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WP.1

D1.3 Policy briefs and guidelines for policymakers and companies to foster their actions towards a more sustainable consumption and prevent greenwashing

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Executive summary

The work produced within Work Package 1 of Spoke 1 aims to shed some light on the strategies, tools, and behaviors that companies and organizations are adopting to become more sustainable and in line with digital and sustainable transitions. Our focus is on the approaches businesses use to enhance the sustainability of their processes, products, and services, with particular emphasis on the critical role of consumers in these transitions. By analyzing consumer behavior, we offer actionable recommendations to help firms design strategies that simultaneously promote sustainable consumption practices and optimize their financial performance.

The adoption of pro-social behaviors supporting the ecological transition can be effectively driven by new digital media, influencing consumer behavior in both digital and physical spaces. Our research highlights two key areas: (i) a study by U. Bocconi exploring how physical-world events and social interactions foster pro-social behaviors, and (ii) two studies by U. Bologna analyzing how digital communication techniques, including multimodality and sensory stimuli, enhance consumer engagement and promote sustainable behaviors, such as purchasing eco-friendly products.

The Bologna Unit. This report examines strategies for effectively pursuing and communicating corporate pro-social initiatives to enhance public perception and engagement. As firms increasingly integrate social and environmental responsibilities into their operations, the importance of clear and compelling communication of these efforts has become paramount. Understanding how to convey these initiatives effectively can help firms build trust, foster consumer loyalty, and promote sustainable and ethical behaviors.

Our research provides evidence regarding two main approaches that can foster consumers' response to green messages: the use of sensory stimuli and the use of messaging involving multimodal approaches (video, audio and text) in a digital context. As companies increasingly promote sustainability, understanding how to effectively communicate green initiatives becomes essential for encouraging consumer engagement and fostering eco-friendly behaviors.

The first approach, involving **multimodal messaging**, integrates various communication modes—such as visual, verbal, and auditory elements—to reinforce green messages. By combining multiple forms of messaging, companies often try to create a cohesive and impactful narrative that resonates with diverse audiences, enhancing message clarity

and retention. Our research however shows that the use of multimodal communication reduces consumers' engagement and possibly their intention to adhere to pro-social initiatives. This report explores each approach in depth, providing actionable insights for companies aiming to improve the effectiveness of their green messaging and to inspire meaningful consumer engagement in sustainability.

The second approach uses **sensory stimuli** to design engaging green messages that can foster the adoption of green conduct. Past work has shown that messages incorporating sensory stimuli increase consumer response to communication. In this work, we validate this hypothesis and examine whether and to what extent this is true in the sustainability contexts. Our findings show that firms can reduce skepticism and increase responsiveness to sustainability efforts by leveraging sensory stimuli, particularly haptic stimuli.

This report provides insights for policymakers on how sensory experiences occurring in digital environments can influence consumer attitudes toward sustainable products and encourage eco-friendly behaviors. In this phase of the project, we have mainly focused on the role played by simulating sensory experiences while proposing eco-friendly behaviors with a particular focus on the role played by vicarious touch. By highlighting the importance of touch and vicarious touch as a transformative factor, the research illustrates how such sensory interactions can drive consumers to adopt sustainable behaviors in their daily lives.

The findings underscore the potential for integrating vicarious touch mechanisms into sustainability initiatives, presenting a novel pathway to promote pro-social behaviors and accelerate sustainable practices. With a focus on both immediate and long-term impacts, this study suggests that leveraging sensory experiences like vicarious touch could enhance engagement in sustainable behaviors and foster a consumer culture more aligned with environmental goals. These insights can support the design of policies that harness sensory-based strategies to effectively influence consumer behavior in favor of sustainability. This investigation is supported by data collected via online experiments examining under which circumstances sensory stimuli foster sustainable behaviors.

The Bocconi Unit. This report investigates the impact of physical-world events and their digital amplification on fostering sustainable behaviors. By analyzing how exposure to environmental activism events, such as Greta Thunberg's Fridays for Future movements, influences observed consumer behavior, we provide insights into bridging the gap between environmental intentions and actions.

Using advanced GPS tracking and Places of Interest (POI) data, we examined the behavior of individuals before and after their exposure to environmental activism

events, being able to distinguish among those who actively participated in the event, were physically exposed but did not participate, and those living in the city. Our findings highlight that both direct participation in such events and indirect exposure through media coverage can lead to meaningful, albeit varied, shifts in sustainable behaviors. Key outcomes include changes in transportation choices, increased visits to sustainable businesses (e.g., vegetarian restaurants and eco-friendly stores), and a higher adoption rate of clean energy options, such as electric vehicle charging.

However, the results also reveal challenges in translating behavioral shifts into significant environmental impacts. For instance, while participants reduced unsustainable dining and shopping habits, increased overall consumption frequency offset these benefits, underscoring the need for deeper systemic changes. Notably, indirect exposure sometimes led to counterproductive behaviors, suggesting the importance of targeting messaging to minimize resistance or misinterpretation of sustainability goals.

The findings from this analysis offer actionable insights for businesses and policymakers. For businesses, the study emphasizes the role of targeted messaging and follow-up communication to reinforce behavioral changes initiated by activism events. For policymakers, the research highlights the importance of education and structural support to ensure that pro-environmental intentions result in meaningful long-term impacts. By leveraging the interplay between physical events and digital media, organizations can create a more consistent and impactful push toward sustainable consumption practices.

The second Bocconi research stream examines how sustainability is communicated through food and beverage packaging in the Italian grocery market. Packaging is not merely a container: it is a strategic point-of-sale communication device through which firms signal environmental and social responsibility using words, symbols, certifications, and visual design choices. To investigate this process, we built a longitudinal dataset, leveraging GS1 Italy's Osservatorio Immagino data, of front, back, and side packaging images for thousands of products sold through major Italian retailers, tracking packaging updates between 2016 and 2024. Sustainability-related textual and visual elements were systematically coded into eight categories, including sustainable packaging materials, sourcing and production claims, environmental footprint claims, generic environmental claims, and social and ethical responsibility.

The findings show that sustainability communication on packaging has become widespread, but not uniform. A central result is the prominence of material-related claims: packaging materials, recyclability, and disposal-related cues emerge as

especially salient across categories. At the same time, different product categories develop different sustainability narratives. These results suggest that firms do not communicate sustainability in a standardized way, but calibrate their packaging strategies according to consumer expectations, category conventions, and regulatory developments.

This evidence points to a key challenge for both firms and policymakers. As sustainability claims proliferate on packaging, the shelf can become a crowded and fragmented communication environment, where greater visibility does not necessarily translate into greater clarity for consumers. Packaging represents a critical interface in the ecological transition: it is the place where corporate sustainability commitments become concrete, but also where ambiguity, generic claims, and information overload may limit their effectiveness. For firms, this means that effective packaging communication should privilege clarity, credibility, and category relevance over the simple accumulation of green signals. For policymakers, it highlights the importance of improving the comparability and interpretability of sustainability information at the point of sale.

Finally, this research opens a further line of inquiry on the relationship between communication and actual purchasing behavior. While consumers increasingly express positive attitudes toward sustainable products, it remains necessary to verify whether the sustainability cues displayed on packaging translate into stronger market performance, such as higher sales, price premiums, or changes in loyalty. For this reason, the next phase of the research will integrate the SKU-level packaging data with sales data in order to assess whether and under what conditions sustainability communication on packaging affects actual consumer response.

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1. Introduction

Household consumption remains one key challenge in the global transition toward sustainability, accounting for approximately two-thirds of global greenhouse gas emissions. Despite growing environmental awareness—driven by the rise of large-scale climate movements, increasing corporate investment in green communication, and greater regulatory pressure on product labeling—translating this awareness into sustained behavioral change remains elusive. Firms are investing heavily in sustainability messaging across digital channels; environmental mobilizations are drawing millions of participants across European cities; and packaging has become a primary vehicle through which brands signal their environmental credentials to consumers at the point of sale. Yet the gap between what consumers say they intend to do and what they actually do remains stubbornly wide.

This deliverable synthesizes the results and policy implications of the research conducted within Work Package 1 of Spoke 1. Our work moves beyond stated intentions to examine observable behavior, combining experimental evidence, large-scale digital content analysis, GPS-based behavioral tracking, and longitudinal packaging data. The contributions of the University of Bologna and Bocconi University, while methodologically distinct, converge on a shared question: does sustainability communication actually shape behavior, and if so, under what conditions?

The answer that emerges across our research streams is nuanced but consistent: how sustainability is communicated matters as much as what is communicated—and the channel and context in which a message is delivered fundamentally change what works.

In digital environments, evidence from the Bologna Unit shows that simplicity drives engagement. Consumers on social media platforms respond more strongly to green messages that use fewer communication modes: educational, single-mode content generates significantly more sharing than complex multimodal formats combining video, text, and audio simultaneously. Complexity, far from reinforcing the message, can trigger skepticism and disengagement. Yet simplicity is not the whole story. When digital content incorporates sensory cues—specifically, the visualization of physical interaction with a product—it can effectively increase consumers' perception of active product demonstration (vs. passive display) and reduce their perceptions of manipulativeness in the firm's sustainability effort. In this case, a richer stimulus works because it makes the brand's sustainability messaging feel more authentic and less suspect of greenwashing.

The offline context tells a complementary but distinct story. Physical exposure to a large-scale climate event creates a genuine window of openness to behavioral change—a moment in which individuals are more receptive than usual to acting on their environmental values. But our evidence suggests that motivation alone is insufficient. When that window opens without the knowledge of how to act effectively—that is, without awareness of which behaviors actually reduce emissions meaningfully—consumers tend to add green actions on top of existing unsustainable ones rather than replacing them. The result is what we term the "green addition trap": overall environmental impact can worsen even as individuals feel they are making progress. The window closes, and the opportunity is lost.

This points to a structural problem that becomes fully visible at the point of sale. When a motivated consumer reaches the shelf, they encounter a communication landscape that is dense, fragmented, and highly variable across product categories. Our analysis of the Italian grocery market shows that sustainability claims on packaging have proliferated substantially over the past decade, but in ways that are shaped more by category conventions and regulatory requirements than by a coherent strategy to guide consumer choice. In some categories, the sheer volume of sustainability signals makes meaningful differentiation difficult, risking confusion rather than clarity at precisely the moment when a purchasing decision is made.

Together, these findings point toward a clear direction for both business practice and public policy. Effective sustainability communication must be designed not merely to raise awareness but to guide consumers toward behaviors that genuinely reduce their environmental footprint. It must be calibrated to the channel and context in which it operates. And it must be accompanied by the knowledge and structural support that allow motivation—when it arises—to translate into impact.

