

## Perceived Barriers and Benefits to Using Recycling Drop-Off Points in Asunción, Paraguay

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### **Abstract**

For waste management in Asunción, Paraguay to improve, so too must the rate of public recycling participation. However, due to minimal public waste management infrastructure, it is up to individual citizens and the private sector to develop recycling solutions in the city. One social enterprise called *Soluciones Ecológicas* (SE) has deployed a system of drop-off recycling stations called *ecopuntos*, which allow residents to deposit their paper and cardboard, plastic, and aluminum. For SE to maximize the use of its *ecopuntos*, it must understand the perceived barriers to, and benefits of, their use. To identify these barriers and benefits, a doer/non-doer survey based on the behavioral determinants outlined in the Designing for Behavior Change Framework was distributed among Asunción residents. Results showed that perceived self-efficacy, perceived social norms, and perceived positive consequences – as well as age – were influential in shaping *ecopunto* use. Other determinants such as perceived negative consequences, access, and universal motivators were significant predictors of gender and age. SE and other institutions looking to improve recycling can use these results to design effective behavior change interventions.

### **1. Introduction**

Asunción, the capital of Paraguay, is a city of 522,000 residents situated along the eastern bank of the Paraguay River (DGEEC, 2019). It is Paraguay's largest city and main economic hub, as well as the home of the national government ministries, the country's largest port, and the South American Football Federation (Arandu, 2009). It is also a city of immense inequalities, where luxury cars share the road with donkey-driven carts, and multimillion-dollar mansions share neighborhoods with precarious wooden shacks. These inequalities are especially visible in the waste and recycling industries, exhibited by many of the city's poorest rummaging through the garbage of the wealthy for anything of value.

Most municipal solid waste in Asunción ends up in one of two landfills: Cateura or El Farol. Cateura, the notorious landfill in the southwestern neighborhood of the same name, has been in operation for over 35 years (Momarandu, 2015). It was first commissioned after a massive 1985 city clean-up ordered by the then dictator Alfredo Stroessner. With no other land available for waste disposal, Cateura was built right next to a lagoon, close to the Paraguay River, and in a designated wetland – without any impermeable liners or other protective infrastructure (Ultima Hora, 2018). It has been at the center of environmental campaigns in Asunción because of the extent to which it contaminates local waterways, endangers the health of nearby residents, and contributes to global climate change. The other landfill, El Farol, was constructed on the other side of the Paraguay River in 1998 and was designed to receive waste

from more than 25 municipalities (Ultima Hora, 2018). Despite more advanced infrastructure and government oversight, it too has been the subject of environmental scrutiny, having been accused of dumping toxic waste in protected wetlands. While the municipal and national governments have set ambitious goals and enacted some of the strictest environmental laws in the region (Junta Municipal de Asunción, 2014; MADES, 2019), the political will and economic incentives have not been enough to implement public waste reduction or recycling campaigns or to enforce proper waste management at the landfills themselves (ABC Color, 2020).

According to the Paraguayan Ministry of the Environment and Sustainable Development (MADES), the average resident of Asunción generates approximately 1 kg of waste per day. This waste is, on average, 68% organic and 32% inorganic. Approximately 57% of household waste is compostable, and around 19% is recyclable, so only 25% of total waste should theoretically be sent to a landfill (SEAM, 2011). However, no studies detail the prevalence of composting in Paraguay, and barely 10% of the total estimated recyclable materials in Asunción are finally recycled (MADES, 2019).

Much of that 10% was originally sent to a landfill. Because there is no municipal curbside recycling service, residents frequently combine their recyclables with the rest of their curbside waste. Three times a week, the Municipality collects this waste and brings it to a landfill (MADES, 2019), where *gancheros*, people named after the long hooks they use to pick through the garbage, work to recover any items of value (ABC Color, 2011). These *gancheros* then sell the materials they find to local recycling consolidation centers, earning approximately \$4/day while subjecting themselves to unsafe and unsanitary working conditions (Romero, 2013). Recyclables that were not sent to a landfill were most likely picked up from people's curbside trash by other informal recyclers roaming the city who also look for materials to sell to the recycling consolidation centers. These people, too, face unsafe and unsanitary working conditions while also working under the public eye (Recicladores de Base, 2019). Informal recyclers working in this manner are frequently exposed to social prejudices on the streets – accused of being lazy, dirty, and poor.

Recognizing the social and environmental consequences of the current system, as well as an economic opportunity, a social enterprise called *Soluciones Ecológicas* (SE) formed in 2016 with the mission to improve the lives of informal recyclers in Asunción and to increase recycling rates in the city (Soluciones Ecológicas, 2020).

The primary method by which SE accomplishes its mission is through installing recycling drop-off points, or *ecopuntos*, on the properties of local businesses. Approximately 1.5 x 2 x 1 meter in size, *ecopuntos* are metal containers divided into three equal parts for the classification of paper and cardboard, plastic, and aluminum, and they are available free of charge for public use. Businesses pay a monthly fee to have an *ecopunto* on their property, and in exchange, utilize the *ecopuntos* as a form of green advertising and for the disposal of their recyclables. Upon installation of an *ecopunto*, SE contacts the local informal recycler in the neighborhood and gives them a key with which to open the *ecopunto* as well as the rights to all of the recyclables collected inside. This makes the work of informal recyclers much more efficient, as

they do not have to go curbside to curbside looking for valuable materials. Instead, they can arrive at a single location and collect already clean and sorted recyclables. SE also provides the recycler with personal protective equipment, such as gloves and boots, as well as vests, hats, and SE t-shirts. This combination of personal protective equipment and official clothing effectively formalizes informal recyclers' work, resulting in significantly less discrimination on the streets and an increase in their quality of life (Asunción Recicla, 2019). SE currently has 25 *ecopuntos* situated around metropolitan Asunción with the goal of having 100 in the coming years (Carlos Jara, personal communication, 2019).

