
Carfora et al. (2017) <a href="#">Carfora et al. (2017)</a>	Italy	Census data	The authors studied how subjective norm and self-identity could affect intention to engage in pro-environmental behaviors.	Intention to engage in pro-environmental behaviors (reducing food waste, for example)	Self-identity (“I think of myself as an environmentally-friendly consumer”)	Households	220

Ciocirlan et al. (2020)	UK	Questionnaires	Authors studied the effects of Value-Belief-Norm (VBN) variables on employee conserving behaviors.	Reducing use (electricity, photocopy, etc.) (5 items)	Personal norms ("I feel a sense of personal obligation to take action at work to stop wasting resources", etc.) (9 items)	Employees	714
Ciocirlan et al. (2020)	US	Mail survey	Authors studied the impact of the altruism scale and NEP score (as internal influence variables) on their green electricity participation decision.	Participation in a solar program	Altruism scale (which is constructed by applying the Schwartz norm-activation model)	Households	557
Clark et al. (2003)	Spain	Questionnaires	The authors studied how parents' and peers' descriptive and injunctive norms impact students' pro-environmental behaviors.	Environmental behaviors (separate paper and cardboard from the rest of the waste", etc.) (8 items)	Personal norm ("because of my own values/principles, I feel obliged to separate paper and cardboard from the rest of the waste")	Students	330
Dean et al. (2016)	Australia	Online survey	Authors studied the importance of community knowledge and environmental identity in conserving water source.	Water conservation (use of everyday water-saving strategies with 12 items of 5-point Likert scales)	Environmental identity ("we think of ourselves as an environmentally sustainable household", etc.) (six 5-scale items)	Internet users	5, 194
Dixon et al. (2015)	US	Online survey	Authors studied the impact of attitudes, subjective norms and behavioral intentions on energy conservation behaviors.	Self-report energy conservation ("turned off lights when not needed", etc.) (6 items)	Attitude ("lowering energy use at work is a good thing") (4 items)	Students	2, 919
Dobnicar et al. (2010)	Australia	Online survey	Authors aimed to identify the factors that are associated with higher levels of public acceptance for recycled and desalinated water.	Stated likelihood of using recycled/desalinated water (10 items)	Attitude towards water conservation ("water conservation is necessary because of water scarcity") (9 items)	Internet users	3, 094
Drescher et al. (2017)	Canada	Mail survey	Authors aimed to investigate the several established social-psychological determinants on landowner participation in a government-sponsored private land conservation program.	Conservation program participation (yes/no)	Attitude towards the action ("how efficient is the conservation program related to several environmental goals?")	Landowners	800
Dursun et al. (2019)	Turkey	Questionnaires	Authors investigated the theoretical and empirical evidence regarding the impeding effects of psychological barriers on individual energy conservation behavior.	Conserving electricity by daily efforts ("turning off the TV immediately if not watching", etc.) (4 items)	Personal norm ("I feel guilty when I waste energy", etc.) (6 items)	Students	415

Fang et al. (2017) Fang et al. (2017)	Taiwan	Questionnaires	The paper studied how descriptive norms could affect the environmental behaviors (sorting waste, outdoor activities, joining an environmental group, etc.).	Environmental behaviors (“I persuade others to sort waste”, etc.) (5 items)	Attitude (“I believe participation in environmental protection clubs is useful”, etc.) (5 items)	Children	385
Fang et al. (2017b) Fang et al. (2017)	Taiwan	Face-to-face interview	The paper investigated the effects of normative beliefs, attitudes, and social norms on pro-environmental behavioral intentions.	Behavioral intentions (“I will carry my own reusable tableware when I visit theme parks in the future”, etc.) (3 items)	Attitude (“It is inconvenient to carry reusable tableware”, etc.) (2 items)	Residents	391
Gilli et al. (2018) Gilli et al. (2018)	Italy	Online survey	The paper empirically investigated the relationship between reciprocity (the household declares to prefer a waste management tariff based on the average waste production of the municipality) and food waste recycling behaviors.	Food waste minimization (dummy with minimization = 1)	“Cluster 3” (in which participants are motivated mainly by the intrinsic motivation)	Households	556
Chazali et al. (2019) Chazali et al. (2019)	Malaysia	Questionnaires	The paper investigated the impact of Value-Belief-Norm variables on six different types of PEBs (i.e., activist, avoider, green consumer, green passenger, recycler and utility saver).	Green consumption (“use energy-efficient light bulbs”, etc.) (14 items)	Personal norm (“feelings of moral obligation for environmental preservation”) (8 items)	Residents	581
Han and Hyun (2018) Han and Hyun (2018)	South Korea	Questionnaires	The paper investigated the impact of moral obligation, attitude, and negative affect, and identified the salient role of moral obligation in determining eco-purchase and recycling activities.	Recycling behavior while traveling	Sense of obligation toward eco-friendly behaviors while traveling (“I feel an obligation to act pro-environmentally by choosing eco-friendly activities while traveling to a destination”) (3 items)	Students	518
Ho et al. (2015) Ho et al. (2015)	Singapore	Face-face interview	The paper examined the effects of attitude, subjective norms, perceived behavioral control on green-buying behaviors.	Green-buying intentions (“intentions to buy products in refillable packages, products with green labels”, etc. in the next 6 months)	Attitude toward environmental behavior (“respondents’ belief that engaging in PEBs is enjoyable, beneficial, important, and pleasant”)	Households	1, 168
Korkala et al. (2014b) Korkala et al. (2014)	Finland	Questionnaires	The author conducted a population-based cross-sectional study to assess if the understanding of climate change, concern over climate change or socio-economic characteristics are reflected in the frequencies of climate-friendly food choices.	Climate friendly food consumption (frequency intake of the climate-friendly food items)	Concern about climate change	Households	1, 623



Kurz et al. (2007) Kurz et al. (2007)	Ireland	Mail survey	The author studied how attitudes toward recycling, which has a strong sense of community, affect individuals' actions to participate in recycling.	Recycling participation (monthly bin collection)	Attitudes toward recycling (based on the recycling attitude scale on literature) (7 items)	Households	586
Landon et al. (2018) Landon et al. (2018)	US	Questionnaires	The authors studied the internal attributes that lead tourists to adopt three dimensions of pro-sustainable behavior drawing on the value-belief-norm model.	Eco-behavior (separate recycling from waste, etc.) (4 items)	Personal norm ("as a tourist, I feel morally obligated to do whatever I can to minimize my environmental impact", etc.) (5 items)	Tourists	623
Li et al. (2017) Li et al. (2017)	US	Online Survey	The authors studied the impact of peer pressure on energy conservation in which individuals feel comfortable to explain how to conserve energy to their friends and know that their close friends and colleagues always conserve energy.	Workplace pro-environmental actions ("turning off the office room lights when not in use")	Motivation about environmental actions ("how concerned are you about your personal energy consumption at your office?")	Employees	177
Liao et al. (2018) Liao et al. (2018)	China	Face-face interview	The paper investigated key factors influencing rural residents' separation intention, as well as analyzing the moderating effects of perceived policy effectiveness on the relationship between the determinants and the intention, using survey data of 538 rural residents in the province of Sichuan in China.	Separation Intention (PCA of 3 items)	Attitude ("waste separation is good", etc.) (4 items).	Households	538
Lin (2015) Lin (2015)	Taiwan	Face-face interview	The paper investigated how subjective norms and environmental attitudes affect intention toward efficiency environmental actions	Environmental efficiency intention ("when I replace a lamp, I will purchase an energy-saving one", etc.) (PCA of 4 items)	Environmental attitude ("using energy-saving lamps is not necessary to mitigate global warming", etc.) (4 items).	Households	235
Liu et al. (2017) Liu et al. (2017)	China	Mail survey	The authors proposed an integrated model based on the norm activation model and the theory of planned behavior by combining normative and rational factors to predict individuals' intentions to reduce car use.	Intention to reduce car-travel (Four 7-point scale items)	Attitude towards car-transport reduction (7-point semantic differential scale)	Car-drivers	600
Lubell et al. (2006) Lubell and Vedlitz (2006)	US	Tel. interview	The paper studied how the perceived risk, trust in policy elites, knowledge of the policy problem, and efficacy can help improve the intention to reduce air pollution.	Behavioral intentions (respondent's willingness to perform specific behaviors to reduce air pollution) (five 11-level items)	Personal influence (respondent believes their own actions influence the level of air pollution in their community)	Households	1, 326

