

# Boosting Recycling Behaviour Among Urban Households in Peru

A Field Experiment on the Role of Social Norms and Beliefs  
(AEARCTR-0007063)

Hanna Fuhrmann-Riebel<sup>12</sup> Ben D'Exelle<sup>2</sup> Kristian López Vargas<sup>3</sup>  
Sebastian Tonke<sup>4</sup> Arjan Verschoor<sup>2</sup>

<sup>1</sup>German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE)

<sup>2</sup>University of East Anglia (UEA)

<sup>3</sup>University of California, Santa Cruz (UCSC)

<sup>4</sup>Max Planck Institute for Research on Collective Goods (MPI Coll)

Lab in the Field Workshop 2021

# Table of Contents

- 1 Background and motivation
- 2 Theory: social norms and beliefs
- 3 Experimental design
- 4 Results
  - Beliefs distribution
  - Graphical overview and statistical tests
  - Regressions
- 5 Conclusion and next steps

# Table of Contents

- 1 Background and motivation
- 2 Theory: social norms and beliefs
- 3 Experimental design
- 4 Results
  - Beliefs distribution
  - Graphical overview and statistical tests
  - Regressions
- 5 Conclusion and next steps

## Why household recycling behaviour in Peru?

- Environmental pollution → main global challenge; threat to people and ecosystems (UNEP, 2015)
- Waste management in low- and middle-income countries is often insufficient, while waste accumulation is growing rapidly
- Peru: only 4% of total waste generated in Lima is recycled (WWF, 2018)
- Waste separation at the household level is essential for the recycling sector to work (Dai et al., 2015; Varotto and Spagnoli, 2017)
- → Behavioural change at the individual level is needed

## Study context

- Municipalities are responsible for coordinating recycling activities at the household level in Peru
- Some municipalities have established local recycling programmes (voluntary, free of charge), though uptake of households is low
- We teamed up with the municipality of Miraflores in Lima (upper-middle to high-income neighbourhood)
- At point of data collection, only 12% of all households are participating
- → Aim: increase sign-up rates to the municipality's recycling programme

## Challenge

- Recycling behaviour = collective action problem (Harring et al., 2019; Sparkman et al., 2020)
- Individual costs and collective benefit → social dilemma (“tragedy of the commons”; Hardin, 1968) → incentives are needed
- Social norms can help to overcome collective action problem (Bicchieri and Dimant, 2019; Ostrom, 2000)

# Table of Contents

- 1 Background and motivation
- 2 Theory: social norms and beliefs**
- 3 Experimental design
- 4 Results
  - Beliefs distribution
  - Graphical overview and statistical tests
  - Regressions
- 5 Conclusion and next steps

## Social norms

- Highlighting social norms can encourage pro-environmental behaviour (see e.g. Allcott, 2011; Ferraro et al., 2011; Goldstein et al., 2008)
- Deviating from norm has moral cost (Levitt and List, 2007)
- Descriptive (what others do) vs. injunctive norms (what others approve of doing)
- Mostly appeal on descriptive majority; mostly static approach

## Dynamic norms

- But: what if the desired target behaviour is not the norm (yet)? → Positive trend that can be highlighted? → Relevant for many pro-environmental behaviours
- Recent literature shows effectiveness of dynamic norms in such a context (Loschelder et al., 2019; Mortensen et al., 2018; Sparkman and Walton, 2017)

## Beliefs

- Prior errors in beliefs about social norms can explain heterogeneous treatment effects (Byrne et al., 2018; Bursztyn et al., 2020)
- Social norm information particularly effective among those who previously underestimated the norm → Response to social norm information as a direct result of belief updating



## Bringing the theory together in the context of recycling in Miraflores

- Participation in the recycling programme has doubled from 6% in 2017 to 12% in 2020 → Dynamic norms seem promising
- But: is that enough? 12% still far from being the norm ...
- From small pre-survey (n=100) we know: 97% think participating in the recycling programme is important → high injunctive norm

→ Thus, we face a situation with **low current prevalence** (12%), **considerable increase** over the last three years (doubled from 6%-12%) and **high social approval** (97%)

→ Why do so many people support the behaviour but only few people actually recycle?