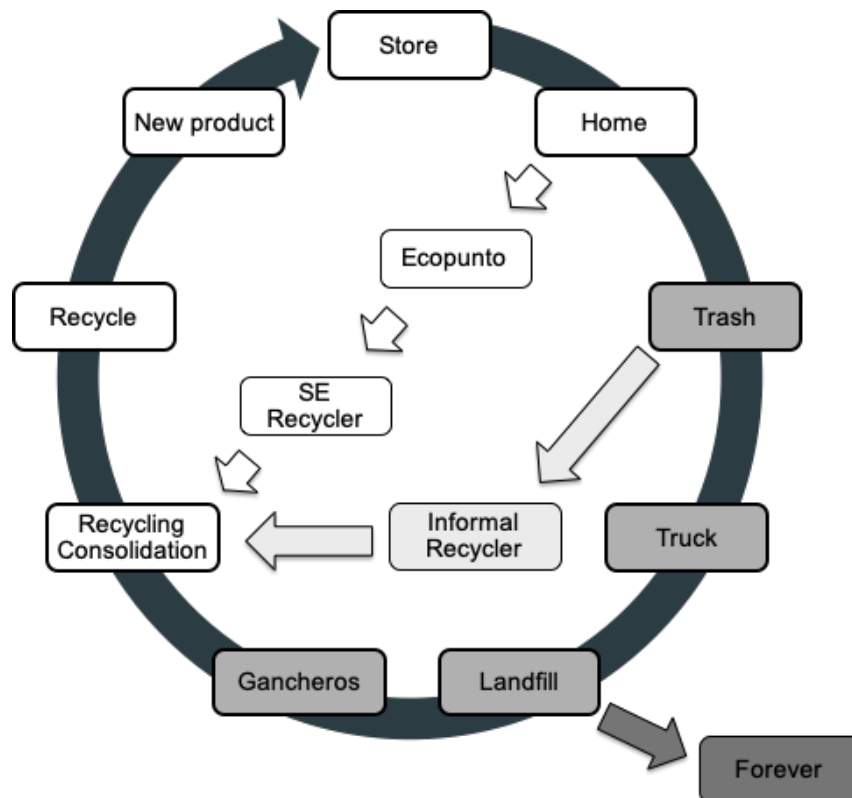


Fig. 1. Possible avenues for recycling in Asunción. The darker the grey, the less desirable the outcome.

Given this desire to expand operations, improve recycling rates in the city, and support informal recyclers, one may ask: *How can Soluciones Ecológicas increase the use of their ecopuntos?* This question, while important, is too big for the scope of this particular investigation, though it can serve as a guide for a more manageable research question. One way to frame this larger question is through Community Based Social Marketing (CBSM), which is a framework used to design sustainable behavior change interventions (McKenzie-Mohr, 2011).



Fig. 2. Steps of Community Based Social Marketing (McKenzie-Mohr & Schultz, 2014)

The steps are as follows: choose a sustainable behavior to promote, identify the pertinent barriers and benefits to that behavior, design strategies to overcome the barriers and enhance the benefits, pilot test those strategies, then implement at full-scale. In the case of Asunción, the sustainable behavior is known: use *ecopuntos*. However, the pertinent barriers and benefits to *ecopunto* use are not yet known – and so forms the research question: *What are the perceived barriers and benefits to ecopunto use?*

## 2. Literature Review

### 2.1 Designing for Behavior Change

To contextualize the determinants that influence *ecopunto* use, it is important to understand behavior change theory. Based on ample evidence that knowledge alone does not change behavior (McKenzie-Mohr, 2011), behavior change theory encompasses many forms, such as the Theory of Reasoned Action (Ajzen & Fishbein, 1980), the Theory of Planned Behavior (Ajzen, 1985), Rosenstock’s Health Belief Model (Jones et al., 2015), and Community Based Social Marketing (McKenzie-Mohr & Schultz, 2014).

While those frameworks are widely cited in academic literature, there is another resource that is not. Designing for Behavior Change (DBC) is a framework created by Bonnie Kittle as part of her 2013 document, *A Practical Guide for Conducting a Barrier Analysis*. This is the framework used by several international development organizations, including the US Agency for International Development (USAID) and the Peace Corps. While one could trace many aspects of DBC to the previously mentioned behavior change frameworks, as well as Davis Jr. & Thomas’ Barrier Analysis Facilitator’s Guide (2004), DBC is more extensive and specific in its classification of behavioral determinants. Because of its extensivity, specificity, as well as its absence from academic literature, this research utilizes DBC to frame behavioral determinants and provide academic insight into a method adopted primarily by practitioners. The following subsections describe the behavioral determinants outlined in DBC and the relevant studies pertaining to those determinants.