McCarty and Shrum (2001)Mc-Carty and Shrum (2001)	US	Mail survey	The study investigated the influence of value orientations measured at the individual level (individualism, collectivism, and locus of control) and of economic status on environmental beliefs and behavior.	Recycling behavior ("I recycle newspapers used at home", etc.) (3 items)	Recycling belief ("recycling is important to save natural resources", etc.) (3 items)	Households	534
Meyer and Liebe (2010)Meyer and Liebe (2010)	Switzerland	Census data	The paper took into account various competing economic, psychological and sociological determinants of individuals' willingness to pay (WTP) for both public environmental and quasi-private environmental goods. The standard error is calculated using the reported t-value.	Willingness to pay in environmental protection (yes/no etc.) (3 items)	Environmental concern point scale question on respondent's environmental attitudes)	Households	1, 522
Miao and Wei (2013)Miao and Wei (2013)	US	Mail survey	The authors studied comparison of pro-environmental behavior and the underlying motivations between household and hotel settings.	Recycling behaviors ("I sort trash based on whether it can be recycled", etc.) (3 items)	Normative motives ("feel morally obligated to display pro-environmental behavior")	Households	581
Mzoughi (2011)Mzoughi (2011)	France	Questionnaires	The authors investigated empirically the role of moral and social concerns in farmers' decision to adopt organic farming. The standard error is calculated using the reported significance level.	Adoption of organic farming (in category 1,2,3)	Moral concerns (farmer thinks that do not feel guilty about his own choices is important)	Farmers	243
Panzone et al. (2018)Panzone et al. (2018)	UK	Field experiment	The authors investigated the role of environmental recall and carbon taxation on sustainable food shopping using the online experimental data.	Log amount of estimated CO2 emission save (gram in 7 days)	Environmental attitudes ("how important is it that you perform environmental behaviors?", etc.) (three 7-scale items)	Students	198
Passafaro et al. (2019)Passafaro et al. (2019)	Italy	Questionnaires	The authors investigated the role of local norm on intention to perform household waste recycling.	Behavioral intentions (during the next month, I intend to engage in household waste recycling) (two 6-scale items)	Attitude toward household waste recycling (one 6-scale items)	Students	222
Rees and Bamberg (2014)Rees and Bamberg (2014)	Germany	Mail Survey	The paper investigated the concept of social norms into the social identity model of collective action, to investigate the determinants of individuals' collective climate action intention. The standard error is calculated using the reported significance level.	Participation intention (three 5-scale items)	Group-based emotion ("I feel guilty about how we humans are treating the environment", etc.) (5-scale items)	Students	302

Reyhanloo et al. (2018) <a href="#">Reyhanloo et al. (2018)</a>	Switzerland	Online survey	The authors studied the factors that motivate the private-sector investors' intention and motivation to invest in land degradation neutrality. The standard error is calculated using the reported significant level.	Intention to invest in land degradation neutrality (yes/no)	Attitudes ("To the best of my knowledge, I think Land Degradation Neutrality is a promising solution to counteract land degradation in the long-term") (four 6-scale items)	Investors	68
Reynolds-Tylus et al. (2019) <a href="#">Reynolds-Tylus et al. (2019)</a>	US	Online survey	The authors studied the impact of choice clustering and descriptive norms on water and energy conservation.	Intention ("I intend to take steps to conserve my [energy/water] use on a daily basis")	Attitudes (taking steps to conserve my [energy/water] use would be beneficial to me)	Internet users	455
Sánchez-Medina et al. (2014) <a href="#">Sánchez-Medina et al. (2014)</a>	Spain	Face-face interview	The objective of this paper are to clarify the attitudes of the managers of Canarian small and medium-sized companies about taking environmental measures, and try to demonstrate whether there is a relationship between the proposed factors and the intention to take these measures.	Intention to perform pro-environmental behaviors	Attitude toward pro-environmental behaviors	Employers	201
Schirmer and Dyer (2018) <a href="#">Schirmer and Dyer (2018)</a>	Australia	Face-face interview	The objective of this paper are to investigate the factors that influence adoption of pro-environmental behaviors in promoting water-sensitive gardening behavior	Water-sensitive gardening behavior (mean of four measures: composting, mulching, raking, raking-blowing to street)	Attitude toward pro-environmental behaviors (belief own actions affect water quality)	Households	3,334
Sherkat and Ellison (2007) <a href="#">Sherkat and Ellison (2007)</a>	US	Census data	The author studied the connection between religion and environmental concern and activism.	Private Environmental Behaviors (frequency of engaging in recycling, reducing automobile use and buying food products grown without pesticides and chemicals)	Willingness to sacrifice for the environment ("pay much higher prices in order to protect the environment", etc.)	Households	908
Sujata et al. (2019) <a href="#">Sujata et al. (2019)</a>	Malaysia	Online survey	The author studied the moderating role of governmental and non-governmental organizations (NGOs) in translating recycling intention.	Recycling intention (I'd rather use old plastic/durable bags for shopping than new ones", etc.) (4 items)	Attitude ("I believe that my recycling behavior will help reduce pollution", etc.) (5 items)	Internet users	233
Terry et al. (1999) <a href="#">Terry et al. (1999)</a>	Australia	Questionnaires	The authors investigated how norms, self-identity and social identity could affect the intention to perform recycling behaviors.	Intention to perform household recycling	Attitude toward recycling	Households	143

Tesfaye et al. (2012) Tesfaye et al. (2012b)	Ethiopia	Questionnaires	The authors investigated the attitude and intention of households towards participating in collective forest management (tree planting) activity.	Intention to participate in tree planting	Attitude towards participating in planting	Households	349
Testa et al. (2016) Testa et al. (2016)	Italy	Mail survey	The paper explored the influence of personal capabilities and moral norms, along with trust in information on energy saving actions provided by different entities on two energy saving behaviors.	Energy-saving behaviors (4 items)	Personal norm ("I have a responsibility to contribute to environmental preservation by using energy saving products", etc.) (4 items)	Students	198
Van den Broek et al. (2019) Van den Broek et al. (2019)	Multiple countries	Online survey	The paper investigated the relative influence of intentional, normative, situational and habitual processes on energy saving behavior.	Energy-saving intention (2 items)	Personal norm ("due to values important to me, I feel obliged to use as little energy as possible")	Internet users	247
Unal et al. (2018) Unal et al. (2018)	Netherlands	Face-face interview	The paper explored whether personal norms are important predictors of eco-driving.	Intention to eco-drive (3 items)	Personal norm ("I feel morally obliged to drive in a fuel-efficient way", etc.) (2 items)	Households	83
Van Dijk et al. (2015) Van Dijk et al. (2015)	Netherlands	Mail survey	The authors studied the effectiveness of agri-environment schemes (AES) in enhancing biodiversity on farmland and motivating farmers toward environmentally-friendly practices.	Intention to participate in ditch bank/meadow bird management	Attitude toward ditch bank/meadow bird management ("I think that ditch bank/meadow bird management is positive")	Farmers	297
Viscusi et al. (2014) Viscusi et al. (2014)	US	Questionnaires	The paper studied how the legal and regulatory environment is strongly related to average county recycling rates and private perceptions of neighbors' attitudes toward recycling.	Number of cans and papers recycled	Neighbor would be upset (yes/no)	Households	4, 058
Wesselink et al. (2017) Wesselink et al. (2017)	Netherlands	Online survey	The study examined the role of organization and managers and workplace pro-environmental behaviors.	Pro-environmental behavior in the workplace	Attitude toward pro-environmental behaviors	Employees	479
Whitmarsh et al. (2018) Whitmarsh et al. (2018)	UK	Online Survey	The paper examined the predictors of recycling and waste reduction habits across the workplace, home and holiday contexts, and examined whether consistency across contexts is a function of pro-environmental identity.	Proportion of waste recycled	Attitude ("I believe that recycling at home benefits (1) me, (2) my local area and (3) the environment, respectively")	Employees	213