→ Could **biased beliefs** about the positive trend and high social approval be a reason?

## Our contribution

- We investigate whether informing people about the positive trend in recycling behaviour and the high social approval by other people can increase the moral cost of not recycling, thereby encourage people to sign up to the recycling programme
- To our knowledge, we are the first to contrast the effect of dynamic and injunctive norms for behavioural change in a field experimental context (while evidence on the role of dynamic norms is still limited in general)
- We further investigate whether there are systematic biases in beliefs about the positive trend and social approval, and whether such biased beliefs can explain people's response to our treatment messages that directly aim at correcting those beliefs
- To our knowledge, Byrne et al. (2018) and Bursztyn et al. (2020) are the only studies so far that combine measuring people's individual pre-treatment beliefs with information treatments that directly aim at correcting those beliefs (no prior evidence in the context of dynamic norms)

# Table of Contents

- 1 Background and motivation
- 2 Theory: social norms and beliefs
- 3 Experimental design**
- 4 Results
  - Beliefs distribution
  - Graphical overview and statistical tests
  - Regressions
- 5 Conclusion and next steps

## Experimental procedure

- Experiment was conducted via phone surveys through local survey company (using SurveyCTO)
- Subjects were recruited through the official data base of the municipality
- Sample size = 1,709 households

## Phone survey:

- Brief intro, consent, check that not yet participating in programme
- Elicit individual **pre-treatment beliefs** (incentivized) about
  - How many households are currently participating (x out of 100)
  - How many households have been participating three years ago (x out of 100)
    - Now – past = trend
  - Whether people themselves think participating in the recycling programme is important (yes/no/dk)
  - How many other people think participating in the recycling programme is important (x out of 100)
- Demographics and controls (“buffer questions”)
- **Treatment message:** feedback about dynamic and/or injunctive norm
- **Sign-up decision:** ask whether person would like to sign up (binary dv1)
- Post-treatment beliefs and controls related to recycling
- Contact details for programme (if person wanted to sign up)

## Afterwards:

- People receive official registration link (via WhatsApp or email)
- Check whether people really did sign up (binary dv2)

Table: Treatment groups within 2x2 design

	Injunctive norm: No	Injunctive norm: Yes
Dynamic norm: No	A	B
Dynamic norm: Yes	C	D

- **A (control group):** no message
- **B (injunctive norm):** Of the 100 households in Miraflores we asked, **97%** think that it is important for the environment that households participate in the municipality's recycling programme!
- **C (dynamic norm):** The number of households in Miraflores that are participating in the municipality's recycling programme has **doubled, from 6% to 12%**, over the last three years!
- **D (dynamic + injunctive norm):** The number of households in Miraflores that are participating in the municipality's recycling programme has **doubled, from 6% to 12%**, over the last three years! Of the 100 households in Miraflores we asked, **97%** think that it is important for the environment that households participate in the municipality's recycling programme!

## Hypotheses:

Response to our treatments will depend on the distribution of individual pre-treatment beliefs about dynamic and/or injunctive norms, depending on the treatment

### Average treatment effects:

- H1 (injunctive norm effect): Not recycling has a moral cost. Learning that more other people than expected think recycling is important increases the moral cost. When the moral cost increases, people are more likely to recycle (compare B and A).
- H2 (dynamic norm effect): Not recycling has a moral cost. Learning that the number of other people that recycle is increasing more than expected increases the moral cost. As the moral cost increases, people are more likely to recycle (compare C and A).
- H3 (dynamic + injunctive norm effect): Learning that the number of other people that recycle is increasing more than expected and also that more other people than expected think recycling is important increases the moral cost. As a consequence, people are more likely to recycle (compare D and A).

