

NEW HORIZONS FOR PRODUCTIVE TRANSFORMATION IN THE ANDEAN REGION

LOWERING BUSINESSES' CARBON FOOTPRINT:

Adoption of Eco-efficiency Indicators
in Colombia and Peru

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**Lowering Businesses'
Carbon Footprint:**
Adoption of Eco-efficiency
Indicators in Colombia and Peru

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EXECUTIVE SUMMARY

This document provides a guide for conducting behaviorally informed interventions to reduce businesses' carbon footprint. It draws insights from a pilot study within Colombia's textile industry and Peru's plastic industry. The study addresses the critical need for businesses to adapt to the challenges posed by climate change and transition risks, such as the European Union's Carbon Border Adjustment Mechanism (CBAM), which requires significant adaptations from companies in Latin America and the Caribbean to stay competitive. A key component of this study was developing and testing the "Green Tool," designed to assist companies in adopting eco-efficiency indicators (EIs), which can be used as an input to calculating and reducing companies' carbon footprint.

Central to the intervention's success was a preliminary diagnosis stage that pinpointed specific behavioral barriers hindering the reduction of carbon footprints, including present bias and prevailing social norms. By combining a behaviorally informed communications strategy with mentorship, the intervention enhanced the adoption of EIs among the businesses in the treatment group compared to those in the control group. This pilot study highlights the essential role of targeted interventions, mentorship, and the strategic application of behavioral tools in encouraging sustainable practices within the business sector. Furthermore, this guide demonstrates the effectiveness of behavioral interventions in supporting businesses to transition towards lower carbon footprints, showcasing a path forward in the global effort to combat climate change.

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1. INTRODUCTION

Extrême weather and climate change impacts, globally significant, are directly affecting Latin America and the Caribbean (LAC). Effects include glacial retreats, rising sea levels, and an increased frequency of extreme weather events, all posing threats to regional ecosystems and populations (WMO, 2022). Alongside these physical risks, transition risks—associated with moving toward a low-carbon economy—include changes in policy, market prices, and technological innovations (Ramírez et al., 2020). This situation is leading to a shift in market dynamics, necessitating that firms adapt their behavior in light of policy and legal risks, contingent upon government regulations, and market and reputation risks, which hinge on investor and consumer preferences for environmental sustainability. For example, demand is growing in Europe for sustainable practices, clean technologies, and eco-friendly solutions in consumer products.

The Carbon Border Adjustment Mechanism (CBAM), which has been adopted by the European Union (EU), is one of the policies that poses a transition risk for companies in LAC. It imposes taxes on imports according to their carbon footprint.¹ In practice, the CBAM will force the affected sectors to (1) estimate the carbon footprint of their product and either (2) pay a fine if the product is associated with more carbon emissions than an equivalent product made in Europe or (3) modify its production to reduce the level of emissions. This will translate into an increase in the production cost of LAC products for EU exports, with potential employment and welfare consequences.² This project aims to anticipate the changes by the CBAM and help companies adapt their behavior to minimize this transition risk.

We developed the Green Tool (*Eco-Herramienta* in Spanish) to guide companies in creating and monitoring eco-efficiency indicators (hereafter EEI). Eco-efficiency refers to the production of more goods and services while using fewer resources and generating less waste and pollution. It is often measured through indicators that assess the product or service value ratio to environmental impact, focusing on factors such as energy, materials, or water consumption and greenhouse gas emissions, wastewater, and pollution emissions (UNESCAP, 2009). The Green Tool is a spreadsheet that helps identify up to four indicators using the resource consumption level and the number of workers to measure the environmental cost and economic output. These standardized measures help businesses track their environmental impact and serve as inputs for measuring their carbon footprint by registering information about their electricity and water consumption and waste generation.

¹ Human activities have been identified as the primary driver of climate change, primarily through the burning of fossil fuels that generate greenhouse gases. Carbon dioxide (CO₂) represents the bulk (65 percent) of these greenhouse gas emissions.

² While there are many studies on the impact of the CBAM within the EU, few studies have estimated the impact of the spillover effects on developing economies that export to the EU, like those of LAC. UNCTAD (2021) estimates that the spillover effect in terms of income loss ranges from USD 589 to 1033 million. Another study provides a more optimistic estimate of USD 199.1 million (Chepeliev, 2021).

This report presents a field experiment informed by insights from the behavioral sciences to help businesses initiate their journey toward lowering their carbon footprint. The intervention involved 155 micro, small, and medium enterprises (MSMEs) in Colombia's textile industry and Peru's plastic industry.³ It was conducted over 20 weeks following a diagnosis, which enabled us to identify structural and behavioral barriers preventing MSMEs from lowering their carbon footprint. We surveyed the MSMEs participating in the experiment at baseline and endline to measure their knowledge and perceptions about and intentions of lowering their carbon footprint. The intervention combined a behaviorally informed communications strategy with mentorship for the MSMEs in how to use the Green Tool.

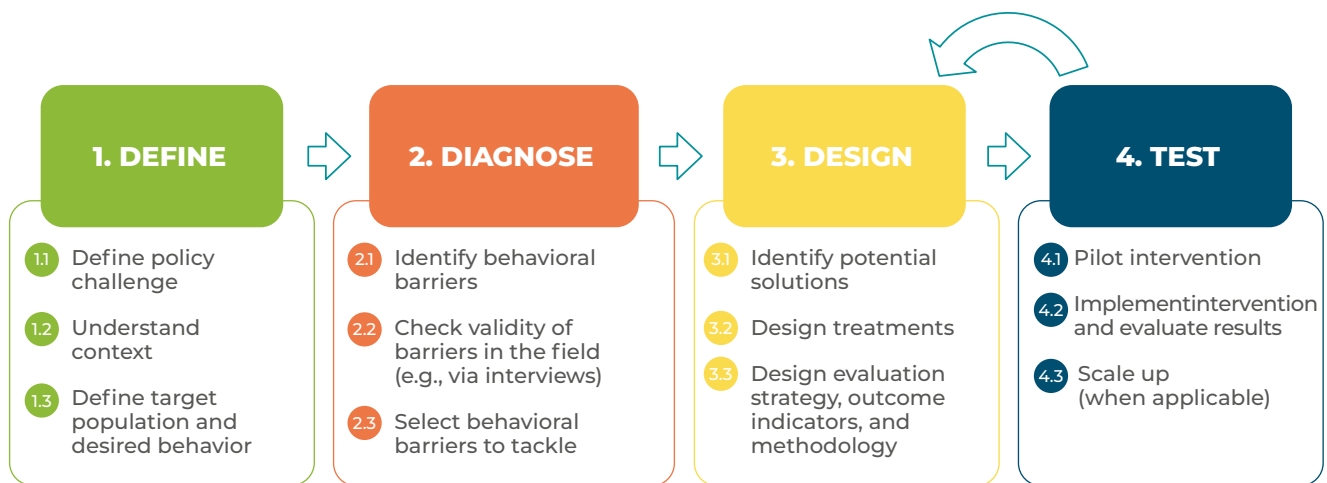
This document thus provides a guide on implementing a diagnosis and designing a project to help businesses take the first steps toward lowering their carbon footprint. The examples of Colombia's textile and Peru's plastic industries can be informative for other companies in other sectors embedded in the global value chains that must mitigate various transition risks to remain competitive in the worldwide market.

³ These industries were chosen for the study due to their regional or global value chain integration potential.

2. APPLIED INTER-AMERICAN DEVELOPMENT BANK METHODOLOGY

We followed the Inter-American Development Bank (IDB) Behavioral Economics Group Work Methodology depicted in Figure 1. This methodology comprises four steps: define, diagnose, design, and test. The initial step involves pinpointing a specific problem within a population. This diagnosis then helps identify the underlying behavioral barriers causing this problem and informs the development of targeted strategies to alter individual behaviors. Subsequently, the interventions are tested to assist the population in question. Validating the effectiveness of these strategies through field interventions is crucial, as it helps determine the most effective solutions for the identified problem and explores the possibility of scaling them up.

Figure 1. IDB Behavioral Economics Group Work Methodology



2.1 Definition

Understanding the context is critical to the proper definition of a problem. Therefore, the characteristics and policy environment of the plastic industry in Peru and the textile industry in Colombia are delineated as the first step in the project. Most critically, doing so enables us to understand the industry structure better and identify the focus of the intervention. We provide some institutional context for each industry below.

2.1.1 The Plastic Industry in Peru

The plastic industry in Peru is limited to plastic manufacturing, because the country does not have a petrochemical industry to produce plastic resins. Consequently, Peru imports 100 percent of the resins used in the plastic industry. The main sectors of plastic use in Peru are construction (22 percent), commerce (13 percent), other plastic products (9 percent), production of nonalcoholic beverages (7 percent), manufacture of pesticides and other chemical products (4 percent), and preparation of cleaning and toilet products (3 percent).

Several decrees and resolutions have been implemented to regulate firms' behaviors regarding plastic use in all sectors. They involve limiting the use of single-use plastics, incentivizing the use of biodegradable plastic bags, and making industrial production more sustainable when it comes to plastic use. Under decree 0.17-2015-PRODUCE, manufacturing firms, including plastic-manufacturing ones, are responsible for the adequate environmental management of their waste and any damage generated due to their activities. Companies also need to obtain an environmental certification from the Ministry of Production.

In December 2018, the government implemented new laws to regulate single-use plastics and increase the use of nondisposable containers. The government also targeted manufacturers of single-use plastics, forcing them to use a certain proportion of recycled material in their production processes. In addition, regulations to improve the reuse of plastic items have been passed.

More generally, Peru adopted the Framework Law on Climate Change⁴ in 2018, which aims to incorporate climate risk and vulnerability analysis and identify mitigation and adaptation measures in the face of climate change in evaluating investment projects subject to the National Impact Evaluation System. The implementation and enforcement of these regulatory changes have been limited to date. One positive outcome has been the creation of the Peru Carbon Footprint tool, a digital tool that helps private and public entities measure their carbon footprint. Enterprises have been encouraged to measure their carbon footprint—however, this remains voluntary and is not a mitigation measure.⁵

⁴ Law No. 30754 which was formalized by the Supreme Decree No. 013-2019-MINAM.