Wong et al. (2018)Wong et al. (2018)	Taiwan	Questionnaires	The paper examined the extended Theory of Planned Behavior (TPB) research model, which includes environmental concern and sensory appeal to predict consumers' purchase intention to suboptimal foods	Purchase intention (suboptimal food)	Attitude ("buying suboptimal food is a good idea", etc.) (4 items)	Households	539
Wynveen and Sutton (2015)Wynveen and Sutton (2015)	US	Tel. interview	The paper examined the role of stakeholder trust in a management agency, as a source of information about climate change, in climate-change-pro-environmental behaviors.	Climate-change-pro-environmental behaviors ("using energy efficient products, recycling", etc.) (20 items)	Personal norm ("I feel guilty about the ways I negatively impact the health of the marine park", etc.) (8 items)	Households	324
Xu et al. (2018)Xu et al. (2018)	China	Field experiment	The study tested the effects of economic incentive and social influence, which are theoretically considered as two general solutions to the domestic waste separation dilemma.	Household waste separation (separate recyclables, etc.) (4 items)	Personal norm ("due to my personal values/principles for environmental protection I feel obliged to separate waste in my everyday life", etc.) (2 items)	Households	188
Yildirim and Semiz (2019)Çakır Yıldırım and Karaarslan Semiz (2019)	Turkey	Questionnaires	The study investigated pre-service teachers' sustainable water consumption behaviors using the Value-Belief-Norm theory.	Sustainable water consumption behavior (I purposefully select products that allow me to conserve water) (4 items)	Personal norm ("I feel personally obliged to save as much water as possible", etc.) (8 items)	Teachers	482
Zhang et al. (2015b)Zhang et al. (2015)	China	Questionnaires	The study examined factors associated with waste separation behaviors by analyzing responses to questionnaires distributed in Guangzhou, China.	Separation intention ("I am glad to participate in the government waste separation plan", etc.) (3 items)	Attitude ("waste separation can create a better community environment") (3 items)	Households	208
<b>External social influence</b>							
Adda (2011)D'Adda (2011)	Bolivia	Laboratory experiment	Authors estimated how motivation, crowding and social image affect environmental conservation decisions	Contribution to a tree planting project (0-50 Bolivianos)	Public treatment (announce the contribution to others in the group)	Households	63
Agarwal et al. (2017)Agarwal et al. (2017)	US	Field experiment	Authors estimated how the "zero carbon" project in schools (school children nudges/information nudges) affects electricity consumption.	Monthly electricity consumption (in Kwh)	The treatment variable (electricity conservation messages from children to homes)	Households	69, 257

Alberts et al. (2016)Alberts et al. (2016)	UK	Field experiment	Authors investigated the impact of information feedback mechanism on electricity usage at a student resident.	Percentage change in total energy consumption	Weekly home energy report	Students	890
Allcott and Rogers (2014)Allcott and Rogers (2014)	US	Field experiment	Authors investigated the social comparison (which is the household energy report) in the OPOWER program on household monthly energy consumption.	Electricity use (in Kwh/day)	Treatment which is the post-arrival of the household energy report	Households	8, 515, 691
Asensio et al. (2015)Asensio and Delmas (2015)	US	Field experiment	Authors investigate how nonprice-based environment and health messaging can have substantial and economically meaningful reductions in demand at the household level. The result used in the meta-analysis is the estimation of the treatment variable "health group" (which is an information nudger treatment) on household energy consumption.	Weekly household energy consumption (in Kwh)	The treatment "health group" (which is an information nudger treatment)	Households	490, 994
Aydin et al. (2018)Aydin et al. (2018)	Netherlands	Field experiment	Authors investigated the impact of household consumption feedback on energy consumption through the use of in-home displays during two discrete stages.	Monthly electricity consumption (in log)	Treatment where treated group received weekly energy feedback and information regarding their consumption levels relative to other households	Households	948
Bamberg et al. (2015)Bamberg et al. (2015)	Germany	Face-to-face interview	The author studied the effect of subjective norms, which is when individuals think that their active actions and regular participation are supported by people who are important, on the intention to participate in climate action.	Participation intention in environmental group (in category)	Subjective norm ("would people, who are important to you, support your active and regular participation in a local TT group?")	Students	652
Bauwens and Eyre (2017)Bauwens and Eyre (2017)	Belgium	Online Survey	Authors empirically addressed the question of selection in community-based energy projects in terms of energy use, focusing on the case of renewable energy cooperatives.	Participation in a renewable energy cooperative	Pro-environmental orientation (whether the respondent perceives him or herself as someone concerned with the environment)	Households	2, 357
Bolderdijk et al. (2013)Bolderdijk et al. (2013)	Dutch	Laboratory experiment	Authors investigated how informational incentives (informing the public about the environmental consequences of their actions via environmental movies) should result in increased pro-environmental intentions and behavior.	Pro-environmental intentions ("I'm planning to reuse water bottles, etc.)	Information treatment which is the environmental movie.	Students	266

Brekke et al. (2010) <a href="#">Brekke et al. (2010)</a>	Norway	Questionnaires	Authors investigated how common glass recycling could affect household recycling behavior. The standard error is calculated using the t-stats reported in the paper.	Probability of recycling glass	“Glass recycling is common”	Households	1, 104
Busic-Sontic and Fuersta (2018) <a href="#">Busic-Sontic and Fuerst (2018)</a>	UK	Census data	Authors investigated the impact of geographical concentrations of personality traits on peer effects for adoption of solar photovoltaic (PV) systems. The result used in the meta-analysis is the estimation of the variable “installed base” (number of solar PV installations per dwelling in a postcode 3 months prior to adoption), which is used to capture the peer effect on the number of solar PV adoptions.	Number of new solar PV installations per dwelling	“Installed base” (number of solar PV installations per dwelling in a postcode 3 months prior to adoption)	Households	69, 930
Carfora et al. (2017) <a href="#">Carfora et al. (2017)</a>	Italy	Census data	The authors studied how subjective norm and self-identity could affect the intention to engage in pro-environmental behaviors.	Intention to engage in pro-environmental behaviors (reducing food waste, for example)	Subjective norm (“I think that most people who are important to me would approve with my reducing the amount of food that they throw away from my household over the next week”)	Households	220
Carrico and Riemer (2011) <a href="#">Carrico and Riemer (2011)</a>	US	Online survey	Authors studied the impact of different behavioral interventions on monthly electricity consumption in a workplace. The standard deviation is calculated using the reported t-statistics.	Monthly electricity consumption (in Kwh)	Group-level feedback treatment	Employees	145
Carrico and Riemer (2011) <a href="#">Carrico and Riemer (2011)</a>	US	Online survey	Authors studied the impact of different behavioral interventions on monthly electricity consumption in a workplace. The standard error is calculated using the reported t-statistics.	Monthly electricity consumption (in Kwh)	Peer education treatment (sending volunteers as peer educators within departments)	Employees	145
Cho and Kang (2016) <a href="#">Cho and Kang (2017)</a>	South Korea	Tel. interview	The authors studied the impact of norms, which is when community members work with each other and share the same values, on private environmental actions (donating money or volunteering to participate in an environmental group).	Private environmental behavior (“prefer to buy environmentally-friendly products”, etc.) (three 4-level items)	Norms (“I care about what my neighbors think about my behaviors”, etc.) (three 4-level items)	Households	1, 348
Collado et al. (2019) <a href="#">Collado et al. (2019)</a>	Spain	Questionnaires	The authors studied how parents’ and peers’ descriptive and injunctive norms impact students’ pro-environmental behaviors.	Environmental behaviors (separate paper and cardboard from the rest of the waste”, etc.) (8 items)	Best friend’s descriptive norm (“my best friend separates paper and cardboard from the rest of the waste”)	Students	330