In terms of empirical outputs, our work generates several key datasets that contribute to understanding and influencing sustainable behavior. These include:

- **Instagram Dataset**: An archival panel of 2,766 Instagram posts from 30 sustainability-positioned brands spanning mass-market and sustainability-native firms across apparel, food and beverage, personal care, consumer electronics, automotive, and household categories. Posts are annotated for visual elements (particularly human hand presence) and engagement metrics, enabling analysis of the association between sensory cues and consumer engagement in real-world digital environments.
- **Experimental Data:** Three controlled experiments examining why and when vicarious touch stimuli in digital environments influence consumer preference for

sustainable products, implemented across multiple geographical contexts and testing various cognitive mechanisms and boundary conditions.

- **Video Communication Dataset:** A corpus of 417 sustainability-related TikTok videos posted by European Fortune 500 companies between April 2022 and April 2023, annotated for multimodality, educational content, influencer presence, and engagement metrics.
- **Geo-Behavioral Dataset: A** synthetic illustrative dataset designed to demonstrate what types of behavioral data can be collected and analysed using GPS mobility tracking and Points of Interest (POI) mapping. The dataset includes examples of the variables that can be observed—such as visits to sustainable vs. unsustainable restaurants, fuel stations, clothing stores, and second-hand shops—and illustrates how such data can be used to construct sustainability indices and track behavioral change at the individual level over time.
- **Packaging Dataset:** A longitudinal dataset of packaging images and sustainability-related claims for thousands of Italian food and beverage products, collected in collaboration with GS1 Italy's Osservatorio Immagino and covering 2016–2024. The dataset tracks the evolution of sustainability signals at the SKU level over time, enabling analysis of how companies adapt their packaging communication strategies across product categories and in response to changing regulatory and market pressures.

The overall structure of our research—its methodology, findings, and contributions—is summarized in Figure 1. The remainder of this document presents the detailed results and policy implications for each research stream in turn.

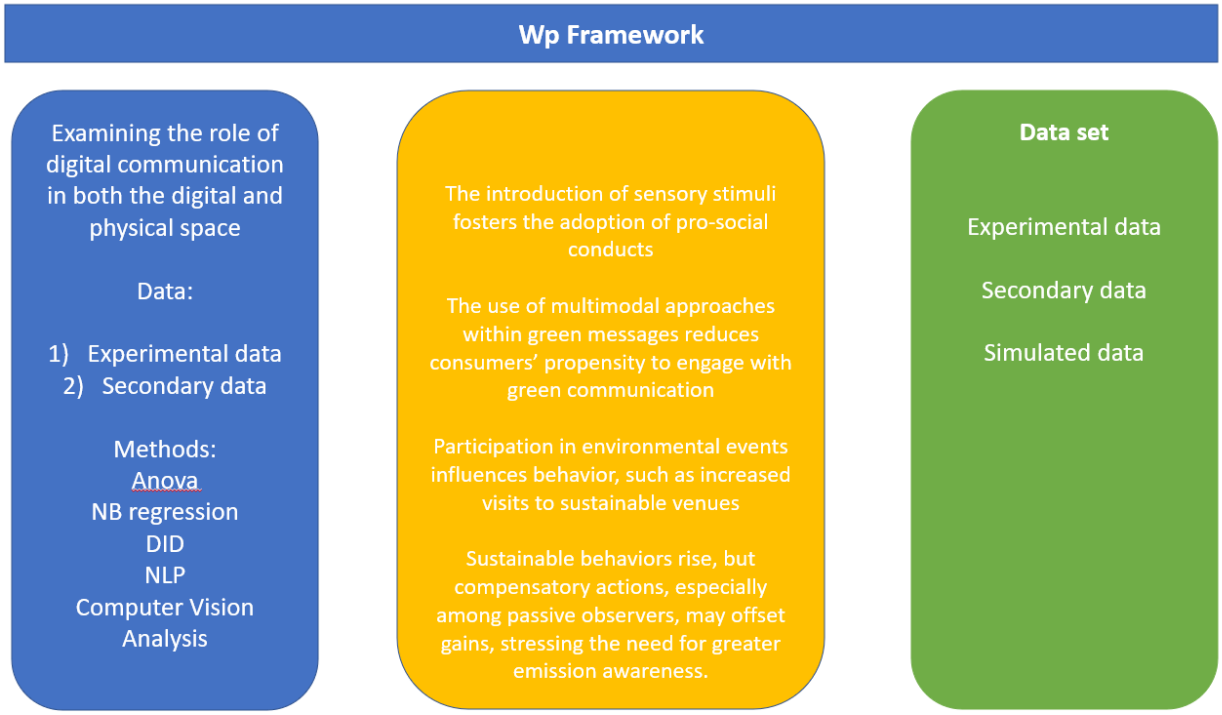

Figure 1 WP Framework

2. Research Overview

Bologna Unit: Multimodality Communication and Sustainable Behavior

This study analyzes a corpus of 417 TikTok videos posted by European Fortune 500 companies between April 2022 and April 2023. Videos were systematically annotated for level of multimodality (image only; image + caption + text overlay; image + caption + voice; image + caption + text overlay + voice), presence of influencers, educational vs. entertaining content, and engagement metrics including likes, impressions, and shares. Negative binomial regression models with brand and time fixed effects were estimated to assess the impact of each variable on share count, the strongest indicator of social media engagement. This research was integrated by looking at an additional dataset. This dataset includes TikTok activity from European companies listed in the 2023 Global Fortune 500 with verified accounts, reflecting the relevance of large firms due to their resources, visibility, and societal impact. The European setting is particularly appropriate given growing consumer and regulatory pressure for clearer sustainability communication. One verified account per company was selected, prioritizing global profiles, then European ones, or the most followed among multiple regional accounts; affiliated brands within corporate groups were included due to their independent strategies. Using the TikTok Research API, 6,194 organic posts were collected and filtered to retain only video content, excluding unavailable or non-video posts. The final sample consists of 5,749 videos published in 2023 by 52 companies across 21 industries, providing a solid basis for analyzing corporate sustainability communication on TikTok. These results indicate that, overall, social media videos benefit from the inclusion of text overlays and voice-overs. However, when brands communicate green-oriented content, adding text overlays, voice-overs, or both on top of the baseline elements (i.e., visuals and captions) appears to have a counterproductive effect, likely driven by increased skepticism and psychological reactance among viewers.

Bologna Unit: Haptic Stimuli and Sustainable Behavior

This study investigates how haptic cues in sustainability-related advertising and social media shape consumer engagement and preference, and how their persuasive effect is conditioned by eco-claim framing. The work progresses from field evidence to controlled experiments. Study 1 analyzes 2,766 Instagram posts from 30 sustainability-positioned brands to test whether hand presence is associated with higher consumer

engagement. Studies 2–4 build on this with three controlled experiments examining the psychological mechanisms underlying the hand-presence effect and testing moderation by claim type (self-transcendence vs. self-enhancement). Study 5 shifts focus to the consumer side, examining how political ideology shapes receptiveness to climate change beliefs, policy support, and green product choice through psychological distance from nature. Together, these studies establish a coherent logic: field data demonstrate that haptic cues work in real-world contexts; experimental data isolate why and when they work; and the final study identifies how consumer ideology filters the effectiveness of any sustainability communication.

Bocconi Unit: Eco-Movements and Sustainable Behavior

This study examines how physical exposure to a large-scale climate activism event influences actual consumer behaviors in the weeks and months that follow. The analysis leverages device-level GPS mobility data and a Points of Interest (POI) mapping framework aligned with the United Nations ActNow behavioral taxonomy, covering venues associated with sustainable choices (vegetarian restaurants, sustainable fashion retailers, electric charging stations, second-hand stores) and unsustainable ones (fast food chains, fast fashion brands, gasoline stations). Individuals in the sample are classified along a spectrum of exposure: those who physically attended the event, those incidentally present in the surrounding area, and those with no physical exposure. A descriptive fixed-effects model is estimated for each behavioral outcome, with controls for seasonality, device type, weather, and time trends. Robustness checks include alternative exposure thresholds, Coarsened Exact Matching (CEM) on home and work census tracts, and a placebo test using pharmacy visits as an outcome unrelated to sustainability. An emission index is constructed by assigning life-cycle assessment emission factors to each observed behavior, enabling translation of behavioral changes into estimated CO_2 equivalent impacts. A latent class segmentation based on pre-event behavioral profiles is also estimated to explore heterogeneity in treatment response.

Bocconi Unit: Sustainability Communication through Packaging

This study analyses how sustainability is communicated through food and beverage packaging in the Italian grocery market. The dataset was built in collaboration with GS1 Italy's Osservatorio Immagino and covers front, back, and side packaging images for thousands of products among several product categories, distributed through major

Italian retail chains, with longitudinal tracking of packaging updates between 2016 and 2024. For each product, sustainability-related textual and visual elements were systematically coded according to eight claim categories: ingredients and nutritional quality; sustainable lifestyle positioning; practical sustainability guidance; sustainable packaging materials; sustainable sourcing and production; environmental footprint claims; generic environmental claims; and social and ethical responsibility. Keywords were identified using both expert-defined lists and data-driven fuzzy matching and textual embedding techniques. Three product categories are analysed in depth and reported in this document — mozzarella, pasta, and wine — to examine how sustainability communication strategies vary across categories with different consumer expectations, shelf-life profiles, and regulatory contexts.

3. Results

3.1 Bologna Unit: Multimodality Communication and Sustainable Behavior

Overview

Sustainability has become a central factor shaping consumer behavior, with growing demand for eco-friendly products and more transparent brand communication. However, companies often struggle not only with what to communicate about their environmental efforts, but also with how to communicate it effectively, as many sustainability claims are perceived as vague or misleading.

In response, video-based communication—especially short-form social media content—has emerged as a powerful tool, given its ability to combine visual, textual, and auditory elements to convey complex messages and engage audiences emotionally. Yet, these videos differ in their level of multimodal richness, ranging from simple formats with visuals and captions to more complex ones incorporating text overlays and voice-overs. While prior research suggests that combining multiple modes can enhance message effectiveness, excessive information may also reduce engagement, particularly in sustainability contexts. Despite the growing importance of brand-generated video content, limited research has examined how different multimodal elements interact to influence consumer responses, especially for green communication. Addressing this gap, this study investigates how varying video designs affect engagement and whether these effects differ between green and non-green messages. Using a large dataset of TikTok videos from major European companies and

applying advanced analytical techniques, the findings reveal that although richer video designs generally enhance performance, they can backfire in sustainability-related content, likely due to increased skepticism. This research contributes to both theory and practice by highlighting the importance of carefully balancing multimodal elements in green communication and suggesting that, in this context, simpler designs may be more effective.

Key findings

This section positions TikTok as a highly relevant setting for studying brand video communication, given its focus on short-form video and its growing importance for corporate visibility and engagement. The study analyzes 5,749 TikTok videos posted in 2023 by 52 large European companies across 21 industries, with a focus on whether different video designs shape engagement differently for green versus non-green content. Green-oriented videos represent 13.69% of the sample, and are especially concentrated in automotive, utilities, and energy sectors.

