

Design and Development Plans for “El Parque”



ABSTRACT

The objective of the “El Parque” Interactive Qualifying Project is to measure and understand the visitors’ demographic trends in the green spaces on the Ciudad del Saber campus while also measuring visitor feedback with certain attractions to make meaningful suggestions to the ongoing development plan to increase foot traffic.



WPI



Design and Development Plans for “El Parque” Panama City, Panama

An Interactive Qualifying Project
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Abstract

The objective of the “El Parque” Interactive Qualifying Project is to measure and understand the visitors’ demographic trends in the green spaces on the Ciudad del Saber campus while also measuring visitor feedback with certain attractions to make meaningful suggestions to the ongoing development plan to increase foot traffic.

Acknowledgments

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Executive Summary

Ciudad del Saber (CdS), known in English as The City of Knowledge, is located about fifteen minutes outside of the heart of the city and is home to El Parque, or The Park. This relatively new park comprises green areas, a two-kilometer trail, softball field, baseball field, soccer field, tennis, racquetball, and basketball courts, a driving range, swimming pool, gym, and children's parks (CdS, 2022). It is the prime place for many, if not all, outdoor activities and still has potential for expansion. Parks are often overlooked as a crucial factor in having a happy life. Maintaining the physical health of a population is important and can be difficult in urban areas. The high density of people, pollution, and the lack of opportunities for physical activity are all contributing factors. Green spaces are significant because they can help solve many of the problems that lead to poor health in communities.

The City of Knowledge has created the perfect balance between traditional family homes, modern buildings, and open spaces. They are aware of the benefits that come from having areas dedicated to enjoying the outdoors, however, CdS lacks the information and data to grow El Parque, document current trends, and solicit ideas to attract more visitors. With ownership of El Parque transferring from Kiwanis International to CdS in 2021, only a year's worth of data and information regarding foot traffic in this area is available for reference. Our project group was tasked with implementing a method of collecting data on the demographics of visitors, discovering what the consumers feel the park needs, and suggesting new ways to encourage park use. Since El Parque was created, The City of Knowledge has not received much user feedback from the community. After surveying the community, we reviewed the data and provided concrete suggestions to CdS to improve user experience and park facilities. We concluded that CdS should focus on four main problems when considering renovations: Lighting, bathrooms,

water access, and communication. This project will give The City of Knowledge a new, data-driven perspective on its park and will allow it to expand with efficiency, while also improving visitor experience and raising awareness for the importance of green spaces in an urban environment.

Methodology

Ciudad del Saber already has sufficient ways of measuring how many people are in their park at a given time, however, what they do not have is the means of knowing “who” those people are. They are unable to determine visitor demographics or discern detailed patterns of facility usage through seasons which has left certain facilities under-utilized. Surveys are crucial to understanding these concerns and help “collect information from people for descriptive or predictive purposes” (Leong, Austin, 2006, 114). They can be used to draw conclusions about the entire country or, in our case, a small sample of consumers. Our survey established the following information about the park visitors:

1. Demographics
2. Relationship to CdS
3. Favorite parts of the park
4. Favorite days/times to visit
5. Other parks they visit
6. Suggestions to improve the park

The demographics include age, gender and nationality and the relationships to CdS include workers, residents, visitors, or students. With these six categories, we helped CdS answer their question of “Who is using our park?” as well as achieve other goals like determining the peak user hours and gaining consumer input on how the park can be upgraded.

To maximize response rate, we distributed our survey using three different methods. First, we posted fliers around the City of Knowledge contain QR codes connecting to our survey. Next, we personally went into the park on different days at different times asking the visitors if they would mind contributing to our data collection. Finally, our sponsors sent out an email to all Ciudad del Saber employees and residents containing our survey.

Throughout our project, we have encountered many challenges that have forced us to come together as a team and troubleshoot. The first challenge occurred after our first in person meeting with our sponsors, where we changed the focus of our project from measuring foot traffic to measuring satisfaction and understanding user demographics. Our sponsors also wanted our survey, initially a google form, to be formatted in Typeform, which is an online software used for building surveys and allowed us to skip certain questions based on previous answers. Next, once we posted our fliers around the City of Knowledge, we received a complaint and had to take them down. We replaced the fliers with five small plastic stands which were placed out front of the gym and in bathrooms in the park. The biggest issue that affected our ability to collect more surveys was the lack of people in the park caused by the inclement weather during the rainy season. There were fewer people in the park than there would be during the dry season. We changed our in-person survey schedule, but by week two, there were growing number of repeat attendees that we had already encountered. Our biggest issue overall for in-person data collection was the language barrier between English and Spanish. When asked follow-up questions regarding the survey, it was difficult to understand what was being asked due to limited knowledge of the language and discouraged a handful of people from taking the survey.

Findings

Our survey lasted for 14 days, 10 of those days spent utilizing the manual surveying method and received a total of 173 responses. From the start, we knew that not everyone who completed the survey would be an avid park visitor, therefore, we asked all our respondents “How often do you use the City of Knowledge Park facilities?” We determined that 68.8% of attendees use the park at least once per week, 11.6% being attendees who use the park every day. This question is also where the Typeform program filtered out the people who have not attended in the past 30 days in order to avoid unnecessary questions. In this, 21 of our 173 respondents said that they have not visited the park in the past 30 days, so only 152 respondents answered questions 6-9. Our results could also be representative of more than 173 people due to the fact it was expected for an individual to complete the survey as a representative for the group they visit with. We asked each person who took our survey who they go to the park with. 38 of our respondents (25%) said they attend alone, however, most of the visitors come with family and or friends. In total, 62 respondents said that they come with family and 43 said that they come with friends.