#### 2.1.1 Perceived Self-Efficacy

According to Kittle (2013), perceived self-efficacy is 1 – the knowledge, skills, and abilities necessary to perform a behavior and 2 – an individual’s belief that their knowledge, skills, and abilities are sufficient. Research in South Africa (Strydom, 2018), the US (Pearson et al., 2012), and the UK (Tonglet et al., 2004) show that participants cite a lack of knowledge about recycling

as reasons for not engaging in recycling behavior. However, it is important to keep in mind that participants in these studies may have had sufficient recycling knowledge but for various reasons may not have perceived that they did. This differentiation would change potential behavior change strategies.

### *2.1.2 Perceived Social Norms*

This is the perception that people important to an individual think that the individual should perform a behavior. Norms have two parts: who matters most to the individual on a particular issue and what the individual perceives those people think they should do (Kittle, 2013). Social norms are frequently cited in the literature as drivers of pro-environmental behavior, such as energy consumption on university campuses (Mtutu & Thondhlana, 2015), corporate decision-making (Pajunen & Heiskanen, 2012), and recycling (Schultz et al., 1995).

### *2.1.3 Perceived Positive Consequences*

These are the positive things a person thinks will happen as a result of performing a behavior. Positive aspects of a behavior may include direct benefits to the individual, the positive views they have about the behavior, and the perceived positive results of the action (Kittle, 2013). Researchers in New Zealand found that self-satisfaction influences decisions to use reclaimed or recycled building materials (Balazador et al., 2019), residents of Tijuana mentioned helping the environment as their biggest incentive to separate household waste (Aragón Cruz & Córdova, 2019), and residents in the US were less likely to view the cleaning of packaging for recycling as a barrier if they were doing so to save energy (Klaiman et al., 2017).

### *2.1.4 Perceived Negative Consequences*

These are the negative things a person thinks will happen as a result of performing a behavior. Negative aspects of the behavior may include disadvantages to the individual, their negative views of the behavior, and the perceived negative results of the action (Kittle, 2013). In South Africa, research participants frequently listed the dirtiness and untidiness of recycling as a reason for not recycling (Strydom, 2018), perceived negative attributes played a significant role in determining recycling behavior in Missouri (Lindsay & Stratham, 1997), and in the UK, the possibility of pests arose as a significant factor in household composting decisions (Tucker & Spears, 2003)

### *2.1.5 Access*

The access determinant describes the availability to an individual of a certain product or service required to adopt a given behavior, as well as barriers related to cost, geography, distance, linguistics, cultural issues, and gender (Kittle, 2013). Price of disposal services and distance to a disposal facility were important factors influencing e-waste disposal in the midwestern US (Arain et al., 2020), availability of time influenced San Francisco residents' curbside composting use (Wu et al., 2019), and Nova Scotia farmers reported opposition to any program for the

disposal of agricultural plastic waste if the program required taking those materials off-site (Muise et al., 2016). This determinant also includes the perception of convenience (Davis Jr. & Thomas, 2004), which many studies show to factor into decision-making (Zeng et al., 2018; Hua, 2017; Siu et al., 2016; Tonglet et al., 2004).

#### *2.1.6 Cues for Action or Reminders*

This is the presence of reminders that help a person remember to perform a particular behavior, such as signs, memory aids, or key powerful events that trigger behavior change in an individual (Kittle, 2013). Recycling bins placed in the lobbies of residential buildings in Ontario, Canada served as reminders to use recycling chutes more accessible to units (Lakhan, 2016). Studies in various places were able to increase curbside recycling by handing out brochures (Jacobs et al., 1982), taking out newspaper ads (Jacobs et al., 1984), mailing letters (Arbutnot et al., 1976), and calling residents (Jacobs et al., 1984; Schultz et al., 1995). Initiatives that couple reminders with convenience factors are shown to be especially effective (McKenzie-Mohr, 2014).

#### *2.1.7 Perceived Susceptibility or Risk*

This is an individual's perception of how vulnerable or at risk they feel to a problem (Kittle, 2013). A study in the UK found that residents who had a concern for the community's well-being were more likely to exhibit positive recycling behavior (Tonglet et al., 2004), and residents in Missouri who felt they were more at risk to the adverse effects of poor recycling practices were more likely to recycle (Lindsay & Stratham, 1997).

#### *2.1.8 Perceived Severity*

This refers to the belief that a problem, which a certain behavior can prevent, is serious (Kittle, 2013). A study comparing perceptions of climate change between residents of Portland, OR and Houston, TX found that those who were more concerned about climate change were more likely to change their behavior (Semenza et al., 2008), and a study in Missouri found that people who deemed waste management as a severe problem were more likely to engage in recycling practices (Lindsay & Stratham, 1997). Perceived susceptibility and perceived severity are closely related, with the latter describing the problem itself and the former describing the likelihood that an individual will be negatively affected by it.

#### *2.1.9 Perceived Action Efficacy*

This refers to the belief that by practicing the behavior one will avoid the problem or that the behavior is effective in solving the problem (Kittle, 2013). In Tijuana, residents cited the mixing of recyclables with other types of waste by the municipality as their principal demotivator (Belazador et al., 2019), and in China, 62.5% of rural households reported a positive willingness to pay for recycling services (Zeng et al., 2018), demonstrating residents' perception that recycling is an important component of solving the waste problem. Perceived action efficacy is

often linked with issues of susceptibility and risk, because as problems grow, so too do the actions needed to solve them (Kittle, 2013).

