Pre-Analysis Plan

The Effectiveness of Information Transfer in Reducing Food Waste: Evidence from an RCT with Small and Micro Enterprises in Cusco's Hospitality Sector[1]

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1 Introduction

1.1 Abstract

Food waste is a major challenge for the short-term business profitability and the long-term environmental sustainability of food service providers, mainly in developing countries. This research is focused on food waste generated at kitchen stage by SMEs restaurants in the for-profit hospitality sector of Cusco (Peru). SMEs are at least 90% of food service providers in the study context. Restaurants generate approximately 14.6 tons of organic waste per day (99% is food waste), which constitutes 24% of the total food waste and 13% of the total solid waste generated in Cusco city. This research aims to enhance the existing literature by evaluating experimentally the effects of information transfer on small and micro-sized food service enterprises, with the ultimate objective of reducing food waste generation. To capture causal effects, a Randomized Control Trial (RCT) is employed. Small and medium-sized enterprises (SMEs) are randomly assigned to treatment and control groups. The RCT will comprise a baseline, midline, and endline. The treatment intervention offers information and training to SMEs managers (owners) and chefs to incentivize the adoption of food management innovations and ultimately to reduce the generation of organic waste at the kitchen stage. Based on Cost-benefit and Cost-effectiveness analyses, this study provides evidence-based policy instruments to improve the pro-environmental performance of firms.

1.2 Motivation

The hospitality industry can be categorized into non-profit and for-profit sectors. The non-profit sector includes catering services for schools, colleges, and universities, hospitals, nursing homes, prisons, military facilities, and self-operated canteens within companies. The for-profit sector is comprised of hotels, restaurants, and cafeterias. This sector plays a crucial role in economic development, contributing an average of 6% to the Gross Domestic Product (GDP) and employing 7% of the active labor population worldwide. The United Nations World Tourism Organization projects that international tourist arrivals will reach 1.8 billion by 2030, creating nearly 126 million new jobs in the next decade. However, this sector has significant adverse environmental impacts related to unsustainable resource use and greenhouse gas emissions. Food waste is a relevant contributor to the tourism industry's environmental footprint (Gössling (2013); Gössling and Peeters (2015); Lenzen et al. (2018)).

Food waste refers to organic waste that originates from food or inputs used in food production. In the for-profit hospitality sector, food waste can be divided into two categories: kitchen waste (generated during food preparation) and guest waste (generated by consumers). According to Demeter et al. (2023), food service providers in the hospitality sector, such as hotels, restaurants, and cafeterias, are among the most polluting industries

globally. They account for approximately 12% of overall food waste, with restaurants and cafeterias contributing to more than 60% of this waste within the hospitality sector.

In the United Kingdom, between 45% and 65% of food waste in restaurants is generated in the kitchen (Pirani and Arafat, 2016). Silvennoinen et al. (2015) found that 69% of food waste in Finnish restaurants and cafés is from kitchen waste. Sehnem et al. (2022) found that in a middle-town city in Brazil, restaurants generated an average of 13 kilograms of food waste per day at the kitchen stage, accounting for 62% of total waste. This resulted in a loss of USD 530 per month per establishment. In Malaysia, Sha'ari et al. (2023) found that 51% of food waste was generated at the kitchen stage.

According to Demeter et al. (2023), Small and micro-sized enterprises (SMEs) make up over 90% of food service providers in the hospitality sector. SMEs may lack awareness and knowledge to undertake socially and environmentally responsible actions without guidance (Grieder et al., 2021). There is a direct correlation between the growth of tourism and the generation of food waste (Filimonau and Delysia, 2019), therefore food waste is a critical environmental, social, and economic issue in the hospitality sector. (Filimonau et al., 2023b).

Additionally, food waste poses a significant challenge to SMEs' short-term profitability and long-term sustainability. It also results in the unnecessary consumption of natural resources such as water and generates GHG emissions like methane, which significantly contribute to climate change (Beretta and Hellweg (2019); Filimonau et al. (2020); Antonschmidt and Lund-Durlacher (2021)).

1.3 Study Context

This research focuses on the organic waste generated in kitchens of small and medium-sized enterprises in the for-profit hospitality sector in Cusco, Peru. Peru is a middle-income country located in western South America with a population of 36 million. Cusco, a mid-sized town situated 3300 meters above sea level on the Andes Mountain. Tourism accounts for 4% of Peru's GDP, making it the 4th most popular tourist destination in South America after Argentina, Brazil, and Chile. Cusco is the main destination for tourism in Peru. UNESCO declared Cusco City a Cultural Heritage of Humanity in December 2019. The local economy heavily relies on hospitality activities, which contribute to 19% of Cusco's regional GDP (Del Pozo-Loayza, 2017). According to the Ministry of Commerce and Tourism of Peru, Cusco's hospitality sector has shown a progressive recovery since the COVID-19 pandemic. In 2022, there were 1,038,748 visitors to Cusco, which is a 125% increase from the previous year.

Similar to other tourist destinations globally, businesses in Cusco's for-profit hospitality sector aim to attract more customers by focusing on profitability growth. However, there is a lack of emphasis on improving current systems to achieve sustainable, environmentally friendly outcomes in the long run. SMEs make up a significant portion of Cusco's

hospitality sector. However, many SMEs lack awareness of the environmental impact of food waste and have knowledge gaps in minimizing it.

Table 1 shows the average amount of solid waste generated per day in Cusco city during 2022, and this information comes from administrative data from the Municipality. Solid waste was generated at a rate of 116 tons per day (t.d), of this, 46% (53 t.d) was produced by households, while non-households generated 54% (63 t.d). Organic waste accounted for 56% of solid waste, with households generating 35 t.d and non-households generating 29 t.d. Food waste makes up 53% of solid waste and 95% of organic waste. Households generate the most food waste at 34 tons (55%), followed by the hospitality sector at 20 t.d (33%), and other activities at 7.5 .d (12%). Restaurants in Cusco City produced 14.6 t.d of organic waste, with 99% of the organic waste being food waste. This food waste accounts for 24% of the total food waste and 13% of the total solid waste generated in the city.

Table 1: Solid Waste generated in Cusco City, tons per day

	Solid waste	Organic waste	Food waste
Total	115.6	64.3	61.3
(1) Households	53.1	35	33.9
(2) Non-households	62.5	29.3	27.4
Hospitality	26.6	20.4	19.9
(1) Restaurants	16.4	14.6	14.5
(2) Hotels	10.2	5.8	5.4
Rest of activities	35.9	9	7.5
(1) Road sweeping	7.5	1.6	0.9
(2) Business establishments	8.1	0.6	0.6
(3) Schools	8.3	2.7	2.3
(4) Public and private institutions.	5.9	0.8	0.6
(5) Farmers' markets	6.1	3.4	3.1

Source: Solid Waste Management - Oficlal Report 2022. Municipalidad Provincial del Cusco

The hospitality sector in Cusco is concentrated in a small area known as the "Centro Histórico de Cusco" (CHC). This area covers 85 square kilometers and is home to the main cultural and architectural heritage of the Inca Empire and the Spanish Colonial period. It also boasts 10 museums and other tourist attractions. Based on administrative data from the Municipality of Cusco for the year 2023, the for-profit hospitality sector in the CHC area comprises approximately 1002 businesses. Of these, 457 (45%) are hotels (including guesthouses), and 545 (55%) are restaurants (including cafes). The CHC area has a range of medium and large-sized firms, including 28 international chain hotels such as Casa Andina, Terra Viva, Wyndham, San Agustin, JW Marriott, Hilton, Accor, Aranwa, Sheraton, and others. Additionally, there are ten fast-food chains like Burger King, KFC, McDonald's, and one international cafeteria - Starbucks.

In regards to the Peruvian government's regulations for solid and organic (food) waste produced by the hospitality industry, Table 2 provides information on the institutions responsible for setting policies related to restaurant food waste management. This shows respect for the national and local regulatory frameworks. To summarize, the objectives of regulations in waste management are to minimize waste generation, ensure proper storage and disposal of waste, and implement segregation of waste based on its type (organic, inorganic, etc.). The Municipality of Cusco is the primary institution responsible for overseeing food waste management in restaurants.

All solid waste in Cusco City is collected and directly disposed of by the Municipality through the public waste collection service at the Haquira dump. The public waste collection service's operating costs are primarily funded through municipal taxes. Citizens and businesses pay taxes annually at a fixed rate, separate from Property Tax or water and electricity bills. This means the collection process is not forceful enough, leading to high delinquency rates.

In 2022, the public cleaning service incurred operating costs of PEN 8.1 million (USD 2.1 million). Excise taxes covered 79% of these costs, while Cusco's municipality provided direct subsidies to finance the remaining 20%. At present, the collection capacity of the Municipality of Cusco is inadequate for receiving payments for the public waste collection service provided to households and businesses. This leads to a limited budget and poor service quality, specifically in collecting and disposing of solid waste.

The Haquira dump is a 7.7-hectare waste disposal area located 7.5 kilometers northeast of Cusco City. Its operation period exceeds 17 years. Every day, the Haquira dump receives 454 tons of waste, of which 228 tons (57%) are organic waste. This waste comes from eight districts in the Cusco province, with approximately 34% of the total waste originating from Cusco City.

According to Valderrama Rocca (2018), Gas control is carried out through an active ventilation system that uses vertical chimneys for gas extraction. This system is distributed throughout the disposal cells, but there is no gas treatment, energy recovery, or burners involved. Unfortunately, the measurement and control of gases is not carried out

at the established frequency. Leachate control is achieved through a drainage and storage system with recirculation. However, without proper design and maintenance, there is no regulation of the volume and composition of the leachate at established intervals. The Haquira dump is causing harm to both public health and the environment. The nearby population is affected by disease-carrying rats and flies, as well as gastrointestinal and skin diseases. Additionally, the dump is polluting cultivated land and surface water due to leachate generated by rainfall, and is contributing to atmospheric pollution through methane emissions.

Table 2: Peruvian government's regulatory framework for solid waste management in the for-profit hospitality sector

Institution	Regulatory instrument	Related policy objective
Congress of Peru	Legislative Law 1278 Integral Management of Solid Waste Law	(1) Reduction of waste generated (2) Materials use-efficiency
Congress of Peru	Law 27972 Organic Municipalities Law	(1) Municipalities roles related to Solid Waste Management at local level (2) Promotion of pro-environmental awareness (3) Reduction of waste generated
Ministry of Commerce and Tourism	SUPREME DECREE 003-2023-MINCETUR Regulation of environmental management of the tourism sector	(1) Promotion of pro-environmental practices in tourist activity
Ministry of Environment of Peru	National Environmental Action Plan	(1) All solid waste at the municipal level managed, used, and properly disposed
Ministry of Health of Peru	Ministerial Resolution 363-2005 Solid waste management plan in restaurants	(1) Solid waste management in restaurants (2) Delegation to municipalities as responsible for enforcement and supervision
National Institute of Quality	NTP 900.058.2019 Waste management color coding for storage	(1) Regulates the colors to be used for the proper storage of solid waste in municipal management areas Green: usable waste (paper, plastic, etc.) Black: non-suable waste (sanitary residuals Brown: organic waste (food waste) Red: dangerous waste (chemicals)
Municipality of Cusco	Comprehensive plan for the environmental management of municipal solid waste in the province of Cusco 2020-2025	(1) Minimization of food waste at origin Households and non-households (2) Promotion of pro-environmental awareness at local level (3) Promotion of waste segregation: organic, inorganic, etc. (4) Provision of solid waste collection public service (5) Promotion of the circular economy reduce, reuse and recycle

Source: Own preparation based on Peruvian´s government regulations

1.4 Literature Review

1.4.1 Food Waste in the Hospitality Sector

According to a literature review conducted by Dhir et al. (2020), the issue of food waste in the hospitality industry has been extensively researched in developed countries. The review analyzed 33 studies from around the world, but none were found for South American countries. The research sheds light on the need for more studies focused on this region to better understand the extent of food waste in the hospitality industry.