Through our survey, we found that most park attendees were Panamanian visitors to CdS. Most respondents fell between the ages 35 – 44 and were split overall almost evenly between male and female. The most popular services that the park offers were the green areas and the walking trails, and the least popular was the racquetball court that received only 1 vote. We found that the park experiences much higher foot traffic on the weekends than on weekdays and more people come in the evening and in the morning compared to the midafternoon. There were also two main competitors for El Parque: Omar Park and Metropolitan National Park, due to the closeness to more homes and the change in scenery. Finally, we asked the people what they

would like to see improved or added to the park. Of the 173 survey responses we received, 142 respondents took the time to fill out the last open-ended question asking for their opinion on what should be done with the park. Some of the most used words were “bathrooms”, “pool”, “lighting”, “water”, “maintenance”, and “activities.” This highlights the focus of attendees in where they believe improvement should be made.

Recommendations

Based on the criticisms our team received from the park visitors, we established several strategies as to how Ciudad del Saber might improve the experience of the park. Since there is not enough time or funds to add everything the community wants, we narrowed the most important additions down to four simple renovations:

1. We recommend Ciudad del Saber add more lighting to the park’s walking paths and fields. Presently, the only lights at El Parque are located at the driving range, parking lots, and baseball fields during organized games. Without lights, the park is almost in complete darkness once the sun has set. A lot of people use the park in the evenings after work and lights on fields and walkways would allow people to stay later. Lights on the fields would also allow more time slots for teams/individuals to rent fields. Another reason to install more lights in the park is safety. It is important that visitors feel safe when using the park and adding lights would make them feel safer in the evenings.

2. We recommend Ciudad del Saber improve the existing bathrooms in the park as well as add more. There are only two bathrooms in El Parque, located relatively close to each other next to the baseball field and next to the driving range. These bathrooms are not well maintained and close early in the night which led to bathrooms receiving a substantial number of requests to

improve on our survey. Many people mentioned that the lack of bathrooms leads to them leaving the park earlier than intended.

3. We recommend Ciudad del Saber increase drinking water access throughout the park and upgrade the existing water fountains. This problem could be solved by installing water fountains or vending machines throughout the park. Water fountains would be the most convenient option and are free for visitors' use. However, vending machines would bring in revenue and can also provide snacks and more beverage options. The solution could also be taken a step further in the form of a food stand/snack shack. A food stand at the center of the park would be a great quality addition for visitors and would also bring in more money for other projects. The stand could include drinks, snacks, and easily prepared foods and treats: hot dogs, grilled cheese, shaved ice, popsicles, ice cream, smoothies, etc. One downside to installing a food stand is the lack of foot traffic that the park receives during the week. However, this problem could be solved by only fully opening the stand on the weekends, and leaving it closed or partially open during the week. Ideally, as upgrades are made to the park, the foot traffic during the week will increase enough to warrant keeping a food stand fully open even on the weekdays.

4. We recommend Ciudad del Saber improve their communication skills between themselves and their community. Possibly the weakest link in El Parque, the communication between Ciudad del Saber and their visitors needs improvement. While in the field, our team encountered many people who were confused and had questions about reservations, operating times, prices, etc. We were asked, "What time do the tennis courts open?" and, "How do we reserve the basketball courts?" One respondent on our survey even wrote in the free response, "Improve the communication of your products and services. Greater clarity of prices and

possibilities. Until very recently, I didn't know there was a racquetball court, for example” (Translated from Spanish). And although the current reservation system is being revamped, there would be no way for the people to navigate to it. The simplest and least expensive solution that our team proposed was that Ciudad del Saber establish a park website containing all information regarding reservations, operating times, and prices while also having pages for announcements and community forums.

Those responsible for El Parque at Ciudad del Saber are free to implement whatever improvements and/or additions to the park they see fit, however, we suggest that these four subjects remain in high priority. Delegating the extra funds and manpower to making these improvements would cultivate a better experience for people using the parks facilities.

Authorship

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Executive Summary	ML	ALL
Introduction	ML	ALL
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3.5 Changes and Challenges	DC	ALL
4.1 Total Responses	ML	ALL
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4.3 Relationship to Ciudad del Saber	OG	ALL
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Chapter 1: Introduction

Families and friends laughing and chatting as they walk, they are enjoying the sun and the fresh air. Dogs barking and running around in the freshly dewed grass. Birds singing so beautifully and loud enough to distract from the almost uncomfortable humidity. This atmosphere is exactly what one should expect when visiting Panama City's second largest park, Ciudad del Saber's "El Parque." Acting as the bridge between North America and South America, Panama is the destination for many to live, work, or travel. The country is rich with life and culture, and thick forests sprawl for miles. The capital city features a myriad of architectural achievements including the F&F Tower, the Biomuseo, and of course the Panama Canal. However, amidst all the buildings and skyscrapers, there are not many green areas or open spaces for one to enjoy the fresh air.

Ciudad del Saber (CdS), known in English as The City of Knowledge, is located about fifteen minutes outside of the heart of the city and is home to El Parque, or The Park. This relatively new park comprises green areas, a two-kilometer trail, softball field, baseball field, soccer field, tennis, racquetball, and basketball courts, a driving range, swimming pool, gym, and children's parks (CdS, 2022). With the available sporting facilities, they have hosted affiliates of Major League Baseball teams like the Miami Marlins, Milwaukee Brewers, and Los Angeles Dodgers, along with international tournaments in rugby, cricket, softball, basketball, soccer, and baseball. There is also a barbeque ranch for families to gather and cook together at picnic tables. It is the prime place for many, if not all, outdoor activities and still has potential for expansion. Overall, this area was intended to "... fulfill different functions with increasing size and distance from home. Variety of park function is thus achieved through a spatial supply of sites where the

most diverse functions are offered by the largest parks” (Burgess, Harrison, Limb, 1988). This was the fundamental rule for the Greater London Development Plan (1969) which advocated for open spaces within the city. Since El Parque is so large, it offers a wide variety of functions, previously listed, while the smaller “parks” scattered through Panama City are better used as walking or biking trails- the path along the Cinta Costera being a significant one.

