DESIGNING A BUSINESS MODEL FOR AN ENVIRONMENTAL START-UP

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ABSTRACT

Case Description: *The primary subject matter of this case concerns business modeling. Secondary issues examined include environmental issues, recycling, and waste management. The case has a difficulty level of three, appropriate for the lower level. The case is designed to be taught in four class hours (two class sessions: two hours each) and is expected to require two hours of external preparation by the students.*

Case Synopsis: *The case seeks to place the class group in the position of a student with business concerns. His teacher shares the result of research carried out in his town. The subject of the research is the separation and recycling of household waste. From the results of the study, students canvisualize business opportunities from an environmental problem, and propose business models associated with waste management.*

Case Body: *Alfredo Gonzales is a first-year student at Universidad Federico Henriquez y Carvajal in the Dominican Republic. This morning his professor of the subject "Environmental Education" presented in the classroom the results of a study on solid waste carried out by a team of researchers in the city of San Francisco de Macorís[1]. Being this his place of residence, and seeing the results of the study, Alfredo immediately understood that this could constitute an excellent business opportunity. Without thinking twice, he asked his professor to email him the results of the research.*

Keywords: Business Model, Environmental Economics, Recycling, Waste Management, Circular Economy

CASE ANALYSIS

The Situation of Solid Waste Management in the Dominican Republic: The Dominican Republic is a Caribbean country with an area of 48,730 km^2 and 10,169,172 inhabitants (One, 2016). In 2016, the country had a per capita GDP of approximately 17,000 USD (CIA, 2018), and enjoyed the highest economic growth in Latin America in the period 2014-2017, with an average annual growth of 7% (IMF, 2017). The main economic sectors contributing to GDP are tourism, industry, agriculture, mining, foreign trade, and services.

Economic growth, coupled with the displacement of the rural population to large cities, brings with it significant challenges (ECLAC, 2015). In the case of the Dominican Republic, Wolf (2018) points out that this has brought new challenges with environmental repercussions such as the management of protected areas, air pollution, water management and wastewater treatment, and the management of increasing amounts of waste. This waste is managed through the joint collection without classification, and its destination is open-air dumps, a scheme that is not very favorable for the environment (Sánchez, 2010).

For example, in 2007, the country had 356 solid waste landfills, and 64% of a sample of 39 was

classified as Class One, because it uses waste burning, thus releasing dioxins and furans. García de González & González de Disla (2007).

The above is supported by Wolf (2018), who notes that this activity in the country is mainly characterized by the collection and disposal of waste in open-air dumps.

It is mostly in these places where recovery is carried out by basic recyclers. However, this activity is minimal due to the mixture that exists in all the waste. Wolf (2018) also confirms that the burning of waste is a widespread practice in the country.

Wolf (2018) notes that the destination of recovered waste is export, domestic recycling and energy recovery, but the latter, to a lesser extent, because there are currently no source separation activities, so all the waste is collected and transported together.

In the Dominican Republic, the municipalities are responsible for managing municipal waste, which includes operating the systems for collection, treatment, transport, and final disposal of non-hazardous solid waste Ley 176-07 (2007); Ley 64-00 (2000). The Ministry of the Environment and Natural Resources regulates the waste management activities for dangerous waste. The dangerous waste generator is responsible for the cost of all management from storage to final disposal at an authorized site (Mimarena 2017).

The municipalities are also responsible for managing the financing of the activity. The budget of the national government allocates the resources for these activities. Those resources, in most cases, are not sufficient to carry out all the required activities (Mimarena 2017).

Municipalities rely on the private and informal sectors to provide these services. According to Wolf (2018), the private sector consists of companies that treat, recover and export waste, collect and transport, manage landfills, receive and recover usable waste, as well as associations and networks, among others. The informal sector has a diverse composition, including various factors such as grassroots waste recyclers, transporters, and different types of intermediaries. Coordination between the different actors is stressful most of the time.

The Research in San Francisco de Macorís[2]

The research was carried out in the municipality of San Francisco de Macorís, as this is the fourth regional economic center of the Dominican Republic and the head of the Duarte province, located in the northeastern part of the Cibao region, with a territorial extension of 284.5 km^2. The average annual temperature in the area varies between 20.8°C and 30.6°C, with an average annual rainfall of 1446 millimeters. The city has an urban population of 188,118 inhabitants, of which 8% have a high income, 69% medium income, and 23% low income (ONE, 2010).

The objectives of the study were as follows: (1) to quantify the amount of solid waste generated, (2) to classify it, and (3) to know the disposition of people in the municipality towards classification and separation of solid waste.

The sample was determined by quotas, divided into parts proportional to the social strata of the population. Based on this criterion, 64 homes were accessed: 15 low-income, 43 middle- income, and six high-income households.