⁵ From 2019 to August 2022, the total number of organizations registered on the platform was 885, of which 417 have had reported their carbon footprint, with 417 achieving level 1, "Measurement." Of the 417 organizations, 108 verified their carbon footprint, that is, they achieved level 2, "Verification," and of these, 44 reduced their emissions (Tier 3, "Reduction"). Finally, of the 44 organizations, 15 achieved level 4, "Reduction+."

2.1.2 The Textile Industry in Colombia

The textile sector in Colombia is one of the oldest in the country, with a history of over 100 years. The production of textiles comprises four main stages: fiber production, threading, fabric creation, and textile manufacturing. Cotton is the primary material used in the textile industry, with the main areas of production being the coastal zone (including Córdoba, Cesar, Bolívar, Sucre, Guajira, Antioquia, and Vichada) followed by some inland zones (notably Tolima, Huila, and Valle del Cauca).

The Colombian government has implemented a series of regulations to reduce the negative impact of economic activities (including those of the textile sector) on the environment. The regulations include the Single Decree of the Environment and Sustainable Development Sector (Decree 1076 of 2015), which regulates water use and pollution emissions into the atmosphere. Additional resolutions complement this decree in order to optimize water usage further and limit air pollution, noise, and dangerous waste.

Several existing initiatives help Colombian companies reduce their carbon footprint. First, the Ministry of Environment and Sustainable Development oversees the measurement and management of greenhouse gas emissions. Through the National Carbon Neutrality program, the ministry seeks to promote self-management models of companies' carbon footprint in public and private organizations. The ministry also created the My Carbon Footprint Program, which aims to sensitize citizens to climate change and help them quantify and identify their greenhouse gas emissions and their environmental impacts and how they can mitigate them; to support participation, the government launched a new app in the third quarter of 2022.

2.2 Diagnosis

The diagnosis stage of the project was carried out between July and September 2022. This stage aimed to develop an understanding of the behavioral barriers that MSMEs face to lower their carbon footprint. The process consisted of background research, followed by the formulation of a list of hypotheses that were later tested with structured interviews with 10 firms in Colombia and 11 in Peru. The following sections present the results from each step in the diagnosis.

2.2.1 Hypotheses

We formulated eight main hypotheses that could explain firms' challenges in reducing their carbon footprints. These hypotheses are listed in Table 1.

Table 1. Hypothesized behavioral barriers.

Hypothesized behavioral barriers	1	Ignorance about the importance of reducing the carbon footprint
	2	Lack of knowledge about how to reduce the carbon footprint
	3	Structural barriers*
	4	Business culture
	5	Present bias
	6	Social norms
	7	Lack of moments of reflection
	8	A belief that solutions to climate change are not the responsibility of companies

Note: *All the hypotheses in the list stem from behavioral barriers except hypothesis 3, structural barriers, which refer to a lack of monetary or technological resources. While structural barriers are distinct from behavioral ones, acknowledging and addressing them is crucial, because overcoming these fundamental obstacles is a prerequisite for designing effective interventions regarding behavioral barriers.

Each of the eight main hypotheses has a list of related subhypotheses that were also tested. Table A1 in the Appendix lists each hypothesis with its corresponding subhypotheses that describe specific behavioral barriers. A questionnaire comprised of 27 questions was administered through structured interviews to test each hypothesis and understand why companies are not taking action to reduce their carbon footprint. The interviews were conducted during September 2022 and were mainly with employees in managerial roles.

The strategy for selecting firms for the diagnosis and later for the experiment was adapted to each country's context and information availability.

» **Peru:** We identified 989 businesses⁶ that manufactured plastic products. Among these, 64.3 percent (636) were microenterprises, 33.5 percent (331) were small enterprises, and 2.2 percent (22) were medium enterprises. Representatives of 11 businesses—5 microenterprises, 4 small enterprises, and 2

6 We used the Directory of MSMEs in the Manufacturing Sector from the Ministry of Production (PRODUCE) reported for 2020, which we cross-referenced with the National Superintendence of Customs and Tax Administration (SUNAT) platform to ensure we had the most current information.

medium enterprises—were interviewed. It is worth noting that to complete this number of interviews, 50 companies were contacted. This indicates a response rate of 22 percent.

- » **Colombia:** The textile sector involves several stages in the production process. We decided to focus on MSMEs in the textile manufacturing stage, because this is where the most significant carbon footprint is generated. We first interviewed important sector stakeholders, including representatives of the Chamber of Commerce of Medellín and large companies in the textile industry. We then selected a sample of 10 MSMEs (4 micro, 3 small, and 3 medium) based on referrals from these stakeholders to conduct the diagnosis and interviewed representatives from each.

Based on the interview responses, each hypothesis was assessed for each company and coded either “not confirmed,” “confirmed,” or “does not apply.” We calculated the share of companies that confirmed each hypothesis and then ranked the hypotheses accordingly. Among the confirmed hypotheses, the three with the highest shares of confirmation were selected to be addressed in the intervention design.

2.2.2 Diagnosis Results

We identified hypotheses 5, 6, and 3 as most relevant in the case of Peru and hypotheses 5 and 3 in the case of Colombia (see Tables 2 and 3 below for the full ranking). **Interestingly, the same hypotheses were identified in both case studies, even though the industries and countries were different.** Companies are not reducing their carbon footprints mainly because of present bias, social norms, and structural barriers. Our results indicate that at least 58 percent of companies face these barriers to lowering their carbon footprint. In the case of Colombia, the third-most common barrier was not being aware of the importance of lowering the carbon footprint. However, this applied to less than half of companies (47 percent). We next expand on the main barriers identified during the diagnosis.



Companies are not reducing their carbon footprints mainly because of present bias, social norms, and structural barriers.



Present bias is the most significant barrier in both countries. We identified this barrier as impacting 77 percent of the businesses in Peru and 70 percent of the businesses in Colombia. Present bias is visible in companies' emphasizing that they focus their business decisions on day-to-day operations and solving other problems they feel are more urgent. For example, one manager pointed out that "on a day-to-day basis, we [the business manager] try to resolve and plan according to how issues arise," and another stated that "the priority is the current production." This result aligns with the conclusions presented in the literature that certain business decisions are postponed because the business actor procrastinates and does not invest in the future. One seminal paper on the topic is Duflo et al. (2011), who document that farmers in Kenya fail to invest in fertilizers on time, even though they are profitable investments. They show how a nudge that reduces the present bias successfully increases the use of fertilizers among farmers. Hence, interventions aimed at reducing MSMEs' present bias could spur them to invest time and money in reducing their carbon footprint— something they will have to do, given coming regulatory changes.



Social norms also play a role: MSMEs do not reduce their carbon footprint partly because they do not see others doing it and do not discuss this issue with other local actors. Respondents generally did not know of competitors trying to reduce their carbon footprint. They reported that they could not talk with local actors about the issue. For instance, one producer in the Colombian textile industry said, "We don't actually talk about that topic [reducing the carbon footprint]; it would be a lie to tell you that if I get in touch and start talking with those who work there, I'm going to talk about it, we talk about the jacket, the size." This result echoes previous research on the importance of social norms regarding firms' tax compliance. For instance, Tilleard et al. (2011), Holz et al. (2020), and Doerrenberg et al. (2022) show that behavioral interventions that highlight social norms and moral appeals improve firms' tax compliance. In terms of climate change, Tang and Demeritt (2018) show that firms partially comply with mandatory carbon reporting because of social pressures and reputational costs.



Structural barriers included financial costs in the form of increased production costs, lack of access to additional financing, lack of access to the right technology and materials to meet the new requirements, and the need for technical advice in the transition. Representatives of MSMEs interviewed mentioned "the high cost of the technology needed" as well as the "high cost of the decarbonization process" in general, that accessing other raw materials was "the biggest challenge," and that there was a "lack of more financial resources and specialized financing." The structural barriers were primarily financial. However, the need for specialized advice was also brought up, with some respondents viewing it as a potential avenue to secure additional financial support.

Representatives of many companies in Colombia highlighted that they did not know of government programs to reduce the carbon footprint. In addition, some mentioned that they did not see the benefit for the business or the product. On this topic, papers in environmental economics have documented how information can help reduce one's electricity consumption (Jesoe & Rapson, 2014) and guide more cost-efficient investments in appliance energy efficiency (Newell & Siikamäki, 2014). Similarly, bridging the information gap about government programs aimed at helping companies calculate and reduce their carbon footprint could help businesses enroll in and benefit from these programs.

Table 2. Diagnosis Results for Peru

Hypothesis	Companies do not reduce their carbon footprint	Confirmed
1	Due to ignorance about the impact of doing so	58%
2	Due to a lack of knowledge about how to do it	39%
3	Due to structural barriers	60%
4	Because of their business culture	21%
5	Due to the present bias	77%
6	Because that is the social norm	67%
7	Because they do not have moments of reflection on it	45%
8	Because they believe that solutions to climate change are not the responsibility of the companies	55%

Note: The table results should be read as follows: Hypothesis 1 was confirmed for 58 percent of companies and so forth.

Table 3. Diagnosis Results for Colombia

Hypothesis	Companies do not reduce their carbon footprint	Confirmed
1	Due to ignorance about the impact of doing so	47%
2	Due to a lack of knowledge about how to do it	37%
3	Due to structural barriers	58%
4	Because of their business culture	26%
5	Due to the present bias	70%
6	Because that is the social norm	47%
7	Because they do not have moments of reflection on it	30%
8	Because they believe that solutions to climate change are not the responsibility of the companies	20%

Note: The table results should be read as follows: Hypothesis 1 was confirmed for 47 percent of companies and so forth.

2.3 Design

Reducing a business's carbon footprint is a process that may span several years. Even measuring the carbon footprint alone could take up to a year. This task can be expensive, because businesses typically lack the in-house resources necessary for such calculations. Consequently, they often require the services of a specialized firm. Viewing the reduction of MSMEs' carbon footprint as a journey, our design concentrates on the initial step: adopting Eco-Efficiency Indicators (EIs) to begin the measurement of businesses' carbon footprint.