### Heterogeneous treatment effects:

- H4 (belief updating on injunctive norm): We expect the message in treatment B to be particularly effective among those people that previously underestimate the injunctive norm.
- H5 (belief updating on dynamic norm): We expect the message in treatment C to be particularly effective among those people that previously underestimate the dynamic norm.
- H6 (belief updating on dynamic + injunctive norm): We expect the message in treatment D to be particularly effective among those people that previously underestimate the dynamic and the injunctive norm.
- H7 (belief updating on current prevalence): The dynamic norm treatment (C) as well as the combined treatment (D) also convey information about the low current prevalence in participation rates (12%). We therefore expect the effect of the message in treatment C and treatment D to be less effective among those people that previously overestimate the current participation rate.

# Table of Contents

- 1 Background and motivation
- 2 Theory: social norms and beliefs
- 3 Experimental design
- 4 Results**
  - Beliefs distribution
  - Graphical overview and statistical tests
  - Regressions
- 5 Conclusion and next steps



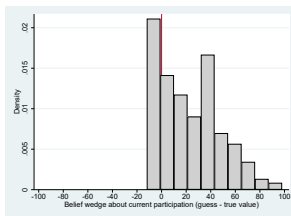
Table: Beliefs distribution

Belief type	True value	Belief mean	% that underestimate	N
Participation today	12	35.31	23.23%	1,511
Participation three years ago	6	22.31	28.36%	1,520
Trend in absolute numbers (now-past)	6	13.04	38.14%	1,505
Trend in ratio (now/past)	2	2.53	47.42%	1,299
Injunctive norm	97	80.21	67.13%	1,582

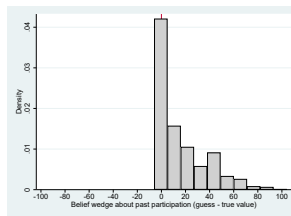
- On average, people overestimate the participation in the present and in the past
- On average, people overestimate the trend in absolute numbers and in ratio (albeit less strongly)
- On average, people underestimate the injunctive norm

Figure: Wedges in beliefs (guess - true value)

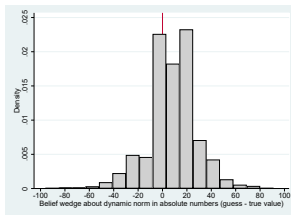
(a) Current participation



(b) Past participation



(c) Trend (absolute)



(d) Trend (ratio)

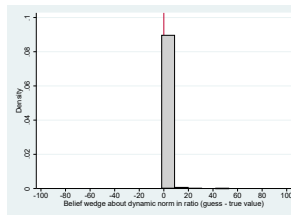
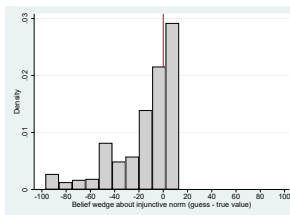


Figure: Wedges in beliefs (guess - true value)

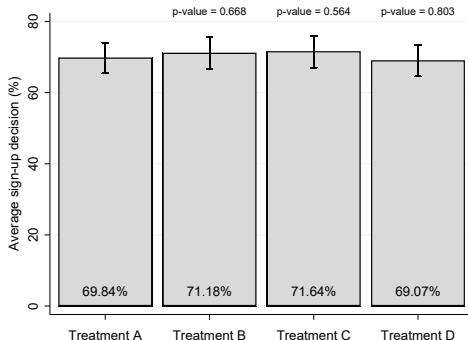
(e) Injunctive norm



*Notes:* Individual wedges in beliefs are calculated as the difference between the participant's guess and the true value of the current participation, past participation, trend in absolute numbers, trend in ratio, and injunctive norm, respectively.