Costa and Kahn (2013)Costa and Kahn (2013)	US	Field experiment	The study aimed to examine how energy conservation “nudges” could help to promote the pro-environmental behavior via the Home Electricity Report (HER) experiment.	Mean daily electricity consumption (Kwh)	Treatment (home energy report - HER treatment)	Households	2, 760, 175
Dixon et al. (2015)Dixon et al. (2015)	US	Online survey	Authors studied the impact of attitudes, subjective norms and behavioral intentions on energy conservation behaviors.	Self-report energy conservation (“turned off lights when not needed”, etc.) (6 items)	Descriptive norm (“the people I work with, whose opinions I value, are concerned about their energy use”) (3 items)	Students	2, 919
Fang et al. (2017)Fang et al. (2017)	Taiwan	Questionnaires	The paper studied how descriptive norms could affect the environmental behaviors (sorting waste, outdoor activities, joining environmental group, etc.).	Environmental behaviors (“I persuade others to sort waste”, etc.) (5 items)	Subjective norm (“people I know want me to save water”, etc.) (5 items)	Children	385
Fang et al. (2017b)Fang et al. (2017)	Taiwan	Face-to-face interview	The paper investigated the effects of normative beliefs, attitudes and social norms on pro-environmental behavioral intentions	Behavioral intentions (“I will carry my own reusable tableware when I visit theme parks in the future”, etc.) (3 items)	Social norms (“I am willing to follow the strategy that the government employed to limit the use of disposable tableware”, etc.) (5 items)	Residents	391
Fanghella et al. (2019)Fanghella et al. (2019)	UK	Online Survey	Authors studied how participants’ environmental self-identity and social information leads to increased donations to an UK environmental organization.	Donation to UK WWF environmental organization ( 0-1)	Social information treatment (in which the participants receive information that “last week, we conducted a similar survey on Prolific: participants were willing to donate on average 40% of their bonus to WWF UK.”)	Internet users	397
Ghazali et al. (2019)Ghazali et al. (2019)	Malaysia	Questionnaires	The paper investigated the impact of Value-Belief-Norm variables on six different types of PEBs (i.e., activist, avoider, green consumer, green passenger, recycler and utility saver).	Green consumption ( “use energy-efficient light bulbs”, etc.) (14 items)	Social norm (“most people who are important to me think I should purchase green products in place of conventional, non-green products”, etc.) (7 items)	Residents	581
Graziano and Gillingham (2015)Graziano and Fiaschetti (2016)	US	Census data	The paper reported that the average number of solar PV installations in the neighborhood has an impact on the adoption of photovoltaic (PV) systems.	Number of PV installations	Installed base (previous installation in the neighborhood)	Households	90, 090



Ho et al. (2015)Ho et al. (2015)	Singapore	Face-face interview	The paper examined the effects of attitude, subjective norms and perceived behavioral control on green-buying behaviors.	Green-buying intentions ("intentions to buy products in refillable packages, products with green labels, etc. in the next 6 months")	Subjective norm ("family members, close friends, and the general public engage in PEBs on a regular basis")	Households	1,168
Hopper and Nielse (1991)Hopper and Nielsen (1991)	US	Field experiment	The author investigated how social norms, which is when friends and neighbors expect recycling or they expect their friends and neighbors to recycle, has an impact on recycling behavior.	Recycling score (number of times each household recycled)	Information treatment (receiving informational brochure about the curbside recycling program)	Households	240
Horne and Kennedy (2017)Horne and Kennedy (2017)	US	Online survey	The paper studied whether participants used their emissions-related behavior as a signal to others to affect participants' reduction in emissions.	Carbon emission reduction responses (0-10)	Visibility (information was visible to the other players) with control for the respondents' liberal ideology.	Households	199
Jachimowicz et al. (2018)Jachimowicz et al. (2018)	US	Field experiment	The paper explored the role of first and second-order belief in household energy saving.	Percentage of monthly energy saving	Second-order normative belief ("the majority of neighbors (or community) thinks that reducing household energy contributes to saving the environment")	Households	211
Janmaimool and Denpaiboon (2016)Janmaimool and Denpaiboon (2016)	Thailand	Questionnaires	The paper evaluated determinants of villagers' engagement in pro-environmental behavior (PEB) which is the involvement in reusing and recycling products and waste reduction behavior by using potential predictors including a community norm, environmental knowledge, sense of obligation and self-efficacy and psychosocial characteristics.	Frequency of engagement in pro-environmental activities	Community norm ("your neighbors pay attention to issues related to ecological conservation and environmental protection").	Households	102
Lee (2010)Lee (2010)	Hong Kong	Questionnaires	The paper examined the possible contextual and individual factors that affect green purchase behavior in young consumers in Hong Kong.	Green purchasing behaviors (PCA of 4 items)	Peer influence ("how much do your friends tell you about things that are related to environmental protection?", etc. (2 items)).	Students	5,682

Leoniak and Cwalina (2019) Leoniak and Cwalina (2019)	Poland	Field experiment	The paper examined the impact of descriptive norm messages as well as the role of congruent or conflicting normative cues on promoting light-switching behavior.	Light-switching in unoccupied room (yes/no)	Descriptive norm message ("the vast majority of people turn off the light when leaving a restroom").	Students	710
Liao et al. (2018) Liao et al. (2018)	China	Face-face interview	The paper investigated key factors influencing rural residents' separation intention, as well as analyzing the moderating effects of perceived policy effectiveness on the relationship between the determinants and the intention, using survey data of 538 rural residents in the province of Sichuan in China.	Separation intention (PCA of 3 items)	Subjective norm ("most people who are important to me think I should separate household waste", etc.) (3 items).	Households	538
Lin (2015) Lin (2015)	Taiwan	Face-face interview	The paper investigated how subjective norms and environmental attitudes affect intentions toward efficiency environmental actions	Environmental efficiency intention (when I replace a lamp, I will purchase an energy-saving one, etc.) (PCA of 4 items)	Subjective norm ("when I buy a lamp, the person whom I concern will remind me to purchase an energy saving one", etc.) (4 items).	Households	235
Linder et al. (2018) Linder et al. (2018)	Germany	Field experiment	The paper investigated whether an information intervention can be effective in promoting recycling of food waste in an urban area	Household waste collected (in Kg)	Information intervention (information leaflet send to households with the information "Join your neighbors on Hovmästargatan, recycle your food waste").	Households	364
Liu et al. (2017) Liu et al. (2017)	China	Mail survey	The authors proposed an integrated model based on the norm activation model and the theory of planned behavior by combining normative and rational factors to predict individuals' intentions to reduce car use.	Intention to reduce car-travel (Four 7-point scale items)	Subjective norm ("most of the people important to me think that I should reduce car-transport", etc.) (three 7 point scale items)	Car-drivers	600
Long et al. (2014) Long et al. (2014)	New Zealand	Field experiment	The author investigated how perceived friends' norms for littering affect students' littering behaviors in a New Zealand high school community.	Recycling behavior ("I put my bottles and cans into the school recycling bins")	Perceiving friends' recycling norms ("my friends put their bottles and cans into the school recycling bins")	Students	600
Meyer and Liebe (2010) Meyer and Liebe (2010)	Switzerland	Census data	The paper took into account various competing economic, psychological and sociological determinants of individuals' willingness to pay (WTP) for both public environmental and quasi-private environmental goods. The standard error is calculated using the reported t-value.	Willingness to pay in environmental protection (yes/no)	Conditional cooperation ("Regardless of what other people do, I personally try as much as possible to behave in a way that is environmentally aware")	Households	1, 522