The available research on food waste has explored various topics, including the reasons behind food waste (such as kitchen types, over-production, lack of skills among employees, and inadequate management capacity regarding purchase planning and demand forecasting), incentives for financial benefits arising from savings in food costs, food waste hotspots (such as cultural factors and food types), stages of food waste generation (such as kitchen waste and plate leftovers), food waste by type of establishment (including practices, conditions, and characteristics of the establishment), demographic factors and food waste (such as consumer's socio-economic characteristics, attitudes, and preferences on food), the impact of food waste (such as climate change, monetary losses, and food security), behavioral interventions to reduce food waste in customers (such as reducing plate size, removing side-plate, providing social cues, offering to pack leftovers, and giving informational and normative prompts), and practices to reuse and recycle food waste. Food waste generated at the kitchen stage is an often overlooked problem by firms in the Hospitality Sector.

Previous research conducted on reducing food waste in the hospitality sector has shown that behavioral interventions such as providing information have been effective. However, these interventions have mainly focused on consumers as evidenced by studies conducted by Lorenz and Langen (2018), Stöckli et al. (2018), Chen and Jai (2018), and Antonschmidt and Lund-Durlacher (2021).

There is currently limited evidence available regarding the effectiveness of behavioral interventions aimed at reducing food waste in restaurants at the kitchen stage, with few exceptions such as Raab et al. (2018) and Salzberg et al. (2019). These studies explore the factors that motivate the adoption of sustainable practices in restaurants based on the Theory of Planned Behavior Ajzen (1991); Ajzen and Cote (2008). However, these papers focus on sustainable innovations in a general way and do not specifically address the issue of food waste.

According to several studies, such as Strotmann et al. (2017); Principato et al. (2018); Aamir et al. (2018); Silvennoinen et al. (2019); Hennchen (2019); Lins et al. (2021); Sehnem et al. (2022), the main causes of food waste generation in restaurants at the kitchen stage are related to the lack of awareness and knowledge about food management.

Based on Pirani and Arafat (2016), it has been found that small and medium-sized enterprises (SMEs) in the hospitality sector may lack access to relevant information and

guidelines, or they may lack the motivation to implement eco-friendly practices. Generally, managers and chefs of SMEs do not attend any training in food management (Heikkilä et al. (2016); Okumus (2020); Kasavan et al. (2019); Lins et al. (2021); Sehnem et al. (2022); Filimonau et al. (2023a)). This lack of knowledge about food management can lead to over-production and therefore food waste (Pirani and Arafat (2016); Aamir et al. (2018); Okumus (2020);Lins et al. (2021); Amicarelli et al. (2022)). At the kitchen stage, other causes of food waste include a lack of kitchen storage (leading to spoilage), errors in food preparation (such as inaccurate demand forecasting, cooking mistakes, and ordering mistakes), and errors in food service (such as long menus, large portions, over-ordering, and over-plating) (Sha'ari et al. (2023); Filimonau et al. (2023a)).

According to Filimonau and Delysia (2019) and Filimonau et al. (2020), improvements in food management depend on the managerial evaluation of opportunities and challenges. These opportunities include corporate image, consumer preferences, cost savings, staff motivation, and time and risk preferences. However, there are also challenges such as adoption costs, disengaged suppliers, societal bias, local culture, rigid operational procedures, resource constraints, and staff and management resistance. Recently, Filimonau (2020) explored food waste management practices in restaurants in China using a qualitative approach. The study suggests that providing specialist training to restaurant managers and kitchen staff could be useful in improving food management in hospitality firms.

1.4.2 Experimental Evidence for Improving Pro-Environmental Behavior of Consumers in the Hospitality Sector

According to a recent systematic literature review conducted by Demeter et al. (2023), experimental studies have focused on improving pro-environmental behavior in the hospitality sector for consumers (tourists). The main interventions are related to reducing food waste, reusing towels, and reducing water consumption. Most experiments were conducted in large hotels and restaurants in Europe and the US. Effective interventions to reduce food waste are based on the Nudge Theory (Thaler and Sunstein, 2009). Some interventions include using smaller plates (Hansen et al., 2015), inviting guests to return to the buffet as often as they like (Kallbekken and Sælen, 2013), offering discounts to guests who eat up, changing from rolling trolley carts to self-service buffets (Chang, 2022), using flyers to encourage guests to eat up (Dolnicar et al., 2020), increasing the demand for plant-based dishes (Sparkman et al., 2020), and informing guests that the salad originates from local and organic farms (Cozzio et al., 2020).

The evidence suggests that changing beliefs is consumers' most commonly tested behavioral intervention. This aligns with belief-based theories of human behavior, such as the Theory of Planned Behavior. However, experimental studies often face limitations and challenges, including threats to external validity, imperfect randomization, lack of simultaneous control groups with temporal changes influencing behavior, non-compliance,

and difficulty in measuring the dependent variable (food waste measure). As stated in a study by (Demeter et al., 2023), there is a need for new theoretical approaches to understanding consumers' behavior towards pro-environmental actions, as these behaviors are not naturally associated with enjoyment.

According to a recent study Souza-Neto et al. (2022), the hospitality sector has been testing various types of nudges, including informative nudges, heuristic blockers, and heuristic triggers, to improve pro-environmental behaviors such as bed linen reuse, use of refillable shampoo, energy conservation, and towel reuse. These interventions have been found to be effective in leveraging social norms, increasing pleasure, and changing beliefs. However, most of the evidence comes from studies conducted in developed economies, with the limited evidence available from Latin American and Caribbean countries - LAC (1/49 studies). This study also suggests that while the attitude-behavior gap remains constant in hedonic contexts like tourism, social norms, framing effects, and appealing scenarios can be effective in promoting pro-environmental behaviors.

Several behavioral intervention experiments have been conducted globally to reduce food waste, but their effectiveness remains uncertain. Tian et al. (2022) conducted a meta-analysis based on 58 studies selected after screening 1143 papers, which were conducted between 2011 and 2021 and covered 26533 participants. However, most studies were concentrated in Europe and the US, with only a small number of studies from the Asia Pacific and no experimental evidence from Latin America. The experimental interventions to reduce food waste are based on information prompts and environmental alteration. Most studies collect direct weighted of food waste. The education interventions achieved a moderate to significant effect (z=0.36), consistent with the idea that the knowledge and norms gained from education are more specific due to higher information intensity. Environmental alteration, a nudge-type intervention that uses cognitive bias and choice architecture to influence behavior, achieved a moderate effect (z=0.19). The authors argue that the current research using incentives and environmental alteration is highly inadequate because it only leads to sparse food waste reduction in the short term. While such findings are important, they do not directly apply to restaurant's pro-environmental performance.

1.4.3 Experimental Evidence to Improve Firm's Pro-environmental Performance

Over the past thirty years, there has been a significant amount of literature on the environmental performance of firms in developing countries. However, the evidence from rigorous quasi-experimental methods is limited, and experimental approaches are exceedingly rare. To our knowledge, there are no available studies on reducing food waste in firms in the hospitality sector, although there is some evidence related to other environmental issues. For instance, Duflo et al. (2013) conducted an intervention on Indian industrial firms.

They implemented a modified environmental audit system, where auditors were paid from a central pool instead of by the firm, and their fee was predetermined at a flat rate, high enough to cover pollution measurement and leave the auditor with a modest profit margin. The intervention aimed to improve the willingness of firms to generate accurate pollution reports. The authors found that reforming incentives for third-party auditors can enhance accurate reporting and make pollution regulation more effective.

A field experiment was conducted by Earnhart and Ferraro (2021) with 328 municipal wastewater treatment facilities in Kansas (US). In this experiment, certificated letters were randomly sent to these facilities, which contrasted each facility's discharge behavior to the behavior of other facilities in the state. The objective was to measure the degree to which the recipient facilities complied with discharge limits under the US Clean Water Act. The study found that letter recipients reported discharge ratios 8% lower than non-recipients in the 18-month period after the letters were sent.

According to a study conducted by (Grieder et al., 2021), a field experiment was carried out in Switzerland to test the effectiveness of behavioral economic interventions for promoting an environmental consulting program to small and medium-sized enterprises. This study involved randomly calling owners/managers of firms from various economic sectors and promoting the program to SMEs by appealing to either the environmental or financial benefits of environmental consulting, as well as using loss or gain-framed nudges. The experiment aimed to determine the probability of firms taking part in environmental consulting. The study found that loss frames were not more effective than gain frames, and that appealing to the environmental benefits of sustainability measures was just as effective as emphasizing the financial benefits for firms. The research also indicated that the personal motivation of managers and the long-term environmental impact were the most important factors in determining whether they were willing to implement additional environmental sustainability measures. The study highlights the significance of incorporating environmental sustainability measures in the business operations.

In a recent study Zachmann et al. (2023), researchers experimented with the adoption of pro-environmental farming practices in the agriculture sector. They specifically focused on planting fungus-resistant grapevines to reduce pesticide use in grapevine production. Through a randomized controlled trial involving 436 grapevine farmers in Switzerland, the researchers aimed to test whether providing personalized or general information on growers' use of environmentally toxic fungicides would change their planting intentions of fungus-resistant varieties. However, the study found no effect of providing personalized or general information on the adoption of these practices. The null results were explained by the potential boomerang effects, where a persuasive message produces attitude change in the opposite direction intended. This can happen when recipients generate counter-arguments that are substantially stronger than the arguments contained in the original message.

1.5 Decision-Making in SMEs for Pro-environmental Performance

In this subsection, we delve into the differences in decision-making between consumers and firms about pro-environmental behavior in the hospitality context. On one hand, several theoretical frameworks aim to explain the gap between possessing environmental awareness and knowledge, and displaying pro-environmental behavior among consumers. The most commonly used theoretical models include linear models of consumer behavior, Theory of Planned Behavior, Theory of Interpersonal Behavior, Habit Theory, Theory of Normative Conduct, Norm Activation Theory, and Nudge Theory (Kollmuss and Agyeman (2002); Dolnicar (2020); Han (2021); Demeter et al. (2023)).