The key results are clear and practically relevant. In the overall sample, richer video designs tend to improve engagement: adding text overlays is associated with higher engagement, voice-over produces the strongest positive effect, and combining text overlay with voice-over is also beneficial. However, this pattern reverses for green-oriented communication. After matching green and non-green videos through propensity score matching, the results show that adding text overlays, voice-over, or both significantly reduces engagement for sustainability-related posts. Specifically, green videos with text overlays show lower engagement, those with voice-over perform substantially worse, and videos combining both also suffer a strong engagement penalty. This suggests that, while multimodal richness generally helps social media videos, it can backfire when brands communicate sustainability, possibly because viewers perceive richer green messages as overly persuasive, educational, or promotional.

The additional analyses help clarify why richer video designs may backfire in green communication. The study considers several alternative explanations and tests whether the negative effect is simply due to differences in how green videos are structured, framed, or aligned with the brand. First, it accounts for content redundancy across modes, measured through semantic similarity between verbal elements—caption, text overlay, and voice-over—and through visual-verbal similarity, captured by comparing video-frame embeddings with verbal cues using the CLIP model. This checks whether engagement drops because multiple modes repeat or conflict with each other. Second, it controls for whether the post is more informative versus commercial, measured as the proportion of informative words relative to informative

and commercial words. This tests whether enriched green videos perform worse simply because they appear too educational or instructional. Third, it controls for brand congruity, measured as the semantic similarity between a brand's green and non-green communication, to assess whether consumers penalize green videos that feel inconsistent with the brand's usual style. Fourth, it accounts for assertiveness, measured using Kronrod and colleagues' language assertiveness tool, because more forceful wording could trigger reactance.

These results are documented in Table 1 where alternative models are compared.

Table 1. Summary of Results: Multimodality Communication.

DV: Engagement	Model 1: only IVs			Model 2: Baseline controls			Model 3: Multimodal controls		
	IRR	Coeff.	p	IRR	Coeff.	p	IRR	Coeff.	p
Independent Variables:									
Video Design									
Image+Caption+TO	.696	-.362 (.199)	.069	1.008	.008 (.105)	.937	.910	-.095 (.116)	.416
Image+Caption+VO	1.552	.440 (.375)	.242	1.189	.173 (.203)	.393	.807	-.214 (.228)	.348
Image+Caption+TO+VO	.528	-.639 (.182)	.000	1.074	.071 (.108)	.512	.719	-.330 (.148)	.026
Green Claim:									
Yes	2.001	.694 (.279)	.013	1.012	.012 (.139)	.933	1.202	.184 (.155)	.235
Interactions: Video Design * Green Claim									
Image+Caption+TO * Green Claim	.234	-1.451 (.334)	.000	.726	-.320 (.168)	.057	.634	-.456 (.180)	.011
Image+Caption+VO * Green Claim	.081	-2.512 (.600)	.000	.313	-1.161 (.303)	.000	.287	-1.247 (.313)	.000
Image+Caption+TO+VO * Green Claim	.271	-1.305 (.315)	.004	.770	-.261 (.158)	.099	.600	-.511 (.173)	.003
Additional Controls:									
Log (Views)				1.868	.625 (.013)	.000	1.836	.608 (.013)	.000
Log (Video Duration)				1.468	.384 (.317)	.227	.705	-.349 (.353)	.323
Log (Video Duration)2				.941	-.061 (.049)	.217	1.070	.068 (.057)	.235
Audial Controls									
Volume							1.016	.016 (.007)	.022
Pitch							1.000	-.000 (.000)	.072
Speech Rate							1.237	.212 (.050)	.000
Visual Controls									
Colorfulness							1.177	.163 (.308)	.596
Saturation							235.316	.856 (.241)	.000
Faces							.869	-.141 (.108)	.193
Happy							1.226	.204 (.117)	.082
Sad							.859	-.152 (.152)	.318
Surprise							.866	-.144 (.423)	.733
Fear							1.234	.210 (.152)	.167

Angry							1.358	.306 (.218)	.161
Disgust							.530	-.634 (.625)	.310
Verbal Controls									
Caption Hashtags							1.014	.014 (.014)	.337
Caption Mentions							.844	-.170 (.082)	.037
Caption Emoji							.945	-.057 (.024)	.019
Valence							.588	-.532 (.228)	.020
Arousal							1.609	.475 (.289)	.100
Concreteness							.998	-.002 (.001)	.095
Readability							.990	-.010 (.004)	.013
Verbal Density							.992	-.008 (.025)	.752
Fixed Effects									
Time FE					Included			Included	
Brand FE					Included			Included	
Intercept	9288	9.137 (.145)	.000	4.337	1.467 (.645)	.023	91.385	4.515 (.972)	.000
N		1,256			1,256			1,225	
AIC		21,738.490			19,222.506			18,640.759	
Log likelihood		-10,860.245			-9,547.252			-9,236.380	

Importantly, the core result remains stable after including these measures. Text overlays, voice-over, and their combination continue to reduce engagement when used in green-oriented videos, even when similarity, informative tone, brand congruity, and assertiveness are considered. This suggests that the backfire effect is not merely driven by poor message fit, excessive repetition, lack of brand consistency, or overly directive language. Rather, the findings point to a broader mechanism: when brands use richer multimodal designs to communicate sustainability, consumers may interpret the additional verbal and auditory cues as a stronger persuasive attempt, increasing skepticism or greenwashing concerns and lowering engagement.

3.2 Bologna Unit: Haptic Stimuli and Sustainable Behavior

Overview

This study examines how a simple visual element of sustainability communication — the depiction of a human hand engaging with the advertised product — affects consumer engagement, evaluation, and purchase intention, and the cognitive mechanism through which this effect occurs. Across five studies we move from large -

scale field evidence to mechanism - focused experiments, to a moderation test of claim framing, to a multi - country replication, and finally to a study of stable individual differences (political ideology and psychological distance from nature) that condition the receptiveness of consumers to sustainability appeals more broadly. Three convergent insights emerge: (i) the presence of a hand in sustainability content meaningfully increases consumer response in real digital environments and in controlled experiments; (ii) the effect is carried by perceived demonstrative communication — the inference that the brand is showing rather than telling — and is partially reinforced by perceived manipulativeness, with perceived demonstrative communication further reducing perceived manipulativeness in a serial - mediation chain; and (iii) the persuasive value of the hand cue depends on the moral logic of the accompanying eco - claim, working most reliably when the claim emphasizes self - transcendence (planet, others) rather than self - enhancement (personal gain). A complementary study on political ideology shows that the effectiveness of any sustainability appeal is further filtered by the consumer's psychological distance from nature (Trope & Liberman, 2010; Xu, Liu, & Chen, 2022), which mediates the well - documented gap between conservative and liberal segments in pro - environmental belief, behavior, and choice.

Table 2. Summary of studies, samples, and main findings.

Study	Sample (N)	Method	Headline finding
Study 1	2,766 Instagram posts (30 brands)	Field panel; FE regression	Hand presence → +10.5% engagement (β=.10, p=.016). Brand pool first established via a 148-consumer pretest.
Study 2	1,004 (US/UK/IE)	Online experiment; PROCESS 4 & 6	Perceived demonstrative communication and perceived manipulativeness are the operative mediators; serial Hand→perceived demonstrative communication → perceived manipulativeness → outcome chain confirmed.
Study 3	1,205 (US/UK/IE)	Moderated serial mediation (PROCESS Model 84)	Conditional serial indirect effects via perceived demonstrative communication and perceived manipulativeness reliable under self-

			transcendence claim; null under self-enhancement.
Study 4	625 Italian adults	hand × claim, single-mediator moderated model (PROCESS Model 7)	Hand cue reduces perceived manipulativeness only under self-transcendence claim; index of moderated mediation excludes zero.
Study 5	800 IT adults	Mediation through psychological distance with nature	Psychological distance with nature mediates ideology → beliefs in climate change, green policy support, index of pro-environmental behavior, green product choice (all reliable).

Study 1. Field evidence: hand cues in 30 sustainability brands on Instagram

Study 1 began by identifying the brand universe through a brief pretest with 148 European consumers (M_age = 40.52, SD = 13.36; 44.6% female), who were asked to spontaneously list brands they associate with sustainability positioning. The resulting 30-brand roster spans both mass-market firms (e.g., Adidas, Apple, H&M, IKEA, Nestlé, Toyota, Unilever) and sustainability-native firms (e.g., Allbirds, Ecover, Fairphone, Patagonia, Veja). This roster anchored the field corpus in Study 1 and ensured ecological validity of the brand stimuli employed in subsequent experiments.

Study 1 assembled a panel of 2,766 Instagram posts from 30 sustainability - positioned brands, with hand presence, hand perspective, touch type, and gesture type coded by a large language model (Gemini 2.5 Flash). Two thirds of posts in the analytic sample (66.2%) depict a hand. Negative - binomial regressions of log - engagement on hand presence with brand and time fixed effects, plus an extensive battery of post - , text - , and image - level covariates, reveal a robust and meaningful effect (see Table 3): hand - present posts generate approximately 10.5% higher engagement than otherwise identical hand - absent posts (M3: β = .10, SE = .04, p = .016, R^2 = .59), an effect that survives every successive tier of controls (M1: β = .34, p < .001; M2: β = .11, p = .001) and is robust to brand - clustered standard errors (β = .10, clustered SE = .029, p = .002).

The subgroup contrast analyses indicate that not all hands are equally persuasive (see Figure 2). The engagement lift is concentrated in (a) first - person (self) perspective (Elder & Krishna, 2012) hands (+.23, p < .001) over third - person hands (+.08, p = .056), with the self - vs. - other contrast roughly threefold in magnitude (F(2, 1984) = 8.39, p < .001); (b) instrumental touch — hands purposefully grasping or manipulating the product to extract haptic information about weight, texture, or hardness (Peck &

Wiggins, 2006; Streicher & Estes, 2016; Thai, Chang, & Wyer, 2024) (+.10, p = .016); and (c) iconic gestures (gestures associated with concrete objects or events that visually resemble the concept they represent; McNeill, 2005) (+.12, p = .006; F(3, 1984) = 3.01, p = .029). These patterns are theoretically diagnostic and align directly with the perceived demonstrative communication and perceived manipulativeness account established in Studies 2–4: the hand cues that work are precisely those that most strongly signal authentic, hands-on demonstration of the product, the very perceptions that elevate perceived demonstrative communication and dampen suspicion of manipulative intent. They also pin down the stimulus design adopted in Studies 2–4.