Mizubuchi and Takeuchi (2013) Mizubuchi and Takeuchi (2013)	Japan	Field experiment	The authors studied the impact of comparative feedback with reward on percentage of energy reduction.	Electricity reduction (in Kwh)	Comparative feedback with reward	Households	208
Mizubuchi and Takeuchi (2013) Mizubuchi and Takeuchi (2013)	Japan	Field experiment	The authors studied the impact of comparative feedback with reward on percentage of energy reduction.	Electricity reduction (in Kwh)	Social norm (5-point Likert scale)	Households	208
Mzoughi (2011) Mzoughi (2011)	France	Questionnaires	The authors empirically investigated the role of moral and social concerns in farmers' decisions to adopt organic farming. The standard error is calculated using the reported significance level.	Adoption of organic farming (in category 1,2,3)	Variable "Show" which is "farmer thinks that showing one's environmental commitment to others is important"	Farmers	243
Park and Yang (2012) Park and Yang (2012)	China	Online survey	The author studied the factors associated with online environmental community members' intentions to participate in environmental activities in the Chinese context.	Behavioral intention to participate in environmental activities (5 items)	Subjective norm ("most people important to me think that I should participate in environmental activities") (3 items)	Internet users	260
Passafaro et al. (2019) Passafaro et al. (2019)	Italy	Questionnaires	The authors investigated the role of local norm on intention to perform household waste recycling.	Behavioral intentions ("during the next month, I intend to adopt household waste recycling") (two 6-scale items)	Subjective norm ("most of the people who are important to me think that I should recycle household waste") (Four 6-scale items)	Students	222
Rees and Bamberg (2014) Rees and Bamberg (2014)	Germany	Mail Survey	The paper investigated the concept of social norms in the social identity model of collective actions, to investigate the determinants of individuals' collective climate action intention. The standard error is calculated using the reported significance level.	Participation intention (three 5-scale items)	Participation norm (injunctive and descriptive norm)	Students	302
Reyhanoğlu et al. (2018) Reyhanoğlu et al. (2018)	Switzerland	Online survey	The authors investigated how the subjective norm could affect investment in land degradation. The standard error is calculated using the reported significance level.	Intention to invest in land degradation (yes/no)	Subjective norm	Investors	68

Reynolds-Tylus et al. (2019)	US	Online survey	The authors studied the impact of choice clustering and descriptive norms on water and energy conservation.	Intention ("I intend to take steps to conserve my [energy/water] use on a daily basis")	Perceived descriptive norm ("most of the people I know take steps each day to conserve their [energy/water] use")	Internet users	455
Schultz et al. (2014)	US	Field experiment	The author studied the role of social norms messages in promoting water conservation.	Weekly water consumption	"Aligned norms feedback" treatment	Households	301
Sujata et al. (2019)	Malaysia	Online survey	The author studied the moderating role of governmental and non-governmental organizations (NGOs) in translating recycling intentions.	Recycling intention (rather use old plastic/durable bags for shopping than new ones", etc.) (4 items)	Social norm ("my neighbors expect me to engage in recycling behavior", etc.) (3 items)	Internet users	233
Terry et al. (1999)	Australia	Questionnaires	The authors investigated how norms, self-identity and social identity could affect the intention to perform recycling behaviors.	Intention to perform household recycling	Subjective norm	Households	143
Tesfaye et al. (2012)	Ethiopia	Questionnaires	The authors investigated the attitude and intention of households towards participating in collective forest management (tree planting) activity.	Intention to participate in tree planting	Subjective norm	Households	349
Van den Broek et al. (2019)	Multiple countries	Online survey	The paper investigated the relative influence of intentional, normative, situational and habitual processes on energy saving behavior.	Energy saving intention (2 items)	Social norm ("people who are important to me support me when I curtail my energy use") (2 items)	Internet users	247
Van Dijk et al. (2015)	Netherlands	Mail survey	The authors studied the effectiveness of agri-environment schemes (AES) in enhancing biodiversity on farmland and motivating farmers toward environmental-friendly practices.	Intention to participate in ditch bank management/meadow bird agement	Subjective norm ("most people who are important to me think it is important that I carry out ditch bank management/meadow bird management")	Farmers	297
Wesslink et al. (2017)	Netherlands	Online survey	The study examined the role of organization and managers and workplace pro-environmental behaviors.	Pro-environmental behavior in the workplace	Subjective norms	Employees	479

Whitmarsh et al. (2018)	UK	Online Survey	The paper examined the predictors of recycling and waste reduction habits across the workplace, home and holiday contexts, and examined whether consistency across contexts is a function of pro-environmental identity.	Proportion of waste recycled	Social norm ("most of my friends and family recycle at home")	Employees	213
Willy and Muller (2013)	Kenya	Face-face interview	The author studied the effects of social influence and participation in collective action initiatives on soil conservation efforts among smallholder farmers in Lake Naivasha basin, Kenya.	Number of soil conservation practices implemented	Subjective norm ("would adopt a technology because those important to me think I should") (yes/no)	Households	307
Wong et al. (2018)	Taiwan	Questionnaires	The paper examined the extended Theory of Planned Behavior (TPB) research model, which includes environmental concern and sensory appeal to predict consumers' purchase intentions in relation to suboptimal foods	Purchase intention (suboptimal food)	Subjective norm ("most people, important to me, think that I should buy suboptimal food") (3 items)	Households	539
Zhang et al. (2015b)	China	Questionnaires	The study examined factors associated with waste separation behaviors by analyzing responses to questionnaires distributed in Guangzhou, China.	Separation intention ("I am glad to engage in the government waste separation plan", etc.) (3 items)	Subjective norm ("my neighbors expect me to separate waste") (3 items)	Households	208
<b>Network size</b>							
Ando et al. (2010)	Multiple countries	Mail survey	The authors investigated how social factors such as the number of networks and subjective norms affect collective pro-environmental behaviors.	Reducing behaviors (not buying throwaway products)	Eco-net (number of environmentally-minded friends who the respondents see less than once a month) (2 questions)	Residents	1,456
Derksen and Gartrel (1993)	Canada	Field experiment	The authors investigated how people who have access to a structured recycling program (sending a blue box for recycling to households) have a higher level of recycling.	Number of items recycled	Single-family dwelling (yes/no)	Households	1,245
Kim et al. (2014)	South Korea	Questionnaires	The author studied the impact of motivation in work groups and social responsibility on voluntary green behavior in the workplace.	Workplace green advocacy ("I work with my group members to create a more environmentally-friendly workplace", etc.) (3 items)	Work group size (number of employees in the work group)	Employees	496