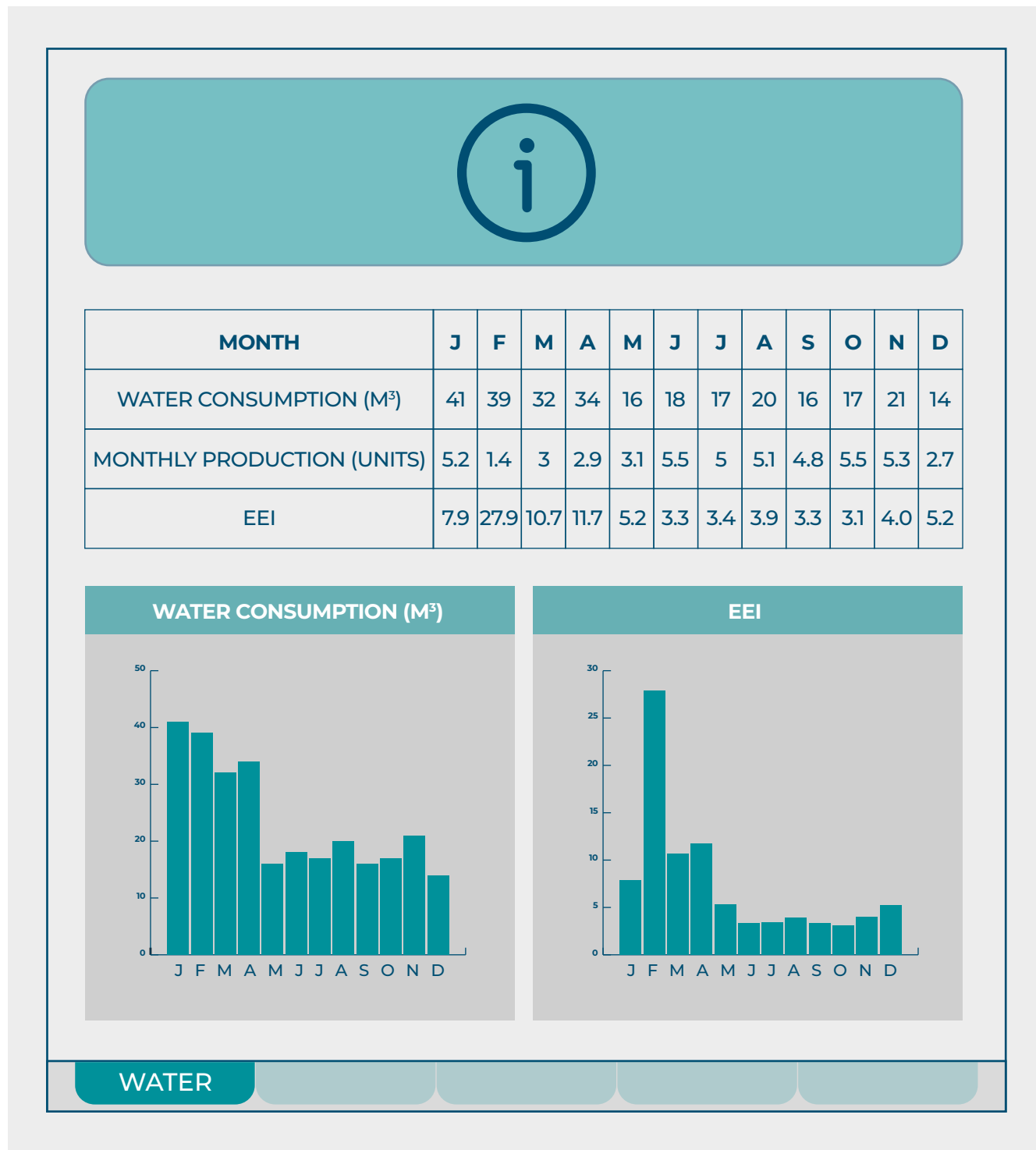
2.3.1 Proposed Solution: The Green Tool

Approaches developed in the behavioral sciences can help businesses in the textile and plastic industries take action to initiate their journey toward lowering their carbon footprints. In collaboration with us, our implementation partner, Fundes, took the lead in developing the Green Tool. This tool, designed as an instrument to facilitate the establishment of EIs, streamlines the data collection process. By simplifying the recording of essential information related to greenhouse gas emissions and environmental impacts, the Green Tool makes it easier for businesses to engage in sustainable practices.

The Green Tool assists MSMEs in establishing EIs and tracking them monthly, which provides valuable information for measuring the carbon footprint and identifying potential business improvements. For example, a businessperson leading one of the companies in our sample might notice an increase in the electricity bill compared to the previous month. This may indicate a price surge, but it may also indicate higher electricity consumption—thus the increase by itself is not informative enough to lead to an actionable strategy. However, once an EI is established the measurement of, for example, the electricity consumed weighted by sales volume makes it clear to the company whether the consumption change resulted from a problem (e.g., machinery was not turned off when it should have been) or from increased business, because the latter would not affect the EI.

The Green Tool was developed as a spreadsheet with a simple format to guarantee that all firms could use it regardless of their computer's data-processing speed and memory capacity (Figure 2). It comprises five forms, each presented as a tab in a spreadsheet: fuel, water, electricity, solid waste generation, and solid waste valorization. By utilizing the Green Tool, companies can easily and effectively document these indicators. Each format is predefined, with graphs and tables ready to be automatically populated once the businessperson registers their company information. The Green Tool was initially provided as a shared file to enable us to verify whether companies were using it and measure the effect of the intervention accurately.

Figure 2. The Green Tool



Note: This is a representation of the Green Tool. An example of a company's Green Tool is included in Figure B5 in the Appendix. EEI stands for Eco-Efficiency Indicator and its calculated as the water consumption over monthly production units.

2.3.2 Behavioral Tools

Having identified the main behavioral barriers MSMEs face in the diagnosis stage, we incorporated some insights from the behavioral sciences into a communications strategy for the treated MSMEs to help them overcome those barriers. We hypothesized that by doing so, the treatment group would adopt the Green Tool at a higher rate than the control group. The following behavioral tools were applied in this experiment.



We incorporated some insights from the behavioral sciences into a communications strategy.



Emotions: Emotions play a fundamental role in shaping human behavior and social interactions. They serve various functions, from fostering connections to influencing our decisions and responses. In the context of climate change, Brosch (2021) finds that one of the strongest predictors of risk perceptions, mitigation behavior, adaptation behavior, policy support, and technology acceptance are the affective responses of people toward climate change. Positive emotions can be used in social contexts to enhance motivation in others to achieve important goals (Sels et al., 2021). The positive emotion we emphasize in the intervention is awe, an intense emotional state characterized by wonder and amazement, often elicited by experiences of the natural world's grandeur and complexity.



Pledge: A pledge is a formal and voluntary promise made by individuals to commit to specific actions, principles, or values, often related to a cause or organization. Pledges are commonly used in various contexts, from social activism to personal goal setting, and serve as public declarations of intent and commitment. Promoting behavioral change through pledges is a persuasive approach. Even if nonbinding, public commitments effectively encourage individuals to modify their behavior, such as reducing emissions (Abrahamse et al., 2005; Lokhorst et al., 2013). This is due to their role in enhancing transparency regarding contributions to the public good and establishing social norms. Additionally, once other actors have publicly committed, there is a social cost associated with renegeing on that commitment, because observers are now aware of the opportunity to contribute that the individual deliberately avoided (Yoeli et al., 2017).



Social norms: Utilizing social norms as a tool for environmental behavior change proves highly effective (Abrahamse & Steg, 2013). When informed that specific actions that benefit the environment also align with the prevailing social norm, people are more inclined to engage in those actions, even if they come at a personal cost. For instance, hotels saw a 9 percent increase in towel reuse when they informed guests that 75 percent of previous guests had reused their towels (Goldstein et al., 2008). Similarly, companies like OPower, WaterSmart, and Enertiv have successfully encouraged energy and water conservation by comparing customers' consumption rates to those of their neighbors (Allcott, 2011; Ayres et al., 2013; Bhanot, 2017). This approach of leveraging social comparisons can lead to long-term behavioral changes, especially when people are uncertain about what the norm is. However, it is essential to avoid using descriptive norms when the desired behavior is not widespread. This was the case in our setting; thus, we were careful in the language and aspects of the social norm we highlighted.



Sense of urgency: Present bias was identified as the primary behavioral barrier MSMEs faced in both markets. At least 70 percent of the MSMEs in this project are not reducing their carbon footprint because of the common tendency to prioritize the present over the future, leading them to overemphasize the immediate costs and undervalue the potential future benefits of certain decisions or actions. This bias often impedes the achievement of long-term goals, where firms may focus on short-term challenges, such as time and effort, while downplaying the long-term advantages of business strategy. To counter present bias, we included messaging augmenting the sense of urgency in order to increase the likelihood of goal achievement.



Loss aversion framing: Tversky and Kahneman's influential 1991 study shows that loss aversion is a cognitive phenomenon rooted in behavioral economics. It revolves around the idea that individuals tend to strongly prefer avoiding losses compared to acquiring equivalent gains. Loss aversion framing highlights the potential losses from specific actions, or the lack of action, to motivate change. This type of framing has proven effective in motivating proenvironmental decisions. In their analysis of 61 studies on framing effects in proenvironmental decisions, Homar and Cvelbar (2021) find that loss framing is either more or equally effective in changing behavior and intentions. Conversely, gain framing is more successful when the choices require lower commitment, particularly with regard to attitudes.

2.3.3 Experimental Design⁷

The primary purpose of this field experiment was to test strategies to help MSMEs establish EEs. We established take-up of the Green Tool by MSMEs as the primary outcome of the experiment. However, knowledge, perceptions, and intentions were also measured as outcomes, considering that these are important steps to take before action. The following outcomes were considered:

1. *Knowledge* about climate change.
2. *Perceptions* about measuring and lowering the carbon footprint for business competitiveness.
3. *Intentions* related to measuring and lowering the carbon footprint in the next five years.
4. *Actions* related to keeping records of water, electricity, and fuel consumed and waste generated.