Prior to the Industrial Revolution, most urban inhabitants lived in less-densely populated cities coupled with abundant green space on a city’s fringe. The Industrial Revolution caused internal migration from rural areas to cities, which made populations start to swell significantly. For lower-class residents, the resulting environmental and social conditions were less than optimal, sparking a concern in the upper-class community. “One of the outcomes of this concern to improve the urban environment was a call for the provision of urban parks and open spaces.” (Duffield, Walker, 2007). The solution was the expanding of the public’s access to these facilities. Outdoor parks are great places to exercise and socialize, especially in modern cities where close-built apartments leave less private space that is not shared with neighbors. Areas like El Parque provide parents a place to bring their kids to develop friendships in sports and on the playground, while also providing space for others to walk around and get outside. Especially during the pandemic when social distancing became the standard, wide, open-air spaces are needed for communities to get outdoor recreational time while also staying safe.

The City of Knowledge has created the perfect balance between traditional family homes, modern buildings, and open spaces. They are aware of the benefits that come from having areas dedicated to enjoying the outdoors, however, CdS lacks the information and data to grow El Parque, document current trends, and solicit ideas to attract more visitors. With ownership of El Parque transferring from Kiwanis to CdS in 2021, only a year's worth of data and information

regarding foot traffic in this area is available for reference. Our project group was tasked with implementing a method of collecting data on the demographics of visitors, discovering what the consumers feel the park needs, and suggesting new ways to encourage park use. Since El Parque was created, The City of Knowledge has not received much user feedback from the community. After surveying the community, we reviewed the data and provided concrete suggestions to CdS to improve user experience and park facilities. This project will give The City of Knowledge a new, data-driven perspective on its park and will allow it to expand with efficiency, while also improving visitor experience and raising awareness for the importance of green spaces in an urban environment.

Chapter 2: Background

2.1 Importance of Green Spaces

Parks are often overlooked as a crucial factor in having a happy life. Someone who believed this statement unequivocally is Fredrick Law Olmsted. Olmsted is a revered American landscape architect and designer who is credited for significant works such as Central Park in New York City. On top of his architectural achievements, Olmsted was also an advocate for social reform. He would witness upper class citizens enjoy the outdoors on their private property while the poorer people could not. He believed that parks and open spaces should be available to all people and that they "...should be safe and enjoyable, free of distraction, and feature restful scenery to help unbind people from their stress" (Dettman, 2021). Olmsted was a big proponent of public health throughout his lifetime due to the public health crisis at the end of the 19th century. The rapid urbanization of America led to nonexistent sanitation and crowded living that contributed to widespread disease. Olmsted recognized the necessity for urban planning to

preserve public health. This realization led him to urban park design. He saw parks "...not just as pretty places, but also as an antidote to urbanization and poor health" (Dettman, 2021).

In an area where most people reside in the city, the growing urbanization and cramped living spaces leaves many disconnected from the earth and the benefits associated with it. Areas such as El Parque hold the importance of contributing to the feeling of community in a population and supporting the mental and physical health of people.

Maintaining the physical health of a population is important and can be difficult in urban areas. The high density of people, pollution, and the lack of opportunities for physical activity are all contributing factors. Green spaces are significant because they can help solve many of the problems that lead to poor health in communities. There are numerous studies that suggest green spaces have a substantial impact on the physical health of a community.

One such study investigated the relationship between the amount of green space in a household's surrounding area and its perceived general health. The results of the study showed a strong relation between green space and physical health. The authors emphasize the importance of these findings saying, "This research has shown that green space is more than just a luxury, and the development of green space should therefore be allocated a more central position in spatial planning policy" (Maas, 2006). The article goes on to talk about how policy makers should include green space planning in discussions involving the health of the community.

Another study based in Tokyo explores the effect of green space access on physical activity levels as well as morbidity and mortality rates. The study investigated a group of senior citizens grouped by the year they were born and compared the probability of five-year survival to green space and walking trail access. The authors found that, "Living in areas with walkable green spaces positively influenced the longevity of urban senior citizens independent of their

age, sex, marital status, baseline functional status, and socioeconomic status” (Takano, 2002).

The article also emphasized the importance of green spaces and walking trails in urban planning.

The benefits of green spaces are numerous, and of them, mental health is one of the most important. The relationship between green space access and mental health is well documented, and there are various studies to suggest green spaces are necessary for maintaining the mental well-being of a population. One such study conducted in Auckland City, New Zealand examined the relationship between access to urban green spaces and mood disorder treatments among residents over 15 and found strong ties between the two (Nutsford et al., 2013)

		Green space quartile	Age-standardized rate (mean) of anxiety/mood disorder treatments	NZ deprivation decile (mean)	Range of green space measure
Total green space	% within 30 km	1 – Low	1762.2	4.8	8.7
		2	1542.3	5.7	2.4
		3	1573.5	5.5	2.3
		4 – High	1223.4	5.7	8.0
	% within 300 m	1 – Low	1490.6	5.0	1.8
		2	1665.8	5.4	5.7
		3	1517.6	5.7	10.5
		4 – High	1429.9	5.6	81.9
	Dist to nearest green space	1 – Near	1413.2	5.6	44
		2	1591.5	5.6	119
		3	1512.4	5.4	147
		4 – Distant	1587.4	5.0	827

Figure 2.1: Descriptive Statistics summarized by quartiles for each of the measurements of green space (Nutsford et al. 2013)

This study attempts to quantify the hypothesis that if the access to urban green spaces increases, then the average mental health of residents will be improved. In the table above, access to green spaces is measured in three categories (percentage of green space within 30km,

percentage of green space within 300m, and the distance to the nearest green space). Each of these categories is split into quartiles ranging from either low percentage to high percentage or from near to distant. To quantify the effect of these measures on mental health, the age-standardized rate(mean) of anxiety/mood disorder treatments was calculated for each quartile.