During the investigation, daily solid waste was collected and weighed in the municipality's homes for seven days, for one week. These guaranteed the inclusion of working days and weekends, where a different consumption pattern might exist. In each house, researchers determined the total mass of waste generated on the day, and then they characterized the waste using the quartering technique. All the resulting information was tabulated in Microsoft Excel spreadsheets.

Researchers also surveyed the household heads to find out their disposition towards classification and separation. Researchers conducted personal interviews to apply the survey.

RESULTS

Table 1 shows the information on the generation of solid waste (in total and per capita), grouped by income level, number of houses, and number of occupants, obtained by weighing the waste of the dwellings contained in the sample of the city of San Francisco de Macorís.

Table 1
CALCULATION OF SOLID WASTE GENERATION

Income level	No. of houses	No. of occ.	Daily solid waste weighing values (kg)							Total one week	Kg - day/ person
			Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.		
H	6	23	28.00	22.30	23.60	37.35	13.41	17.25	32.60	174.51	1.08
M	43	168	184.95	244.00	151.40	150.30	150.30	133.30	158.60	1172.11	1.00
L	15	58	48.35	53.60	42.20	38.30	38.30	43.80	40.80	308.79	0.76
Totals	**64**	**249**	**261.30**	**319.90**	**217.20**	**202.01**	**202.01**	**194.35**	**232.00**	**1655.41**	**0.95**

The results showed that, in the city of San Francisco de Macorís, the rate of solid waste generation decreases with the income level of the population, with a higher generation in the high-income population and lower generation in the low-income population. On average, a rate of 0.95 kg/person/day is generated.

With the results of table 1, it was possible to estimate the costs incurred by the municipality in these activities. For this purpose, (Skoddow, 2014) estimates that municipalities invest on average as an expense for the collection and transportation of solid waste 24.79 USD/ton and 4.02 USD/ton for the final disposal, which totals 28.81 USD/ton as an average rate (quoted in Worf, 2018) quoting. Thus, the estimated totals cost in daily waste management in San Francisco de Macorís is 5,149 USD, which translates into 156,606 USD per month and 1,879,274 USD per year.

The information obtained from the weighing process also made it possible to calculate the mass density of the solid waste generated. For this purpose, the formula Density = Weight / Volume was applied. The substitution of the values resulted in an average density of 248.19 kg/m³, as shown in the calculation of the formula:

$$\text{Density} = 194.97 \text{ kg} / 0.786 \text{ m}^3 = 248.19 \text{ kg/m}^3$$

Table 2 shows the characterization of solid waste generated in San Francisco de Macorís, based on the weighing of waste from each home.

Table 2
SOLID WASTE COMPOSITION

Types of Waste	%
A. Usable	**88%**
A.1 Organic	**68%**
Food Waste	59%
Garden waste	9%

Types of Waste	%
A.2 Recyclables	**20%**
Paper	0.5%
White Paper	0.4%
Newspaper	0.1%
Cardboard	1.6%
Glass	3.5%
White Glass	1.3%
Brown Glass	0.5%
Green Glass	1.6%
Plastic	6.7%
Tetra pack	0.3%
Metals	1.6%
Aluminum	0.3%
Iron (Iron, Copper, Etc.)	1.3%
Other Metals	0.0%

Types of Waste	%
B. Not usable	**4%**
Candy and Cookie Wrap	1%
EPS Foam	1%
Textiles	2%
Others	0%
Inert material (soil, stones)	0%
C. Dangerous Waste (Batteries, oil containers, light bulbs, paint, toilet paper, sanitary towels, and diapers)	**8%**
Total (A+B+C)	**100%**

The results of the classification of waste show that 87% of this can be used, with the organic waste line being the one that generates the most, with 68% of the total percentage. The composition of these organic wastes reveals that 59% of them correspond to food waste.

In the composition of recyclable waste, paper-cardboard, glass and metals have similar percentages, while plastic occupies the highest percentage with 6.75%.

Non-usable waste accounts for four percent of the total. It is worth noting that eight percent of the total waste is dangerous.

Furthermore, the survey made it possible to identify the willingness of heads of households to separate solid waste at the source. As a result, 91% of those surveyed said they were willing to separate waste, while nine percent said they did not have enough knowledge to carry out effective separation at the source.

The survey also asks about the willingness to pay for more effective service of collecting and sorting waste from households. 23% of those surveyed were not willing to pay, claiming in most cases that the municipality should provide this service and that it is its sole responsibility. 28% indicated that they would be willing to pay 50 pesos, 22% a sum of 100 pesos, while 9% the sum of 200 pesos. Only 2% indicated that they would be willing to pay more than 200 pesos. 3% would pay 150 pesos and eight percent 75 pesos.