MSMEs were randomized into control and treatment groups stratified by business size (measured by the number of employees.) A survey was administered before and after the intervention (baseline and endline) that included the same questions in order to measure the change in responses in a difference in differences (DiD) estimation comparing the control and treatment groups in each country. This document includes results for the 80 MSMEs in Peru and 73 in Colombia that completed the process. Table 4 details the allocation of businesses into each group and Table C1 in the appendix shows that attrition was balanced across treatment and control groups, as the only statistically significant difference was whether the firm exported at least part of its production. This difference was present only in Colombia, where the control group presented a higher proportion of exporting firms. On average, businesses in Colombia were older than those in Peru, with average ages of 14 and 10 years, respectively. The distribution of business

⁷ A list of links to access all the experimental materials is included in the appendix.

sizes varied between the two countries. In Colombia, 19 percent of the businesses were classified as microenterprises, 39 percent as small enterprises, and 42 percent as medium enterprises. In contrast, 69 percent of the businesses in Peru were microenterprises, 29 percent were small enterprises, and 2 percent were medium enterprises (Figure 3.)

Figure 3. Sample characteristics

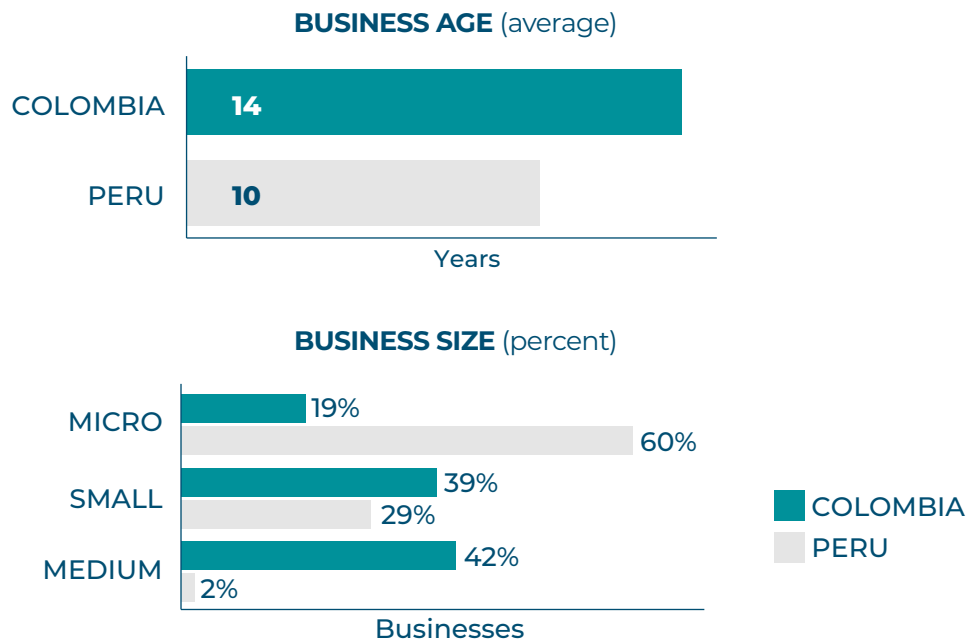
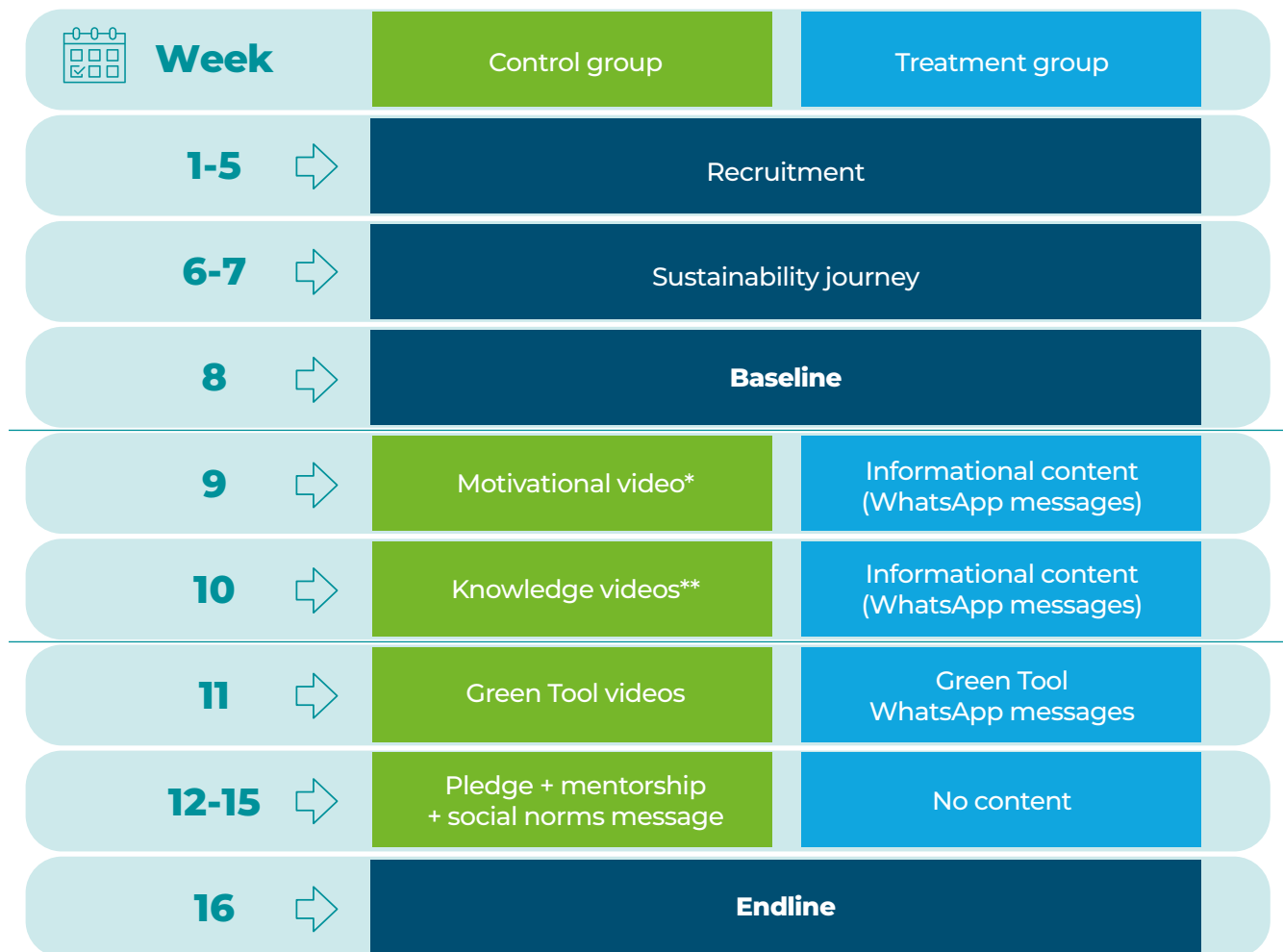


Table 4. Number of businesses in each group

Country	Treatment	Control	Total
Colombia	38	36	74
Peru	41	39	80
			154

The experiment was conducted over 20 weeks, from the beginning of the recruitment to the end-line, between October 2022 and February 2023. However, there were two pauses of 2 weeks each: one between weeks 8 and 9 and one between weeks 10 and 11, as shown by the lines in Figure 4. The first pause was due to the time needed to finalize the details of the materials to be provided during the experiment and to randomize MSMEs into treatment and control groups. The second pause was due to the end-of-the-year festivities. WhatsApp messaging was the primary means of contact with representatives of firms throughout the experiment.

Figure 4. Experimental Timeline



Note: *The motivational video included the following behavioral elements: emotions (awe), loss framing, and social norms; **the knowledge videos included a sense of urgency and loss framing.

The recruitment targeted MSMEs in Colombia's textile sector and Peru's plastic sector, following the same strategy used for recruitment in the diagnosis, i.e., using a combination of referrals and databases. The recruitment process took five weeks, because getting enough MSMEs to register to participate was a challenge. This process involved sending an invitation through email to the MSMEs that introduced them to the opportunity to enhance their businesses while contributing to environmental sustainability (Figure B1 in the appendix.) The email highlighted the benefits of participating and clarified that there was no monetary cost for participation.

During weeks 6 and 7 of the experiment, all MSMEs received an infographic describing the "sustainability journey" they were about to begin (Figure B2 in the Appendix). In week 8, we collected answers to the baseline survey with a set of questions for each target outcome: knowledge, perceptions, intentions, and actions.⁸ After the baseline survey, MSMEs were randomly allocated into a control and a treatment group using strat-

⁸ The survey also collected information of business characteristics: number of employees, years in business, type of commercial activity, main activity, number of establishments, and monthly production level.

ified randomization by company size.⁹ Three levels were defined according to the number of employees: micro, less than 10 employees; small, between 11 and 50 employees; and medium, more than 51 employees.

The intervention was applied from week 9 of the experiment to week 15. The treatment consisted of a communication campaign using the behavioral tools explained in the previous section to incentivize using the Green Tool. Additionally, the treatment group was offered a one-hour online mentorship session. The control group also received the Green Tool, but it was delivered using a purely informative communication strategy that lacked any behavioral science elements.

Before sharing the Green Tool with all the participants, we introduced some background information covering the list of topics in Table 5. These topics were communicated to the treatment group by incorporating the following behavioral tools: emotions, loss framing, social norms, and a sense of urgency.

Table 5. Climate change knowledge shared with businesses.

Order	Topic
1	Climate change
2	Climate change impacts in general
3	Climate change impacts on business operations
4	Climate change adaptation and mitigation
5	Carbon footprint
6	Types of greenhouse gas emissions
7	Benefits of lowering the carbon footprint

In week 11 of the project, the Green Tool (Figure B5 in the Appendix) was introduced to both groups with a corresponding user guide. During this week, the control group received WhatsApp messages about the Green Tool, while the treatment group received a series of seven videos explaining in detail how to use the Green Tool. Over the following four weeks, mentorship in the form of an online one-hour meeting was offered to MSMEs in the treatment group. They were also asked to sign a pledge by clicking a WhatsApp survey.