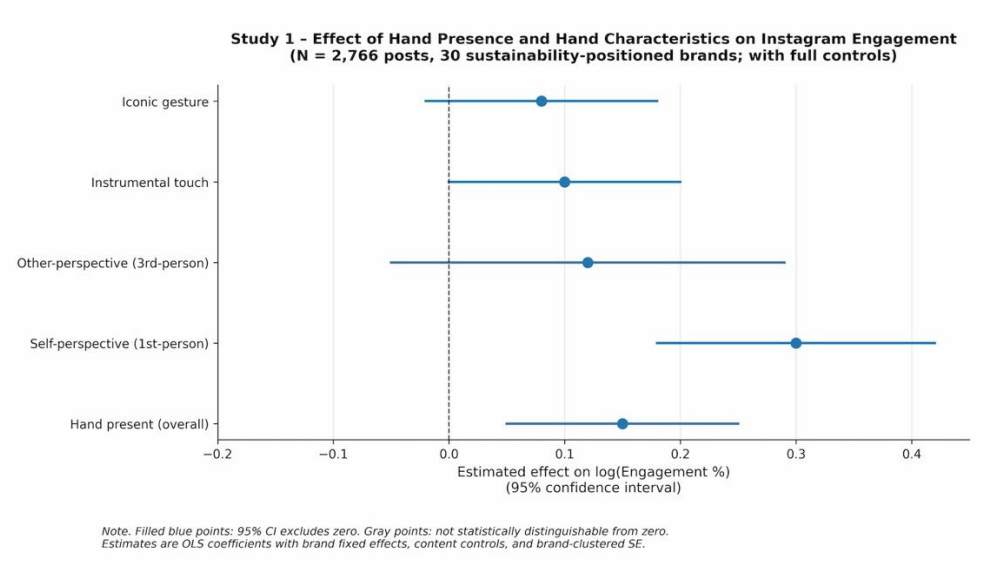

Figure 2. Study 1 — Hand Attribute Effects on Log(Engagement)

Table 3. Study 1 — Effect of hand presence on consumer response

Outcome	M1 (no controls)	M2 (+ FE)	M3 (+ controls)
log_Engagement	β = .34, p < .001	β = .11, p = .001	β = .10, p = .016
log_Likes	β = -.21, p = .015	β = -.09, p = .057	β = -.02, p = .694
log_Comments	β = -.10, p = .124	β = -.04, p = .333	β = -.03, p = .580

Studies 2 and 3. Mechanism: perceived demonstrative communication and perceived manipulativeness

To isolate the cognitive mechanism through which hand cues operate, Study 2 (N = 1,004; United States, United Kingdom, Ireland) used a sustainable t - shirt advertisement and a single between - subjects manipulation of hand presence, while measuring four alternative mediators previously proposed in the haptic and ownership literatures (virtual touch, psychological ownership, body ownership, self - efficacy; Lee et al., 2022;

Luangrath et al., 2022; Zhang et al., 2025) alongside two focal candidates: perceived demonstrative communication (α = .95), which captures the inference that the brand is "showing" the product rather than "telling" the consumer to buy it, and perceived manipulativeness (α = .90), which captures the suspicion that the brand is trying to influence the viewer through illegitimate means. Hand presence significantly increased perceived demonstrative communication (M_hand = 5.88 vs. M_no-hand = 5.25, t(990) = 4.71, p < .001, d = 0.30) and also slightly increased perceived manipulativeness (M_hand = 4.16 vs. M_no-hand = 3.91, t(995) = 2.28, p = .023, d = 0.14), while leaving virtual touch, psychological ownership, body ownership, and self - efficacy unaffected. In a parallel multiple - mediator model (PROCESS Model 4) (Hayes, 2022) with all six candidates simultaneously entered, only perceived demonstrative communication (indirect = .153, 95% CI [.070, .260]) and perceived manipulativeness (indirect = -.021, 95% CI [-.052, -.001]) carried reliable indirect effects. Perceived demonstrative communication and perceived manipulativeness were inversely related, with perceived demonstrative communication reducing perceived manipulativeness substantially (d = -.198, p < .001), motivating a serial - mediation specification (Model 6) that uncovers a small but reliable positive Hand → perceived demonstrative communication → perceived manipulativeness → outcome chain (PE: indirect = .015, 95% CI [.005, .027]; PI: indirect = .010, 95% CI [.002, .022]).

Study 3 (N = 1,205; balanced quotas across the United States, United Kingdom, and Republic of Ireland) re - specifies the serial - mediation logic as a moderated serial mediation (PROCESS Model 84), entering claim type as a first - and second - stage moderator of the Hand → perceived demonstrative communication → perceived manipulativeness chain on three downstream outcomes (product evaluation, purchase intention, green - product preference). The focal evidence is the conditional indirect effect of hand presence under the self-transcendence claim: the serial Hand → perceived demonstrative communication → perceived manipulativeness pathway is reliably positive on product evaluation (ab = .014, 95% CI excluding zero), purchase intention (ab = .012, 95% CI excluding zero), and green-product preference (ab = .006, 95% CI excluding zero; see Figure 3).

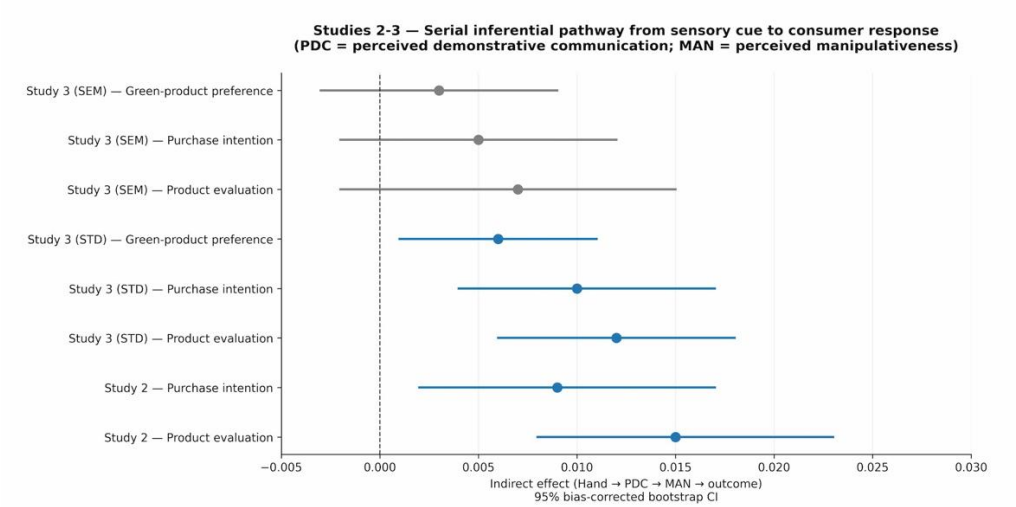

Figure 3. Serial mediation

Study 4. Boundary condition: claim framing

Study 4 (N = 625 Italian adults; 51.5% female; 2 × 2 between - subjects: hand × claim) tested whether the persuasive value of the hand cue depends on the moral architecture of the eco - claim it accompanies. We compared a self - transcendence claim ("You have the responsibility to protect the planet…") with a self - enhancement claim ("You have the choice to take an action for personal realization…"), with both appeals embedded in identical visual stimuli of an eco-friendly laundry detergent. The hand cue did not produce significant main effects on product evaluation or purchase intention, and the Hand × Claim interactions on those downstream outcomes were not significant, but the Hand × Claim interaction was significant on the mediator perceived manipulativeness (b = 0.57, SE = 0.28, 95% CI [0.02, 1.11], p = .041). Decomposing the interaction, the human - hand cue significantly reduced manipulativeness only under the self - transcendence claim (b = -0.44, SE = 0.20, p = .024, 95% CI [-0.83, -0.06]), whereas under the self - enhancement claim the effect was statistically null (b = 0.12, p = .52). Because perceived manipulativeness strongly predicts both product evaluation (b = -0.33, p < .001) and purchase intention (b = -0.33, p < .001), the conditional indirect effect through perceived manipulativeness was reliably positive under the self - transcendence claim (0.16, 95% CI [0.02, 0.31]) and indistinguishable from zero under the self - enhancement claim (-0.04, 95% CI [-0.18, 0.09]); the index of moderated mediation excluded zero (index = -0.20, 95% CI [-0.41, -0.01]). The hand cue therefore acts as a credibility - protective device: it pre - empts the skepticism that moral, other - oriented eco - claims tend to arouse, but it adds little when the claim is already framed as personally beneficial.

Study 5. Audience - side moderator: political ideology and psychological distance from nature

Study 5 (N = 800 Italian adults, M_age = 51.06, 51.6% female) shifts the analytical angle from the firm-controlled cue to the consumer-side filter through which any sustainability appeal is processed. We measured political ideology in two ways: a single-item self-placement on the left–right continuum and a seven-item issue-based index (Poli_IT; α = .79) tapping immigration, taxation, and welfare attitudes. Outcomes were belief in climate change (BCC), policy support (PS), the pro-environmental behavioral index (PBI), and green product choice (PChoi). Across all four outcomes and across both ideology measures, more conservative ideology significantly predicted lower pro-environmental responses (BCC: b = -0.48, p < .001; PS: b = -0.32, p < .001; PBI: b = -0.20, p < .001; PChoi: b = -0.35, p < .001). Critically, parallel mediation through psychological distance from nature (PD_env) and individualizing moral foundations (Indivi; care and fairness, Graham et al. 2011), entered jointly with eight further candidate mediators (perceived impact, perceived prevalence, psychological reactance, skepticism, binding moral foundations, need for cognitive closure, preference for deliberation, and preference for intuition), produced reliable indirect effects of ideology on every outcome: PD_env mediated the ideology effect on BCC (ab = -0.021, 95% CI [-0.039, -0.007]), PS (ab = -0.017, [-0.032, -0.005]), PBI (ab = -0.019, [-0.034, -0.007]), and PChoi (ab = -0.029, [-0.058, -0.005]). Individualizing moral foundations played a parallel and numerically larger role (ab = -0.150 on BCC, -0.088 on PS, -0.054 on PBI, -0.142 on PChoi), perceived impact contributed an additional reliable indirect effect on three of the four outcomes (ab = -0.030 on BCC, -0.027 on PS, -0.042 on PBI; non-significant on PChoi), and the remaining seven candidate mediators were either fully or largely ruled out (binding moral foundations, need for cognitive closure, preference for intuition: non-significant on all four outcomes; perceived prevalence, reactance, skepticism, preference for deliberation: significant on at most one or two outcomes and with effect sizes well below those of PD_env and individualizing moral foundations). We carry PD_env, rather than individualizing moral foundations, forward as the focal audience-side lever because individualizing moral foundations have already been extensively studied in the political-ideology and moral-psychology literatures and reflect a relatively stable trait that is difficult to shift through marketing or policy communications, whereas PD_env is more amenable to targeted communicative manipulation. The conservative-leaning consumer is therefore not "uninterested" in sustainability per se but processes it through a psychologically more distant, less self-implicating lens. This finding is essential for the design of policy and firm communications: the segments most resistant to sustainability messaging are

precisely those for whom psychological distance from nature must be reduced before the persuasive elements identified in Studies 1–4 can take hold.