The general trend of the data supports the hypothesis that greater access to green spaces has a positive effect on mental health. In both the category concerning the percentage of green space within 30km and the category concerning the percentage of green space within 300m, the lowest quartiles had higher rates of anxiety/mood disorder treatments when compared to the highest quartiles. This trend can also be observed in the category regarding the distance to the nearest green space. The quartile with the closest proximity to green spaces also had the lowest rate of anxiety/mood disorder treatments. This study, along with many others, supports the idea that green spaces can have a significant impact on mental wellness.

The relationship between green space and mental health is further examined in a 2014 study conducted in Wisconsin by the International Journal of Environmental Research and Public Health. In this study, it was determined that, “The associations between green space and mental health are significant and sizeable and persist with different measurement techniques” (Beyer et al. 2014). They found that when controlling for a broad spectrum of confounding

variables (age, gender, employment status, marital status, etc.), more access to green space corresponded with reports of better mental health, shown in figure 2.2.

Green Space Measure	Depression	Anxiety	Stress
25% More Tree Canopy	-1.005 (0.293) **	-0.273 (0.139)	-0.548 (0.261) *
25% Higher NDVI	-1.369 (0.464) **	-0.512 (0.227) *	-0.701 (0.432)
25% More Greenspace (NDVI & Tree Canopy Average)	-1.379 (0.397) **	-0.427 (0.185) *	-0.735 (0.349) *

Notes: * $p < 0.05$; ** $p < 0.01$; §§ Numbers in the table represent the adjusted linear regression coefficient (in depression, anxiety, or stress score units) and its standard errors (in parenthesis)—adjusting for all the variables displayed in Table 2.

Figure 2.2: Difference in Symptoms of Depression, Anxiety and Stress Associated with 25% More Neighborhood Green Space (Beyer et al. 2014)

These two studies both support the idea that green spaces have a positive impact on mental health. Another study, conducted in the Netherlands, investigates the connection between mental health and green space, but also factors in stressful life events. The study proposes that many people seek out nature and activity as coping strategies in tough times. One of the examples used in the paper was the increase in the amount of national park visitors following the attacks on the World Trade Center in 2001 (van den Berg et al., 2010).

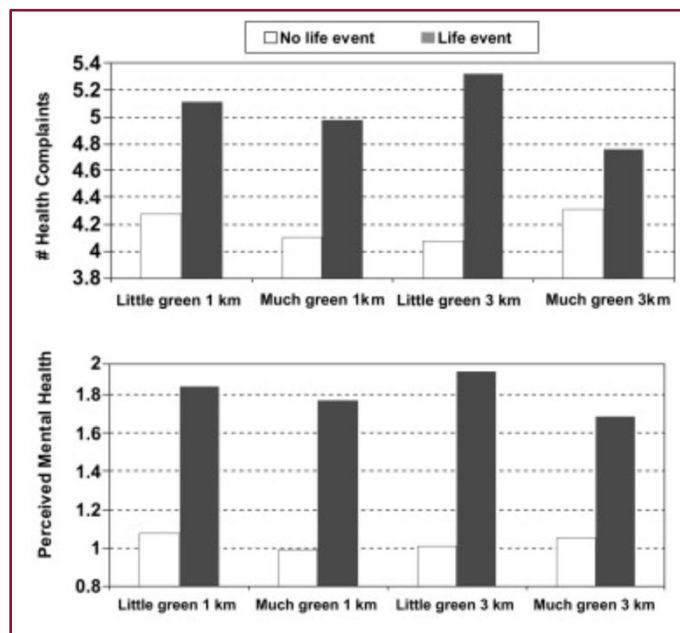


Figure 2.3: Perceived mental health and number of health complaints to green space access considering major, stressful life events.

The table above shows the results of this study relating mental health, green spaces, and stressful life events. There is not any significant correlation between improved mental health and people with no life event displayed in the graphs. However, all three graphs show mental health improvements in people with significant, stressful life events that have access to more green space. These data reinforce the idea that green spaces can be a great coping mechanism for people dealing with high levels of stress.

The connection between green spaces and mental has become reinforced through numerous studies, and according to these studies and many others, it is a well-founded one. The research conducted in Auckland City and Wisconsin are only two examples of how parks are beneficial to the community they serve. These two studies were also conducted in two very different places in the world, New Zealand, and the United States, showing that the conclusions drawn can be the same overseas. Especially in a country like Panama, which has very similar weather conditions and population density to New Zealand. This research suggests that our team's analysis of El Parque will be beneficial not only to FCdS, but also to local Panamanians in urban environments, improving the health of those that use the park.