The pledge read, “I, [name], commit to generating eco-efficiency indicators in my company to contribute to reducing the carbon footprint (Please select an option to advance on the environmental sustainability path).”

The options to answer were:

“Yes, I commit to supporting the environment.”

“No, I do not commit to supporting the initiative.”

⁹ Business size may capture variables correlated with the outcomes of interest; bigger businesses may have more financial resources, specialized human capital, and more aptness for innovation, all of which facilitate the adoption of proenvironmental strategies like using the Green Tool.

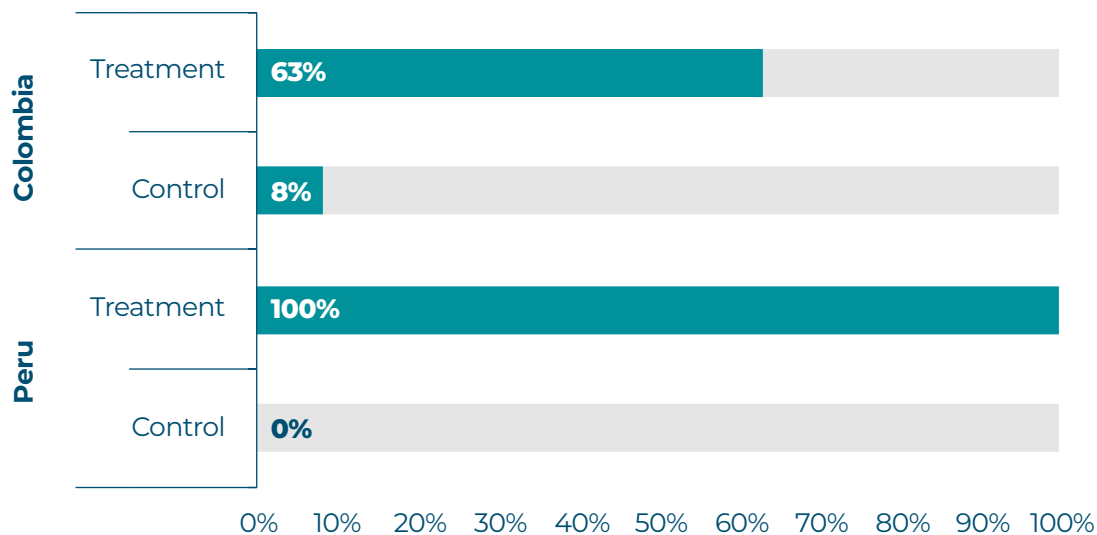
In addition to setting intentions and increasing the likelihood that pledge signers would follow through with their commitments, we also wanted to gather accurate information about the social norm in place. After gathering the answers concerning the pledge, the social norm was communicated to MSMEs in the treatment group. The message read: “We inform you that so far, 65% of the companies participating in this project have committed to using the Green Tool. You have our support if you need it.”

The endline survey was distributed among all MSMEs in week 16 of the experiment. The survey also included some satisfaction questions to gather suggestions and feedback from MSMEs about their experience participating in this initiative. After the experiment concluded, an 8-page manual was distributed to all firms, giving them information on how to continue following the sustainability journey independently (Figure B6 in the Appendix). It included helpful tips, a list of partner organizations (Peru), and green providers (Colombia.)

3. EXPERIMENTAL RESULTS

As a result of this project, 68 MSMEs implemented EEIs using the Green Tool, 27 in Colombia and 41 in Peru. Figure 5 shows the proportions of companies that adopted the Green Tool in each group, where adoption is measured in the extensive margin, i.e., the number of MSMEs that used the Green Tool at least once. Even though all the MSMEs participating in this project received the Green Tool and a manual explaining how to use it, all the MSMEs that adopted EEIs were in the treatment group, except for three Colombian MSMEs. Therefore, the combination of behavioral tools and mentorship sessions provided to the treatment group was successful in helping MSMEs in both countries to establish EEIs. This shows that information alone is insufficient to help businesses overcome behavioral barriers to establishing EEIs.

Figure 5. Green Tool Adoption: Extensive Margin



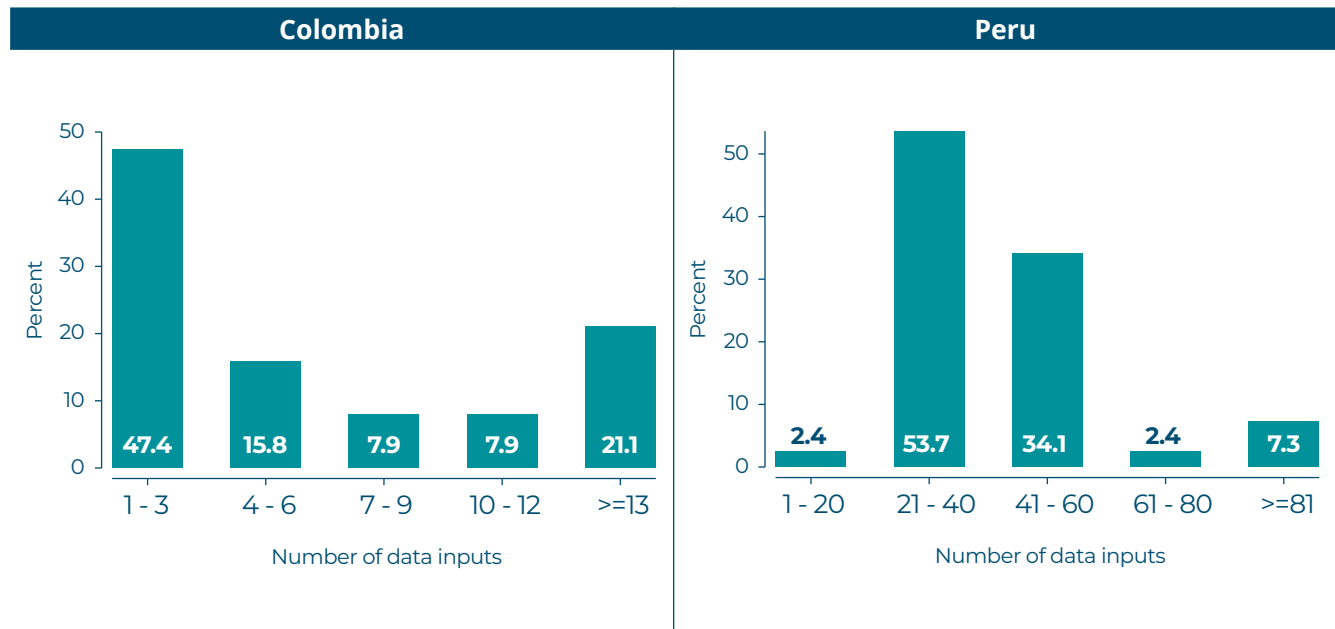
Note: Each bar presents the percentage of MSMEs that adopted the Green Tool. Using the Green Tool to enter information about at least one consumption or waste generation dimension qualifies as successful tool adoption.

All the businesses in the treatment group that adopted the Green Tool had a mentorship session. This suggests that the mentorship session may be driving the effect of the EEIs adoption. However, we cannot separate its effect from the behavioral tools applied to the treatment group's communication strategy. Contrary to what we expected, MSMEs did not use the mentorship session to ask questions about the information in the videos and manual; instead, it was used as a commitment device, with most businesses starting to use the Green Tool during the mentorship session. This is consistent with the main behavioral barrier identified in the diagnosis: present bias.

Access to the Green Tools of all the enterprises allows us to explore the intensive margin of the Green Tool adoption. Figure 6 shows the number of data input distributions among the Green Tool adopters. On average, MSMEs using the Green Tool in Colombia entered 12 data inputs, while the average for Peru was

44. In both countries, most MSMEs used the Green Tool for their electricity consumption. This indicates that measuring the carbon footprint generated by water, fuel, and waste represents a bigger challenge that businesses may have to tackle in the future.

Figure 6. Green Tool Adoption: Intensive Margin



Note: This graph only includes data on Green Tool adopters.

We also analyzed the answers from a survey administered before and after the intervention to measure conditions prior to the process of implementing EEIs: knowledge about climate change, perceptions about the importance of lowering the carbon footprint, intentions of lowering the carbon footprint, and actions in terms of keeping records of water, electricity, and fuel consumed and waste generated. We created an index based on the average score for the group of questions included in each category. All the questions are presented in Appendix A3. Figure 6, which depicts the average score for each group by category and country, shows that the treatment group has a higher mean than the control during the endline in both countries and for all the categories.