On the other hand, firms have two main objectives, namely increasing profitability and reducing environmental risks. While the former is quantifiable and can be achieved through various mechanisms, the latter often lacks well-developed measures to assess its progress. Firms have realized the significance of environmental issues across all levels of their operations. Social norms and government regulations have a positive influence on reducing environmental issues such as pollution, but profitability needs can have a negative impact. The service sector, particularly the hospitality industry, is less likely to adopt measures that reduce environmental risks.

Grieder et al. (2021) analyzes the determinants of SMEs' pro-environmental performance under the Nudge Theory. The first determinant is the environmental preferences of managers (owners). SMEs managers can directly determine the firm's decision due to its less complex governance. Pro-environmental preferences of managers are quite relevant for environmental management decisions in SMEs. However, SMEs tend to perceive environmental measures as a cost rather than a business opportunity, as they have a for-profit logic. They are usually less exposed to public scrutiny than larger firms and have a smaller customer base. The second determinant of pro-environmental performance is the present bias in intertemporal choice. From the SME's point of view, environmental management measures could be associated with an immediate up-front cost. Present bias disproportionately increases decision-makers weight on such immediate costs and influences long-term decisions, such as training workers in environmentally-friendly practices. Managers' tendency to procrastinate was negatively associated with these types of investments. Present bias implies a lack of interest and time to tackle environmental questions. The third determinant is related to loss aversion and reference-dependent preferences. Loss aversion is related to the role of framing scenarios. Loss-framed pro-environmental incentives have proved more effective than providing the same incentives but framing them in the gain domain.

The decision-making process in SMEs is heavily influenced by specific individuals such as managers and owners. As a result, this process is more likely to be prone to biases present in individual-level decision-making than larger firms. Managers in SMEs tend to use decision-making heuristics and are more susceptible to individual decision-making

than managers in larger firms. Moreover, many SMEs do not prioritize environmental management as their core business usually absorbs them and has limited engagement with environmental management questions. Additionally, SMEs often lack knowledge of how to implement good environmental management practices and have limited awareness of business issues related to and best practices in environmental management (Grieder et al., 2021).

In Appendices, Figure 7 displays our proposed Theory of Change (ToCh) that explains how our intervention can enhance awareness and knowledge about food waste management and generate a positive environmental performance change for SMEs regarding organic (food) waste generation. We hypothesize that our intervention, based on information transfer, will increase awareness and knowledge to implement food management innovations to reduce food waste at the kitchen stage. Changes in these mechanisms could, in turn, stimulate the willingness to adopt food waste management innovations such as food manipulation practices, purchasing planning, storage, food production planning, and food use optimization. Attitudes, subjective norms, perceived control, and pro-environmental preferences of managers and chefs can condition the adoption. The SMEs' characteristics, such as size, core business, and governance complexity, mediate the causal chain. An underlying assumption of our causal chain is that the food management innovations offered in the intervention are simple and less expensive to implement by SMEs. Therefore, we expect that our intervention will reduce organic waste generation at the kitchen stage.

1.6 Research gaps and Expected Contribution

Reducing food waste in the hospitality sector has been a widely discussed topic. Still, experimental interventions to tackle this issue at the firm level are yet to be tested (Souza-Neto et al., 2022). Most experimental interventions to reduce food waste in the hospitality sector have focused on consumers, with fewer or no studies focusing on food providers. Furthermore, there are few available intervention experiments to reduce organic waste in developing countries, with none for Latin America, and very few interventions to improve environmental issues in firms, with none for Latin American countries and none for food provider SMEs such as restaurants. To the best of our knowledge, this research is one of the first field experiments to reduce food waste in Latin America at the firm level, particularly at the SME level. It aims to explore the effectiveness of an information transfer on organic waste generated at the kitchen stage by SMEs in a developing country with high tourism flows, such as Peru.

The evidence presented in (Grieder et al., 2021) highlights the importance of SMEs in environmental policy, as they often lack the knowledge and resources necessary to implement effective environmental management practices. Therefore, public policy measures targeting SMEs can help enhance sustainable economic decision-making. Additionally, this research contributes to the existing literature by exploring the effectiveness of be-

havioral insights in improving the environmental performance of micro and small firms in developing countries. In general, in these types of countries, the rates of informality in the economy are high.

1.7 Research Questions

Our main research questions are:

Research question 1: What is the effect of providing food management information and training for SME managers (owners) and chefs on organic waste segregation in Cusco's hospitality sector?

Research question 2: What is the effect of providing food management information and training for SME managers (owners) and chefs on organic waste generation in Cusco's hospitality sector?

Research question 3: What is the effect of providing food management information and training for SME managers (owners) and chefs on the adoption of food management innovations (improved food manipulation practices, purchasing planning, storage, food production planning, and food use optimization) in the Cusco's hospitality sector?

Research question 4: Food management information and training intervention is privately and socially beneficial in improving the pro-environmental performance of SMEs in Cusco's hospitality sector?

1.8 Hypothesis

We will test in the field the following hypothesis:

Hypothesis 1: Providing information and training increases awareness and knowledge about food management, motivating SMEs to segregate organic waste at the kitchen stage in Cusco's hospitality sector.

Hypothesis 2: Providing information and training increases awareness and knowledge about food management, thereby reducing the generation of organic waste at the kitchen stage by SMEs in Cusco's hospitality sector.

Hypothesis 3: Providing information and training increases the awareness and knowledge about food management, thereby motivating the adoption of food management innovations at the kitchen stage by SMEs in Cusco's Hospitality Sector.

Hypothesis 4: Providing information and training to SMEs' managers and chefs is a useful policy instrument for improving the pro-environmental performance of SMEs in Cusco's Hospitality Sector, according to cost-benefit and cost-effectiveness analyses.

2 Research Strategy

2.1 Sampling

2.1.1 Sampling Frame

Our research focuses on managers (owners) and chefs of firms that operate for-profit food services in the hospitality sector of Cusco, Peru. To determine our sampling frame, we conducted a door-to-door census listing of firms in the hospitality sector of the CHC area in May 2023 to collect data on for-profit food services.

We conducted a short survey to gather information about the basic characteristics of food providers in Cusco. We collected the names and cellphone numbers of the managers, owners, and chefs. We asked them to self-categorize their type of food service (such as restaurants, Peruvian traditional restaurants, pizza places, chicken grills, Peruvian-Chinese food, cafes, bistros, or others). We also asked whether they had their water installation, the amount of their monthly water bill, the number of kitchen burners, and the number of kitchen and food service workers. We inquired if the kitchen and service workers were the same and whether the manager and owner were the same person. Lastly, we collected geolocation information (latitude and longitude) using a GPS app called Survey GPS Cam, which allowed us to map the study area and mark the location of each surveyed establishment.

Out of 618 SMEs identified in the Centro Histórico de Cusco, only 288 could provide information for the brief survey. The remaining 321 denied the initial survey instrument application, citing a lack of interest or time constraints during their visit. In Appendices Figure 8, we present the geographical distribution of all identified firms. During our door-to-door census listing, we excluded hotels, fast-food chains, and cafeterias. Table 3 includes the main characteristics of firms that were able to provide us with the required information.

According to this sample, 90% of firms have their water installation, and the average monthly bill for water is USD 87. On average, each firm has 5 kitchen burners and 3 kitchen workers, as well as 2.5 food-service workers. Approximately 30% of firms have the same people working in the kitchen and the service, while 50% have the same person serving as both the manager and owner. In Peru, all enterprises are formally classified based on the number of employees they have. Micro-small businesses have 1-10 workers, small businesses have 1-100 workers, medium businesses have 101-500 workers, and large businesses have more than 500 workers. Our sample's companies can be considered small or micro-sized enterprises (SMEs).

Table 3: Door-to-door census listing of firms in the hospitality sector of Cusco

Variable	Mean	Standard Deviation
Own water installation	0.9	0.4
Water monthly bill (USD per month)	87	136
Kitchen burners	4.6	2.7
Kitchen's workers	3.1	2.2
Food service's workers	2.5	2.1
Kitchen and service workers are the same	0.3	0.4
Manager and owner are the same person	0.5	0.5
Observations	288	

Firms listed in Centro Histórico de Cusco
Source: Own fieldwork

Our census data can be used to predict organic waste generated in SMEs. We used Principal Component Analysis (PCA) to stratify SMEs within the sample framework. In Table 4, we present the correlation matrix showing the relationships between various basic characteristics of SMEs. Specifically, we found positive correlations between water monthly bill, kitchen burners, kitchen workers, and food service works. On the other hand, we observed negative correlations between less complex businesses and SMEs size proxies.

Table 4: Correlation matrix, SMEs main characteristics

Characteristics	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Own water installation	1						
(2) Water monthly bill	0.1216	1					
(3) Kitchen burners	0.1547	0.1884	1				
(4) Kitchen's workers	0.1129	0.4757	0.5992	1			
(5) Food service's workers	0.1606	0.4420	0.5193	0.7308	1		
(6) Kitchen and service workers are the same	-0.1805	-0.2238	-0.3533	-0.2913	-0.2343	1	
(7) Manager and owner are the same person	-0.064	-0.0984	-0.1772	-0.2745	-0.2621	0.162	1

Source: Own fieldwork

In Table 5, we show the coeficients estimated related to the main PCA using a regression framework, its useful to estimate a proxy mean test, based on SME's main characteristics, to compute a stratification index. Most characteristics are correlated with the stratification index.

Table 5: Scoring coefficients, Stratification index

Characteristics	Estimated coefficients
Own water installation	-0.1415
Water monthly bill	0.4016
Kitchen burners	0.1871
Kitchen's workers	0.3698
Food service's workers	0.3577
Kitchen and service workers are the same	0.0362
Manager and owner are the same person	0.1406

Note: Scoring coefficients estimated by regression methods with varimax rotated factors
Source: Own fieldwork

Using the stratification index, we stratify the sample of SMEs into 5 strata. We present the heterogeneity of SMEs among the strata in Table 6. Generally, SMEs differ across strata in most characteristics.

Table 6: Characteristicis by stratum (means)

Observations	Stratums				
	1	2	3	4	5
Own water installation	0.96	0.83	0.75	0.74	0.93
Water monthly bill (USD)	32	55	52	94	203
Kitchen burners	2.71	3.39	4.38	4.98	7.59
Kitchen's workers	1.56	1.98	2.32	3.27	6.17
Food service's workers	1.13	1.61	1.96	2.56	5.51
Kitchen and service workers are the same	0.46	0.22	0.35	0.17	0.08
Manager and owner are the same person	0.48	0.54	0.62	0.55	0.31
Number of observations	58	59	56	58	57

Source: Own fieldwork

2.1.2 Statistical Power

Our main outcome is the amount of organic waste generated, measured in kilograms per day per SME. We consider this variable to be both continuous and normalized. When analyzing the data, we assume the following parameters: (i) A significance level of 5%. (ii) The standard deviation for normalized outcomes is the same for both the treatment and control groups, with a value of 0.80. (iii) We expect a feasible treatment effect size of -15% on waste generation for treated SMEs.

According to our preliminary power calculations in Table 7, we require a sample of at least 260 SMEs (N=260) to determine whether the average treatment effect is zero. This sample size should be divided equally between the treatment group (T=130) and the control group (C=130). Our initial power calculations indicate that with a sample size of N=260, we will have a statistical power of 80% and the ability to detect something greater than 0.279 standard deviations in the minimum detectable effect (MDE)..