2.2 Fort Clayton

Ciudad del Saber, the former US military base that was named Fort Clayton, was created in 1919 during WWI and continuously improved through WWII. The main architects of this military base have far-reaching influences, which affected many other sites throughout Panama, and can be identified through the stylistic approaches taken on the military base. Samuel M. Hitt, the designer of the original horse-shoe shaped Fort Clayton was also the architect of the Canal Administration building in Balboa and two wards of the Gorgas Hospital

in Ancon. As an architect, Hitt pushed for beauty in functionality as the incorporation of red Spanish tile remained a common staple throughout his work (Gorgas Hospital, n.d). The buildings from the late 1930s and early 40s have red roof tiles and strongly defined eaves which was a common theme for most buildings in Panama that were constructed during this time. CdS has kept most of these buildings intact due to their belief in the conservation and preservation of the buildings with respect to the history that they stand for, and these buildings continue to function as offices and other purposes. They also wished to preserve the history of the military base by not altering the exterior structure at all the original buildings.

During the mid and late 1900s, there were many years of treaty negotiations between the US and Panama regarding the Panama Canal. The United States believed that they alone possessed the knowledge necessary to operate the canal (Timms, 2018). Finally, in 1977 after a long history of events such as the January 6th flag riots that occurred 13 years prior, Panama was guaranteed control over the canal. Even with this, the full over this area would take 22 years after to finalize. On November 30th, 1999, Fort Clayton was officially transferred to the National Government of Panama, which on the same day, passed the land to the City of Knowledge Foundation (CdS, 2022).



Figure 2.4: City of Knowledge Campus Map (Inveziona 2022)

The green spaces in and around Fort Clayton have evolved over the years, but they have kept the same purpose, to provide an area for recreation and a getaway from the different stresses of the world throughout the history of Panama. The first facilities constructed at Fort Clayton went up in the southeastern corner. The site was bounded by the Cardenas River on the south and the Panama railroad on the west, and at its center, there was a quadrangle formed by barracks and a headquarters building that surrounded a large parade ground. When this fort was first built, the green area that stood in the middle was known as Miller Field.

Miller Field was located to the northeast of an arched road at the top of the quadrangle and was originally used as an airfield for military aircraft (Chevalier, 2022). The field then transitioned to be a common green space and an area of recreation for those who live in proximity which became a significant portion of its existence. Currently, the land that was once Miller Field is the soccer field and golf range making up a large portion of El Parque as it stands today.

Although initially it was primarily a place to work and train, Fort Clayton quickly became a place to live. It was meant to feel as if the US soldiers were not as far away from home, and as a place for families to live comfortably in an effort to boost morale. Soldiers had plenty of opportunities for leisure and friendly competitions during their free time. By 1925, the 1200 men stationed at the fort had a polo team and playing field and two tennis courts. There were monthly dances hosted by each of the local military forts on a rotation, and the soldiers had access to two golf courses on the Pacific side of the isthmus. Athletic competitions between the troops were encouraged by the commanding officers to encourage their men to work as a team outside of canal work, and competitive sports included baseball, track and field,

horse shows, swimming, and tennis.

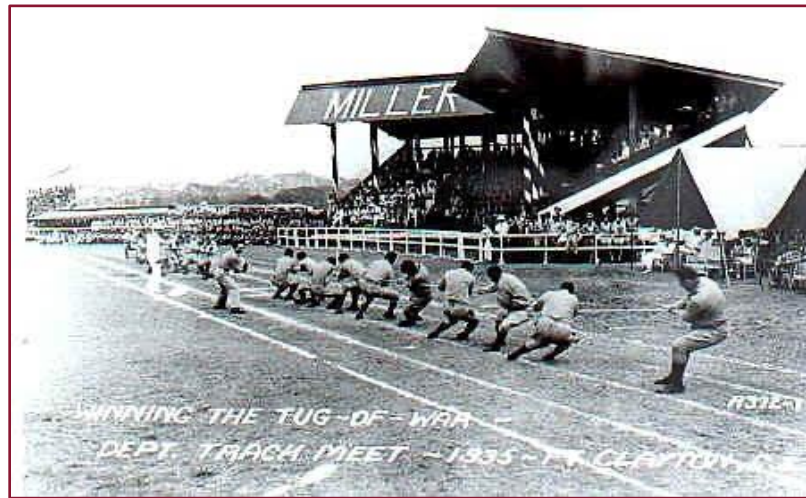


Figure 2.5: Department Track Meet on Miller Field in 1935 (Encscore, 2000)

2.3 The City of Knowledge

Fundación Ciudad del Saber (FCdS) is a non-profit organization that was created in the summer of 1995, after a small group of businessmen from Panama developed the idea in the few years prior. The goal was to turn the former military base into a collaborative space where people with different talents could work together to bring about economic and social development. The purpose was to improve the standing of Panama in relation to other countries through education and sharing of knowledge, a status that was not increased through monetary wealth. CdS now consists of 120 hectares of land and 200 buildings and is the home of the previously mentioned “El Parque.” Their mission is to cultivate an innovative community that will promote social change through science and business. The City of Knowledge is located just a few miles from downtown Panama City and is strategically placed right across from the Panama Canal. They have a wide range of offices, classrooms, and laboratories where wisdom can be shared through people of many backgrounds. There are also several areas for temporary

lodging as well as facilities, meetings, and events (CdS, 2022). Other assets within the city can be separated into four separate categories by the services in which they offer: outdoor and sporting; waste management; commercial activities; and meeting spaces.