#### *2.1.10 Perceived Divine Will*

This is a person's belief that it is God's will (or the gods' wills) for them to have the problem and/or to overcome it. This includes the priority group's perception of what their religion accepts or rejects and perceptions about the spirit world or magic. Numerous unpublished Barrier Analysis studies have found this determinant to be important for many behaviors (Kittle, 2013).

#### *2.1.11 Policy*

This is the laws and regulations at the local, regional, national, or international level that affect behaviors and access to products and services (Kittle, 2013). Pietzsch et al. (2017) found through a systematic literature review of the subject of zero waste that political barriers were one of several factors inhibiting zero waste practices, and Cox et al. (2010) found that public-private partnerships and public intervention campaigns are critical to preventing household waste in the UK.

#### *2.1.12 Culture*

This is the set of history, customs, lifestyles, values, and practices within a self-defined group. Culture may be associated with ethnicity or lifestyle and it often influences perceived social norms (Kittle, 2013). In a study in the UK of the sustainability practices of Somali immigrants, MacGregor et al (2019) found that concerning various environmental metrics, participants were heavily influenced by their previous practices in Somalia, and in Semanza et al.'s 2008 study of Portlanders and Houstonians, local culture was a predictor of environmental values and decisions.

#### *2.1.13 Universal Motivators*

These are factors that have been found to motivate most people, irrespective of other variables. Frequently leveraged in mass media activities such as billboards, posters, and public service announcements, these motivators include love, security, comfort, recognition, success, freedom, positive self-image, social acceptance, peace of mind, status, pleasure, and power (Kittle, 2013). In Australia, feelings of responsibility, pride, identity, and optimism associated with the Great Barrier Reef (Goldberg et al., 2017), and values such as "a varied life" and "freedom" in South Africa (Strydom, 2018) were associated with pro-environmental behaviors.

### *2.2 Drop-Off Recycling*

According to Sidique, Lupi, & Joshi (2013), drop-off recycling refers to programs where individuals deposit sorted recyclables into specially marked containers at designated sites.

These programs are generally cheaper for cities to operate than curbside initiatives because there is no need to invest in transportation infrastructure or labor, as these costs are usually transferred to the public (Saphores et al., 2012). They have also been shown to be the most financially viable option for recycling in areas with low population density (Tiller et al., 1997).

A review of the literature provides examples of drop-off recycling models around the world, each with their differences in ownership, public-private relationships, and infrastructure. In Munich, Germany, residents put their general household waste, paper, and organics on the curbside for pickup and must bring their plastics, glass, and metal to public neighborhood collection sites (Keuschnigg & Kratz, 2017). In Prespa Park, a transboundary area straddling Albania, Greece, and Macedonia, individual villages are responsible for recycling – producing both curbside and drop-off recycling models (Grazhdani, 2016). In Kuala Lumpur, Malaysia, the federal government provides recycling drop-off bins, but a consortium of contracted businesses handles collection and disposal (Zen & Siwar, 2015). In Hampshire, UK, there are over 700 public “bring-sites” where residents can deposit their recycling, but the vast majority only accept one type of recyclable (Hickford et al., 2009). In Kaohsiung, Taiwan, low participation in a government curbside recycling scheme led to the development of localized recycling drop-off points run by communities, schools, and independent foundations. A “pay-back” incentive allowed for local organizations to earn money from the collected recyclables (Chang & Wei, 1999).

Most studies on drop-off recycling deal with questions of access and convenience. In Grazhdani’s study on Prespa Park (2016), recycling rates increased when access to recycling services also increased. In a national survey of US households, Saphores & Nixon (2014) concluded that the most effective policies for encouraging recycling were the presence of curbside recycling services, followed by conveniently located recycling drop-off centers. Economic incentives provided by state bottle refund bills exerted less influence on recycling participation than convenience strategies, which was expected given that convenience is an important factor in recycling behavior (Miafodzyeva & Brandt, 2013). Sidique, Lupi, & Joshi (2010) found that travel costs and the availability of recycling for different materials heavily influence drop-off point usage, providing further evidence that convenience is a driving factor of recycling drop-off success. Hickford et al., (2009) argue that recyclers’ annual driving mileage and environmental impact could be reduced with the implementation of more localized recycling bring-in sites.

Other studies, however, include different behavioral determinants in their analysis. Saphores et al. (2012) investigated the factors influencing the use of e-waste drop-off programs in California and found that prior e-waste recycling experience, strong moral norms, and knowledge of e-waste toxicity, in addition to convenience, factored into e-waste recycling decision-making. Sidique, Lupi, & Joshi (2010) found that in addition to convenience, a person’s familiarity with the drop-off site influenced recycling behavior. Ishimura (2013) found that the normative influences of traditional neighborhood associations and independent community associations affect participation in pro-environmental behavior, including drop-off recycling

usage, but Keuschnigg & Krantz (2018) find that normative influences drive recycling decisions only when the normative expectations are weak.

Through these studies, we find that perceived self-efficacy, perceived social norms, perceived severity, and access (which includes the concept of convenience) influence drop-off recycling use; however, there are other behavioral determinants outlined in DBC that researchers have not included in their studies, or have not found to be statistically significant. The following research includes the remaining DBC behavioral determinants to shed more light on the factors influencing *ecopunto* use in Asunción.

### **3. Research Design**

#### *3.1 Survey Design*

In order to understand the perceived barriers and benefits to *ecopunto* use, a doer/non-doer survey was created, which is a survey method that compares people who engage in sustainable behaviors with people who do not (Kittle, 2013). Based on *A Practical Guide to Conducting a Barrier Analysis*, the survey was divided into two sections: demographic and screening questions, and barrier/benefit questions.