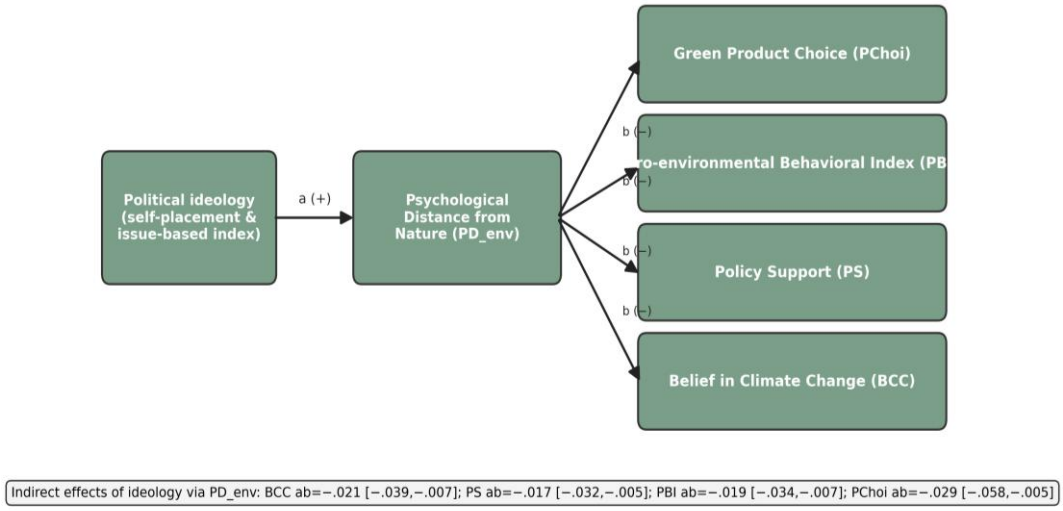

Figure 4. Audience-side filter: political ideology → psychological distance from nature → pro-environmental outcomes.

3.3 Bocconi Unit: Eco-movements and sustainable behavior — evidence from GPS data

Overview

This study examines whether and how physical exposure to a large-scale climate activism event translates into changes in actual consumer behavior. Rather than relying on self-reported intentions, we leverage device-level GPS mobility data to construct two methodological contributions that, to our knowledge, are novel in the literature. First, we develop a directly observable and measurable index of sustainable and unsustainable consumer behavior based on GPS-tracked visits to categorized venues, and translate these behavioral changes into estimated CO_2 equivalent emissions using life-cycle assessment factors. Second, we distinguish between three types of physical exposure to the event — individuals who physically attended the event (dwell time ≥ 15 minutes), those incidentally exposed while in the surrounding area (dwell time > 0 and < 15 minutes), and those not physically exposed — allowing us to assess not just whether the event had an effect, but how the nature and intensity of exposure shape the behavioral response.

Key findings

The results reveal a consistent and encouraging pattern: across all groups, exposure to the event is associated with an increase in visits to sustainable venues — particularly

sustainable restaurants and clean energy stations — and a reduction in visits to unsustainable alternatives. However, a more nuanced picture emerges when behavioral changes are translated into estimated emissions. Despite the shift toward more sustainable choices, total emissions increase on average, driven by a rise in the overall frequency of consumption. Individuals appear to add green behaviors rather than substitute unsustainable ones — a pattern consistent with what we term the "green addition trap."

Heterogeneity across exposure groups is substantial. Those physically attending the event show the strongest and most consistent pro-environmental behavioral shifts. Incidentally Exposed individuals display larger movements in some dimensions — particularly in clean fuel adoption — but less consistent reductions in unsustainable behaviors. The Not Physically Exposed group shows more modest changes overall.

A latent class analysis adds a further layer of heterogeneity. To capture pre-existing behavioral profiles, we use three months of GPS-tracked consumption data prior to the event to identify four distinct segments among physically attending participants: a predominantly unsustainable segment (36%) characterized by frequent visits to fast food chains and fast fashion retailers; a sustainable food segment (23%) with a higher share of visits to vegetarian and plant-based restaurants; a sustainable fashion segment (21%) oriented toward eco-conscious clothing brands; and a high-frequency buyer segment (19%) defined not by the sustainability of their choices but by the sheer volume of their consumption across all categories. This last group is particularly interesting: their high overall consumption generates substantial emissions, and yet their participation in the climate event appears to trigger a meaningful reduction in total consumption frequency — making them, paradoxically, among the biggest beneficiaries of the event in terms of emission reductions. The results underscore that the event's impact is heavily conditioned by who attends and what their baseline habits are.

Table 4. Behavioral responses to the climate event by exposure group

	Not Physically Exposed	Incidentally Exposed	Physically Exposed (>15 min)
Sustain. Rest. Visits	0.004	0.212***	0.140***
Unsustain. Rest. Visits	0.008	-0.008	-0.029
Sustain. Shops Visits	0.005	-0.010	-0.001
Unsustain. Shops Visits	0.002	-0.039	-0.033
Clean Fuel Station Visits	0.105***	0.712***	0.517***

Gasoline Station Visits	-0.007*	0.001	-0.017**

*Note: Estimated coefficient β on Post. Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01. Controls include seasonality, device type, weather, flu, and time trends.*

Across all exposure groups, the most consistent and pronounced behavioral response is observed in the energy domain: visits to clean fuel stations increase significantly, while gasoline station visits decline — a pattern that holds across all groups and points to a genuine substitution effect in fuel choices. In the food domain, both those Physically Attending the Event and Incidentally Exposed individuals shift toward sustainable restaurants, though the reduction in visits to unsustainable restaurants is less consistent, particularly among Incidentally Exposed individuals. This asymmetry — sustainable options added without a corresponding drop in unsustainable ones — is the clearest signature of the green addition trap in the behavioral data. Shopping-related behaviors show weaker and less consistent effects across groups.

Table 5. Emission index by exposure group

	Full Sample	Not Physically Exposed	Incidentally Exposed	Physically Exposed (>15 min)
Sustainable Emission	2.118***	1.350***	2.685***	3.207***
Unsustainable Emission	-0.650***	-0.693***	-0.733	-1.074**
Total Emission	1.315***	0.557	1.841*	2.272*

***Note**: * p < 0.1, ** p < 0.05, *** p < 0.01.*

Table 5 translates behavioral changes into estimated CO_2 equivalent impacts using emission factors drawn from established life-cycle assessment sources (Poore & Nemecek, 2018; Ellen MacArthur Foundation, 2017; U.S. EPA). A striking result emerges: despite reductions in unsustainable behaviors, total emissions increase significantly for the full sample and for both physically exposed groups. This is driven by the rise in sustainable emissions — that is, emissions associated with newly adopted green behaviors that were added on top of, rather than in replacement of, existing unsustainable ones. The not-physically-exposed group shows no significant change in total emissions, suggesting that the effect is genuinely tied to physical exposure to the event.

Table 6. Emission changes by pre-event behavioral segment (Physically Exposed >15 min)

Segment (% of sample)	Total Emission	Sustainable Emission	Unsustainable Emission
Unsustainable (Fast Fashion, Fast Food) — 36%	4.652***	6.276***	-1.541***
Sustainable (Food) — 23%	-5.779***	-1.788**	-4.168***
Sustainable (Fashion) — 21%	-3.673***	-2.321***	-2.751***
Frequent Buyers — 19%	-26.276***	-15.472***	-12.614***

*Note: Latent class segmentation based on pre-event behavioral profiles. * p < 0.1, ** p < 0.05, *** p < 0.01.*

Table 6 reveals the most policy-relevant finding of the study. Among those who physically attended the event, the impact on emissions is diametrically opposite depending on pre-existing behavioral habits. The 36% of participants with predominantly unsustainable pre-event habits show a large increase in total emissions post-event (+4.652), driven by an increase in sustainable consumption that does not offset their continued unsustainable behaviors. In contrast, all three remaining segments — those already oriented toward sustainable food choices (23%), sustainable fashion (21%), and the high-frequency buyer segment (19%) — show significant reductions in total emissions post-event. The most striking effect is observed among high-frequency buyers: despite not being characterized by particularly sustainable baseline habits, their participation in the event appears to trigger a reduction in overall consumption frequency, which — given the high emissions associated with their volume of purchasing — translates into the largest absolute emission reduction across all segments (-26.276 kg CO_2eq). This suggests that climate events may be especially effective at converting high-volume consumers into lower-frequency ones, even absent a strong prior sustainability orientation. The heterogeneity in responses underscores the importance of targeting: the same event can reduce emissions substantially for some participants while increasing them for others.

Sensitivity analysis: robustness across exposure thresholds

A key methodological question concerns the definition of physical exposure. The main results use a threshold of 15 minutes of dwell time at focal event locations to define active participation. Figures 5 and 6 below present sensitivity analyses testing the stability of results across four alternative thresholds: >5, >10, >15, and >20 minutes.