Category	Outdoor & Sporting	Waste Management	Commercial Activities	Meeting Spaces
Facilities Offered	<ul style="list-style-type: none"> →Swimming Pool →Racquetball →Softball Field →Baseball Field →Soccer Field →Tennis Court →Driving Range →Gym →Walking Trail →Green Areas 	<ul style="list-style-type: none"> →Collection Center and Waste Management Center 	<ul style="list-style-type: none"> →Bookstore →Veterinary Office →Pharmacy →Bank →Laundry Services →Grocers →Beauty Salon →Urban Markets →Interchangeable Temporary Markets 	<ul style="list-style-type: none"> →Barbeque Ranch →Picnic Tables →Auditorium/Theater →Lecture Halls

Figure 2.6: Allotment of the Four Zones

Fundación Ciudad del Saber has a vision to create a sustainable city. The idea is that the City of Knowledge will soon be a “city that recovers and energizes its own life” (CdS 2022). Already rich with so much culture, it is a land where people can foster their own peace, education, social unity, and cultural integration while respecting its natural environment without the influence of colonization that has hung over the people for nearly the entirety of its history. CdS also wants to keep a competitive and supportive environment that takes from both local and global influences where knowledge is seen as the most valuable form of wealth. We want to ensure that we are gleaning information from multiple demographics and not singling one out

for the sake of convenience. Recognizing how culturally diverse this area is and the heavy influence of colonization in the past pushes the reminder that listening and understanding what would work best for the people here has a potential to be worlds different than what we believe the best option may be.

One of the ways Ciudad del Saber can immerse itself and its guests in so many different cultures is by hosting events. The Panama Jazz Festival is one of the biggest events hosted by The City of Knowledge each year and makes use of most of the green spaces that concern our research. Referred to as “the most important music festival in the country” by the Ciudad del Saber website, the Panama Jazz festival has been hosted by the City of Knowledge since 2011 and drew an impressive crowd of 25,000 at the closing concert and 30,000 at the workshops. The Panama Jazz Festival takes place every January during the beginning of Panama’s dry season. The festival consists of an entire week of concerts, and it also has an educational component that allows young musicians to connect with artists. The Executive President of the City of Knowledge Foundation, Dr. Jorge R. Arosemena said that this festival “helps us achieve our mission of being an innovative community that promotes social change through humanism, science and business” (CdS, 2022). We hope our work will help guide The City of Knowledge in a direction where they can improve the day-to-day operations of the park while also keeping in mind important annual events.

2.4 Previously Collected Data

In the past, El Parque and most of its assets were owned by Kiwanis International which is a “...global organization of volunteers dedicated to improving the world one child and one community at a time” (Kiwanis, 2018). In mid-2021, the City of Knowledge acquired the company and now controls the aspects of the park. Since the acquisition, FCdS has been

collecting data regarding its entire campus. They have a year of information on foot traffic (how many people are on their campus and where) as well as finances (how much money each asset is making).

2.4.1 Foot Traffic

There is a paper on the Public Use of Central Park written with the help of the Central Park Conservancy that uses a manual approach to measure the amount of people who visit Central Park in New York City annually. Through manual counting, as well as surveys and exit interviews, they were able to determine an approximation of the number of annual visitors in the park. "...[I]t is estimated that Central Park receives 37 - 38 million visits annually, by approximately 8 - 9 million different people" (Blonsky, 2011, vii).

Figure 3.1 – Geographic Distribution of Arrivals

REGION ENTERED	Summer	Fall	Winter	Spring	ANNUAL TOTAL	TOTAL VISITS*
North	23%	28%	26%	25%	25%	9.1 million
CPN (110 St)	6%	4%	6%	5%	6%	2.2 million
East Side > 86 St	8%	11%	10%	10%	9%	3.3 million
West Side > 86 St	9%	13%	10%	10%	10%	3.7 million
South	77%	72%	74%	75%	75%	27.4 million
CPS (59 St)	31%	27%	28%	26%	29%	10.6 million
East Side < 86 St	24%	23%	26%	26%	24%	8.8 million
West Side < 86 St	22%	22%	20%	23%	22%	8.0 million
TOTAL	100%	100%	100%	100%	100%	36.5 million

* General park use (excludes large events)

Figure 2.7: Central Park, NY, Geographic Distribution of Arrivals (Blonsky, 2011)

Ciudad del Saber took a different, and more efficient approach to finding these data. They have multiple antennas placed strategically throughout their campus so that they can see where their visitors are at a given time. They have five antennas in total, one at the bus entrance of the campus, one at the car entrance, one in their Cuadrado Central, one in La Plaza, and, of course,

The graph above is another product of the data collected by the antennas, specifically the antenna presiding over El Parque. It is a representation of the times that people typically visit the park throughout the day. During the time of data collection, the month of July 2022, most visitors arrived between 5:00 pm and 11:59 pm, meaning many of them most likely came after work because the Panamanian workday typically ends around 6:00 pm. The late morning and afternoon time slots are the next highest both at about 20%. The lowest percentage of foot traffic in the park occurs between noon and 2:00 pm which coincides with the higher percentage of foot traffic that occurs at La Plaza at that time. Many employees are on their lunch break and go to La Plaza to purchase food. We must consider these data when planning our data collection as well as our data analysis. Data collection methods like surveys will be more effective when there is a higher volume of people, and it will be helpful to know where most of the foot traffic most likely is at a given time.

We are also able to look at the areas that are capturing data with antennas to conclude where most of the parks' visitors originally come from. Figure 2.10 shows a foot-traffic flow chart showing how many people enter the park from each area: 3.3% from the car entrance, 11.2% from La Plaza, and 27% from Cuadrado Central. Although this method is not entirely lossless since most children do not own a mobile device and some people may enter the park from an area without an antenna present, we are still able to see that almost a third of the people who were originally at Cuadrado Central seek to go to the park next. We can assume that when employees or students are finished with their day, they go straight from Cuadrado Central to the park to stretch their legs or get some exercise.