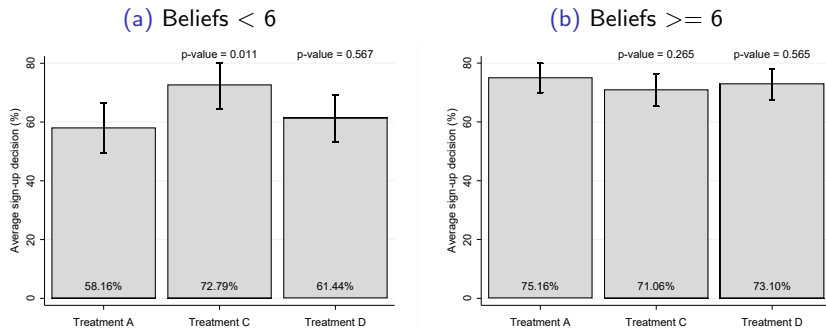
## Graphical overview and statistical tests (sign-up decision during survey)

Figure: Average sign-up decision by treatment group



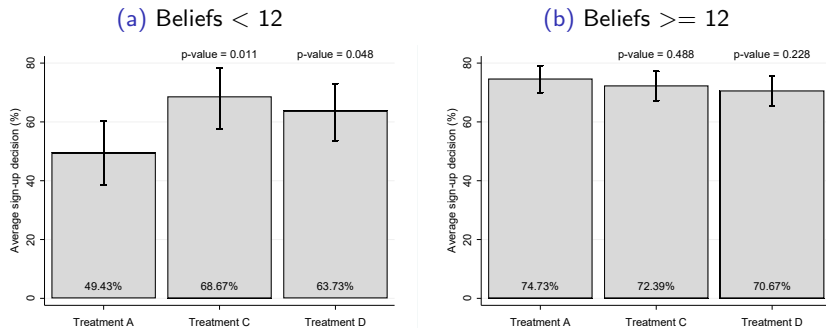
Notes: p-values are obtained from Wilcoxon rank-sum tests, comparing treatment B, treatment C, and treatment D with the control group A, respectively. Graphs show the average sign-up decision by treatment, with 95% confidence intervals for proportions.

**Figure:** Heterogeneity in average sign-up decisions between people who under- or overestimate the trend in absolute numbers



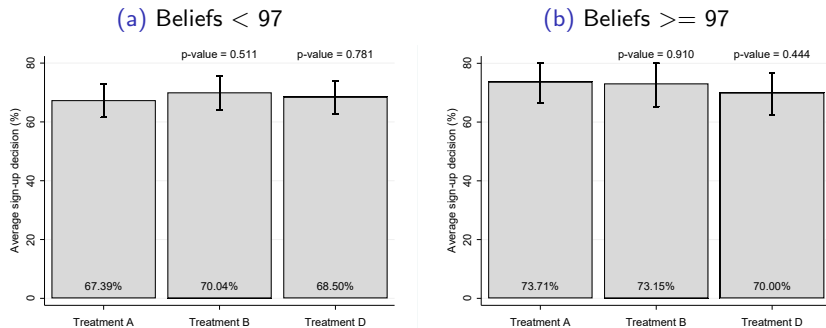
*Notes:* Average sign-up decision of people who under- or overestimate the trend in absolute numbers, comparing the dynamic norm treatment C and the combined treatment D with the control group A. p-values are obtained from Wilcoxon rank-sum tests, comparing treatment C and treatment D with treatment A, respectively. Graphs show the average sign-up decision by treatment, with 95% confidence intervals for proportions.

**Figure:** Heterogeneity in average sign-up decisions between people who under- or overestimate the current participation



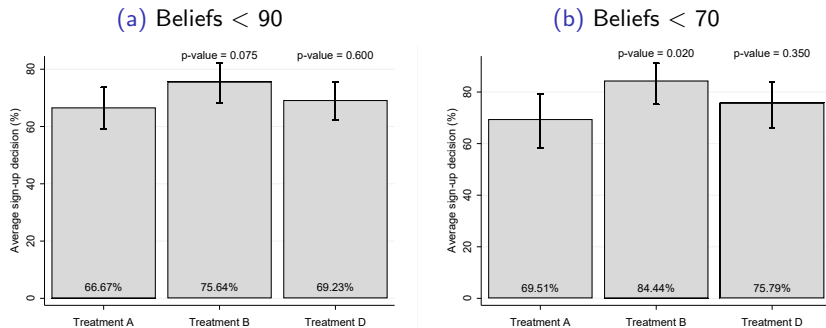
*Notes:* Average sign-up decision of people who under- or overestimate the current participation, comparing the dynamic norm treatment C and the combined treatment D with the control group A. p-values are obtained from Wilcoxon rank-sum tests, comparing treatment C and treatment D with treatment A, respectively. Graphs show the average sign-up decision by treatment, with 95% confidence intervals for proportions.