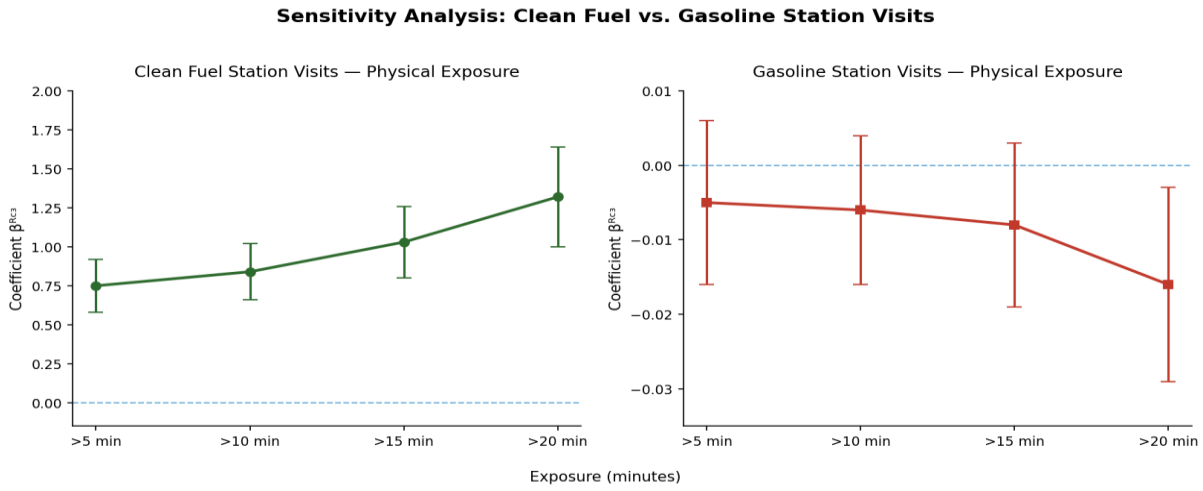

Figure 5: Figure 1. Sensitivity Analysis: Clean Fuel vs. Gasoline Station Visits

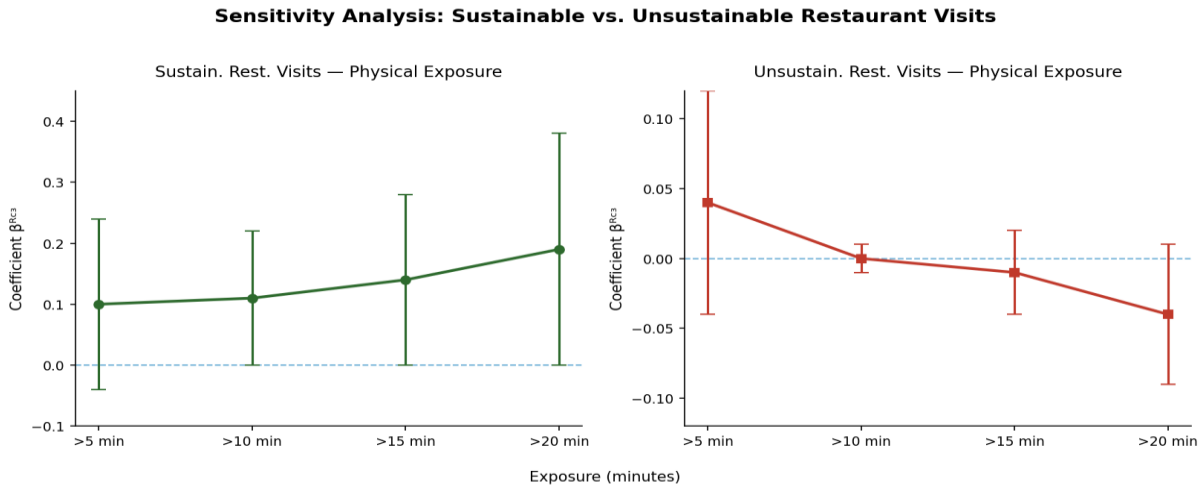

Figure 6. Sensitivity Analysis: Sustainable vs. Unsustainable Restaurant Visits

As shown in the figures, the direction and significance of the results are highly stable across all exposure thresholds. For clean fuel station visits (Figure 5, left panel), the estimated coefficient is positive and statistically significant at all thresholds, and increases monotonically with the stringency of the exposure definition — suggesting that the most committed attendees drive the strongest behavioral response in the energy domain. The coefficient for gasoline station visits (Figure 5, right panel) is negative across all thresholds, becoming more negative and more precisely estimated as the threshold increases, consistent with a genuine substitution away from fossil fuels among those most deeply exposed to the event.

For restaurant visits (Figure 6), the positive effect on sustainable restaurant visits strengthens monotonically with the exposure threshold, while the effect on unsustainable restaurant visits turns progressively more negative as the threshold increases — from a slightly positive (and statistically insignificant) coefficient at >5 minutes to a clearly negative coefficient at >20 minutes. This pattern suggests that

incidental or brief exposure may be insufficient to produce substitution in food choices, while deeper engagement with the event — captured by longer dwell time — does generate meaningful behavioral change across all domains.

Together, these sensitivity analyses reinforce confidence in the main results and suggest that the exposure threshold of >15 minutes, used in the primary specification, provides a conservative and credible definition of active participation.

3.4 Bocconi Unit: Communicating sustainability through packaging — evidence from the Italian grocery market

Overview

Packaging is not merely a container that protects a product. It is a strategic component of the marketing mix that can directly shape consumer behavior at the point of sale. Beyond its functional role, packaging conveys information, influences perceptions, and guides purchase decisions. On the shelf, it often represents the first point of contact between brands and consumers, effectively acting as a silent salesperson. Through materials, symbols, colors, labels, and textual claims, packaging attracts attention, conveys brand values, and contributes to perceived product quality. Consumers may also rely on packaging cues in place of direct product evaluation, which makes packaging especially consequential in in-store decision-making. Well-designed packaging can therefore support product differentiation, reinforce positioning, and influence choice (e.g., Branca et al., 2024; Herédia-Colaço, 2023; Briand Decré & Cloonan, 2019; Park & Ma, 2019).

This research stream examines how sustainability is communicated through food and beverage packaging in the Italian grocery market. The focus is on packaging as a point-of-sale communication device through which firms signal environmental and social responsibility using words, symbols, certifications, and visual design choices. This is the moment at which sustainability communication becomes concrete for consumers, but also potentially crowded, fragmented, and difficult to interpret.

The empirical basis of the analysis is a longitudinal dataset developed in collaboration with GS1 Italy's Osservatorio Immagino, covering front, back, and side packaging images for thousands of food and beverage products among several product categories (bottled water, milk, mozzarella cheese, pasta, ricotta cheese, wine, yogurt) commercialized through major Italian retailers and tracks packaging updates between

2016 and 2024. This makes it possible to observe not only whether sustainability-related cues are present, but also how firms revise their packaging communication strategies over time and across product categories. The analysis therefore captures sustainability positioning as expressed on pack, that is, the way firms frame their environmental and social credentials in the competitive context of the grocery aisle.

Key findings

To analyse how sustainability is communicated, we systematically coded a broad set of sustainability-related elements appearing in both the textual and visual components of packaging, including claims, phrases, certifications, and logos. This coding procedure allowed us to build a longitudinal SKU-level dataset tracking the presence of sustainability cues over time. Each time a product's packaging changed, a new observation was recorded, making it possible to identify how firms adapt their sustainability communication strategies across years and categories.

To operationalize the coding, we developed an extensive list of sustainability-related keywords and grouped them into categories representing different dimensions of sustainability. These keywords included both common Italian and English expressions associated with specific sustainability aspects, such as *riciclabile* and *biodegradabile*, and the names of logos, associations, and certifications commonly found in the Italian market, such as ISO 14001 and Forest Stewardship Council. The list was further refined using fuzzy matching and textual-embedding techniques in order to make the coding approach more data-driven and robust.

The coding scheme identifies eight categories, as summarized in Table 6.

Table 6: Sustainability-related labels and claims

Labels and claims	Description	Relevant examples
Ingredients and nutritional quality	Claims referring to specific ingredient or nutrient characteristics.	no preservatives, high in protein, gluten-free, low fat
Sustainable lifestyle positioning	Claims linking the product to broader sustainable or natural lifestyles.	vegan, vegetarian, natural ingredients
Practical sustainability guidance	Instructions concerning disposal, use, or conservation.	
Sustainable packaging materials	Claims highlighting the environmental sustainability of the packaging itself.	recycled, biodegradable, plastic-free, Mobius loop, bio-based

Sustainable Sourcing and Production	Certifications or claims related to ethical or environmentally responsible production and sourcing.	FSC, traceability, renewable source, organic farming guidelines
Environmental footprint claims	Data or certifications concernings environmental impact (LCA).	carbon footprint, CO2 offset, EPD, carbon neutral, LifeGate®
Generic environmental claims	Broad or vague terms are used connoting environmental sustainability.	eco-friendly, green, sustainable, circular
Social and Ethical Responsibility	Social impact, ethics, or animal welfare are cited.	Fair Trade, B Corp, animal welfare, ICEA certification

The category "Ingredients and nutritional quality," while not strictly environmental, is analytically relevant because these claims often position products as healthier, cleaner, or more natural. In practice, these attributes increasingly overlap with consumers' broader understanding of sustainable lifestyles.

Figure 7 reports how these labels and claims evolve over time across the product categories considered in the study.

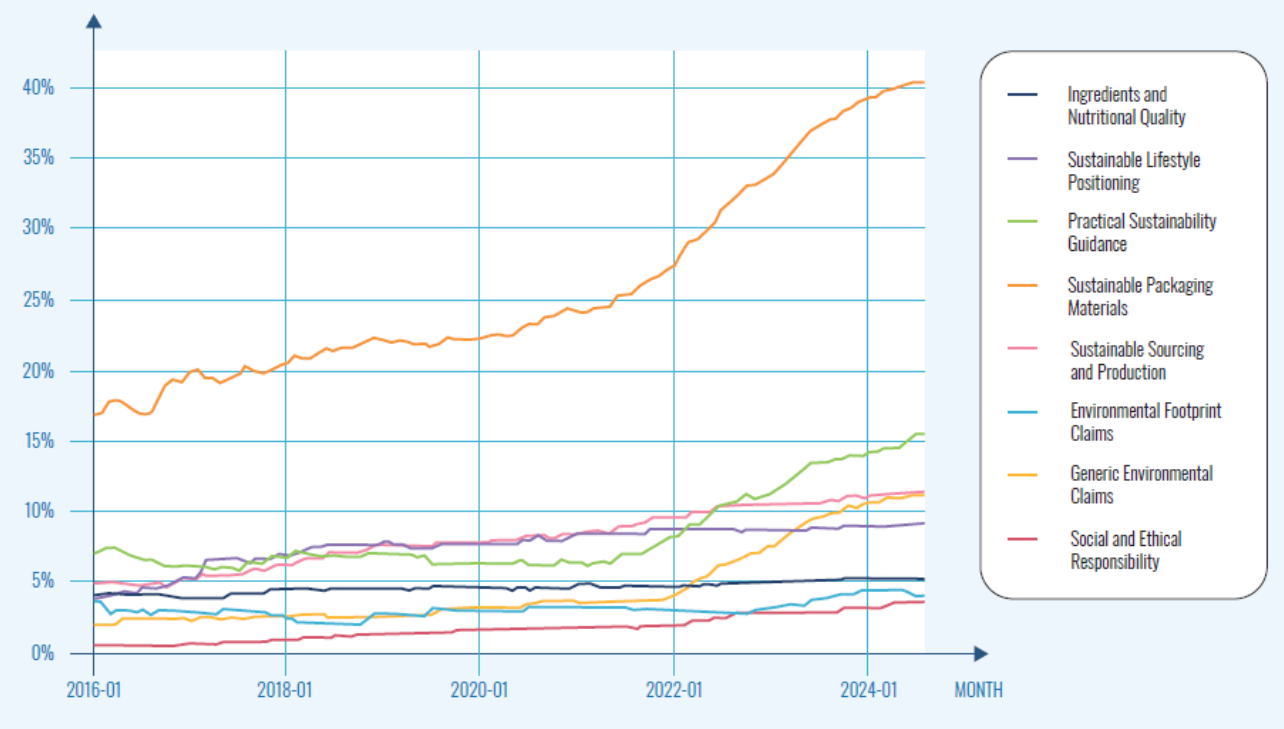

Figure 7: Labels and claims distributions over time. Source: authors' elaboration, Economia & Management 2025/3

Differences at the category level

To examine category-level variation more closely, we here focus on three product categories: mozzarella, pasta, and wine. The distribution of sustainability labels across these categories reveals clear differences in how firms communicate sustainability.

A first general result is the centrality of packaging materials as a sustainability communication lever across categories, especially for pasta (77%) and mozzarella (56%). This strong emphasis suggests that both firms and consumers pay particular attention to recyclability and material-related cues when sustainability is communicated on food packaging. This pattern is consistent with prior literature showing that structural packaging attributes are especially salient in consumers' interpretation of sustainable packaging (e.g., Branca et al., 2024; Herbes et al., 2020).

At the same time, the data point to distinct category-specific narratives.