Liu et al. (2014)	China	Questionnaires	The author studied the role of social capital in encouraging residents' pro-environmental behaviors.	Pro-environmental behaviors ("I'll take actions to protect the environment", etc.) (3 items)	Structural social capital (number of associations participated in, etc.) (3 items)	Households	420
Pillemer et al. (2010)	US	Questionnaires	The paper tested the hypothesis that volunteering in environmental organizations in midlife is associated with greater physical activity and improved mental and physical health over a 20-year period.	Environmental volunteering and physical activity	Social isolation (number of close friends or relatives they saw at least once a month)	Households	2,630
Terry et al. (1999)	Australia	Questionnaires	The authors investigated how norms, self-identity and social identity could affect the intention to perform recycling behaviors.	Intention to perform household recycling	How many of your friends and peers would engage in household recycling?	Households	143
Van Laerhoven (2010)	Multiple countries	Census data	The author studied the effective local forest governance regime using a large-N cross-national dataset.	Monitoring ('do forest user groups engage in regular monitoring?') (yes/no)	Number of user group members (log)	Forest groups	240
Wang et al. (2018)	China	Face-face interview	The paper aimed to explore the factors that influence Chinese farmers' willingness to pay for health risk reductions of pesticide use by applying the contingent valuation method.	WTP to reduce pesticide use (yes/no)	Social network (number of organizations the farmers belong to)	Farmers	261
Yang et al. (2013)	China	Face-to-face	The authors studied the effect of group size, which is the ratio of parcel size to group size in a forest parcel, on forest-cover changes.	Total labor input for resource monitoring per year	Group size (the number of households monitoring a single forest parcel) (in quadratics)	Households	156
<b>Network connections</b>							
Aprile and Fiorillo (2019)	Italy	Census data	Authors studied the relationship between environmental concern and household waste collection, controlling for social capital.	Recycling (householder recycles at least one material among paper, plastic, glass, aluminium and food waste) (yes/no)	Bonding social capital (frequency of meetings with friends and relatives every day or at least twice a week)	Households	24,474
Barnes et al. (2016)	Hawaii	Questionnaires	Authors used information-sharing networks among large-scale commercial tuna fishers to examine how social networks relate to shark bycatch, a global environmental issue.	Shark bycatch (any species) per fishing set	'V-A' network (network with more links and strong ties)	Fishers	12,060

Cho and Kang (2016) <a href="#">Cho and Kang (2017)</a>	South Korea	Telephone interview	The author studied the impact of community ties, which is when community members frequently interact with their neighbors and look after each other, on private environmental actions (donating money or volunteering to participate in an environmental group).	Private environmental behavior (prefer to buy environmentally-friendly products, etc.) (three 4-level items)	Community ties ("I think people in this neighborhood look after each other", etc.) (three 4-level items)	Households	1,348
Dixon et al. (2015) <a href="#">Dixon et al. (2015)</a>	US	Online survey	Authors studied the impact of attitudes, subjective norms and behavioral intentions on energy conservation behaviors.	Self-report energy conservation (turned off lights when not needed, etc.) (6 items)	Sense of community ("feel a sense of community with the people they work with") (6 items)	Students	2,919
Doran et al. (2017) <a href="#">Doran et al. (2017)</a>	Norway	Mail survey	The author studied whether the choosing eco-friendly travel choices is sensitive to in-group identification.	Behavioral intentions (how much of the paper you use do you recycle?, etc.)	In-group identification (degree to which they identified with members of that group)	Students	134
Hao et al. (2019) <a href="#">Hao et al. (2019)</a>	China	Face-face interview	The study examined the ways in which social capital (measured through social networks and trust) influences people's environmental concern in China.	Pro-environmental behavior (six 4-level items)	Social capital (frequency of socializing with relatives and friends) (5-level item)	Households	3,672
Kurz et al. (2007) <a href="#">Kurz et al. (2007)</a>	Ireland	Mail survey	The author studied how living in an area that has a strong sense of community, affects individuals' actions to participate in recycling.	Recycling participation (monthly bin collection)	Sense of community (frequency of socializing with relatives and friends) (8 items)	Households	586
Landon et al. (2017) <a href="#">Landon et al. (2017)</a>	US	Mail survey	The authors tested an augmented Schwartz's Norm Activation Model (NAM) that incorporates community attachment to understand the factors that lead to the development of moral obligations to conserve water and with residential outdoor water use.	Monthly water use	Community attachment ("overall, I am attached to my community") (2 items)	Household	654
Macias and Williams (2014) <a href="#">Macias and Williams (2016)</a>	US	Census data	The author investigated the relationship of social capital and pro-environmental behaviors.	Reduce household energy consumption (4-level item)	Social evenings with neighbors (1 = never and 7 = several times a week)	Households	1,417
Miller and Buys (2008) <a href="#">Miller and Buys (2008a)</a>	Australia	Face-face interview	The authors studied how fostering social capital, environmental responsibility, and socio-demographic lifestyle may encourage people to work together on environmental and sustainable initiatives in a drought-prone Australian community.	Car washing on lawn (yes/no)	Neighborhood connections (5 items)	Households	209

Miller and Buys (2008b) Miller and Buys (2008b)	Australia	Questionnaires	The authors investigated how eight distinct elements of social capital predict a "feeling of responsibility" for local environmental issues in a drought-prone community.	Responsibility for water conservation and environmental conservation	Neighborhood connections	Households	276
Nepal et al. (2007) Nepal et al. (2007b)	Nepal	Census data	The paper investigated the links between the strength and type of social networks and private forest conservation activity in rural Nepal.	Number of trees planted on own land	Social network indices related to forest group (network density between respondent and forest users)	Households	2, 657
Raineri et al. (2016) Raineri et al. (2016)	Mexico	Questionnaires	The paper tested whether a model of taking initiatives based on the workplace social exchange network may influence suggestions for constructive change toward the environment.	Eco-initiatives (I carry out environmental actions and initiatives in my daily work activities) (3 items)	Affective commitment to the work group ("I really feel like I am a part of this work group") (3 items)	Students	535
Rees and Bamberg (2014) Rees and Bamberg (2014)	Germany	Mail Survey	The paper investigated the concept of social norms in the social identity model of collective action, to investigate the determinants of individuals' collective climate action intentions. The standard error is calculated using the reported significance level.	Participation intention (three 5-scale items)	Sense of community ("It is very important to me that there is a sense of community in my neighborhood")	Students	302
Terry et al. (1999) Terry et al. (1999)	Australia	Questionnaires	The authors investigated how norms, self-identity and social identity could affect the intention to perform recycling behaviors.	Intention to perform household recycling	How much do you identify with your group of friends and peers, as well as feelings of belonging to the group?	Households	143
Tindall and Piggot (2015) Tindall and Piggot (2015)	Canada	Questionnaires	The authors studied the influence of social ties, which is the total number of ENGOs (Environmental Non Government Organizations) connections, on the public's concern about climate.	Plan to deal with climate change (Do you personally plan to do anything in response to climate change?) (yes/no)	Network ties to ENGOs (total number of ENGOs (from a list of 15 organizations) to which the respondent held personal ties)	Households	1, 227
Van Laerhoven (2010) Van Laerhoven (2010)	Multiple countries	Census data	The author studied the effective local forest governance regime using a large-N cross-national dataset.	Monitoring ("do forest user groups engage in regular monitoring?") (yes/no)	How many cooperative activities other than forest governance do user group members engage in (0-6)?	Forest groups	240