##### *3.1.1 Demographic and Screening Questions*

The first two questions were about age and gender, which, along with other demographic variables such as education and income, have been shown to influence recycling behavior (Saphores et al., 2012; Sidique et al., 2010). Education and income, however, were not included in this survey for concerns of sensitivity and neutrality.

Next came two screening questions. The first question – Have you ever heard of *Soluciones Ecológicas* or their *ecopuntos* before? – controls for knowledge. If a respondent answered yes, they moved on to the next screening question. If the respondent answered no, the survey ended. There are two main reasons for this control. First, for SE to accomplish its goals, everyone in metropolitan Asunción will have some base knowledge of the program. SE has an active social media presence and engages in community outreach initiatives, so as they continue to do so, the number of people who know about the system should increase and this variable will become less important. Second, as cited in the literature, knowledge alone is an insignificant factor in behavior change (McKenzie-Mohr, 2014). People often have enough knowledge of environmental problems, but for various social reasons, they fail to act in ways that solve them – and the same can be said for using *ecopuntos*. Just because someone knows about their existence does not mean they will use them, so instead of simply spreading knowledge, SE must focus on the behavioral determinants that are proven to influence behavior.

The second screening question – Have you ever used a *Soluciones Ecológicas ecopunto* before? – divided the participants into doers and non-doers. If the respondent answered yes, they were

classified as a doer, and if the respondent answered no, they were classified as a non-doer. Depending on their doer/non-doer classification, the survey lead them to similar but slightly different questions.

### 3.1.2 Barriers and Benefits

Regardless of doer/non-doer status, all respondents answered the same first set of questions because they were external to an individual’s *ecopunto* behavior. These questions related to specific DBC determinants and were as follows:

<b>DBC Determinant</b>	<b>Survey Question</b>
Perceived self-efficacy	With your current knowledge, how effective are you at recycling?
Perceived social norms	Do your friends or family recycle at <i>ecopuntos</i> ?
Perceived severity	To what extent is waste a problem in Asunción?
Perceived susceptibility	How likely is it that waste will negatively affect your life this month?
Perceived action-efficacy	How much do you agree or disagree with the following statement? “Increased recycling would improve waste management in Asunción.”
Culture	How much do you agree or disagree with the following statement? “Recycling is a part of Paraguayan culture.”

Fig. 3. Representation of DBC determinants in survey questions relating to perceived barriers and benefits

Then, participants were split into doers and non-doers according to their answers to the screening question. While doer questions asked about a participant’s real experience with *ecopuntos*, non-doer questions were hypothetical, as those participants had never used an *ecopunto* before. Nonetheless, the questions represent the same behavioral determinants and can be compared with one another to identify key differences between people who had used *ecopuntos* before and those who had not. A sampling of the questions is as follows:

<b>DBC Determinant</b>	<b>Doer Questions</b>	<b>Non-Doer Questions</b>
Perceived self-efficacy	How easy or difficult is it for you to recycle at <i>ecopuntos</i> ?	How easy or difficult would it be for you to recycle at <i>ecopuntos</i> ?
Perceived social norms	Do people approve of you recycling at <i>ecopuntos</i> ?	Would people approve of you recycling at <i>ecopuntos</i> ?
Perceived positive consequences	What are the advantages of recycling at <i>ecopuntos</i> ?	What would be the advantages of recycling at <i>ecopuntos</i> ?
Perceived negative consequences	What are the disadvantages of recycling at <i>ecopuntos</i> ?	What would be the disadvantages of recycling at <i>ecopuntos</i> ?
Access	Approximately how far do you have to go to recycle at an <i>ecopunto</i> ?	Approximately how far would you have to go to recycle at an <i>ecopunto</i> ?

Fig. 4. Representation of DBC determinants in doer/non-doer survey questions

Due to administrative constraints placed on the research team, it was recommended that the survey remain free of questions regarding religion, politics, income level, and education level – in order to avoid potential risk of alienating particular stakeholders or groups of people key to the overall effort. While this information would have been valuable from a research point of view, various practical considerations required the research team to avoid potentially sensitive topics. Any follow-up studies independent of these constraints should include these aspects to create a more holistic understanding of the relationships between demographic variables and *ecopunto* use.

### 3.2 Survey Distribution

The survey was created with Qualtrics and distributed through the social media applications WhatsApp and Facebook. For WhatsApp, the survey was originally posted in a *Soluciones Ecológicas*-sponsored group chat. Group members were informed about the purpose of the survey and were encouraged to take it and share it with their networks. It is unknown how many of the respondents shared the survey upon completion. The research team also shared the survey with its WhatsApp contacts, who then shared the survey with other unknown groups. For Facebook, SE published the survey on its page and asked its followers to complete it.

#### 4. Results and Discussion

This survey was conducted from November to December of 2019. In total, 100 people started the survey and 84 finished. Of the 84 complete responses, 75% were female, 23% male, and 1 person did not wish to disclose their gender. In terms of age, 47% were between 18-29 years, 24% between 30-39 years, 10% between 40-49 years, and the remaining 19% were over 50.

Of the 97 respondents who made it to the first screening question, 90% had previously heard of SE and/or their *ecopuntos* while the other 10% were dismissed. Then, of the remaining 87 participants, 52% reported having used an *ecopunto* at least once before, while 48% reported never having used one.