Table 7: Preliminary power calculations

Sample	Treatment	Control	MDE (80%)	MDE (90%)
200	100	100	0.3185	0.3685
210	105	105	0.3108	0.3596
220	110	110	0.3036	0.3512
230	115	115	0.2968	0.3434
240	120	120	0.2905	0.3361
250	125	125	0.2846	0.3293
260	130	130	0.2790	0.3229
270	135	135	0.2738	0.3168
280	140	140	0.2688	0.3110
300	150	150	0.2596	0.3004
310	155	155	0.2554	0.2955
320	160	160	0.2513	0.2908
330	165	165	0.2475	0.2863
340	170	170	0.2438	0.2821
350	175	175	0.2403	0.2780
360	180	180	0.2369	0.2741
370	185	185	0.2336	0.2703
380	190	190	0.2305	0.2667
390	195	195	0.2275	0.2633
400	200	200	0.2247	0.2599

Note: Estimated experimental-group mean for a two-sample mean test
Note: MDE in terms of Standard Deviations
Source: Own calculations

However, the previous MDE calculation needs to be adjusted to account for imperfect compliance. As per Glewwe (2022), the following equation assumes a statistical power of 80% (t_{1-k}) and a statistical significance level of 5% (t_{α}). The proportion of SMEs in the treatment group ($\overline{P}$) is 50%, the variance of the outcome (σ^2) is 0.80, and the sample size (N) comprises 260 SMEs (130 treated and 130 untreated). The parameter w represents the proportion of SMEs assigned to the treatment group who have been invited to the food management training sessions at Instituto Khipu but did not attend. On the other hand, the parameter "p" represents the proportion of SMEs assigned to the control group who participated in the training, which we assume to be 0.

Based on the assumptions made, we have calculated a range of MDE, while controlling for imperfect compliance. The MDE range is calculated based on the proportion of compliance. With a compliance rate of 50%, we can detect an effect size larger than 0.558 standard deviations. With a compliance rate of 75%, we can detect an effect size larger than 0.372 standard deviations. Finally, with a compliance rate of 95%, we can detect an effect size larger than 0.279 standard deviations.

$$MDE = (t_{1-k} + t_{\alpha}) \sqrt{\frac{1}{\overline{P}(1-\overline{P})}} \sqrt{\frac{\sigma^2}{N}} \frac{1}{w-p} \tag{1}$$

Some clarifications are needed regarding our initial power calculations. As we could not find any previous experimental studies that estimated the effects of behavioral interventions on small and medium-sized enterprises (SMEs) to reduce waste generation in the kitchen stage of the hospitality sector, we do not know the mean and variance of organic waste generation. Additionally, the feasible effects are also unknown. Therefore, we have relied on available information from other non-experimental studies, mainly case studies from the European context. (Pirani and Arafat (2016); Silvennoinen et al. (2015); Silvennoinen et al. (2019)).

Before randomization, we will conduct a pilot audit to collect information from randomly selected 30 SMEs. The pilot audit aims to achieve two main objectives: (i) To test the research protocol for measuring organic waste at SMEs and (ii) To obtain preliminary measures of organic waste generation. We believe the pilot audit will provide us with a basic understanding of the operational procedures required to measure food waste at the SME level. Additionally, it will allow us to determine the mean and variance of the outcomes before establishing the baseline. Additionally, collecting baseline data will enable us to enhance our power calculations through simulations with more accurate information regarding organic waste generation. The baseline data will also serve to ensure that the observable characteristics of SMEs are balanced between the treatment and control groups.

2.2 Intervention

2.2.1 Intervention Framing

The intervention is possible through an institutional agreement between the Universidad Nacional de San Antonio Abad del Cusco (UNSAAC) and Municipalidad Provincial del Cusco (MPC). To implement the intervention with SMEs in the CHC area, we have employed an umbrella program called "Programa: Reducción de desperdicios en la preparación de alimentos en restaurantes de la Ciudad de Cusco" (Program: Waste Reduction in Food Preparation in Cusco City Restaurants in English). This program aims to ease the decision-making process for SMEs considering participating in the intervention by generating trust. This is particularly relevant in business informality and uncertainty,

such as Cusco in Peru. In Figure 1, we have included the program logo.:

Figure 1: Intervention framing, Program's logo

Source: Warner Rios Digital Designer

We plan to invite at least 400 SMEs to participate in the program, with 30 SMEs as part of the pilot phase. Of these 400 SMEs, 288 have already agreed to be interviewed in our first data collection, while the remaining 172 firms did not explicitly reject our first data collection. We consider all of these firms as potential participants. We randomly select SMEs from this population to offer the opportunity to participate in our program. We send formal letters that provide information about the program and incentives to encourage participation. The formal letters are delivered to create a reliable intervention framework to encourage participation from SMEs.

As part of the program, we provide additional information about its components and how it will affect SMEs. To invite SMEs to participate in the program, we will follow these steps: (i) We will deliver formal letters to each SME and ask their managers or owners if they are willing to participate. (ii) If we receive an affirmative response, we will ask the SME to sign a formal commitment and informed consent to participate in the program's components. We will also provide a waste container to each participating SME as an incentive. (iii) We will create a directory of all participating SMEs, including the manager or owner's name and the chef's phone numbers.

The final sample only comprises SMEs who have agreed to participate in the program. We had estimated an enrollment rate of at least 65% of the invited SMEs, which would be around 260 out of 400. We believe that the characteristics of SMEs, such as their water installation, monthly water bill, kitchen burners, kitchen and food service workers, and the correlation between the kitchen and service workers and the manager and owner, are potentially correlated to the outcome of organic waste generation. Therefore, the final sample will be stratified into five strata based on the stratification index that was previously constructed using these characteristics.

2.2.2 Intervention Components

The program intervention consists of four main components: Baseline, Training, Midline, and Endline. The first component involves collecting information about each SME's outcomes, managers' perceptions about food waste generation and management practices,

and SME characteristics. This component serves as a baseline and includes all SMEs in the final sample. Each SME will be visited once for waste generation measurement (audit) and to complete a baseline survey. As part of the baseline, our research team will provide a waste container (a colored brown container for organic waste with a capacity of 50 kilograms, according to Peruvian government regulations about waste management) to each SME participant free of charge. These waste containers would allow us to accurately measure waste segregation and organic waste generation at baseline and endline.

The program's second component involves training to improve knowledge about food management. SMEs will be randomly selected through a stratified lottery, with both treated and untreated SMEs being chosen. Only the treated SMEs will be invited to participate in the training sessions.

The third component of our study includes a midline survey to collect information from the treatment and control groups. We will inquire about using waste container and organic waste segregation in the control group. In the treatment group, we will ask about the use of waste container, organic waste segregation, and the implementation of measures to improve food management in the kitchen stage after training. We will survey cell phone calls. We will contact the control group SMEs one month after they receive the waste container and the treated group SMEs one month after they complete the training at Instituto Khipu.

The final component involves collecting information from each SME about the follow-up measures taken after the intervention. This includes the managers (owners) perceptions regarding the generation of food waste and any improvements in food waste management practices. All SMEs in the final sample will participate in this component. Each SME will be visited once for waste generation measurements (audit) and a survey. The timeline for the intervention is 3 months for the baseline (including the pilot), 3 months for training SMEs (including midline), and 2 months for the endline.

2.3 Treatment

To reduce organic waste generation at the kitchen stage, participating SMEs will be provided with complementary information, along with training sessions to enhance the knowledge of managers and chefs on food management. The training aims to incentivize improvements in food waste management, helping to promote better waste reduction practices. The participants will randomly choose the SMEs invited for the training sessions. In the treatment group, owners and chefs of SMEs receive a free three-hour training session on the operational implementation of food management innovations.

Our training sessions will focus on standardized themes related to food management innovations. We ensure that all the innovations suggested during the training sessions are simple and inexpensive to implement by small and medium enterprises (SMEs). The training sessions will cover the following topics in detail: (i) Introduction to the concept

of food management in the kitchen, (ii) Purchasing planning, (iii) Food storage, (iv) Production planning, and (v) Optimization of food use.

During the training session, we will introduce the importance and benefits of improving food management. Following that, we will discuss purchasing planning and focus on using a perishable inputs and ingredients purchasing table to help prevent the purchase of excess inputs and ingredients. This will ensure that SMEs have real-time control of their food stock. Having more accurate inventory control can minimize storage and spoilage costs and improve our cash flow. We have proposed a food stock control table in Table 8.

Table 8: Food stock control table

Product	Quantity purchased this week	Date of purchase	In stock	Necessary purchase for next week
Fruit 1	...	...	...	...
Fruit 2	...	...	...	...
Vegetable 1	...	...	...	...
Vegetable 2	...	...	...	...
Meats 1	...	...	...	...
Meats 2	...	...	...	...

Source: Instituto Khipu training materials

Optimizing storage procedures is the main purpose of storage. This involves storing perishable products in different ways, such as storing fish pieces and frozen separately, beef/pork/chicken pieces stored/frozen separately, minced meats (beef, pork, fish, chicken, etc.) stored/frozen in separate containers. In addition, warehouse organization is important and can be achieved using the ABC method. This involves categorizing products into three groups: A includes widely used products that take up relatively little space; B are products that will be stored much longer, are not used as much, and take up a lot of space; finally, C products, these are between A and B according to movement and frequency of choice. The ABC method can divide the warehouse and fridge into three zones: Zone A will be the one that is always closest to the door, then B, and then C.

Production planning serves the purpose of improving production efficiency by implementing the 20%+100%+20% strategy. This strategy helps to prevent overproduction by maintaining a daily stock of 100% of the required amount for normal demand, with an additional 20% reserved for high-demand periods, resulting in a total stock of 120%. Frozen stock is kept as a contingency plan and used only in cases of emergency during high-demand days. Any unsold fresh stock, which makes up around 20% of the total stock, is carried forward to the next day. The objective is to use fresh stock as much as possible to avoid waste and ensure that valuable prepared ingredients are not discarded.

Optimizing food use involves recycling surplus ingredients and resourceful cooking techniques to reduce waste (refer to table below).