Videras et al. (2012) Videras et al. (2012)	US	Online survey	The authors investigated whether individuals who have strong connections and who often discuss environmental issues with their neighbors are more likely to participate in environmental groups, recycle and care more about environmental issues.	Recycling (in the last 12 months, how often have you personally recycled card board packaging or paper?)	Neighbor (with strong connections, medium green talk, high green help)	Households	1371
Wakefield et al. (2007) Wakefield et al. (2007)	Canada	Questionnaires	The paper explored the relationships among environmental health, social capital and collective action in the industrial city of Hamilton, Ontario, Canada.	Environmental collective actions (“attending a public meeting about a local environmental issue, and attending a public protest about a local environmental issue”)	In an environmental group (yes/no)	Household	512
<b>Leadership</b>							
Blok et al. (2015) Blok et al. (2015)	Netherlands	Mail survey	The authors examined how factors like leadership support and exemplary pro-environmental behavior by leaders are at stake in the case of pro-environmental behavior in the workplace.	Intention to act environmentally in the workplace	Leadership support (“my employer informs me about the environmental impact of my behavior at work”, etc.) (6 items)	Students	411
Cotterill et al. (2009) Cotterill et al. (2009)	UK	Field experiment	The authors used the data from the experiment “Canvassing projects” that recruit and train canvassers about recycling and then use them as factors to influence recycling behavior by letting them visit, share information with and encourage all households in the streets in the intervention group.	Frequency of weekly recycling	Canvass group intervention (a block leadership approach)	Households	6,580
Fatoki (2019) Fatoki (2019)	South Africa	Field experiment	The author studied the effect of leadership behavior, institutional support and workplace spirituality on hotel employees’ pro-environmental behavior.	Pro-environmental behaviors (“I turn lights off when not in use”, etc.) (6 items)	Leadership behavior (“seeing the owner/manager showing pro-environmental behavior influences the way that I act”, etc.) (3 items)	Employees	366
Graves et al. (2019) Graves et al. (2013)	China	Questionnaires	The author tested the linkages between transformational leadership on environmental issues.	Pro-environmental behaviors (“find ways of working that are better for the environment”, etc.) (12 items)	Environmental transformational leadership (“talks enthusiastically about what we need to do to protect nature”) (5 items)	Employees	510

Hopper and Nielse (1991)Hopper and Nielsen (1991)	US	Field experiment	The author investigated how the block leader for recycling has an impact on recycling behavior.	Recycling score (number of times each household recycled)	Block leader treatment (recruited leaders to travel to each household on their block to talk with their neighbors and encourage them to recycle)	Households	240
Khan et al. (2019)Khan et al. (2019)	China	Questionnaires	The author investigated the relationship between supervisors' ethical leadership and organizational environmental citizenship behavior.	Organizational environmental behavior ("I help my co-workers be environmentally-friendly at work")	Supervisors' ethical leadership	Employees	447
Kim (2014)Kim et al. (2014)	South Korea	Questionnaires	The author studied the impact of motivation in work groups and social responsibility on voluntary green workplace behavior.	Workplace green advocacy ("I work with my group members to create a more environmentally-friendly workplace", etc.) (3 items)	Leader's voluntary green workplace behaviors ("using personal cups instead of disposable cups", etc.) (6 items)	Employees	496
Robertson and Barling (2012)Robertson and Barling (2013)	Multiple countries	Online survey	The paper studied how the influence of the leader's pro-environmental workplace behavior on employees' environmental behaviors.	Workplace pro-environmental behaviors ("turn lights off when not in use", etc.) (17 5-scale items)	Leaders' environmental behaviors	Students	139
Robertson and Carleton (2018)Robertson and Carleton (2018)	US	Mail survey	The paper studied how environmentally specific transformational leadership affect employees' voluntary pro-environmental behaviors.	Voluntary pro-environmental behaviors ("at work, my co-worker recycles whenever possible") (10 items)	Environmentally specific transformational leadership ("my leader is optimistic that I can help improve my organization's environmental performance") (2 items)	Employees	162
Van Laerhoven (2010)Van Laerhoven (2010)	Multiple countries	Census data	The author studied the effective local forest governance regime using a large-N cross-national dataset.	Forest monitoring activities ("do forest user groups engage in regular monitoring?") (yes/no)	Leader ("Does the user group have a leader?")	Forest groups	240
Wang et al. (2018b)Wang et al. (2018)	China	Questionnaires	The study examined the extent of the impact of green transformational leadership on employee green behavior through follower perceptions of value congruence.	Employee green behavior ("this employee puts compostable items in the compost bin") (7-item scale)	Green transformational leadership ("my leader encourages the group members to achieve the environmental goals") (6-item scale)	Employees	220

Wesselink et al. (2017)Wesselink et al. (2017)	Netherlands	Online survey	The study examined role of organization and managers and workplace pro-environmental behaviors.	Pro-environmental behavior in the workplace	Leadership support (“seeing my direct supervisor acting pro-environmentally influences my own acting”)	Employees	479
<b>Trust in others</b>							
Baggio et al. (2015)Baggio et al. (2015)	US	Field experiment	The author investigated how the importance of trust and the environmental variability determines the outcomes of collective action using the irrigation experiments in the lab.	Investment in irrigation (generating the common water resource)	Trust is measured by amount of money sent to another participant	Students	1075
Bauwens and Eyre (2017)Bauwens and Eyre (2017)	Belgium	Online survey	The influence of interpersonal trust, which is when individuals trust others in general, to participate in a renewable energy cooperatives.	Participation in renewable energy cooperative	Interpersonal trust which captures extent to which people trust others in general	Households	2,357
Beitl (2014)Beitl (2014b)	Ecuador	Questionnaires	Authors investigated how resource characteristics and institutions influence people’s behavior toward common pool resources in coastal Ecuador.	Mean shell length in each fisher’s catch (in mm)	Trust that other users comply with rules-in-use	Fishers	95
Carattini et al. (2015)Carattini et al. (2015)	Multiple countries	Census data	The author studied how the share of population that trusts others affects energy consumption in 27 European countries from 1990-2007.	Energy consumption per capita (10 <sup>3</sup> tons of oil equivalent)	Trust (“people you know personally”, etc.) (in share of positive answers)	Countries	197
Cho and Kang (2016)Cho and Kang (2017)	South Korea	Tel. interview	The author studied the impact of social trust, which is when individuals trust other members in the community, on private environmental actions (donating money or volunteering to participate in an environmental group).	Private environmental behavior (“prefer to buy environmentally friendly products”, etc.) (three 4-level items)	Social trust (“I believe my neighbors would help me when I ask them for help”, etc.) (three 4-level items)	Households	1,348
Fairbrother (2016)Fairbrother (2016)	Multiple countries	Face-to-face	The paper studied the effect of social trust, which is the belief that one will not be cheated by a typical stranger, on environmental concern (perceptions of the prevalence and seriousness of environmental problems).	Environmental concern (perceptions of the prevalence and seriousness of environmental problems)	Social trust (“one will not be cheated by a typical stranger”) (2 items)	Households	45,199
Hao et al. (2019)Hao et al. (2019)	China	Face-face interview	The study examined the ways in which social capital (measured through social networks and trust) influences people’s environmental concern in China.	Pro-environmental behavior (six 4-level items)	Trust (“most people can be trusted”)	Households	3,672

Macias and Williams (2014)Macias and Williams (2016)	US	Census data	The author investigated the relationship of social capital and pro-environmental behaviors.	Reduce household energy consumption (4-level item)	Most people can be trusted (5-level item)	Households	1,417
Mekonnen and Bluffstone (2017)Mekonnen et al. (2017)	Ethiopia	Face-to-face interview	The author investigated the effects of community forest on households' incentives to invest in trees located on their own farms.	Number of private tree on own land	Trust others in the village	Farmers	1,080
Meyer and Liebe (2010)Meyer and Liebe (2010)	Switzerland	Census data	The paper took into account various competing economic, psychological and sociological determinants of individuals' willingness to pay (WTP) for both public environmental and quasi-private environmental goods. The standard error is calculated using the reported t-value.	Willingness to pay in environmental protection (yes/no)	'Generalized trust' ('an additive index of three 5-point questions on perceived trustworthiness, opportunism, and helpfulness')	Households	1,522
Miller and Buys (2008)Miller and Buys (2008a)	Australia	Face-face interview	The author studied how individuals who have a high level of trust and safety with their neighbors have a greater intention to perform environmentally-friendly activities.	Car washing on lawn (yes/no)	Trust and safety (5 items)	Households	209
Miller and Buys (2008b)Miller and Buys (2008b)	Australia	Questionnaires	The authors investigated how eight distinct elements of social capital predict a "feeling of responsibility" for local environmental issues in a drought-prone community.	Responsibility for water conservation and environmental conservation	Feeling of trust and safety (Do you agree that most people can be trusted?)	Households	276
Nyangena (2008)Nyangena (2008)	Kenya	Questionnaires	The authors searched for the factors that determine successful development in soil conservation such as social capital, human capital and market integration, and found that social capital measures are significant determinants of investment in soil conservation.	Soil and water conservation investment (yes/no)	Trust index (proxy by three variables reflecting solidarity in reduction of adverse shock, lending of money, food and reciprocity)	Households	556
Polman and Slangen (2008)Polman and Slangen (2008)	Multiple countries	Face-face interview	The paper studied how a high level of trust with other farmers has an impact on the restriction of intensive practices used in farming	Restriction of intensive practices (yes/no)	Social trust ("generally speaking, most people can be trusted") (yes/no)	Farmers	990