Variable	Frequency	Percent
<b>Gender</b>		
Male	20	23%
Female	63	75%
Unknown	1	2%
<b>Age</b>		
18-29	4	5%
20-29	34	41%
30-39	20	24%
40-49	9	11%
50-59	12	14%
60-69	3	4%
70-79	1	1%
<b>Distance from Residence to Ecopunto</b>		
Under 2 km	35	42%
Over 2 km	29	35%
Unknown	20	23%

Fig. 5. Demographic composition of survey respondents

As there was no specific hypothesis being tested, Chi-square and Fisher's exact tests were run on the data to identify statistically significant relationships between variables. Once those relationships were identified, regression analysis was performed to understand the effect that the various behavioral determinants had on *ecopunto* use, as well as the roles they play with regards to gender and age.

#### 4.1 Effects of Behavioral Determinants

Variables	Behavioral Determinant	P-value
<i>Ecopunto</i> use		
Age	N/A	.044
Friends/family use	Perceived social norms	.013
Location knowledge	Perceived self-efficacy	.002
Support informal recyclers	Perceived positive consequences	.003
Gender		
Recycling efficacy	Perceived self-efficacy	.047
Safety	Perceived positive consequences	.041
Age		
Separate at home	Perceived self-efficacy	.005
Bring to <i>ecopunto</i>	Perceived self-efficacy	.022
Separate at <i>ecopunto</i>	Perceived self-efficacy	.003
Bus	Access	.015
Approval of friends/family	Perceived social norms	.023
Cost	Perceived negative consequences	.05
Dirty	Perceived negative consequences	.022

Fig. 6. Statistically significant behavioral determinants

##### 4.1.1 *Ecopunto* Use

Perceived self-efficacy, perceived social norms, and perceived positive consequences – as well as age – were statistically significant behavioral determinants of *ecopunto* use among survey respondents.

For analysis, age was classified into three categories: respondents 18-29 (Youth), respondents 30-39 (Middle Adults), and respondents over 40 (Older Adults). These divisions were done to most evenly distribute the respondents into groups of more uniform size. 68% of Youth in this study had used an *ecopunto* before, which was significantly higher than the 40% of Middle Adults and 40% of Older Adults. While age is not a behavioral determinant, it may manifest itself through differences in perceived self-efficacy, perceived social norms, and access. Younger people in Paraguay are the first to have received formal environmental education, with the first-ever environmental high school degree being offered in 2005 (ABC Color, 2005), so their perceived recycling abilities may be higher than those of older adults. Youth may also participate in social systems such as friend groups, clubs, or schools, that encourage *ecopunto* use.

To gain a sense of the effect friends and family have on *ecopunto* use, the original question allowed participants to select friends only, family only, friends and family, or neither. Upon analysis, none of those options were statistically significant by themselves, but the combination of all responses with friends and/or family included was. 71% of respondents who had friends and/or family who use *ecopuntos* also use *ecopuntos* themselves, while 74% of respondents who did not have friends and/or family who use *ecopuntos* also did not use them. Feeling social repercussions for not using an *ecopunto* or perhaps receiving encouragement from loved ones for using one may help explain this finding.

Upon analyzing responses to how far away people lived from an *ecopunto*, it became evident that it was not the distance itself that played a factor in *ecopunto* use, but rather the knowledge of where exactly the *ecopunto* was that did. While 91% of doers knew where their closest *ecopunto* was, only 60% of non-doers could say the same. Thus, one could argue that in order to use an *ecopunto*, it might be useful to know where exactly it is.

There was a significantly higher number of people who had previously used an *ecopunto* who selected “support informal recyclers” as a benefit than people who had never used one. 91% of doers selected this as a benefit compared to only 60% of non-doers. The most likely reason for this difference is that people who have never used an *ecopunto* before might not know how the system works and be unaware of the benefits to informal recyclers.

The finding that perceived self-efficacy, perceived social norms, and perceived positive consequences were the most influential determinants of *ecopunto* use among participants is consistent with the DBC framework – which distinguishes these as three of the four most influential behavioral determinants (Kittle, 2013). For someone to engage in a behavior, it would be helpful for them to 1) have sufficient knowledge and beliefs in their abilities to perform the behavior, 2) have a social network that supports their behavior, and 3) believe that something good, whether to themselves or otherwise, will manifest as a result of their action.

#### 4.1.2 Gender

Perceived self-efficacy and perceived positive consequences were statistically significant behavioral determinants of gender. Although gender was not a significant predictor of *ecopunto* use, these results can help inform strategies to more effectively reach different audiences.

There was a significant difference in responses to the question “How effective of a recycler are you,” between males and females. 66% of females said they were effective recyclers with an additional 13% saying they were very effective recyclers. 60% of males, however, reported that they were ineffective recyclers. A simpler comparison of “effective” and “ineffective” recyclers revealed an even smaller p-value of 0.015, indicating that surveyed women felt confident in their recycling abilities whereas surveyed men felt unconfident. Literature investigating the role of gender and environmentalism reveals that men are less likely to participate in environmental activities because they are perceived as feminine (Brough & Wilkie, 2017), which may partially explain the discrepancy in perceived recycling abilities, as women more often choose to practice environmental behaviors and thus become better at them. Another possible explanation is the Paraguayan perception of gender roles. Women have historically been the caretakers of the home and have most often been the ones in charge of household waste management, thus they have practiced some form of waste separation more than men.