In mozzarella, the prominence of ingredient statements and nutritional claims (41%) suggests a hybrid communication strategy in which environmental responsibility is closely associated with freshness, naturalness, and health. In short shelf-life categories, perceived quality and safety may take precedence over more technical indicators such as carbon footprint or formal production certifications. Firms appear to respond accordingly, emphasizing cues that are more closely aligned with consumer priorities in fresh-food contexts.

In pasta, sustainability communication appears more developed and multidimensional. This category shows extensive use of packaging material claims together with environmental and sourcing-related cues. The relatively higher presence of certifications and environmental claims suggests a more structured communication approach, in which sustainability is articulated through multiple complementary signals.

In wine, sustainability cues are less prevalent overall. Nevertheless, recent EU regulatory developments may be encouraging gradual change. In this category, generic environmental and social claims are more common than highly specific environmental metrics, suggesting a cautious and incremental entry into sustainability discourse. This slower evolution is plausibly linked to the weight of traditional category drivers such as territory, denomination, provenance, and craftsmanship, as well as to the limited communicative space available on labels already crowded with credence attributes.

Overall, the findings indicate that sustainability communication through packaging is not homogeneous across the grocery market. Rather, it varies according to category-specific dynamics, consumer expectations, and regulatory developments. Some categories adopt broader and more multifaceted strategies, whereas others privilege

cues that are more closely aligned with perceived quality or established cultural conventions. Firms therefore appear to calibrate packaging communication both to the nature of the product and to the maturity of sustainability discourse within the category.

A potential trade-off in consumer evaluation

A further aspect emerging from this research is a possible trade-off in consumer evaluation. Consumers may interpret product packaging along two partially distinct dimensions: "good for me" and "good for the planet." The first refers to attributes such as quality, safety, health, and well-being; the second refers to environmental attributes such as recyclability, lower emissions, or reduced material impact. These two dimensions do not necessarily overlap and may generate different evaluative dynamics at the point of sale. This lens motivates an additional research step aimed at understanding how packaging communication is translated into consumer perceptions.

To deepen this issue, we designed a survey-based study intended to integrate consumer-side perceptions with the packaging classification described above. The goal is to build a richer account of the relationship between what firms communicate on pack and how consumers actually decode, prioritize, and evaluate those signals.

How to address the attitude-behavior gap

The evidence and literature show that packaging has become a major vehicle for sustainability communication and that firms increasingly deploy a wide range of sustainability-related cues. At the same time, the transactional implications of these cues remain an open question. Further work is needed to determine whether packaging elements actually translate into individual preferences and purchasing behavior.

This issue is especially relevant in light of the well-documented attitude–behavior gap in ethical and sustainable consumption. Consumers frequently express positive attitudes toward sustainable products and report a willingness to support responsible companies, yet these stated preferences do not always translate into actual purchases. Measuring the intention could not accurately predict actual purchases, thus relying on intentions alone is insufficient for understanding the market consequences of sustainability communication (e.g., Govind et al., 2019; Sun & Morwitz, 2010).

Our ongoing research addresses this gap by moving beyond stated attitudes and linking packaging communication to marketplace outcomes. In the next phase of the research, the SKU-level packaging data will be integrated with Nielsen sales data in

order to test whether specific sustainability claims, labels or interventions are associated with higher sales, price premiums, or changes in consumers' response. This extension is designed to move from communication exposure to transactional response and thereby assess whether the proliferation of sustainability claims on packaging generates measurable behavioral effects in the market.

4. Policy Implications and Recommendations

4.1 4.1 Bologna Unit: Leveraging Sensory Cues to Inform Without Manipulation

The core challenge: communicative credibility in a saturated marketplace

The central implication of the Bologna Unit's research is that sustainability communication is not only a content problem (what is said) but also a communicative - intent problem (how it is shown, and how it is interpreted). Across five studies, consumers respond more favorably to sustainability messages that include subtle embodied cues — most notably, a depicted human hand engaging with the product — but only when those cues are read as demonstrative rather than manipulative, and only when the surrounding claim invokes a self - transcendence rationale (benefit to the planet, to others, to future generations) rather than a self - enhancement one (benefit to the individual). The same hand image therefore functions as a credibility - enhancing device in one frame and as a neutral, non - additive element in another. In parallel, the audience itself filters sustainability appeals through stable psychological distance from nature, which mediates the ideological gap in pro - environmental belief and behavior. The policy challenge is twofold: to ensure that sensory, embodied, and aesthetic devices are deployed transparently and cannot be exploited as veneers for greenwashing, and to design supporting interventions that reduce psychological distance from nature for the consumer segments most resistant to sustainability messaging.

Recommendations for policymakers

Recognizing sensory and embodied cues as part of sustainability claims is essential for effective regulation. Current green-claims frameworks (e.g., the EU Empowering Consumers for the Green Transition Directive and the Green Claims Directive) primarily focus on textual claims and verifiable attributes. However, evidence from Studies 1–3 shows that visual and embodied cues—such as hand perspective, touch, and gesture meaning—substantially shape consumer engagement and perceived communicative intent. Regulators should therefore treat these elements as integral components of sustainability claims and subject them to the same substantiation standards,

particularly when they imply attributes (e.g., naturalness, craftsmanship, traceability) beyond what is explicitly stated.

Stronger substantiation requirements are particularly important when sensory cues are paired with moral claims. Studies 3–4 demonstrate that such combinations most effectively reduce skepticism and increase persuasion, but also carry the highest risk of greenwashing. When firms combine evocative imagery with self-transcendence claims (e.g., "for the planet"), policy should require clear, verifiable supporting evidence—such as certifications or footprint indicators—to ensure that persuasive impact is grounded in substantiated information.

Reducing psychological distance from nature is a more effective strategy than ideological targeting. Evidence from Study 5 indicates that resistance to sustainability messaging is driven primarily by perceived distance from environmental issues. Public interventions should therefore focus on experiential and place-based approaches—such as access to natural spaces, local environmental education, and locally grounded communication—that make environmental consequences more immediate and personally relevant.

Policy should combine enforcement against greenwashing with incentives for substantive communication. Sensory cues can play a legitimate role in sustainability communication when they reinforce verifiable claims. Regulators can complement stricter enforcement with positive mechanisms—such as regulatory sandboxes, awards, or procurement criteria—that encourage firms to adopt demonstrative, evidence-based communication practices rather than decorative or unsubstantiated approaches.

Recommendations for Firms

Designing sensory cues for demonstrative meaning rather than decorative appeal is central to effective sustainability communication. Across Studies 1–4, the most effective cues are those that support consumers' mental simulation of product use rather than simply adding a human element. This includes privileging first-person perspectives, instrumental touch that reveals product attributes, and gestures that directly map onto the intended action. Such demonstrative cues enhance engagement and clarify communicative intent, often at no additional production cost.

Treating perceived demonstrative communication as a measurable creative asset can significantly improve effectiveness. Studies 2 and 3 identify it as the key mechanism through which sensory cues operate. Firms should therefore incorporate "showing versus telling" into pre-launch testing and evaluate it alongside conventional metrics

such as liking and purchase intent. Monitoring this dimension also helps identify when communication risks being perceived as manipulative rather than informative.

Aligning sensory cues with the underlying claim type is critical for maintaining credibility. Sensory cues are most effective when paired with substantive self-transcendence claims (e.g., benefits to the environment or society), where they both increase engagement and mitigate skepticism. When claims are primarily self-enhancement in nature, such cues offer limited benefit and may dilute credibility. Creative investment should therefore reflect the moral structure of the claim.

Substantive disclosure should accompany sensory-rich communication. Because demonstrative cues are often interpreted as signals of authenticity, they can create misplaced trust if not supported by verifiable evidence. Firms should ensure that all sensory-driven sustainability messaging is paired with accessible, credible substantiation to avoid greenwashing risks and protect long-term brand trust.

Segmenting communication strategies by psychological distance from nature can improve audience effectiveness. Study 5 shows that resistance to sustainability messaging is driven more by perceived distance than by ideology. For audiences with greater distance, communication should emphasize concrete, local, and immediate consequences to increase relevance and engagement.

Finally, sensory cues can be used to reinforce substitution rather than addition in sustainability positioning. Visual demonstrations of replacing conventional products with sustainable alternatives provide a clear and credible way to communicate substitution, aligning creative execution with broader strategies that position sustainable choices as direct replacements rather than incremental additions.

4.2 The Bologna Unit: Leveraging Multimodal Communication to Inform Without Overload

Consistent with the principle established in the haptic studies, the effectiveness of sustainability communication depends on whether added elements are perceived as substantive rather than performative. Across both haptic stimuli on still images and multimodal cues in short-form social video, persuasive value thus derives not from the quantity of cues but from their perceived diagnosticity.The multimodality study, based on 5,749 TikTok posts published in 2023 by 52 European Fortune 500 companies across 21 industries, shows the inverse logic for digital channels: text overlays and voice–overs added on top of baseline visuals and captions raise engagement for general corporate content but suppress engagement for green–oriented content, consistent with elevated skepticism and psychological reactance among viewers. Taken together, the two

streams suggest that "more communicative force" is not produced by piling on cues but by ensuring that each cue earns its place: demonstrative rather than decorative on still imagery, and parsimonious rather than redundant on video. The two recommendations below extend the policymaker- and firm-facing implications already drawn from the haptic studies to the digital, multimodal channels in which most sustainability communication now circulates.

Recommendation for policymakers

Calibrate green–claim guidance to the channel logic of short–form social video. The multimodality evidence (Section 3.1) shows that the marginal effect of adding text overlays and voice–overs on top of baseline visuals and captions is positive for general corporate content but negative for green–oriented content, a pattern consistent with skepticism and psychological reactance. Regulatory and self–regulatory frameworks for sustainability advertising — notably the EU Empowering Consumers for the Green Transition Directive and the forthcoming Green Claims Directive — should pair their substantiation logic with channel–specific implementation guidance. Standardized disclosure templates designed for static or long–form formats can be ill–suited to short–form video and may, when transposed mechanically, amplify rather than dampen the perception of over–claim. National authorities and industry self–regulators (e.g., national advertising standards bodies, AGCM in Italy) should issue platform–aware guidance specifying when an additional multimodal layer (overlay, voice–over) on a green message constitutes informational reinforcement and when it tips into the perception of greenwashing.

Recommendation for firms

Apply a "less–is–more" rule to multimodal layering of green messages on short–form social video. Across 5,749 TikTok posts, stacking text overlays and voice–overs on top of visuals and captions raises engagement for non–green content but suppresses it for green–oriented content. Brands should therefore not transfer their general short–form–video creative playbook to sustainability communication. On green topics, they should reduce — not increase — the density of multimodal layers above baseline visuals and captions, and treat each additional channel of redundant claim assertion as a credibility risk rather than a reach amplifier. This is the digital–channel counterpart of the haptic principle established in Studies 1–4: communicative force does not come from piling on cues but from making the cues that are present demonstrative, coherent, and evidence–anchored. Operationally, brand and creative teams should A/B test green–content variants against baseline (visuals + captions only) before adding overlays or voice–overs, and should retain the more layered version only when it

measurably improves engagement on green metrics rather than on a general engagement KPI.