Other information obtained from the survey was:

1. 57% of food waste is reused by people, mainly for animal feed.
2. 100% of the cans, newspaper, cardboard, and plastic bags somehow end up in the garbage, either by their use as a garbage disposal, as is the case of 100% of plastic bags, or thrown directly.
3. 62% of the glass bottles are used, while the rest is thrown away.

TOWARDS AN ENVIRONMENTAL START-UP PROPOSAL

Back home, and after having analyzed the research several times, Alfredo had many possibilities of an environmental start-up in mind; however, he knew that he had to consider several elements to bring them together in an innovative and feasible proposal. Alfredo was wondering the following questions: How to present a proposal that would valorize the highest percentage of the waste generated in the municipality? How to involve the population in separation and sorting at source? Would it be valid to use some incentive system to motivate the population towards these activities? How to deal with the different actors in waste management in the municipality today, public, private, and informal? Which investors and institutional actors could be interested in financing the initial investment of the project? In response to these questions, Alfredo decided to look for additional information and found the following.

Businesses associated with waste management have had significant potential for success, as demonstrated by the North American company, Waste Management Inc. Nevin et al. (2014). Nevertheless, not only large companies but smaller businesses such as Urban Outreach's organic gardens in the USA proved, through the execution of a solid business plan, the sustainability of such ideas Stephenson et al. (2008).

However, other studies showed that cases such as the start-up Marianas Environmental, LLC, designed for the recycling of vehicle tires Li & Esteves (2009), or Rocky Mountain Fiberboard, dealing with the production of particleboard out of bluegrass straw Lawrence et al. (2005), showed that promising ideas for waste management ventures could face risky beginnings and unknown destinies.

In response to his concern about access to funding sources, the student found that, in the international context, in countries such as the United States, there was a practice of creating non- profit organizations for waste management (Hrncir & Metts 2009), which could be an alternative to creating a for-profit enterprise.

Analyzing funding sources, Alfredo found that environmental start-ups were a priority issue for national and international sources, as shown in Table 3.

Table 3
AVAILABLE FUNDING SOURCES

Funding Source	Origin	Website
Fondos Concursables ACAP	National	https://www.acap.com.do/nosotros/fondos-concursables/
Cree Banreservas	National	http://www.creebanreservas.com.do/Pages/Inicio.aspx
Concurso INNOVAPP	National	https://vicepresidencia.gob.do/vicerdo/innovapp/
Fondo Nacional de Innovación y Desarrollo Científico y Tecnológico	National	https://mescyt.gob.do/programas-especiales/fondocyt/
Development Innovation Ventures (DIV)	Foreign	https://www.usaid.gov/div
Global Innovation Fund	Foreign	https://www.globalinnovation.fund/

One thing he noticed was that, in most of these initiatives, it was an essential condition to present a budget for the idea to be developed, so any business model had to conclude with a financial analysis that demonstrates the viability of the proposal.

Looking at all the gathered information, Alfredo was sure of one thing: the current problem of solid waste management in San Francisco de Macorís was an undeniable business opportunity.

INSTRUCTORS' NOTES

Position in the Course: The case is designed for the course: "*Creation and Management of SMEs*" for the Bachelor of Business Administration. It should be applied later to the topics of identifying business opportunities and business models.

Learning Objectives

1. To raise awareness about the problem of solid waste generation at the local level.
2. To identify socially responsible business opportunities linked to waste management.
3. To generate proposals for business models for small and medium enterprises in the waste management industry.
4. To assess the financial viability of business opportunities linked to waste management.
5. To value the link between applied research, management decisions, and the generation of business ideas.

Suggested Reading

Osterwalder, A., & Pigneur, Y. (2010). Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons.

Questions for the Students

1. Based on the information presented in the case, help Alfredo Gonzalez with business ideas that can solve the problem of waste management in San Francisco de Macorís.
2. Select one of the business ideas and design the business model based on the Canvas model.

Recommendations for Teaching Approaches

1. The professor should circulate the case study in advance to students for reading, analyzing, and preliminarily proposing business ideas generation.
2. On the first day, the professor should provoke a debate on the problem of waste in the country, and its impact on the environment.
3. Then, the professor should form work teams so that students share the business ideas they have generated individually. Students should seek consensus on the most innovative and feasible proposals that provide comprehensive solutions. Teams will take the results to a plenary session for sharing and voting to determine the best ideas.
4. On the second day, the professor will give a blank canvas for the design of the business model. Once the students have completed the design process, each team will present their business model and will receive feedback from the rest of the class and the professor.
5. Although it is not the main objective of this case study to generate a business plan, the professor should stimulate that students make a prior assessment of the financial viability of the business model. In that order, proposals should reinforce the analysis of the building blocks of the canvas: cost structure and revenue streams.

ENDNOTES

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[2]Data used in this case study is adapted from Ureña Meléndez (2017) master's thesis.

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