**Figure:** Heterogeneity in average sign-up decisions between people who under- or overestimate the injunctive norm



*Notes:* Average sign-up decision of people who under- or overestimate the injunctive norm, comparing the injunctive norm treatment B and the combined treatment D with the control group A. p-values are obtained from Wilcoxon rank-sum tests, comparing treatment C and treatment D with treatment A, respectively. Graphs show the average sign-up decision by treatment, with 95% confidence intervals for proportions.

**Figure:** Heterogeneity in average sign-up decisions between people who underestimate the injunctive norm more strongly



*Notes:* Average sign-up decision of people who underestimate the injunctive norm more strongly, comparing the injunctive norm treatment B and the combined treatment D with the control group A. p-values are obtained from Wilcoxon rank-sum tests, comparing treatment C and treatment D with treatment A, respectively. Graphs show the average sign-up decision by treatment, with 95% confidence intervals for proportions.



## Regressions (sign-up decision during survey)

**Table:** Average treatment effects on sign-up decision

	(1)	(2)
Treatment B	0.013 (0.031)	0.017 (0.029)
Treatment C	0.018 (0.031)	0.022 (0.029)
Treatment D	-0.008 (0.031)	0.006 (0.028)
Constant	0.698*** (0.022)	0.138*** (0.045)
Controls		✓
Adjusted $R^2$	-0.001	0.143
Observations	1709	1709

*Notes:* OLS regressions with dependent variable equal to sign-up decision = yes. Column (1) includes treatment dummies alone; column (2) adds control variables for gender, whether the household has children, whether the respondent is the household head, level of education, level of patience, whether the respondent is responsible for recycling within the household and whether the household already recycles through other ways. Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance levels at 1, 5, and 10%, respectively.

**Table:** Heterogeneous treatment effects: under- vs. overestimation of dynamic norm (trend in absolute numbers)

	Beliefs < 6		Beliefs $\geq$ 6	
	(1)	(2)	(3)	(4)
Treatment B	0.078 (0.057)	0.017 (0.047)	-0.023 (0.042)	-0.000 (0.041)
Treatment C	0.146** (0.057)	0.119** (0.048)	-0.048 (0.042)	-0.022 (0.040)
Treatment D	0.033 (0.056)	0.044 (0.046)	0.001 (0.041)	0.001 (0.039)
Constant	0.582*** (0.040)	-0.155** (0.068)	0.727*** (0.029)	0.335*** (0.066)
Controls		✓		✓
Adjusted $R^2$	0.008	0.322	-0.001	0.087
Observations	574	574	931	931

*Notes:* OLS regressions with dependent variable equal to sign-up decision = yes. Columns (1) and (2) are restricted to those who underestimate the trend (in absolute numbers) in participation in the recycling programme; columns (3) and (4) to those who are correct about or overestimate it. Columns (1) and (3) include treatment dummies alone; columns (2) and (4) add control variables for gender, whether the household has children, whether the respondent is the household head, level of education, level of patience, whether the respondent is responsible for recycling within the household and whether the household already recycles through other ways. Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance levels at 1, 5, and 10%, respectively.