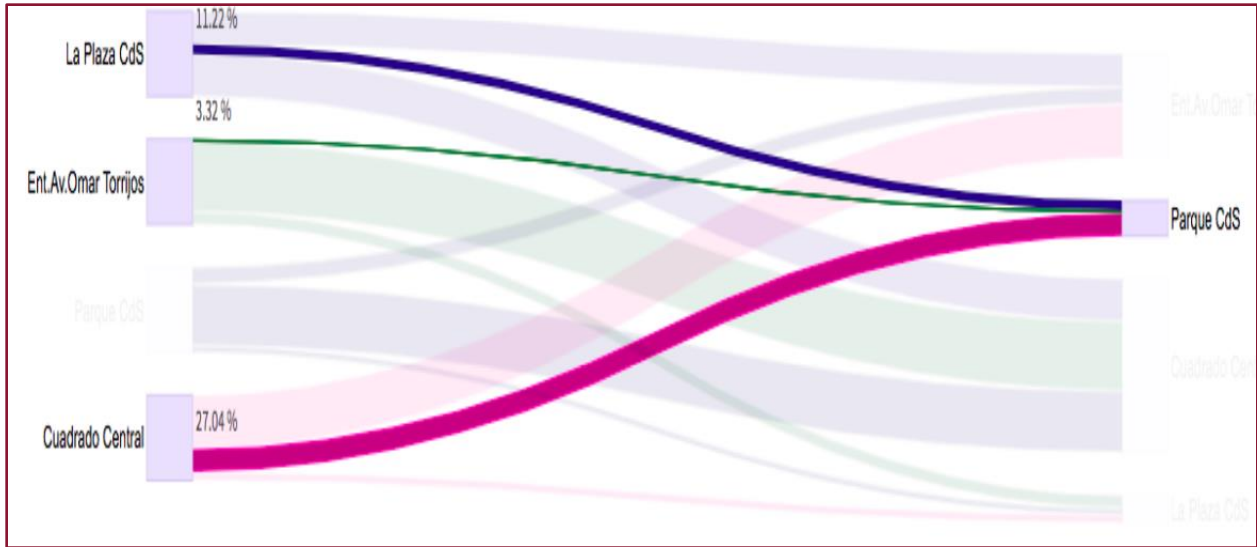


Figure 2.10: Foot traffic flow chart (CdS, 2022)

2.4.2 Finances

The data that Ciudad del Saber has regarding finances and budget show each of the facilities upkeep cost and money they have generated monthly for the last eight months since FCdS acquired the park. While most of these data cannot be shared publicly, Ricardo Eskildsen, the Director of Finance at Ciudad del Saber, shared with us rough estimates for certain areas of interest that we may speak on. For expenses for the year of 2022, Eskildsen says that maintenance costs about \$65,000 and salaries cost around \$215,000, which includes administration and maintenance staff. The annual operating expense (OPEX) for the park is estimated at \$320,000 per year. For annual investments for the park, Eskildsen estimates between \$300,000 and \$500,000 per year, but for 2022, \$300,000 was budgeted for park investments. We were also shown that the pool is the biggest earner along with the racquetball courts. The ping-pong table was the lowest earner with some months having no earnings at all. All the facilities experienced dips in revenue during the wet season when fewer people come to Ciudad del Saber. This information gives us insight on what to focus on when considering where to prioritize our

data collection. Since the pool brings in the most revenue, the people who use it or work at it might have more ideas than others.

2.5 Future Plans

Based on the finance data we were shown, but which cannot be disclosed, Ciudad del Saber plans to commit to an entire revamp of El Parque. They want to make more precise zones based on the activity that happens in each. The plan is to separate the sports and athletics section of the park from the recreational sections. The data we will collect from our own project will give us insight on which zone(s) should be prioritized when it comes time to begin renovations as well as figuring out what to add to the park and where. This information will be relayed to FCdS so they can take our suggestions into account to maximize the overall happiness of the park's visitors.

On top of the park revamp, the park administrators at Ciudad del Saber are also currently in the process of optimizing their reservation process to allow a more user-friendly system. The current system requires the customer making the reservation to message through WhatsApp to confirm their reservation and they then pay when they arrive at the attraction. The new system in progress will allow users to make reservations and pay ahead of time through a software called Salesforce, which is a customer relationship management platform, while also allowing users to make reservations on the weekend which could not be done previously.

Chapter 3: Methodology

3.1 Surveys

Ciudad del Saber already has sufficient ways of measuring how many people are in their park at a given time, however, what they do not have is the means of knowing “who” those people are. They are unable to determine visitor demographics or discern detailed patterns of facility usage through seasons which has left certain facilities under-utilized. Surveys are crucial to understanding these concerns and help “collect information from people for descriptive or predictive purposes” (Leong, Austin, 2006, 114). They can be used to draw conclusions about the entire country or, in our case, a small sample of consumers. Our survey established the following information about the park visitors:

1. Demographics
2. Relationship to CdS
3. Favorite parts of the park
4. Favorite days/times to visit
5. Other parks they visit
6. Suggestions to improve the park

The demographics include age, gender and nationality and the relationships to CdS include workers, residents, visitors, or students. With these six categories, we helped CdS answer their question of “Who is using our park?” as well as achieve other goals like determining the peak user hours and gaining consumer input on how the park can be upgraded. An article published by Ciudad del Saber in 2015 offered insight on we should expect while in the field. Overall, 64% of the population falls between the ages of 15 and 64 along with the 64% of the general population that resides in dense urban areas (CdS, 2022). This information told us a little about the characteristics of the median user of the facilities. Overall, the cultural variety of Panama creates

a melting pot of cultures although the largest group is mestizo, a mixture of indigenous and European ancestry, and most Panamanians identifying as Catholic. Though did not collect the demographic detail of religion it is an influence on the people and may impact variables such as response rates on Sundays.

Conducting surveys also comes with questions of ethics. The survey that we gave to the park visitors includes a question at the very end asking if they would like to provide their email address to enter a raffle. There are people who are paranoid about providing identifying information on a survey, therefore, we made our last question optional. If the respondent did not wish to enter the raffle, they did not have to provide us with their email address, ensuring their anonymity.