Table 9: Food use optimization

Reuse surplus ingredients	Resourceful cooking
Leftover vegetables	Soups
Leftover meat	Appetizers or starter
Leftover miscellaneous	Hot sauces, pickles, and jams

Source: Instituto Khipu training materials

During the intervention, a team from Instituto Khipu consisting of one executive chef and one kitchen assistant will conduct all 25 training sessions for five weeks. Instituto Khipu is a well-known technical education institution focusing on the hospitality sector in Cusco. It has a gastronomy school with the necessary facilities, human resources, and expertise to support the intervention. We expect to include around 130 SMEs in training, and each training session will have representatives from no more than six SMEs. We will conduct no more than six training sessions per week. After each training session, participants will receive a printed guideline containing all the procedures covered. Managers and chefs of treated SMEs will be randomly grouped in each 25-training group. Still, we will try to group participants according to their availability due to their working and business hours. Figure 2 shows the training session schedule:

Figure 2: Timeline for training sessions

Weeks for intervention: training sessions					
Weeks	1	2	3	4	5
Morning sessions	Group 1	Group 7	Group 13	Group 19	Group 25
	Group 2	Group 8	Group 14	Group 20	
Afternoon sessions	Group 3	Group 9	Group 15	Group 21	
	Group 4	Group 10	Group 16	Group 22	
Nigth sessions	Group 5	Group 11	Group 17	Group 23	
	Group 6	Group 12	Group 18	Group 24	
SMEs trained	36	36	36	36	6
SMES trained cumulate	18	54	90	126	132

Source: own's

To minimize the probability of a potential violation of the Stable Unit Value Assumption (SUTVA), we will follow the below strategy: (i) We will standardize the training sessions, themes, and procedures. (ii) To determine the heterogeneity of SMEs in the final sample and the treatment group, we will use the baseline to collect information about the characteristics of SMEs in both the treatment and control groups. (iii) Each training session will be carried out at the Instituto Khipu to ensure that the training is standardized among treatment SMEs and by the same training team (same executive chef and kitchen assistant). Instituto Khipu has implemented standardized kitchens for gastronomy education services. This will eliminate the possibility of training sessions being influenced by the unique characteristics of each kitchen. The intervention is not providing financial resources to SMEs, but rather, aims to motivate managers, owners, and kitchen staff to adopt innovations in food waste management despite resource constraints.

2.4 Assignment to Treatment

We conducted a Randomized Controlled Trial (RCT) to determine the causal effect of information transfer to SME managers (owners) and chefs on business outcomes. The RCT involved detailed audits and surveys at the beginning and end of the study, with a midline phone survey conducted during the intervention. Randomization was only done among SMEs that expressed interest in participating in the umbrella program. After baseline, with more precise power calculations, SMEs were randomly assigned to treatment and control groups using a simple lottery in each of the 5 strata. This will be used as a variable block (stratified), meaning the sample will be distributed according to these strata. The effect by strata will not be analyzed due to limited statistical power.

Figure 3 summarizes our randomization strategy, where participating SMEs were randomly assigned to one of two groups. The Randomized Control Trial (RCT) involves two treatment arms: the treatment and control groups. The control group consists of untreated SMEs, who will participate in baseline, midline, and endline evaluations. We will implement a basic information intervention for the control SMEs to increase awareness of organic waste. During the baseline evaluation, we will visit each SME in person (around n=130) and provide them with a waste container to segregate the organic waste generated. At baseline and endline evaluations, we will collect information on the physical measures of generating organic waste, measured in kilograms (per worker, per day, and per SME).

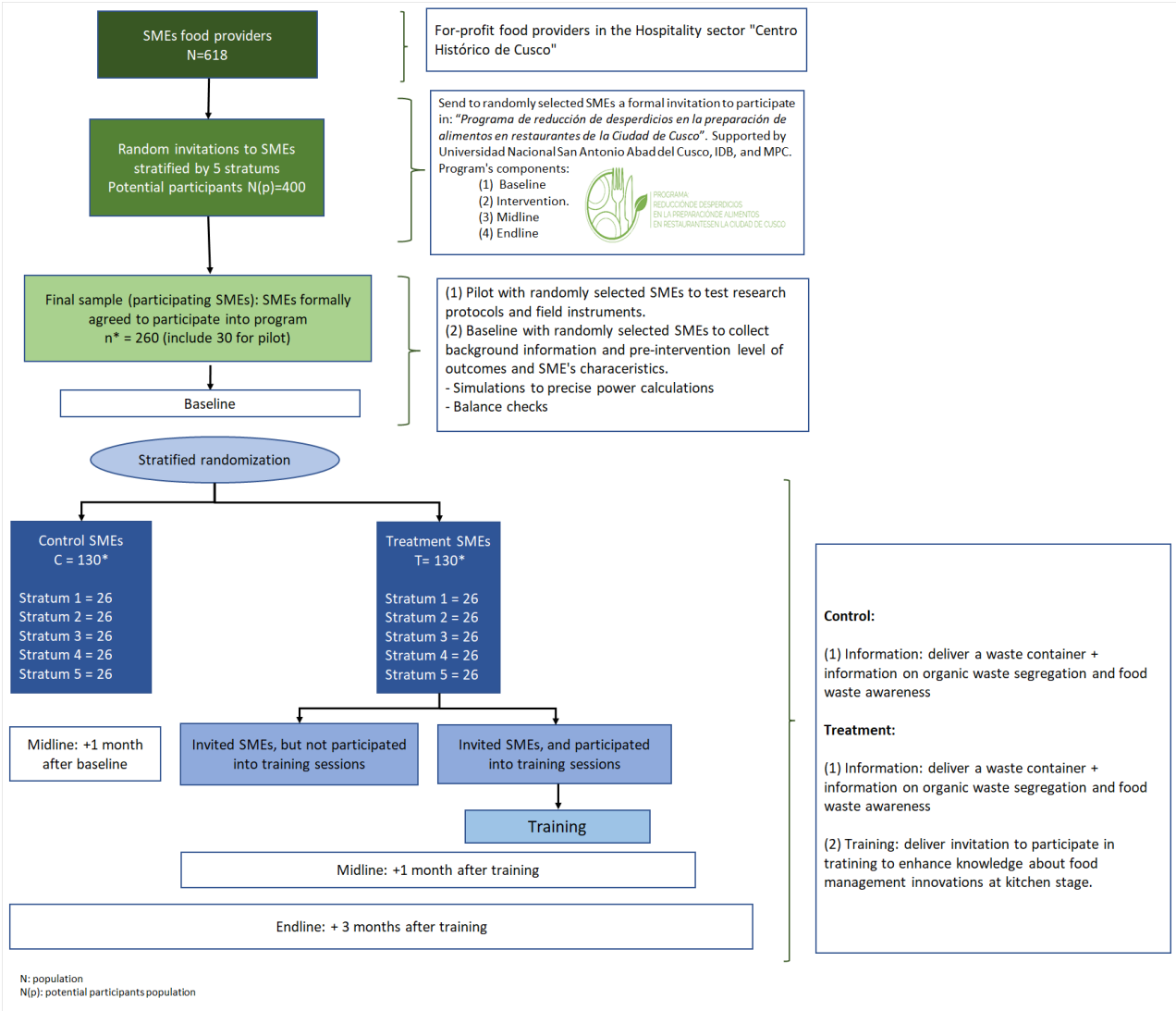
In the midline, we use cellphone surveys to gather information on whether or not the garbage can was used for organic waste segregation by the control SMEs. At the end of the program, we gather information on how the waste cans are used to separate organic waste. Once the program is over, all SMEs in the control group will receive printed guidelines to improve food management and reduce food waste production at the kitchen stage. The control group SMEs participating in the baseline, midline, and endline surveys will receive an official certification from Municipalidad Provincial del Cusco. In baseline and endline

surveys, we will survey managers (owners) to collect information on SMEs' characteristics, background factors, and pro-environmental attitudes, perceptions, and preferences.

Treatment groups consist of randomly selected treated SMEs, each participating in a baseline, midline, and endline survey. To increase awareness, a basic intervention will be implemented in treated SMEs. During the baseline survey, we will visit each SME in person (around n=130) and provide them with a brown garbage can to segregate the organic waste generated. In the baseline and endline surveys, we will collect information on physical measures of the generation of organic waste, all measured in kilograms (per worker, per day, and per SME). In addition to this basic intervention, managers and chefs will receive an invitation to participate in a free three-hour training session at Instituto Khipu. The training session is called "Curso-Taller en Gestión del Área de Alimentos y Bebidas" (Course-Workshop in Food and Beverage Area Management).

After each training session, every participant will be given a printed guideline that includes all the procedures covered during the training. During the midline, we collect information about the use of garbage cans for waste segregation. We also gather information about implementing food waste management innovations related to food manipulation practices, purchasing planning, storage, production planning, and food optimization via cell phone surveys. In both baseline and endline, we survey managers (owners) to gather information about SMEs' characteristics, background factors, and pro-environmental attitudes, perceptions, and preferences. Treated SMEs that participate in the baseline, midline, and endline will receive an official certification for participating in the program from Municipalidad Provincial del Cusco. Additionally, managers and owners who complete the training will receive an official certification for participating in the "Curso-Taller en Gestión del Área de Alimentos y Bebidas" from Instituto Khipu.

Figure 3: Research design



Source: own's

2.4.1 Attrition

Attrition can potentially affect both the control and treated groups. After participating in acceptance and baseline data collection, some SME managers (owners) choose not to participate in the midline and/or endline. This can be a potential problem if the attrition within treatment and control groups is not random, as biased estimates of treatment effects could result. Furthermore, a high level of attrition in the evaluation sample can reduce the statistical power of the RCT and increase the MDE. To reduce sample attrition, we offer incentives to SMEs for participation during baseline, midline, and endline.

As part of our program, we will provide each SME with a free garbage can having a capacity of approximately 50 liters, which costs around USD 11 each. Additionally, all participating SMEs (including both treated and control groups) will receive an official participation certificate. Furthermore, we will offer an official participation certificate in food management to the managers (owners) and chefs of the treated SMEs after the endline. These certificates will be supported by the program's partners: Municipalidad Provincial del Cusco and Instituto Khipu, respectively. Based on our understanding of the Cusco context, we believe that the staff of SMEs will be interested in receiving these certifications. We hope that this approach will help to reduce the potential attrition in the final sample.

The baseline data collection is crucial for checking for attrition bias in the study. This can be done in the following ways: (i) Checking whether the rate of attrition is the same in the treatment and control groups, (ii) Determining whether the units that dropped out of the sample at midline and endline are significantly different across the treatment and control group, and (iii) Checking whether attrition is completely random by regressing a dummy variable for attrition on baseline variables for treatment and control groups separately.

2.5 Fieldwork

2.5.1 Instruments

To gather data from the field, we use several methods: conducting a short survey for door-to-door census listing, sending out invitation letters with program information, maintaining an audit registry, and conducting surveys with SME managers and owners. Initially, the short survey aims to gather SMEs' primary contact information and basic characteristics, including their geographical location. Invitation letters and program information were useful in motivating SME engagement and defining the final sample of participating firms. Audit registry will collect information on organic waste segregation and generation for treatment and control groups, at baseline and endline.

Before conducting surveys with SMEs' managers or owners, informed consent will be obtained. The questionnaire used in the survey will cover SMEs' characteristics, food management, and pro-environmental attitudes, perceptions, and preferences for both treatment and control groups. This instrument will be applied in the field both at baseline and endline, while a specific part of the survey will be useful for midline. The field instruments were developed with the support of the research team and were validated during the pilot stage. These fieldwork instruments are included as annexes in this pre-analysis plan.

2.5.2 Data Collection

The data collection process will consist of three stages: (i) Census listing, (ii) Baseline, and (iii) Endline. The entire process is expected to take place from May 2023 to March 2024. During the door-to-door census listing of SMEs in CHC, the research team collected the contact and basic information of SMEs located in CHC. For both the treated and control groups, the baseline and endline data collection will focus on food waste generation and SMEs' characteristics. The endline data collection will take place three months after the training.