Safety, although not one of the most commonly selected positive attributes of *ecopunto* use, was almost exclusively chosen by women. Only 5% of males indicated that safety was a benefit,

whereas 30% of women did. For comparison, the perception of *ecopuntos* not being safe was not statistically significant – no men reported *ecopuntos* to be unsafe and only 6% of women reported it as such. This finding makes sense perhaps due to the risk women take to be outside in Paraguay, such as catcalling and other forms of sexual harassment. An activity deemed as safe may be more attractive to women than for men. Though this variable is categorized as a perceived positive consequence, it could also be considered a dimension of access because of the extent to which different genders feel they could safely utilize the resource.

#### 4.1.3 Age

Perceived self-efficacy, access, perceived social norms, and perceived negative consequences were statistically significant behavioral determinants of age.

The step-by-step process of separating recycling at home, bringing the recycling to an *ecopunto*, and then successfully classifying recycling at the *ecopunto* revealed different statistically significant relationships at each age range. 88% of Older Adults perceived separating recycling at home to be easy, compared to 75% of Middle Adults and 58% of Youth. As for bringing recycling to an *ecopunto*, 60% of Older Adults perceived it to be an easy activity, followed by 50% of Middle Adults and 35% of Youth. However, when asked about classifying recycling at an *ecopunto*, 73% of Older Adults considered it easy, compared to 80% of Middle Adults and a whopping 95% of Youth. Considering social norms and the economic realities in Paraguay, the people who most commonly handle household waste skew older, so their perceived abilities to classify recycling at home corresponds to the frequency with which they perform that action. They also have the economic resources in Paraguay to afford cars, making transportation to an *ecopunto* easier. Younger people are the most environmentally conscious group and receive the most environmental education, so it makes sense for them to perceive classifying at *ecopuntos* as easier than their older counterparts.

Youth in this survey were much more likely than their adult counterparts to take the bus to recycle at *ecopuntos*. 29% of Youth said they utilize or would utilize the bus, compared to only 15% of Middle Adults and 0% of Older Adults. Given that youth have less time to accumulate the necessary economic resources to own cars than their older counterparts, it follows that youth would more frequently take the bus.

Older adults perceived the approval of friends and family as a benefit to using *ecopuntos* more than their younger counterparts. While overall responses to this benefit were low, 16% of Older Adults selected it, compared to only 5% of Middle Adults and 0% of Youth. Perhaps, since older adults do not see using *ecopuntos* as a particularly easy task, they would perceive positive social reception as an enhanced benefit.

Youth perceived the cost of transporting recyclables to an *ecopunto* as a negative aspect significantly more than older people. 66% of Youth reported cost as a barrier to *ecopunto* participation, compared to 50% of Middle Adults and 44% of Older Adults. This again plays into the economic argument that younger people have less disposable income. Also, we know that

youth are more likely to take the bus to recycle, which, if not coupled with other trips, can add up to significant costs. Older Adults were the most likely to view using *ecopuntos* as dirty. 12% of Older Adults had this view, compared to only 5% of Middle Adults and 0% of Youth. It is uncertain why they feel this way.

#### 4.1.4 Other Findings

While the following factors were not determined to be statistically significant, many questions resulted in consensus answers by doers, non-doers, men, women, and people of all ages alike. 98% of respondents indicated that waste was a problem or a very serious problem in Asunción. 89% of respondents agree or highly agree with the statement that increased recycling would improve waste management in Asunción. 88% of respondents disagree or highly disagree with the statement that recycling is a part of Paraguayan culture. 94% of all respondents indicated that helping the environment is a benefit of using *ecopuntos*, and 84% of respondents said that making the city cleaner is a benefit.

57% of people surveyed said they use or would use a private vehicle, such as their car, to transport recycling to an *ecopunto*, followed by 20% who walk or would walk, 13% who take or would take the bus, 5% who bike or would bike, and the remaining 5% was split between rideshare services and “other” forms of transportation.

A common theme throughout recycling literature is the idea that convenience heavily influences recycling behavior, yet this study did not find convenience to be statistically significant. Only 23% of respondents indicated convenience to be a positive aspect of using *ecopuntos*, and only 19% indicated that inconvenience was an issue. Adding to that the insignificant relationship between distance from an *ecopunto* and *ecopunto* use, the results suggest that the concept of convenience does not appear to be on people’s minds when making these decisions. It is uncertain why, however, that this is the case, though one could dedicate an entire investigation to better understanding Paraguayan perceptions of convenience.

#### 4.2 Research Limitations and Recommendations

The biggest limitation of this study was the sample size. 100 people started the survey, 87 made it past the screening questions, and 84 finished. While this number may be enough to gain a partial understanding of factors that influence *ecopunto* use in Asunción, it is not enough to generalize to the city or to perform certain types of statistical analysis. Factor analysis would have been a useful tool to understand the weight that the different behavioral determinants have on behavior, but Pallant (2010) recommends a minimum of 150 participants and cites others recommending even higher numbers. To make a future study more generalizable and statistically useful, it would be recommended to have at least 300 participants.