**Table:** Heterogeneous treatment effects: under- vs. overestimation of current participation

	Beliefs < 12		Beliefs >= 12	
	(1)	(2)	(3)	(4)
Treatment B	0.088 (0.076)	0.021 (0.058)	-0.012 (0.038)	0.003 (0.036)
Treatment C	0.192** (0.075)	0.124** (0.057)	-0.024 (0.037)	-0.005 (0.036)
Treatment D	0.143** (0.071)	0.145*** (0.055)	-0.028 (0.037)	-0.022 (0.036)
Constant	0.494*** (0.052)	-0.174** (0.076)	0.727*** (0.026)	0.278*** (0.061)
Controls		✓		✓
Adjusted $R^2$	0.012	0.432	-0.002	0.078
Observations	351	351	1160	1160

*Notes:* OLS regressions with dependent variable equal to sign-up decision = yes. Columns (1) and (2) are restricted to those who underestimate the current participation in the recycling programme; columns (3) and (4) to those who are correct about or overestimate it. Columns (1) and (3) include treatment dummies alone; columns (2) and (4) add control variables for gender, whether the household has children, whether the respondent is the household head, level of education, level of patience, whether the respondent is responsible for recycling within the household and whether the household already recycles through other ways. Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance levels at 1, 5, and 10%, respectively.

**Table:** Heterogeneous treatment effects: under- vs. overestimation of injunctive norm

	Beliefs < 97		Beliefs $\geq$ 97	
	(1)	(2)	(3)	(4)
Treatment B	0.026 (0.040)	0.031 (0.037)	-0.000 (0.059)	-0.003 (0.054)
Treatment C	0.021 (0.040)	0.033 (0.037)	0.040 (0.058)	0.042 (0.053)
Treatment D	0.011 (0.040)	0.020 (0.036)	0.005 (0.057)	0.025 (0.052)
Constant	0.674*** (0.028)	0.073 (0.058)	0.664*** (0.040)	0.061 (0.081)
Controls		✓		✓
Adjusted $R^2$	-0.002	0.166	-0.005	0.162
Observations	1062	1062	520	520

*Notes:* OLS regressions with dependent variable equal to sign-up decision = yes. Columns (1) and (2) are restricted to those who underestimate the injunctive norm about participation in the recycling programme; columns (3) and (4) to those who are correct about or overestimate it. Columns (1) and (3) include treatment dummies alone; columns (2) and (4) add control variables for gender, whether the household has children, whether the respondent is the household head, level of education, level of patience, whether the respondent is responsible for recycling within the household and whether the household already recycles through other ways. Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance levels at 1, 5, and 10%, respectively.

**Table:** Heterogeneous treatment effects: under- vs. overestimation of injunctive norm (below or above 90)

	Beliefs < 90		Beliefs $\geq$ 90	
	(1)	(2)	(3)	(4)
Treatment B	0.090*	0.097**	-0.033	-0.038
	(0.050)	(0.045)	(0.044)	(0.040)
Treatment C	0.102**	0.105**	-0.036	-0.027
	(0.048)	(0.044)	(0.045)	(0.041)
Treatment D	0.026	0.044	-0.005	0.002
	(0.047)	(0.043)	(0.044)	(0.041)
Constant	0.667***	0.142**	0.674***	0.024
	(0.034)	(0.067)	(0.031)	(0.064)
Controls		✓		✓
Adjusted $R^2$	0.005	0.169	-0.002	0.168
Observations	699	699	883	883

*Notes:* OLS regressions with dependent variable equal to sign-up decision = yes. Columns (1) and (2) are restricted to those who believe the injunctive norm about participation in the recycling programme to be below 90; columns (3) and (4) to those who believe it to be 90 or larger. Columns (1) and (3) include treatment dummies alone; columns (2) and (4) add control variables for gender, whether the household has children, whether the respondent is the household head, level of education, level of patience, whether the respondent is responsible for recycling within the household and whether the household already recycles through other ways. Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance levels at 1, 5, and 10%, respectively.