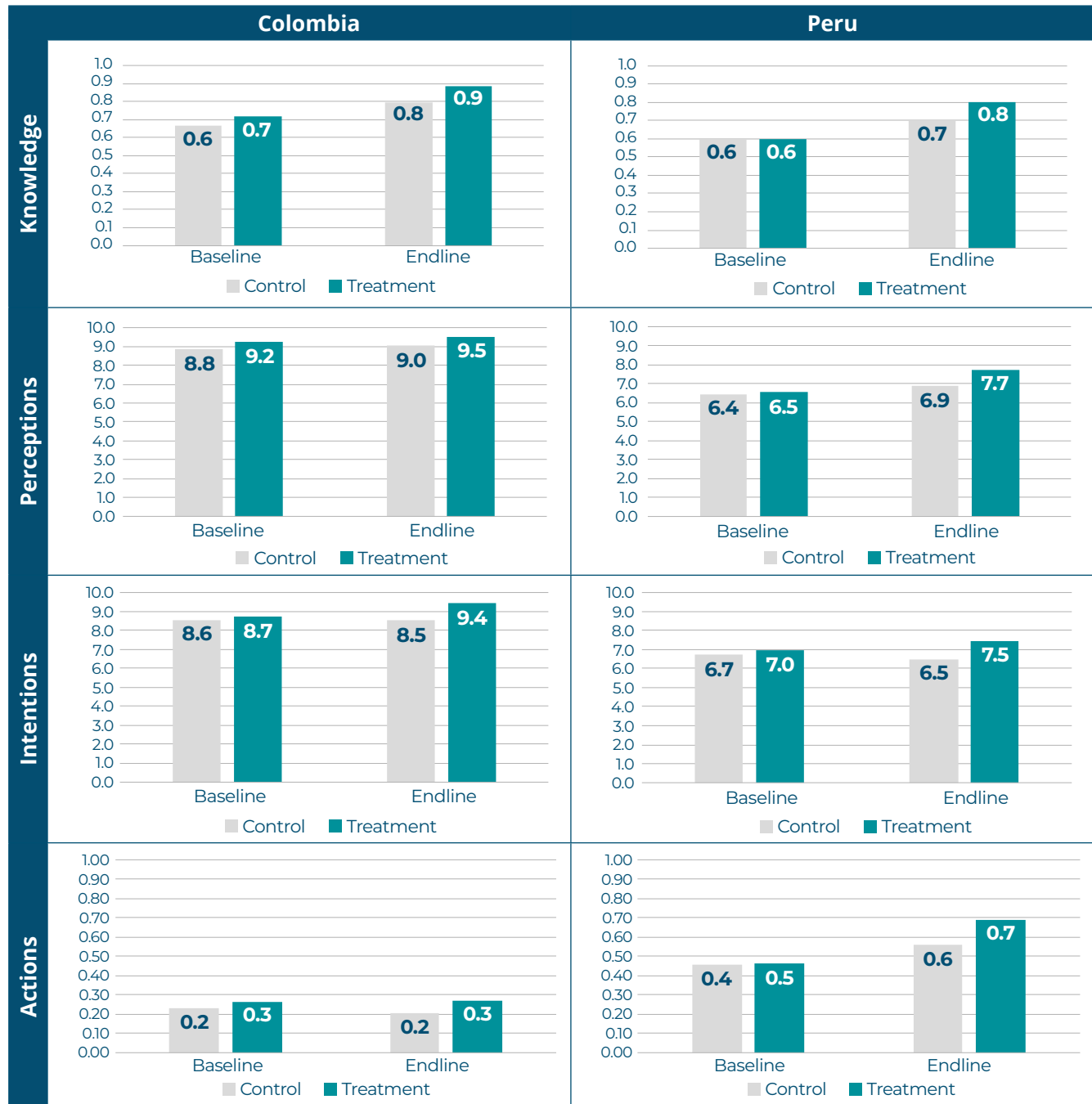
The results from the survey were analyzed using a DiD model, comparing the control and treatment groups before and after the intervention (see Appendix C for a description of the econometric model). We found statistically significant results for knowledge and actions in Peru and intentions in Colombia. However, after a multiple hypothesis correction, these effects wane, and only the difference in knowledge in Peru remains significant at the 10 percent level. Potential explanations for the lack of significance include having a small sample size and the ceiling effects, particularly in the categories of perceptions and intentions in Colombia, as shown in Figure 7.



We also analyzed the answers from a survey administered before and after the intervention to measure conditions prior to the process of implementing EEIs: knowledge, perceptions, intentions, and actions.

An interesting difference between Colombia and Peru is the low scores in the category of actions in the former country. This category measures self-reported answers about whether a business keeps records of water, electricity, and fuel consumed and waste generated. This information is used as input to establish EEIs using the Green Tool. Therefore, compared to the case in Peru, the lower level of Green Tool adoption in Colombia may be related to a lack of information about business consumption levels.

Figure 7. Average Score for Categories in Baseline Vis-a-vis Endline Survey



Note: Each category is measured for every business as the average score of a set of questions. The score for knowledge and actions ranges from 0 to 1, while perceptions and intentions range from 0 to 10.

4. CONCLUSION

Businesses today face significant challenges in the context of climate change, which requires them to adopt innovative strategies to lower their carbon footprint. Using the examples of Colombia's textile sector and Peru's plastic sector, this guide demonstrates a practical approach to implementing a diagnosis of behavioral barriers and designing a project applying behavioral science insights to assist businesses in initiating their journey toward environmental sustainability.

We developed a field experiment with MSMEs to help them adopt EEs. The treatment group was subject to a behaviorally enhanced communications campaign and a mentorship session. As a result, 100 percent of the MSMEs in the treatment group in Peru used the Green Tool developed to facilitate and measure adoption of EEs, while none of the firms in the control group did. In Colombia, the adoption rates were 63 percent for the treatment group and 8.33 percent for the control group. Although the individual effects of the treatment components cannot be isolated, it seems that the mentorship sessions drove the success of the treatment group for the Green Tool adoption. These meetings served as reminders and commitment devices compelling business owners to act. This result aligns with the diagnosis we performed before the experiment, where we found that present bias is the most pervasive behavioral barrier among businesses in both sectors.

We also measured changes in the conditions preceding adoption of EEs: knowledge, perceptions, intentions, and actions. However, the only effect that remained statistically significant after a multiple hypothesis correction was the knowledge increase in Peru. A few challenges may have contributed to the lack of statistically significant differences between the treatment and control groups. First, the sample size was small, which resulted in underpowered estimations. Second, the program's duration did not provide sufficient time for businesses to fully integrate carbon reduction strategies, leading to a lack of direct connections between their operations and environmental goals. Moreover, the busy season for textile companies in Colombia might have affected the intervention's success and led to a higher participant dropout rate. Similarly, the political situation in Peru in December of 2022 posed challenges,¹⁰ although the businesses were not located in areas directly affected by protests.

These findings underscore the importance of targeted interventions to learn how to encourage businesses to take the first steps toward reducing their carbon footprints and enhancing their market competitiveness. Our diagnosis identified common behavioral barriers faced by businesses in Peru and Colombia despite being in distinct sectors (plastic and textiles, respectively). A key barrier is present bias, indicating that businesses prioritize immediate operational concerns over long-term environmental strategies. Additionally, there is a prevailing social norm of neglecting sustainable practices. Structural barriers, such as financial constraints and lack of access to appropriate technology, also pose significant hurdles. Furthermore, the diagnosis highlighted a general lack of awareness of effective carbon footprint reduction measures.

¹⁰ In December 2022, following the impeachment and arrest of President Pedro Castillo after his attempt to dissolve Congress, Peru saw widespread protests and civil unrest.

Despite the challenges, the intervention raised awareness among company leaders about environmental issues and the importance of decarbonization measures. An important benefit of the project identified during the mentorship sessions is that it encouraged participants to think in terms of cubic meters/kilowatt-hours rather than just monetary value when considering their consumption. This helped them shift their perspective from merely focusing on the monetary amounts of their utility bills, to which they previously had had access but had tended to overlook.

Future interventions should consider a bigger sample size and a longer-term approach with ongoing support and monitoring for more-impactful results to foster continuous improvement and sustainable practices. Sharing experiences among participating companies that practice sustainability, green suppliers, and circular economy initiatives could encourage the replication of positive actions and motivate entrepreneurs to embrace environmental strategies.

More support and guidance in measuring and tracking relevant business indicators is needed to promote environmentally sustainable practices within businesses. Accurate data collection and analysis are crucial in assessing the impact of environmental initiatives. Businesses can help the environment by adopting proenvironmental measures while simultaneously promoting operational cost savings and strengthening their market positioning. There is an increasing demand for environmental certifications, which can enhance a company's reputation and market competitiveness, as well as for financial incentives offered by institutions through green financing options.

This study provided some suggestive evidence that behavioral interventions may work for helping businesses adapt to new global market conditions driven by climate change. Thus, this study supports other studies in the field that have shown behavioral interventions increase recycling, reduce water and electricity consumption, and increase green purchases, among other proenvironmental decisions. Given the urgency to reduce the carbon footprint of global value chains, behavioral interventions could be part of policymakers' toolkit. Business organizations can also use them to promote proenvironmental behaviors among employees and customers, thus promoting a circular economy. The intervention we present here is a first step; we hope others follow this path of using behavioral tools to help businesses measure and lower their carbon footprints.

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APPENDIX A: TABLES FROM THE DIAGNOSIS STAGE

Table A1. Hypotheses and Subhypotheses Tested

Main Hypothesis	Sub-Hypothesis
Hypothesis 1: Companies do not reduce their carbon footprint due to ignorance about the importance of doing so	1.a: MSMEs do not reduce their carbon footprint because they do not know what the term means
	1.b: MSMEs do not reduce their carbon footprint because they do not identify economic benefit derived from doing
	1.c: MSMEs do not reduce their carbon footprint because they do not see the-product differentiation benefits and therefore, economic benefits that this can give them
	1.d: MSMEs do not reduce their carbon footprint because they do not see the long term benefits resulting from this and prefer to focus on the present costs/benefits.
	1.e: MSMEs do not reduce their carbon footprint because they are not aware that they have to.
	1.f: MSMEs do not reduce their carbon footprint because they do not know the negative consequences of not doing so
	1.g: MSMEs do not reduce their carbon footprint because they are not influenced by the government's goals and they are not aware of the economic incentives they can receive from this institution.
	1.h: MSMEs do not reduce their carbon footprint because they do not know how to benefit and align with government goals
Hypothesis 2: Companies do not reduce their carbon footprint due to lack of knowledge on how to do it	2.a: MSMEs do not reduce their carbon footprint because they do not have information on the steps they must take to do so
	2.b: MSMEs do not reduce their carbon footprint because they would like to make all the necessary changes at one point in time and it is difficult to know where to start and how to make them.
	2.c: MSMEs do not reduce their carbon footprint because they do not have mapped production processes and it is difficult to identify where it can be reduced
	2.d: MSMEs do not reduce the carbon footprint because they are already committed to suppliers that do not offer "green" raw materials
	2.e: MSMEs do not reduce their carbon footprint because they feel they have no bargaining power with suppliers