To ensure the confidentiality and anonymity of the information provided, the informed consent of the participating SMEs will be requested at both the baseline and endline stages. To minimize interactions with SMEs between the baseline and intervention stages, individual contact will be made with treated SMEs. Participation in the study is completely voluntary and the information provided will be codified in accordance with the Peruvian Personal Data Protection Law (Law 29733).

2.5.3 Data Processing

The entire data processing is expected to take from May 2023 to April 2024, until a publishable manuscript is generated. All data collected will be kept confidential, anonymized, and coded in accordance with Peru's Personal Data Protection Law (Law 29733). The ownership of the collected and processed data belongs to the Inter-American Development Bank and Universidad Nacional de San Antonio Abad del Cusco, in accordance with the Contract RG T0414-P004, which provides the research grant for this project. To ensure proper data processing, we will follow the Data Management Plan approved by the Department of Social Sciences, Wageningen University and Research. This document is part of the pre-analysis plan as an annex.

3 Empirical Analysis

3.1 Outcomes

Our primary outcome is determining whether SMEs segregate organic waste at the kitchen stage. We will conduct audits during the baseline and endline phases to assess whether SMEs use the waste containers provided by the program to segregate organic waste or not. Our second outcome is measuring organic waste generation at the kitchen stage. However, it is considered difficult to measure accurately due to the diverse material types of food and inedible parts and the inventory boundaries. There is no single best definition for an accurate measure, as noted (Cattaneo et al., 2021).

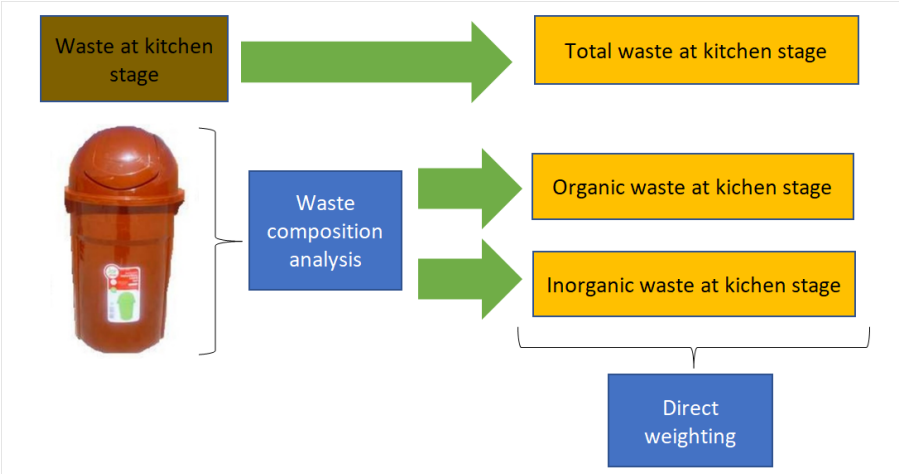
Multiple techniques are available to measure organic and food waste, as explained in the Guidance on Food Loss and Waste Quantification Methods at www.flwprotocol.org. These methods include direct weighing, counting, assessing volume, waste composition analysis, records, diaries, surveys, mass balance, modeling, and proxy data. However, semi-structured interviews are commonly used to gather information about food waste at the SME level. It is important to note that this method may be subject to self-report bias, as mentioned in the related literature (Dhir et al., 2020)

To avoid self-report bias, we employ physical measures to collect data on organic waste generation at the kitchen stage for both treated and control SMEs. This method has been used in previous studies, such as Silvennoinen et al. (2015) and Pirani and Arafat (2016). We use a combination of two methods, namely Direct Weighing and Waste Composition Analysis, to measure the amount of organic waste generated. Direct weighing involves using weighing devices, such as waste cans and electronic scales, to quantify the weight of organic waste generated. Waste composition analysis is used to separate and weigh organic waste from inorganic waste physically.

In Figure 4, we illustrate the process of measuring organic waste generation at the kitchen stage in SMEs. The fieldwork team uses an electronic weighing device to measure the total waste generated and stored in the waste container provided by the program. Additionally, using the Waste Composition Analysis, the fieldwork team separates and weighs organic and inorganic waste from the total waste previously measured. These measurements can be expressed in kilograms per day and per SME. To account for the seasonality of Cusco's Hospitality Sector and the size of the SMEs, we divide the continuous measurements by the number of employees in each SME.

Our procedures provide us with an opportunity to gather detailed information. Direct weighing overcomes many problems faced by methods like surveys and diaries, which often under-report, and methods that rely on approximations, such as those based on material flow analysis, which can be inaccurate. Our procedure is well-suited for analyzing SMEs' waste in developing countries' for-profit hospitality sector.

Figure 4: Procedures to measure waste generation at kitchen stage in SMEs



Source: own's

To study causality mechanisms, we will gather data on the adoption of certain food management innovations. These include (1) whether small and medium-sized enterprises (SMEs) use control tables for purchasing ingredients, (2) whether SMEs store meat pieces separately, (3) whether SMEs have any method for organizing their warehouse, (4) whether SMEs implement any strategy for production planning, and (5) whether SMEs use any techniques for optimizing their food usage.

The attitudes, subjective norms, perceived control, and pro-environmental preferences of SME managers and owners can influence the adoption of food management innovations (Ajzen (1991), Martin-Rios et al. (2018), Raab et al. (2018), Salzberg et al. (2019), Filimonau et al. (2020)). To assess the relevance of these factors, we collect baseline data on the attitudes, subjective norms, perceived control of adoption, and pro-environmental preferences of managers or owners of SMEs.

To summarize, our procedures will be implemented by a fieldwork team consisting of four working groups. Each group will be composed of two enumerators who have been adequately trained in waste composition analysis and direct weighing and one enumerator trained to apply the survey instrument. The fieldwork team will be equipped with electronic weighing devices, bio-security equipment (masks, gloves, and body protectors to reduce contamination from contact with organic and inorganic waste), and colored bags for waste segregation.

To determine the amount of waste generated per SME during a business day, the waste will be measured at a baseline and endline. This will be done after coordination with the SME's manager or owner. If the SME closes a specific food service for the day, the fieldwork team will apply two instruments - a survey and an audit. An enumerator will apply the survey questionnaire to the SME's manager or owner, which takes around 15 minutes to complete. The fieldwork team will also include two members of each working group to weigh the waste generated during the kitchen stage, which includes organic and

inorganic waste.

3.2 Balancing Checks

We use baseline information to ensure a balance between treatment and control SMEs in terms of observable characteristics. We conduct a mean-test differences analysis to explore statistically significant differences between treatment and control SMEs across strata based on variables such as SME characteristics, food management, pro-environmental attitudes, perceptions, preferences, and other characteristics.

3.3 Treatment Effects

Our final sample consists of SMEs whose managers or owners have voluntarily chosen to participate in the program. As a result, there is a selection bias, and our findings are only applicable to the subset of SMEs that opted to join the program (Bloom et al., 2013). We will use two econometric methods to determine causal effects. First, we propose using a Differences-in-Differences approach to determine the impact of the SMEs' participation in the program on the outcomes. The second approach is the Intent-to-treat, which allows us to specifically explore the causal effect on outcomes under imperfect compliance of treated SMEs.

3.3.1 Differences-in-Differences

At a first glance, we will employ a Differences-in-Differences (DiD) approach. This approach considers that SMEs in the final sample self-selected for the program, meaning they chose to participate based on incentives and information. The program consists of two components designed to enhance awareness and knowledge about food management innovations through information and training. This allows us to explore the potential causal effects of the overall program exposure.

The DiD approach involves calculating the differences in outcomes between the treatment and control groups and then taking the difference between the two. The data used in this approach is not randomly selected from the reference population but instead includes both treated and untreated SMEs. DiD eliminates the impact of time-invariant factors that differ between the treatment and control groups, such as the unobserved factors determining self-enrollment into the program. Furthermore, the DiD eliminates the common trend over time by subtracting the differences in the treatment and control groups, such as the seasonality in the hospitality sector.

We have a treatment (T) and a control group (C), a pre-intervention period (Pre) and a post-intervention period ($Post$), we can express the DiD estimator as follow: $DiD = (\overline{Y}_{i,T}^{Post} - \overline{Y}_{i,T}^{Pre}) - (\overline{Y}_{i,C}^{Post} - \overline{Y}_{i,C}^{Pre})$, where $\overline{Y}$ are sample means. The first term represents the change in Y for the treatment group, while the second represents the change in Y for the control group. We can convert the sample average in conditional expectations and

express observed quantities into potential outcomes: $DiD = (E[Y^1_{i,T}|Post] - E[Y^0_{i,T}|Pre]) - (E[Y^0_{i,C}|Post] - E[Y^0_{i,C}|Pre]) + E[Y^0_{i,T}|Post] - E[Y^0_{i,T}|Post]$. DiD estimates the Average Treatment Effects on the Treated ($ATT = E[Y^1_{i,T}|Post] - E[Y^0_{i,T}|Post]$) as follows: $DiD = E[Y^1_{i,T}|Post] - E[Y^0_{i,T}|Post] + (E[Y^0_{i,T}|Post] - E[Y^0_{i,T}|Pre]) - (E[Y^0_{i,C}|Post] - E[Y^0_{i,C}|Pre])$

The expression $(E[Y^0_{i,T}|Post] - E[Y^0_{i,T}|Pre]) - (E[Y^0_{i,C}|Post] - E[Y^0_{i,C}|Pre])$ is equal to zero if we assume parallel trends, i.e., in absence of treatment the difference in the outcomes between the treatment and the control group would be constant. Because $Y^0_{i,T}$ is an unobserved counterfactual, parallel trends cannot be computed and be assumed.

We use a Two-way Fixed effects (TWFE) estimator to identify the causal effect of treatment assignment by comparing treatment and control SMEs before and after intervention.

$$y_{i,t} = \alpha_{did} + \gamma_{did} T_i + \lambda_{did} After_t + \delta_{did}(T_i * After_t) + \varepsilon_{did,i,t} \tag{2}$$

Where $y_{i,t}$ is a vector of outcomes of the SME "i" for time "t" (food management indicators, organic waste in kilograms per day per SME), T_i is a dummy variable equal to 1 if SME "i" was assigned to treatment group, 0 otherwise, $After_t$ is a dummy variable equal to 1 if data come from endline, 0 baseline. Finally, $\varepsilon_{did,i,t}$ is the error term.

The estimated coefficient γ_{did} (Cross-sectional estimator), captures the observed differences in outcomes between treatment and control groups but ignores the bias generated by the unobserved differences between the two groups. The estimated coefficient λ_{did} (Before-After estimator), captures the effect of the program comparing the outcomes measured after the program started with outcomes measured before it started, assuming that the missing counterfactual is equal to the observed outcome at baseline, but ignored any time trend. Therefore, the interaction term between fixed effects T_i and $After_t$ is the δ_{did} coefficient. If the parallel trend assumption holds, This accounts for time trends and time-invariant unobservable differences between treatment and control groups.