4.3 Eco-movements and sustainable behavior: policy implications and recommendations

The core challenge: motivation without direction

The study's central finding carries a direct implication for policy design. Environmental events demonstrably activate consumers: following exposure, individuals increase visits to sustainable venues, shift toward cleaner energy choices, and reduce some unsustainable behaviors. The motivation to act is real. What is missing, for a substantial share of participants, is the knowledge of how to act effectively. When consumers add green behaviors on top of existing unsustainable ones, visiting a vegetarian restaurant while continuing to frequent fast food chains, adopting clean fuel options while leaving overall energy consumption unchanged, the net environmental outcome can be neutral or even negative. Awareness campaigns and mobilization events are necessary but not sufficient. The policy challenge is to ensure that the window of behavioral openness created by these events is met with concrete, targeted guidance on what substitution — rather than addition — looks like in practice. Climate mobilizations are not the end point, but the spark. What matters is what happens after: the choices people make, the signals organizations send, and the tools institutions provide to move from visibility to transformation.

Recommendations for policymakers

Adopt an infrastructure-first approach. Climate events can act as activation points, but their impact multiplies when accompanied by practical structural enablers. Policymakers should ensure that when motivation peaks, the infrastructure to act on it is visible and accessible: charging stations, recycling centers, sustainable transport options, and affordable sustainable alternatives should be deployed and communicated before awareness peaks, not after. Environmental awareness without available alternatives creates frustration rather than change. Ensuring accessibility, affordability, and availability of sustainable options at moments of heightened public attention is a precondition for translating mobilization into lasting behavioral shift.

Reframe climate communication around substitution, not addition. The dominant narrative of "do more green things" risks feeding the green addition trap. Public campaigns should instead celebrate consumption reduction and frame sustainability in terms of concrete trade-offs: replacing car trips with public transport, switching energy suppliers rather than simply adding a charger, choosing one quality item over

multiple fast-fashion purchases. Behavioral feedback systems — tools that allow citizens to visualize their own environmental footprint based on actual mobility and consumption patterns — can foster awareness and self-regulation far more effectively than generic slogans.

Design segment-specific interventions. The heterogeneity documented in this study has direct implications for targeting. For consumers already oriented toward sustainable behaviors, policy should focus on helping them reduce overall consumption frequency and deepen the substitutive dimension of their choices. For consumers with predominantly unsustainable habits, motivational messaging must be paired with specific substitution prompts and economic incentives that lower the barrier to switching. High-volume buyers — who generate disproportionately high emissions but who, as this study shows, can be meaningfully activated toward consumption reduction — represent a particularly high-leverage target for intervention. Unengaged consumers are better reached through structural defaults and convenience nudges than through awareness campaigns alone.

Plan for post-event follow-up and sustained reinforcement. The dynamic effects analysis shows that the behavioral impact of climate events is strongest immediately after the event and fades over time. A three-phase approach is most effective: a preparation phase, before events, focused on mapping consumer segments and ensuring supply-side readiness; an activation phase, during awareness peaks, deploying location-based nudges, substitution-focused messaging, and immediate access to sustainable alternatives; and a reinforcement phase, after events, providing ongoing feedback on environmental impact, social recognition for reduction behaviors, and periodic re-activation. Without this structure, even well-intentioned mobilizations produce short-lived effects that leave the underlying behavioral patterns unchanged.

Recommendations for firms

Redefine success metrics. Firms that measure their sustainability impact by counting green product sales or engagement with environmental content are tracking the wrong indicators. The relevant metric is substitution: the rate at which consumers replace high-emission behaviors with lower-emission alternatives, and the reduction in total environmental footprint per customer. Organizations should develop measurement frameworks that distinguish addition from substitution and track actual consumption frequency changes, not just green product adoption.

Leverage the timing of climate events strategically, and differentiate by exposure type. Those physically attending climate events are most receptive to premium sustainable alternatives and subscription models that reduce purchase frequency. Incidentally Exposed individuals — present in the surrounding area but not actively engaged —

respond better to location-based interventions and time-limited switching offers that lower the cost of substitution. Brands that maintain clear and credible environmental commitments stand to benefit most from these moments: consumers are increasingly skeptical of opportunistic green claims and quickly penalize inconsistency.

Design for substitution, not addition. Firms that frame sustainable products as "something extra to try" risk contributing to the green addition trap. More effective positioning presents sustainable alternatives as direct replacements for high-emission counterparts, making the trade-off explicit and the switch easy. Trade-in programs that remove unsustainable products from circulation, bundled switching offers, and subscription models that replace rather than augment existing consumption are more likely to produce genuine environmental impact — and genuine competitive differentiation — than standard product launches. The communication imperative is equally clear: stop telling consumers to "do more green things" and start helping them "do fewer things, better."

4.4 Bocconi Unit: Communicating sustainability through packaging — evidence from the Italian grocery market

The core challenge: visibility without decisional clarity

The central implication of this study is that more sustainability communication on packaging does not automatically produce better consumer decisions. In the Italian grocery market, sustainability cues have become widespread, but they remain heterogeneous across categories and may often be difficult to compare at the shelf. Consumers encounter a dense mix of material-related claims, certifications, disposal instructions, generic environmental wording, and product-quality cues, all competing for limited attention in a context where packaging space is fundamentally constrained.

The result is a somewhat paradoxical situation: sustainability is increasingly visible, yet not always more interpretable. This problem is amplified by the fact that consumers may evaluate products along two only partially overlapping dimensions, such as "good for the planet" and "good for me", and by the persistent gap between stated pro-sustainability attitudes and actual purchasing behavior. The policy challenge, therefore, is not simply to increase the amount of sustainability information, but to improve its clarity, comparability, credibility, and behavioral relevance at the moment of choice.

Recommendations for policymakers

Standardize the meaning of sustainability claims. Public policy should reduce ambiguity by promoting clearer taxonomies, minimum substantiation requirements, and stronger guidance on the use of sustainability-related language on packaging. Vague terms such as green, eco, or sustainable have low informational value when they are not tied to verifiable attributes. A more effective regulatory approach would require broad claims to be anchored to specific and auditable evidence — for example, packaging material composition, recyclability conditions, sourcing standards, or environmental footprint indicators where methodologically robust. This is particularly important because the research shows that sustainability communication is already widespread, but not homogeneous, and that firms calibrate claims differently depending on category conventions and regulatory pressures.

Prioritize high-diagnostic information at the point of sale. Because packaging is a limited communication surface, regulation should favor the information that is most useful for consumer decision-making. Disposal instructions, recyclability cues, material information, and credible sourcing certifications are more actionable than a proliferation of generic claims. Policymakers should therefore encourage layered information architectures: a small set of clear, standardized on-pack signals supported by optional digital extensions for more detailed evidence. This would reduce informational clutter while preserving transparency. The goal should be to transform packaging from a crowded signaling surface into a decision aid that helps consumers interpret sustainability in concrete terms.

Adopt category-specific guidance rather than one-size-fits-all rules. The findings show that sustainability narratives may differ substantially across categories. Dairy product communication, as an example, tends to be more tightly linked to freshness, naturalness, and ingredient quality; pasta shows a more structured and multidimensional use of sustainability cues; wine remains more cautious, partly because sustainability must coexist with long-established signals related to provenance, denomination, and craftsmanship. For this reason, broad horizontal regulation should be complemented by category-sensitive guidance that reflects differences in shelf-life, consumer expectations, and communicative constraints. Policies that ignore category structure risk either overloading packaging with irrelevant information or pushing firms toward formal compliance without genuine communicative usefulness.

Pair disclosure policy with consumer education and behavioral monitoring. Better disclosure alone is unlikely to affect the attitude–behavior gap effectively. Consumers

also need support in decoding sustainability signals and understanding trade-offs between personal and collective value dimensions. Public campaigns, retailer partnerships, and school-based consumer literacy initiatives should explain the meaning of common symbols, certifications, and disposal instructions, while clarifying how "good for me" and "good for the planet" perspectives may complement. At the same time, policymakers should evaluate packaging policy not only in terms of disclosure compliance, but in terms of actual market outcomes: switching behavior, price sensitivity, claim comprehension, and consumer trust. Without this outcome-based perspective, more information may simply produce more noise.

Recommendations for firms

Move from generic environmental language to specific, credible, category-relevant claims. Firms should resist the temptation to accumulate broad sustainability cues that add visibility but little diagnostic value. In categories where sustainability communication is already crowded, generic claims are unlikely to differentiate the product and may even increase skepticism. More effective communication comes from a limited number of specific, relevant, and credible cues that are coherent with category logic. For dairy products, as an example, this may mean linking environmental responsibility to freshness, ingredient quality, and naturalness without overstating technical environmental performance. For wine, sustainability communication is more likely to work when it is integrated into the broader narrative of provenance and craftsmanship rather than treated as an isolated overlay.

Design packaging as decision architecture, not as message accumulation. Packaging communication should be treated as a hierarchy of cues rather than as a checklist of claims. Because packaging space is limited and consumers process information quickly at the shelf, firms should prioritize readability, salience, and internal coherence. Material claims, disposal instructions, certifications, and textual statements should work together rather than compete. The evidence suggests that in many categories the challenge is no longer whether to communicate sustainability, but how to do so without generating saturation. In this context, the firms most likely to benefit are not those that say the most, but those that say the most useful things in the clearest way.

Align sustainability communication with the dual value logic of consumer evaluation. Consumers do not assess packaging only through an environmental lens. They also infer signals about quality, safety, health, and well-being. Firms should explicitly manage the relationship between "good for the planet" and "good for me", rather than assuming that one automatically implies the other. Where these dimensions reinforce one another, communication should make that complementarity visible. Where trade-

offs exist, firms should address them transparently. This is particularly relevant for food categories in which quality and safety remain primary purchase criteria and sustainability cues must earn their place within that evaluative hierarchy.

Connect on-pack communication to measurable behavioral outcomes. Firms should move beyond treating packaging sustainability claims as a reputational exercise and instead test whether they affect actual market performance. Given the persistence of the attitude–behavior gap, firms should not assume that positive consumer sentiment toward sustainability will automatically translate into purchase. The relevant question is not whether a claim looks sustainable, but whether it changes what consumers buy.

Use digital extensions to add depth without overloading the pack. The future of sustainability communication on packaging is unlikely to lie in ever more visual or textual stimuli. A more effective path is to use packaging as a gateway to a broader omnichannel information ecosystem. QR codes, interactive content, and traceability or supply-chain storytelling can provide detailed evidence without sacrificing on-pack clarity. In this way, firms can preserve the immediacy of packaging communication while offering more transparency to consumers who want to verify claims in greater depth. This approach is especially valuable in categories where packaging is already dense with mandatory and credence-related information.

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