Main Hypothesis	Sub-Hypothesis
Hypothesis 3: Companies do not reduce their carbon footprint due to structural barriers	3.a: MSMEs do not reduce the carbon footprint because the cost to do it is too high and they could not bear it
	3.b: MSMEs do not reduce their carbon footprint due to lack of access to technology
	3.c: MSMEs do not reduce their carbon footprint because they do not have access to raw Materials "green"
	3.d: MSMEs do not reduce their carbon footprint because they do not have who helps them in the process
	3.e: MSMEs do not reduce their carbon footprint because they do not have knowledge of financial products that help them cover costs in a sustainable way
Hypothesis 4: Companies do not reduce their carbon footprint because of their business culture	4.a: MSMEs do not reduce the carbon footprint because the mission and vision of the team do not take into account the carbon footprint
	4.b: MSMEs do not reduce the carbon footprint (innovate) because they do not want to create conflicts between the company's workers
	4.c: MSMEs do not reduce the carbon footprint (innovate) because they do not want to create conflicts between family members, when it comes to family businesses
	4.d: My pimes do not reduce their carbon footprint because they feel they do not have government support
	4.e: MSMEs do not reduce the carbon footprint because the culture is not very focused on sustainability
	4.f: MSMEs do not reduce their carbon footprint (innovate) because the leaders within them who make decisions are from another generation, one where the environment was not prioritized
	4.g: MSMEs do not reduce their carbon footprint because they justify contributing to the planet in other ways (for example: I have a company electric car)
	4.h: MSMEs do not reduce their carbon footprint because they always do what they have been doing for many years, because of the belief that this is how things are done
	4.i: MSMEs do not reduce their carbon footprint (innovate) because leaders believe that making changes is emotionally costly
Hypothesis 5: Companies do not reduce their carbon footprint due to the bias of the present	5.a: MSMEs do not reduce their carbon footprint because the business trend is to focus on today, maximizing what can be done today
	5.b: MSMEs do not reduce their carbon footprint because they are focused on solving other problems that they feel are more urgent.
Hypothesis 6: Companies do not reduce their carbon footprint because that is the social norm	6.a: MSMEs do not reduce their carbon footprint because they do not see others doing it either
	6.b: MSMEs do not reduce the carbon footprint because they do not see that the leaders, who potentially have a higher carbon footprint, do it and justify themselves in this way
	6.c: MSMEs do not reduce their carbon footprint because there are no moments of reflection on this issue with other local actors (MSMEs).

Main Hypothesis	Sub-Hypothesis
<p>Hypothesis 7: Companies do not reduce their carbon footprint because they do not have moments of reflection on it</p>	<p>7.a: MSMEs do not reduce their carbon footprint because there are no moments for reflection on this issue</p>
<p>Hypothesis 8: Companies do not reduce their carbon footprint because they believe that solutions to climate change are not the responsibility of companies</p>	<p>8.a: MSMEs do not reduce their carbon footprint because leaders do not see the urgency in this issue</p> <p>8.b: MSMEs do not reduce their carbon footprint because they do not associate their operations with this issue</p> <p>8.c: MSMEs do not reduce their carbon footprint because they believe that they can only do it marginally, so they justify themselves and do not.</p>

Table A2. Quotes Illustrating Diagnosis Results

Hypothesis	Peru	Colombia
1 Lack of information	"I don't see any benefit [from reducing carbon footprint]. I would have to know more about this topic. I don't know what you are telling me, I wouldn't be able to give an opinion about it."	"There are benefits for the user, for our clients, we can begin to see ourselves as a brand that is increasingly aware of this issue and we are aware that today it is more than ever a priority. The first benefit is the perception and reputation for the client and the management of residues and waste."
2 Lack of knowledge on how to do it	"In the first place, carry out a very thorough analysis and review of all my processes, both horizontally and vertically, to identify where I may be using my resources in an uncontrolled way, whether they are paper, blades, water that are releasing the vapors through nth of the limits; once I review and analyze how I am and identify how I can control and improve it."	"Evaluate the processes carried out within the company and really know if they are carrying out activities that affect the carbon footprint."
3 Structural barriers	"High cost of modifying production process"	"Changing the location of the production processes would affect the production costs that are being presented lately."
4 Business culture	"I am willing to make the changes; for now, I am focusing on covering the payroll payments, and I am getting a little more familiar with the subject; for now, I am changing the new spare parts for the machinery, and later I will be able to buy modern machines."	"One of the first things we did was change the slogan, our DNA is sustainability."
5 Present bias	"We do not plan; we solve the day-to-day."	"In the last three years, there have been radical changes, such as the pandemic. There have been exaggerated price increases, and you have to get comfortable little by little with what is presented in the market."
6 Social norms	"Few people say, hey [name], when are you going to launch your biodegradable line? When are you going to launch your compostable product?"	"With the Chamber of Commerce and a group of businessmen, a seminar was held on two topics, one of which was sustainability."
7 Lack of moments of reflection	"We are part of a WhatsApp group for the sector, an email list with sector news, and a [name] group where information is shared."	"We have open spaces for communication within the company."
8 Lack of sense of ownership	"Yes, we consider that we affect the environment. We use electrical energy that already affects us. To convert the plastic, we melt the plastic with electrical resistances, and that generates gases that harm the environment."	"Nowadays, companies are looking to help the environment and the climate, and we must help the environment through ecological processes; everything depends on us."

Note: Colors indicate whether the hypothesis was mainly confirmed (light blue) or disconfirmed (white).

Table A3. Survey Questions Measuring Preliminary Conditions in the Process of Implementing EEs

Category	Questions	Answer
1. Knowledge about Climate Change and Carbon Footprint	1.1. What is climate change? Choose one	a) It refers to long-term changes in temperatures and climate patterns (1 pt) b) It is the impact due to changes in the seasons (0 pts) c) It is the agreement for government decisions (0 pts) d) The natural disasters caused by temperature change (0.5 pts)
	1.2. What is the carbon footprint? Choose one	a) The coal extractions due to the mining activity (0) b) The total greenhouse gas emissions from direct and indirect human activity (1) c) The quantification of environmental pollution due to human activities (0.5 pts) d) The value of the benefits of the smoke emitted by factories (0)
	1.3. What strategy can the company apply to optimize its productive resources and contribute to the environment? Choose one	a) Business eco-efficiency (1 pts) b) Climate change (0 pts) c) Sustainable development goals (0 pts) d) Strategic planning (0 pts)
	1.4. What benefits can your company obtain by reducing its carbon footprint? Mark all correct responses	a) Improvement of business reputation (0.33 pts) b) Access to differentiated markets (0.33 pts) c) Minimize production costs (0.33 pts) d) Reduce working hours (0 pts)
2. Perception	How important do you consider for your company to take the following actions to be competitive in the market in the next five years? <i>Rate each action on a scale of 1 to 10, with 1 being not at all important and ten being very important.</i>	
	2.1 Monitor the company's consumption of water, electricity, fuel, and solid waste generation.	a) Rate from 1 to 10 b) I do not know
	2.2 Measure the company's carbon footprint.	a) Rate from 1 to 10 b) I do not know
	2.3. Reduce the company's carbon footprint.	a) Rate from 1 to 10 b) I do not know
	2.4 Do collaborators (employees) reduce their personal carbon footprint? [Colombia]	a) Rate from 1 to 10 b) I do not know

Category	Questions	Answer
3. Intention	How much do you agree with the following statements? <i>Rate each action on a scale of 1 to 10, with one being "not at all agree" and ten being "strongly agree."</i> From now to 2027...	
	3.1 We will monitor the company's consumption of water, electricity, fuel, and solid waste generation.	a) Rate from 1 to 10 b) I do not know
	3.2 My company will measure the carbon footprint.	a) Rate from 1 to 10 b) I do not know
	3.3. My company will reduce its carbon footprint.	a) Rate from 1 to 10 b) I do not know
	3.4 The collaborators (employees) of my company will reduce their personal carbon footprint. [Colombia]	a) Rate from 1 to 10 b) I do not know
4. Action	Water:	
	4.1 Does your company keep track of the amount of water it consumes per month?	Yes/No/Do not know.
	4.2 How many cubic meters of water did your company consume last month?	
	Energy:	
	4.3 Does your company keep track of the amount of electrical energy it consumes per month?	Yes/No/Do not know.
	4.4 How many kilowatts of energy did your company consume last month?	
	Solid waste:	
	4.5 Does your company keep track of the amount of solid waste it produces per month?	Yes/No/Do not know.
	4.6 How many tons of waste did your company generate last month?	
	Fuel consumption for transportation:	
	4.7 Does your company keep track of the amount of fuel your vehicles consume per month?	Yes/No/Do not know/We do not have vehicles.
	4.8 How much fuel (gal) did your company consume in vehicles last month?	
	Fuel consumption for machinery:	
	4.9 Does your company keep track of the amount of fuel for the operation of its equipment and machinery per month?	Yes/No/Do not know/We do not have machinery that uses fuel.
	4.10 How much fuel (gal) did your company consume in machinery and/or equipment last month?	