3.3.2 Intent to Treat

We assign participating SMEs randomly to either treatment or control groups. However, our experimental design might be influenced by non-compliance of treatment units, as some SMEs assigned to the treatment group may choose not to participate in the training sessions. We assume one-sided non-compliance explicitly in our field experiment.

Randomized Controlled Trials (RCTs) are designed to estimate the causal effects of treatment assignment in an unbiased manner. However, when non-compliance occurs, the estimated causal effects do not reflect the actual effects of receiving treatment, but rather the effects of being assigned to treatment. (Imbens and Rubin, 2015). To estimate causal effects of the assignment of treatment we will employ the Intention-to-Treat (ITT) estimand. The ITT effect of treatment assignment (T_i) on a potential outcome (Y_i), conditioned on characterisicts (X_i), can be expressed as: $ITT =$

$E[Y_i|(T_i = 1, X_i] - E[Y_i|T_i = 0, X_i]$. Where $T_i = 1$ is the assignment to treatment group and $T_i = 0$ is the assignment to control group for compliers in both groups. Treated SMEs that receive training and effectivelly adopt some food management innovation and untreated SMEs that not receive training. The key assumption for identifying the ITT effects is that we could allow for unconfounded treatment assignment.

We use an OLS estimator to compare treatment and control SMEs and identify the causal effect of treatment assignment. The regression specification is as follows:

$$y_{i,t} = \alpha_{itt} + \beta_{itt} T_i + \gamma_{itt} X_{i,0} + \mu_j + \theta_k + \varepsilon_{i,t} \tag{3}$$

Where $y_{i,t}$ is a vector of outcomes of the SME "i" for time "t" at the endline (food management indicators, organic waste in kilograms per day per SME, all outcomes post-intervention), T_i is a dummy variable equal to 1 during the post-treatment time period if SME "i" was assigned to treatment group, 0 during the post-treatment time period if SME "i" was assigned to control group. To obtain more precise estimates of causal effects, we include additional covariables ($X_{i,0}$). This vector of covariables includes measures of the outcomes at baseline, strata dummies according to the stratification of the sample (stratums 1 to 5), manager (owner) sex, manager (owner) age, manager (owner) educational attainment, business age, and whether SMEs' staff to get previous training in some environmental issue. Finally, μ_j are fixed-effects for group "j" of the fieldwork team, θ_k are fixed-effects for week "k" of the audit to account for seasonality, and $\varepsilon_{i,t}$ is the error term.

The coefficient β_{itt} represents the ITT, that is the effect of offering the treatment. Below is the rewritten text with corrected spelling, grammar, and punctuation errors:

The coefficient should be interpreted as the average impact of being offered the treatment, considering that some SMEs may have been offered the treatment but chose not to implement the suggested innovations. However, certain caveats are important. The program's opportunity to participate was not randomly assigned. We offered the opportunity to participate in the program to SME managers (owners) who were interested and did not refuse this kind of program. The ITT effects only apply to the population that was offered the opportunity to participate in the program, not to the entire population.

4 Cost-Benefit and Cost-Effectiveness Analyses

SMEs such as restaurants and cafeterias in the hospitality sector are often not aware of innovative practices in environmental management. This makes them an important target for public policy measures aimed at improving the pro-environmental performance of businesses in the economy. This paper aims to report the effectiveness of an intervention based on transfer information, which was designed to enhance the awareness and knowledge of SMEs in reducing waste generation at the kitchen stage. The intervention can have positive implications for SMEs' private returns (operational cost savings) and social returns at the local level (reduction of greenhouse gas emissions).

4.1 Calculation of intervention cost

In this section, we present a monetary calculation of the cost of the framing program. We believe that the Municipalidad Provincial del Cusco can easily implement this intervention. The framing program is a low-cost intervention compared to other public policy alternatives. The intervention includes cost-based activities such as registering firms and installing garbage cans, providing training on food management at the kitchen stage, and offering related materials. Additionally, it involves obtaining official certification.

The first intervention component involves two main activities. Firstly, firms are registered, and waste containers are installed. To register the firms, our staff personally visits each firm to collect contact information for the firm and its managers/owners. Secondly, waste cans are installed to segregate organic waste. Each firm is provided with a brown can of 50 liters capacity. The cost associated with these activities includes preparing registration forms, staff visiting each firm in the field, delivering waste cans, and printing informative materials about waste segregation. As part of the second intervention component, we will provide training on food management at the kitchen stage. This training will cover important topics such as food handling practices, purchasing, storage, production planning, and optimizing food usage. The training will be conducted in a classroom setting and include personnel and logistics training. We will also provide printed materials related to the training. The third intervention component includes offering an official certification to participating managers/owners who completed previous activities.

The cost structure is calculated in the table below. The total cost is USD 76 per SME, broken down as follows: USD 25 for registration activities (33%), USD 43 for training activities (57%), and USD 8 for certification (10%). Assuming a target population of approximately 600 small and medium-sized enterprises (SMEs) located in the Centro Histórico de Cusco, the total cost of intervention is approximately USD 45535. For the Peruvian context, in-person inspection is an alternative public policy intervention to lower waste generation at the SME level. According to Bosch Mossi et al. (2021), this type of intervention can cost around USD 409 per firm to implement.

Table 10: Calculation of intervention cost

Activities	Unit cost (PEN)	Unit cost (USD)	Total cost (USD) Target population N=600 SMEs
1 Registering			
1.1 Personnnel	25	7	4054
1.2 Firms registry	10	3	1622
1.3 Waste segregation cans	41	11	6616
1.4 Local transportation	10	3	1622
1.5 Printed materials	5	1	811
2. Training			
2.1 Training	150	41	24324
2.2 Printed materials	10	3	1622
3. Official certification			
3.1 Printed certification	30	8	4865
Total	281	76	45535

Money exchange rate from PEN to USD: 3.7
Target population: All SMEs located into Centro Histórico de Cusco

4.2 Cost-Benefit Analysis

To test Hypothesis 4, we need to perform a Cost-Benefit Analysis (CBA) that involves calculating the monetary benefits of the program. We consider two types of monetary benefits: private and public. Private benefits refer to the cost savings that result from reducing organic and food waste at the kitchen stage in each trained SME. On the other hand, public benefits are related to the cost savings in public waste collection services that result from reduced organic waste generated in the Centro Histórico de Cusco, which can be attributed to the program's intervention.

We assume that 13.5 kilograms of organic waste is generated per SME per day without any intervention. However, with a -15% effect on waste generation, we expect the amount to reduce to 11.5 kilograms per SME daily. The daily average cost of waste generated is USD 1.5 per kilogram per day as per (Sehnem et al., 2022). To calculate the operational cost savings, we subtract the cost with intervention from the cost without intervention, which results in an estimated savings of USD 91 per SME per month. Apart from direct benefits, we will also consider indirect private benefits. One such benefit is its impact on monthly water bills. The monthly water bill without any intervention is approximately USD 95, and we predict a reduction of USD 17 per SME per month in water expenses.

For public returns calculations, we rely on administrative data obtained from the Municipalidad Provincial del Cusco regarding the cost of waste collection for the public waste collection service. According to this information, the monthly cost per ton of waste is approximately USD 6. Based on estimations, we anticipate that SME restaurants (target

population of 600 firms) in the Centro Historico de Cusco will generate around 243 tons of waste per month without intervention. The related collection cost for the waste generated without intervention is estimated to be USD 1450. By implementing the intervention, we expect a reduction of 15% in this cost, resulting in an estimated cost saving of USD 218 per month.

In the table below, we have summarized both private and public benefits. By comparing the cost of intervention and private benefits, we can see that each USD 1 invested in the intervention generates a return of USD 0.19 per SME per month in terms of cost saving. In terms of public returns, the intervention has the potential to generate a cost saving of USD 218 per month for the Cusco Public Waste Collection Service.

Table 11: Calculation of intervention monetary benefits

Returns	Per SME monthly savings (USD)	Cummulate monthly savings (USD) Target popuation N=600 SMEs
1 Private returns		
1.1 Operational cost	-91	-54614
1.2 Water bill	-17	-10200
2. Public returns		
2.1 Waste collection service		-218

Money exchange rate from PEN to USD: 3.7
Target population: All SMEs located into Centro Histórico de Cusco

4.3 Cost-Effectiveness Analysis

According to Moult et al. (2018), organic waste, particularly food waste, generates greenhouse gas (GHG) emissions. One ton of organic waste can generate 2964 kilograms of carbon dioxide equivalent (CO2e) with methane (CH4) release at 0% capture in landfill. Additionally, transport for waste landfill discharge implies 4kg of CO2e per tonne of organic waste. We assume that waste disposed of at the landfill in Cusco (Botadero de Haquira), collected from small and medium-sized enterprises (600 restaurants and cafeterias), generates around 719 tons of CO2e per month. Furthermore, it generates 971 kilograms of CO2e related to emissions of transport to landfill discharge. When comparing the cost of intervention and non-monetary benefits, each USD 1 invested in the intervention can reduce the emission of 2.36 kilograms of CO2e into the atmosphere at landfill per month. Moreover, the intervention can also reduce the emission of 0.003 CO2e during waste transportation to landfill discharge.

Table 12: Calculation of intervention non-monetary benefits

GHG emissions	CO2e per month
1 Landfill	-107 tons
2 Transport landfill discharge	-145 kg

Money exchange rate from PEN to USD: 3.7
Target population: All SMEs located into Centro Histórico de Cusco

5 Research team

5.1 Principal Investigators

César Edinho del Pozo Loayza

Assistant Professor, Department of Economics, Universidad Nacional de San Antonio Abad del Cusco, Perú. PhD Candidate in Environmental Economics and Natural Resources, Wageningen University and Research. Role: Project leader. Contribution: Principal researcher and project leader, experience in research project's management, financial reports, and general coordination of research grants. Prior research experience in the Peruvian's context, tourism sector and field experiments in Cusco (Peru).

Erick Chuquitapa Rojas

Associate Professor, Department of Economics, Universidad Nacional de San Antonio Abad del Cusco, Perú. PhD Student in Economics, Pontificia Universidad Católica Argentina. Role: Co-researcher. Contribution to Project: Co-researcher, experience in research project's management, financial reports, coordination with stakeholders and other institutions, experience in the design and implementation of public policies al regional and local level. Prior research experience in the Peruvian's context, tourism sector and applied research in Cusco (Peru).

José David López Rivas

Postdoctoral Researcher Development Economics Group, Department of Social Sciences, Wageningen University and Research, The Netherlands. Role: Co-researcher. Contribution to Project: Scientific support, research interest transitions to circular food systems in the global south, including interventions to promote behavioral changes in consumers and technology adoption in producers. Prior experience in the design of experimental research designs (e.g. RCTs).

Francisco Alpízar Rodríguez

Chair and Professor of the Environmental Economics and Natural Resources Group, Department of Social Sciences, Wageningen University and Research, The Netherlands. Role: Co-researcher and Scientific Advisor. Contribution to Project: Scientific support, research interest in applied behavioral economics and working in the interface between environmental and development issues. Large research experience in Behavioral insights

into policy design (e.g. food choices, recycling behavior, nature-based tourism) and design and evaluation of economic policy instruments tackling environmental problems in developing countries (focus is biodiversity and agriculture, climate change, plastic pollution, air pollution).