Rompf et al. (2017) Rompf et al. (2017)	Multiple countries	Online survey	The authors studied the institutional and social trust on self-reported recycling behaviors.	Recycling behaviors (three 5-scale items)	Social trust ("generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?"; etc.) (three 10-scale items)	Households	2,935
Sonderskov (2008) Sonderskov (2008)	Multiple countries	Questionnaires	The author studied the influence of generalized social trust (most people can be trusted) on participating in environmental organizations.	Environmental group membership (yes/no)	Generalized trust ("generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?") (yes/no)	Countries	52
Sonderskov (2009) Sonderskov (2009)	Multiple countries	Census data	The author studied the influence of generalized social trust (most people can be trusted) on recycling and consuming green products.	Recycling (recycled share of municipal waste)	Generalized trust ("generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?") (yes/no)	Countries	20
Sonderskov (2009) Sonderskov (2009)	Multiple countries	Census data	The author studied how the influence of generalized social trust (most people can be trusted) on recycling and consuming green products.	Organic food (average annual per capita consumer expenditure on organic foods)	Generalized trust ("generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?") (yes/no)	Countries	20
Testa et al. (2016) Testa et al. (2016)	Italy	Mail survey	The paper explored the influence of personal capabilities and moral norms, along with trust in information on energy saving actions provided by different entities on two energy saving behaviors.	Energy-saving behaviors (4 items)	Level of trust in family and friends (yes/no)	Students	198
Wang et al. (2018) Wang et al. (2018)	China	Face-face interview	The paper aimed to explore the factors that influence Chinese farmers' willingness to pay for health risk reductions of pesticide use by applying the contingent valuation method.	WTP to reduce pesticide use (yes/no)	Social trust (farmers' trust towards people in villages in general)	Farmers	261
Willy and Muller (2013) Willy and Holm-Müller (2013)	Kenya	Face-face interview	The author studied the effects of social influence and participation in collective action initiatives on soil conservation efforts among smallholder farmers in Lake Naivasha basin, Kenya.	Number of soil conservation practices implemented	Level of trustworthiness (trust in other individuals in the community)	Households	307

### Trust in institutions

Arpad (2018)Arpad (2018)	Multiple countries	Questionnaires	The author studied how public support could impact the sustainable development and environmentally-friendly policies in five countries (USA, UK, Italy, Sweden and Romania).	“People’s willingness to support a state’s increased spending on environmentally-friendly policies”	Belief in government competence	Students	13,995
Lubell et al. (2006)Lubell and Vedlitz (2006)	US	Tel. interview	The paper studied how the perceived risk, trust in policy elites, knowledge of the policy problem, and efficacy can help improve the intention to reduce air pollution.	Behavioral intentions (respondent’s willingness to perform specific behaviors to reduce air pollution) (five 11-level items)	Government trust (averages the trust items for the federal government, Texas Department of Transportation, Texas Commission on Environmental Quality, U.S. Environmental Protection Agency, and local elected officials)	Households	1,326
Macias and Williams (2014)Macias and Williams (2016)	US	Census data	The authors investigated the relationship of social capital and pro-environmental behaviors.	Reduce household energy consumption (4-level item)	Trust people in the government (5-level item)	Households	1,417
Michaels and Parag (2016)Michaels and Parag (2016)	Israel	Online Survey	The paper investigated perceptions of demand reduction, load shifting and energy storage technologies as pro-consumer activities in remote controlled household appliances via smart controls to information communicated by the grid.	The acceptance of remote controlled appliances to reduce electricity use	Degree of trust in 5 institutions (from 1-5)	Households	509
Polman and Siangen (2008)Polman and Slangen (2008)	Multiple countries	Face-face interview	The paper studied how a high level of trust in the government has an impact on the restriction of intensive practices used in farming	Restriction of intensive practices (yes/no)	Institutional trust (trust in agricultural administration, environmental administration, or EU)	Farmers	990
Rompf et al. (2017)Rompf et al. (2017)	Multiple countries	Online survey	The authors studied the institutional and social trust on self-reported recycling behaviors.	Recycling behaviors (three 5-scale items)	Institutional trust (trust the legal system, parliament, police, civil service, and government) (five 10-scale items)	Households	2,935

Sonderskov (2009) <a href="#">Sonderskov</a> (2009)	Multiple countries	Census data	The author studied the influence of generalized social trust (most people can be trusted) on recycling and consuming green products.	Recycling (recycled share of municipal waste)	Institutional trust (trust the legal system, parliament, police, civil service, and government) (five 10-scale items)	Countries	20
Sonderskov (2009) <a href="#">Sonderskov</a> (2009)	Multiple countries	Census data	The author studied the influence of generalized social trust (most people can be trusted) on recycling and consuming green products.	Organic food (average annual per capita consumer expenditure on organic foods)	Institutional trust (trust the legal system, parliament, police, civil service, and government) (five 10-scale items)	Countries	20
Testa et al. (2016) <a href="#">Testa et al.</a> (2016)	Italy	Mail survey	The paper explored the influence of personal capabilities and moral norms, along with trust in information, on energy-saving behaviors provided by different entities on two energy saving behaviors.	Energy-saving behaviors (4 items)	Level of trust in public institutions	Students	198
Wakefield et al. (2007) <a href="#">Wakefield et al.</a> (2007)	Canada	Questionnaires	The paper explored the relationships among environmental health, social capital and collective action in the industrial city of Hamilton, Ontario, Canada.	Environmental collective actions (“attending a public meeting about a local environmental issue, and attending a public protest about a local environmental issue”)	Trust the government to do right	Household	512
Wang et al. (2018) <a href="#">Wang et al.</a> (2018)	China	Face-face interview	The paper aimed to explore the factors that influence Chinese farmers’ willingness to pay for health risk reductions of pesticide use by applying the contingent valuation method.	WTP to reduce pesticide use (yes/no)	Institutional trust (trust in local governments)	Farmers	261
Xiao and McCright (2015) <a href="#">Xiao and McCright</a> (2015)	US	Census data	The authors studied the effect of institutional trust, which is when individuals have confidence in the government, on the individuals’ concerns about environmental problems.	Concern about specific environmental problems (5 items)	Trust in government (trust in the executive branch of the federal government and Congress)	Households	1, 620
Zannakis et al. (2015) <a href="#">Zannakis et al.</a> (2015)	Sweden	Mail survey	The author investigated the impact of trust in the government, public authorities and politician on the acceptance of government regulations pertaining to on-site sewage systems and treating sewage from one or a few households not connected to the municipal waste-water grid.	Acceptance of government regulation of on-site sewage systems (OSSs) (“I will change OSS if the municipality recommends it”, etc.) (3 items)	Trust in institutions in general (10-scale item)	Households	1, 481

Zhou and (2019)Zhou and (2019)	China	Questionnaires	The paper explored haze tolerance in Beijing, Shanghai, and Guangzhou, as well as the key influential factors concerning haze tolerance from four different aspects: political trust, per- ceived risk, cost perception and haze knowledge.	Public's tolerance for haze pol- lution	Political trust (political sys- tem, political institutions, and their operation)	Households	517
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