The survey distribution method also limited the study. Because of time constraints, the survey needed to be sent out electronically instead of in-person, and because of resource constraints, the research team was unable to pay for costly software or services that would have made the

survey available to a wider audience. WhatsApp was chosen because of its ability to reach large numbers of people for free, though the successful distribution of the survey depended completely on the research team's social networks and the participants' decisions to share with their social networks. *Soluciones Ecológicas* also shared the survey via their Facebook page, though success via this method relied on people seeing the post in the first place, which is not a guarantee. Follow-up studies should ensure they have sufficient time to distribute the survey while also securing enough financial resources to utilize different distribution avenues.

Another consequence of the survey distribution method was the audience it reached. By using WhatsApp, an application only available to those with smartphones, there was bias against older people as well as people without smartphones. 45% of respondents were under 30 years old and 81% were under 50. The median Paraguayan age is 29 (CIA World Factbook, 2018), so respondents may accurately represent the current population but not sufficiently represent people who are regularly in charge of household waste management decisions. And despite 94% of the Paraguayan population between 13 and 65 having access to a smartphone (Ultima Hora, 2017), they are still more expensive than more basic phones, thus they are used primarily by people with more economic resources. In general, survey respondents skewed young and more economically mobile, but also more environmentally conscious. The WhatsApp groups that first had access to the survey were associated with either *Soluciones Ecológicas* or other environmentally-focused groups in Asunción. This environmental skew is obvious given the overwhelming opinions on recycling efficacy, recycling culture, and benefits of recycling reflected in the survey. However, there was still an almost 50/50 split between doers and non-doers – further evidence that even environmentalists do not always engage in pro-environmental behavior.

One more critique that one might have about the design is that it focuses exclusively on the barriers to, and benefits of using *ecopuntos* instead of potential strategies to increase their use. In reference to solving the childhood obesity crisis, Robinson & Sirard (2005) propose a solutions-oriented research paradigm whereby researchers investigate solutions to problems instead of their root causes. For example, instead of researching the influence of public safety on children's abilities to play outside, researchers could implement a variety of interventions such as neighborhood watches, block parties, and beautification projects to increase public safety. Researchers can then ask questions that regardless of their results (null, positive, or negative) will inform strategies to increase safety and reduce childhood obesity. This research could have followed this paradigm by directly researching interventions that attempt to increase *ecopunto* use, but did not, principally for lack of time and resources. However, the effort to increase *ecopunto* use does not stop with this research. The next step in the process is to design and implement behavior-change interventions with *Soluciones Ecológicas*, which will indeed follow Robinson & Sirard's recommendations and will lead not only to better recycling practices in Asunción, but also to a better understanding of effective behavior change and recycling interventions.

### 4.3 Implications for *Ecopunto* Use in Asunción

While the purpose of this article is not to go in-depth on potential interventions to increase *ecopunto* use, it may be useful to briefly discuss how the results from this research can inform future strategies. One method for designing effective behavior change strategies is Community Based Social Marketing (CBSM). CBSM utilizes data collected from barrier analyses to inform the following types of strategies: commitments, social diffusion, social norms, goal setting, feedback, prompts, incentives, and convenience (McKenzie-Mohr, 2014). The following table exhibits various strategies that utilize CBSM techniques to directly address the identified barriers and benefits to *ecopunto* use.

Strategy	CBSM Behavior Change Tool(s)	Barrier/Benefit Addressed	Description
Publish maps of <i>ecopuntos</i>	Prompt	Knowledge of <i>ecopunto</i> location	Distribute maps and locations of <i>ecopuntos</i> via social media and advertising to ensure people know where their closest <i>ecopuntos</i> are.
Share stories of informal recyclers	Social norm	Wanting to help informal recyclers	Distribute the stories of SE-affiliated recyclers via social media and advertising to show how SE improves the lives of informal recyclers and increase familiarity with the system
Bring a friend, sign a pledge, and get a prize	Incentive, social norm, commitment	Having friends/family who use <i>ecopuntos</i>	Incentivize people to bring their friends/family to recycle at <i>ecopuntos</i> , have them sign a pledge to use <i>ecopuntos</i> in the future, and in exchange, receive a prize – such as a t-shirt.
Masculine advertising	Social norm	Men feel less confident in their recycling abilities than women	Utilize masculine fonts, images, and messages to increase men’s perceived recycling abilities
Bus fare raffle	Incentive, social diffusion	Transportation costs	Weekly bus-fare raffle for people who upload a picture to social media of themselves using <i>ecopuntos</i> and tag SE in the post.

Fig. 7. Table of strategies to increase *ecopunto* use

## 5. Conclusion

Participatory recycling schemes are key to the success of effective waste management programs, and to ensure high participation in these schemes, it is important to understand people's perceived barriers and benefits to participation. Barrier analysis is a useful tool to understand these components, and the Designing for Behavior Change framework provides a lens through which to look at behavioral determinants. Once influential behavioral determinants are identified, institutions can design strategies around them to overcome barriers and enhance benefits.

A doer/non-doer survey based on DBC principles was administered to residents of Asunción, Paraguay with regards to their perceptions of *ecopuntos*. The findings suggest that perceived self-efficacy, perceived social norms, perceived positive consequences, and age were influential determinants of *ecopunto* use. Other determinants such as perceived negative consequences, access, and universal factors were key determinants of gender and age. Convenience, in contrary to the body of evidence on recycling behavior, was not an influential determinant of *ecopunto* use.

The results from this study will inform *Soluciones Ecológicas* and other organizations in similar circumstances in the design of effective intervention strategies to improve recycling rates. Further research on the barriers and benefits that Asunción residents face would help create a more holistic profile of the city and would further inform intervention strategies.

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