5.2 Research Assistants

Mischiel Laura Dueñas-Hancco

Master Student of Economics, Universidad Nacional de San Antonio Abad del Cusco, Perú. Role: Field supervision and stakeholders coordinator. Contribution to Project: Fieldwork general supervision, prior large experience in surveyors' selection and training, design of field instruments (e.g. surveys questionnaires). General coordination of the link between research team and local partners and stakeholders (tourism firms, Municipalidad Provincial del Cusco, Cámara Regional de empresas de turismo y hotelería del Cusco, Chefs gastronómicos del Cusco and Consejo Regional de Turismo).

5.3 Fieldwork assistants

Enumerators: Carlos Enrique Bustamante Toledo, Kaherin Yessica Yupanqui Angulo, Monica Lisset Ramos Sullca, Rosa Salinas Arana, Dina Hancco Ayala, Angela Alatrista Calsino, Karin Leslie Gomez Alarcon. Liz Bertha Farfan Querari, Aida Medali Poma Loaiza, midaluz Esquivel Caballero. Carmen Rosa Ccasa Aparicio. Edgar Jonathan Huamn Ichillumpa, Rayahan Edson Palomino Ccahua, Jhossua Blaise Santisteban Meza, Nohemi Esquivle Caballero, Jesus Jhoel Lobaton Diaz.

6 Deliverables

This research proposal aims to contribute to three different areas of study and the ongoing policy debate. Firstly, there is a lack of information regarding the willingness of managers and owners of hospitality and restaurant services to adopt innovative solutions to reduce food waste.

Secondly, the proposal seeks to expand on existing literature by evaluating the effectiveness of interventions related to information transfer in promoting behavioral change toward food waste management.

Finally, the research aims to provide evidence supporting the adoption of pro-sustainability innovations among tourism SMEs in South American countries.

If the informational intervention proves successful in promoting food waste reduction, this could be a low-cost policy mechanism that can be scaled up to other firms in the food services and tourism sector in Cusco, Peru.

7 Calendar

The intervention timeline spans 8 months: 3 for baseline (including the pilot), 3 for training SMEs (including midline), and 2 for endline.

The study is expected to be completed with the following main steps:

(1) Door-to-door census listing of SMEs: May-Jun, 2023.

(2) Invitations to participate in the project: Jul - Ago, 2023.

(3) Pilot: Ago, 2023.

(4) Baseline: Sep-Oct, 2023.

(5) Data processing and randomization: Nov, 2023.

(6) Training intervention: Nov - Dec, 2023.

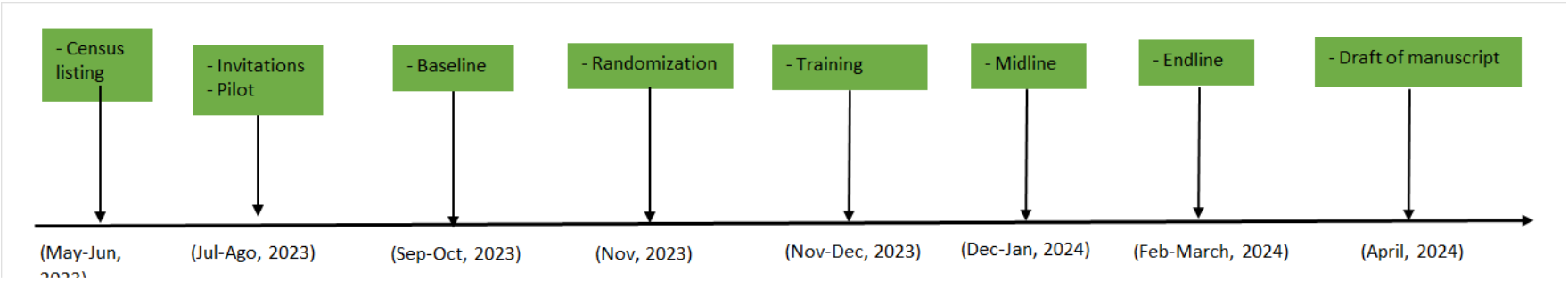
(7) Midline (phone calls): Dec 2023 - Jan 2024.

(8) Endline: Feb-March, 2024.

(9) Draft manuscript: April, 2024.

In the following figure, we present a timeline.

Figure 5: Project's Timeline



8 Budget

In next figure we show a detailed budget:

Figure 6: Project's Budget

Budget Structure	USD	%
1. Profesional honoraria	18520	31%
2. Data collection	18000	30%
3. Treatment: information transfer	8600	14%
4. Travel and reimbursements	5480	9%
5. Equipment rental	0	0%
6. Office cost	3000	5%
7. Publishing cost	3543	6%
Sub-total	57143	
8. Overhead (5%)	2857	5%
Sub-total financed by IDB	60000	100%

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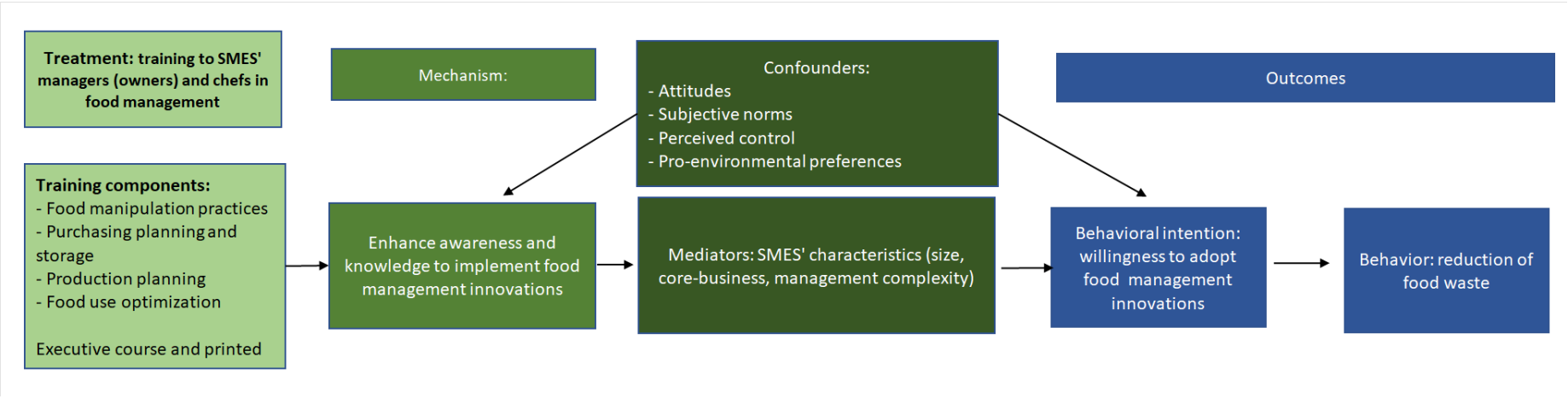
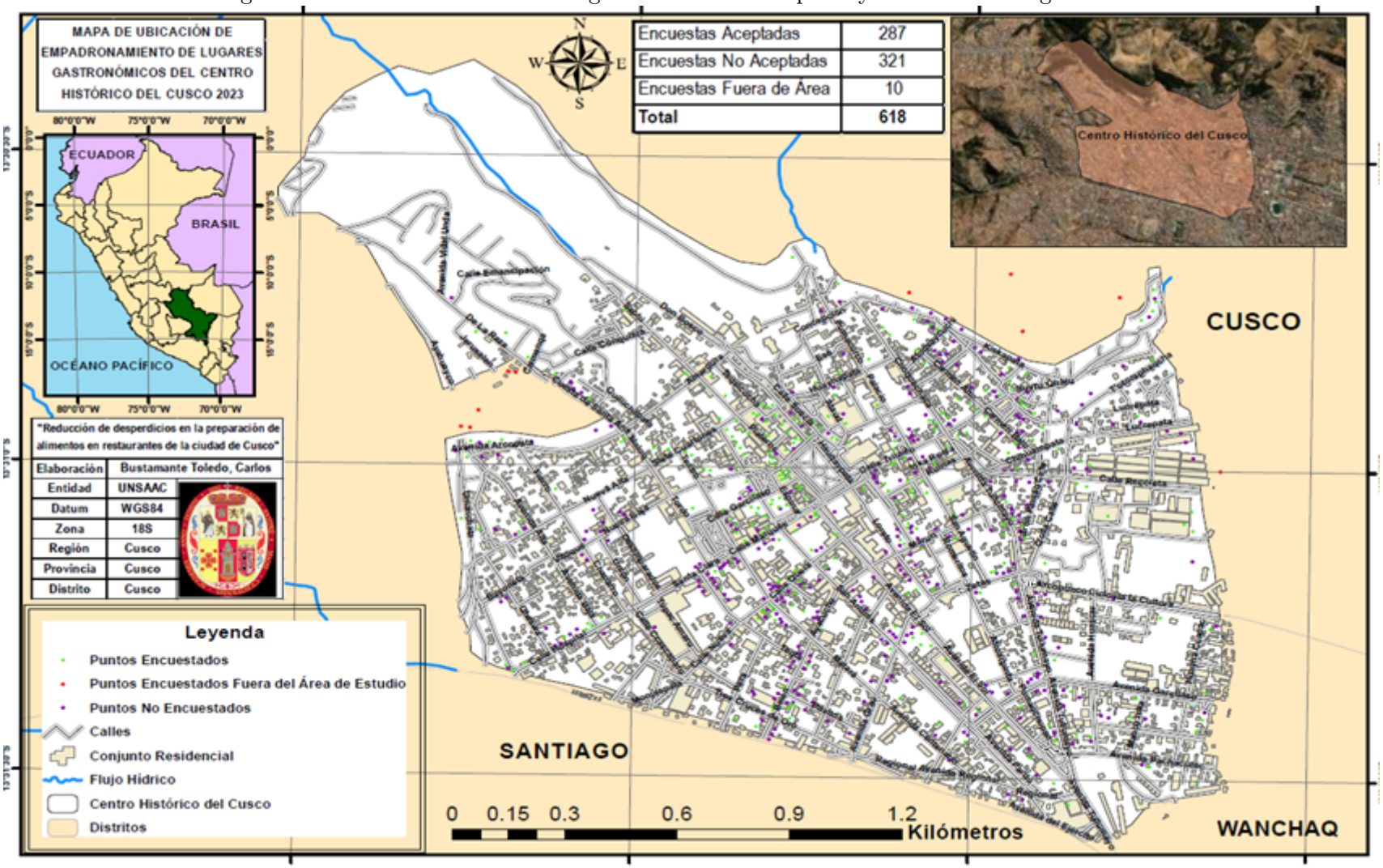
Appendices

Figure 7: Theory of Change



Note: The figure shows the causal chain through our intervention based-on information trasnfer is hypothesized to stimulate a reduction of food waste production by SMEs.

Figure 8: Door-to-door census listing of firms in the hospitality sector of CHC: geo-location



Note: latitude and longitude capture using a GPS app: "Survey GPS Cam"
Source: own fieldwork