APPENDIX B: EXPERIMENTAL MATERIALS

Figure B1. Recruitment Infographic

BID **FUNDES**
LATINOAMÉRICA

AYUDA AL MEDIO AMBIENTE Y A TU NEGOCIO A LA VEZ

1 Paso
Te contamos de qué se trata.

2 Paso
Te compartimos buenas prácticas.

3 Paso
Te hacemos seguimiento.

4 Paso
Socializamos los resultados.

**¡SE PARTE DE
NUESTRO PILOTO!**
Todavía estás a tiempo

Si requieres más información contáctanos
311 486 9424 - 312 454 2186

Haz click aquí

Figure B2. Sustainability Journey

Colombia



Peru



Figure B3. Motivational Video Screenshots**Colombia****Peru****Figure B4.** Knowledge Video Example (Screenshot)

Figure B5. Green Tool Example (Screenshot)

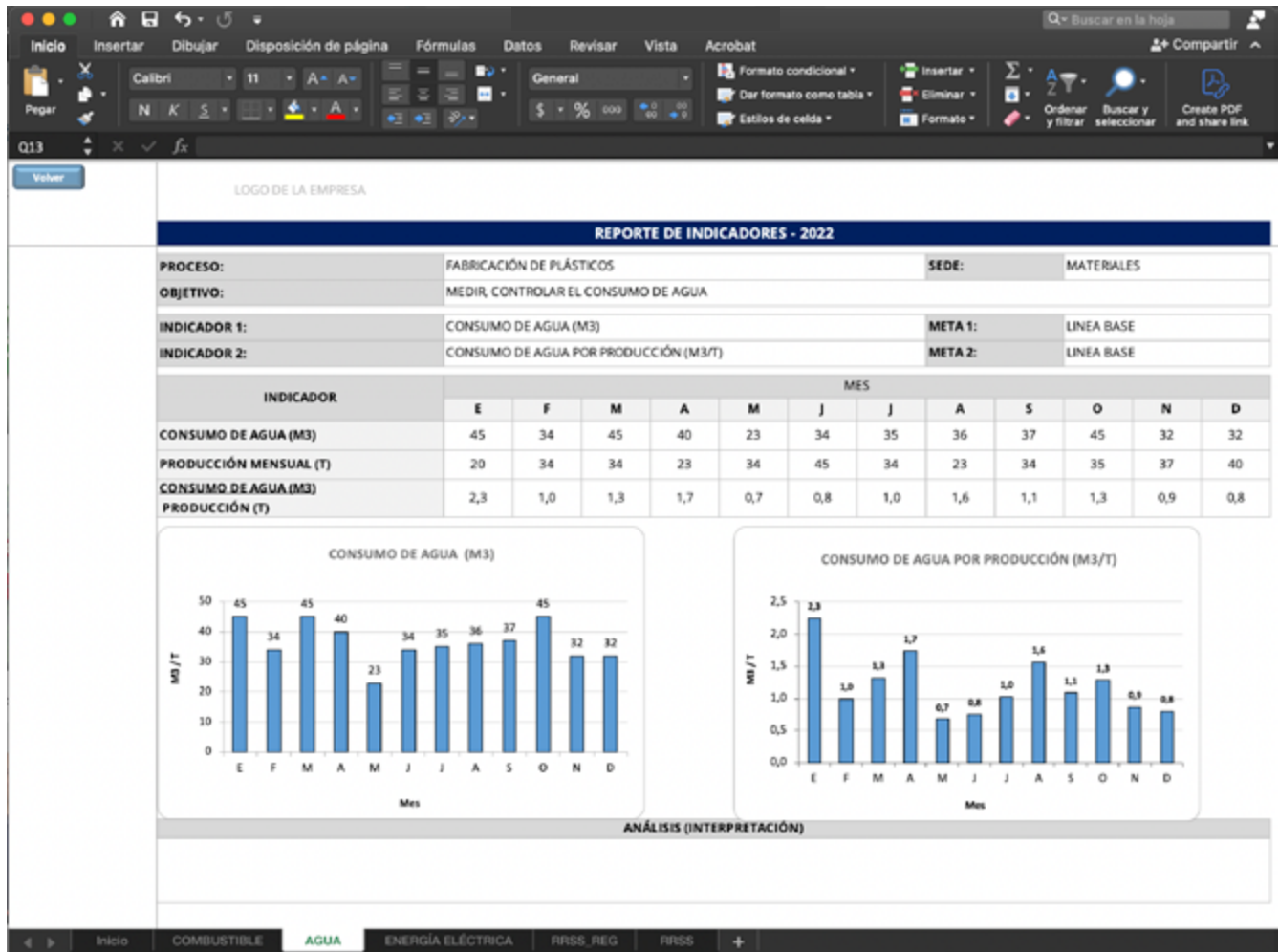


Figure B6. Cover of Manual Distributed to Firms at the End of the Intervention

Table B1. Experimental materials repository

File	Link
Sustainability journeys	
Sustainability journey Colombia	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-510
Sustainability journey Peru	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-509
Sustainability journey video Colombia	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-511
Sustainability journey video Peru	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-512
Motivational videos	
Peru	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-514
Colombia	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-515
Knowledge videos Colombia	
1. Climate change	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-534
2. Climate change impacts in general	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-535
3. Climate change impacts on business operations	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-536
4. Climate change adaptation and mitigation	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-531
5. Carbon footprint	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-533
6. Types of greenhouse gas emissions	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-532
7. Benefits of lowering the carbon footprint	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-530
Knowledge videos Peru	
1. Climate change	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-522
2. Climate change impacts in general	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-537
3. Climate change impacts on business operations	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-538
4. Climate change adaptation and mitigation	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-539
5. Carbon footprint	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-523
6. Types of greenhouse gas emissions	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-525
7. Benefits of lowering the carbon footprint	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-540
Green Tool Colombia	
Video: Eco-efficiency	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-549
Video: Eco-efficiency indicators	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-551
Video: Green tool	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-550
User guide	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-569
Video: Green tool guideline 1	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-553
Video: Green tool guideline 2	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-555
Video: Green tool guideline 3	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-559
Video: Green tool guideline 4	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-558
Video: Green tool - information acquisition	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-556
Video: Green tool - textile residues 1	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-560
Video: Green tool - textile residues 2	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-554

File	Link
Green Tool Peru	
Video: Eco-efficiency	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-545
Video: Eco-efficiency indicators	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-547
Video: Green tool	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-546
User guide	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-570
Video: Green tool guideline 1	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-561
Video: Green tool guideline 2	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-563
Video: Green tool guideline 3	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-564
Video: Green tool guideline 4	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-565
Video: Green tool - information acquisition	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-566
Video: Green tool - solid residues 1	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-567
Video: Green tool - solid residues 2	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-562
Closing information	
Colombia	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-577
Peru	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-576
Manuals	
Colombia Manual	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-572
Peru Manual	https://www.iadb.org/document.cfm?id=EZIDB0000474-1260752364-573

APPENDIX C. ECONOMETRIC MODEL

To assess four conditions preceding adoption of EEs—knowledge, perception, intention, and action—we measured the effect of the treatment on a score created for each category. The following DiD model compares the treatment and the control groups before and after the intervention using a baseline and endline survey. Table C1 shows the results for the following model:

$$Y_{it} = \alpha + \gamma T_i + \lambda D_t + \delta (T_i \times D_t) + \theta C_i + \phi' X_i + \varepsilon_i$$

where Y_{it} is the outcome of analysis for firm i at time t . T is a dummy equal to 1 if the firm was assigned to the treatment group and D is a dummy equal to 1 if the observation is from the endline, i.e., after the intervention. The coefficient of interest, δ , captures the differential change in the outcome after the intervention in the treatment group compared to the control group; C_i are country fixed effects, which also account for the economic sector (plastic or textiles); and X_i is a vector of firm characteristics that include the firm's age, number of employees, number of business locations, a dummy indicating whether the firm was already taking measures to lower its carbon footprint, and market reach. The latter included the following categories: local, regional, national, and international.

Table C1. Balance of Baseline Sample Means

Variable	Colombia			Peru		
	Control (1)	Treatment (2)	t-test (3)	Control (4)	Treatment (5)	t-test (6)
Firm's age (years)	15.14 (2.14)	13.92 (1.99)	0.68	10.77 (1.07)	10.20 (0.10)	0.70
Employees	53.97 (10.12)	55.24 (7.89)	0.92	10.56 (1.79)	9.83 (1.32)	0.74
Exports	0.31 (0.08)	0.13 (0.06)	0.07*	0.13 (0.05)	0.07 (0.04)	0.42
Business locations	2.22 (0.51)	2.30 (0.77)	0.94	1.33 (0.09)	1.41 (0.12)	0.59
Previous actions	0.36 (0.08)	0.37 (0.08)	0.95	0.46 (0.08)	0.46 (0.08)	0.99

Notes: Each row shows statistics for a different variable. Columns (1), (2), (4) and (5) show the average and the standard deviation in parenthesis, and columns (3) and (6) show the p-value for the corresponding t-test. sample and column ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance levels, respectively. *Exports* and *previous actions* are binary variables. The former takes the value of one when the company's products are exported, and the latter takes the value of one if the company was already taking measures to lower its carbon footprint before the intervention.

Table C2. Effects of the Treatment on All Outcome Variables

	ALL		COL		PER	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. Knowledge</i>						
Ti x Dt	0.10** (0.05)	0.10** (0.05)	0.04 (0.06)	0.04 (0.06)	0.15** (0.07)	0.15** (0.07)
Constant	0.68*** (0.03)	0.63*** (0.04)	0.67*** (0.04)	0.62*** (0.05)	0.60*** (0.04)	0.45*** (0.07)
<i>Panel B. Perceptions</i>						
Ti x Dt	0.45 (0.44)	0.45 (0.43)	0.10 (0.35)	0.10 (0.35)	0.78 (0.78)	0.78 (0.72)
Constant	8.76*** (0.23)	8.28*** (0.34)	8.83*** (0.20)	8.49*** (0.29)	6.44*** (0.44)	4.97*** (0.76)
<i>Panel C. Intentions</i>						
Ti x Dt	0.73* (0.43)	0.73* (0.43)	0.73* (0.41)	0.73* (0.42)	0.73 (0.75)	0.73 (0.69)
Constant	8.59*** (0.22)	8.09*** (0.33)	8.56*** (0.20)	8.27*** (0.31)	6.72*** (0.40)	5.31*** (0.70)
<i>Panel D. Actions</i>						
Ti x Dt	0.08 (0.05)	0.08 (0.05)	0.03 (0.08)	0.03 (0.07)	0.13* (0.07)	0.13* (0.07)
Constant	0.19*** (0.03)	0.05 (0.04)	0.23*** (0.04)	0.10** (0.05)	0.45*** (0.04)	0.32*** (0.07)
<i>N</i>	308	308	148	148	160	160
Covariates	No	Yes	No	Yes	No	Yes

Notes: ***, **, and * are used to denote statistical significance at the 1%, 5%, and 10% significance levels, respectively. All outcome variables are measured as the average score of a group of survey questions. In all cases, the minimum score is 0. However, the maximum is 1 for knowledge and actions and 10 for perceptions and intentions. Considering the family-wise error rate, we calculate the Westfall-Young step-down adjusted p-values due to multiple hypotheses being tested, and the statistical significance in knowledge, intentions, and actions wanes. Only the effect on knowledge in Peru remains significant at the 10% level.