# Table of Contents

- 1 Background and motivation
- 2 Theory: social norms and beliefs
- 3 Experimental design
- 4 Results
  - Beliefs distribution
  - Graphical overview and statistical tests
  - Regressions
- 5 Conclusion and next steps

## Main findings:

- Correcting biased beliefs matters: people who underestimate the dynamic norm and/or the injunctive norm are more likely to decide to sign up to the recycling programme when being informed about the actual norm than people who underestimate the respective norm and whose beliefs are not corrected
- Social norm information only works when people underestimate the respective information → no effect for people who overestimate or are correct about it
- Dynamic norms are relevant also when the desired target behaviour is still low

## Next steps:

- Look at interaction of treatments with individual wedges in beliefs → Does the likelihood of wanting to sign up increase in the level of underestimation? → First analyses suggest it does
- Look at actual sign-up behaviour

# Thank you!



## References

- **Allcott, H. (2011).** Social norms and energy conservation. *Journal of Public Economics*, 95, 1082-1095.
- **Bicchieri, C. and Dimant, E. (2019).** Nudging with Care: The Risks and Benefits of Social Information. *Public Choice*, 2019.
- **Bursztyn, L., González, A. L. and Yanagizawa-Drott, D. (2020).** Misperceived Social Norms: Women Working Outside the Home in Saudi Arabia. *American Economic Review*, 110 (11), 3522-3548.
- **Byrne, D. P., La Nauze, A. and Martin, L. A. (2018).** Tell Me Something I Don't Already Know: Informedness and the Impact of Information Programs. *The Review of Economics and Statistics*, 100 (3), 510-527.
- **Dai, Y. C., Gordon, M. P. R., Ye, J. Y., Xu, D. Y., Lin, Z. Y., Robinson, N. K. L., Woodard, R. and Harder, M. K. (2015).** Why doorstepping can increase household waste recycling. *Resources, Conservation and Recycling*, 102, 9-19.
- **Ferraro, P. J., Miranda, J. J. and Price, M. K. (2011).** The Persistence of Treatment Effects with Norm-Based Policy Instruments: Evidence from a Randomized Environmental Policy Experiment. *American Economic Review: Papers and Proceedings*, 101 (3), 318-322.
- **Goldstein, N. J., Cialdini, R. B. and Griskevicius, V. (2008).** A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels. *Journal of Consumer Research*, 35 (3), 472-482.
- **Hardin, G. (1968).** The Tragedy of the Commons. *Science*, 162, 1243-1248.
- **Harring, N., Kagers, S. C. and Nilsson, F. (2019).** Recycling as a large-scale collective action dilemma: A cross-country study on trust and reported recycling behaviour. *Resources, Conservation Recycling*, 140, 85-90.
- **Levitt, S. D. and List, J. A. (2007).** What Do Laboratory Experiments Measuring Social Preferences Reveal about the Real World?. *The Journal of Economic Perspectives*, 21 (2), 153-174.
- **Loschelder, D. D., Siepelmeyer, H., Fischer, D. and Rubel, J. A. (2019).** Dynamic norms drive sustainable consumption: Norm-based nudging helps café customers to avoid disposable to-go-cups. *Journal of Economic Psychology*, 75, Part A, 102146.
- **Mortensen, C. R., Neel, R., Cialdini, R. B., Jaeger, C. M., Jacobson, R. P. and Ringel M. M. (2019).** Trending Norms: A Lever for Encouraging Behaviors Performed by the Minority. *Social Psychological and Personality Science*, 10 (2), 201-210.

- **Ostrom (2000)**. Collective Action and the Evolution of Social Norms. *Journal of Economic Perspectives*, 14 (3), 137-158.
- **Sparkman, G., Howe, L. and Walton, G. (2020)**. How social norms are often a barrier to addressing climate change but can be part of the solution. *Behavioural Public Policy*, 1-28.
- **Sparkman, G. and Walton, G. M. (2017)**. Dynamic Norms Promote Sustainable Behavior, Even if It Is Counternormative. *Psychological Science*, 28 (11), 1663-1674.
- **UNEP (2015)**. United Nations Environment Programme: Global Waste Management Outlook 2015.
- **Varotto, A. and Spagnolli, A. (2017)**. Psychological strategies to promote household recycling. A systematic review with meta-analysis of validated field interventions. *Journal of Environmental Psychology*, 51, 168-188.
- **WWF (2018)**. 'Almost 90% of the garbage generated daily is not recycled' [online]. Available at: <https://www.wwf.org.pe/en/?uNewsID=328834> (22.01.2021).