3.1.1 Survey Types

The three typical types of surveys are questionnaires, interviews, and telephone surveys. Questionnaires are the most simple and common form of surveying and are what we used throughout the duration of this project. Questionnaires utilize items that address the goals of the project and can be self-administered or given by a trained administrator (Leong, Austin, 2006, 115), in our case, we were the administrators. Interviews are very similar to questionnaires but come without the one potential drawback: respondents, in this case, can elaborate as well as be spontaneous. Interviews allow for the administrator to ask follow-up questions based on the respondents' answers. Some of our questions were open ended, for example, "Which services of the park, if any, would you like to see improved and how?". The open-ended style allowed for respondents to write as much as they want, but it was up to us to interpret the responses and draw conclusions without pursuing a more comprehensive response. Finally, telephone surveys are simply questionnaires or interviews that are given over the phone. Since we operated on limited

time to conduct our research, we relied on questionnaires to collect our data. Although interviews allow for more in depth answers, they are not as efficient as questionnaires in terms of the time required for completion. We also did not conduct our surveys over the phone calls because the one-by-one aspect of this method would similarly be too time consuming.

3.1.2 Methods of Giving Surveys

In determining how to distribute the survey to visitors in a way to maximize response rates, the method that is the most likely to yield the most success involves using a combination of several strategies. Throughout the course of collecting data, surveys were distributed via three main methods: through posted quick response (QR) codes, in-person prompts, and email lists.

Throughout the weeks of our stay in Panama, our group patrolled the park asking a random selection of visitors if they would participate in taking our survey. The Central Park Conservancy team used a very similar method to collect data about Central Park. On top of the foot traffic that they measured, shown in Figure 2.7, they also conducted exit interviews to random civilians within the park. Through these surveys, they were able to conclude many of the same demographics of their visitors that we attempted to look at including age, residency, preferred times to visit, and more. While this approach has proven effective, the Central Park study had a year to collect their data, our team had less than two weeks.

The use of everyday, accessible technology was extremely important in working on this project. As previously mentioned, our project team was constrained by time, therefore, we wanted to maximize responses. In 2020, Panama had a total of 5.83 million cellular devices which is 135% of the population (WorldData, 2020). Given virtually all Panamanian adults have cell phones, we posted QR codes around the City of Knowledge for our two weeks of data collection at locations including the autobus stations, the Cuadrado Central, La Plaza, and El

Parque itself. Anyone with a smartphone was able to scan the flyer which brought the visitor to our Typeform survey asking them a multitude of questions. Their responses were automatically registered into a spreadsheet, effectively determining scale, demographic, and the overall approval of the details and services of El Parque.

We also used an email list consisting of Ciudad del Saber employees and residents. The survey sent through these contact lists were the same as the one prompted on QR codes and in-person interactions, however, Typeform offers different questions following specific answers. It first asked everyone their age, gender, and nationality followed by asking the user if they have visited the park in the last 30 days. If they answered yes, they survey continued as intended inquiring about their favorite parts of the park and their favorite days to visit etc. If they answered no, however, the respondents were automatically directed to a later question asking if Ciudad del Saber's El Parque is their most visited park. This feature eliminated any confusion for users who could not answer questions about their preferences of the park when they had none. It is the methods of online contact lists that carry the heaviest priority when delivering surveys as the cheapest alternative to in-person paper drawn responses and is the easiest in integrating to pre-existing systems to continue to collect data after our time here has finished. Our sponsors had full control over what is said in the email and when it was sent out since it is their people who we were attempting to contact.

3.1.3 Testing Our Surveys

It was important to ensure that our survey is intuitive for all respondents. This way we could be sure that the data we collect are accurate. To accomplish this, we conducted cognitive pretests. These were interviews in which we ask respondents to read and interpret each question. By doing this, we were able to check to see if the interpretations are consistently correct,

consistently wrong in the same way, or consistently wrong in different ways. That information was then be used to make alterations to the survey questions as needed.

We also be administered a series of pilot tests in which we distributed the survey to a small population in the planned survey setting. This way we could quickly analyze the results to check for any skewing of the answers before committing to data collection at a larger scale. These pilot tests were also helpful for gauging how long the survey takes to complete. The time it takes to complete our survey was important because it may affect the response rate of our target population. We concluded that the survey took an average of 3 minutes to complete, which was relayed to visitors when asking them to take the survey.

These pilot tests were also helpful for identifying potential gaps in the data. For example, we could have mailed out 2000 surveys and gotten a great response rate but later realized that nearly half of the respondents did not answer question 7 and that no one completed all the questions. The pilot tests gave us insight as to which questions are problematic, so we could remedy the problem before determining the final draft of the survey that was administered.

Finally, before beginning data collection, we ran the questions by our sponsors. They gave us feedback on what questions they liked and disliked, and what questions to add. We were also allowed to veto some of their recommendations as we saw fit for the good of the project. For example, we were asked to add a question asking the visitor what food they would want served in the park. Since our team thought that question did not flow well with the rest of the survey, we respectfully told the CdS employees that it was not necessary. Since our sponsors had influence on what questions were asked, our final deliverable to them were direct representations of what they wanted to know about their visitors.

3.1.4 Handling Missing Data

The attempt to handle problems with missing data can be a major problem for survey research. Other than altering the questions there are not many effective ways of solving the problem. In some small survey situations, it is possible to recontact respondents to request the missing information. Unfortunately, in our situation, this method was impossible because the only personal information that was collected from our respondents are email addresses, so there was no way to connect specific answers of their respective respondents. We also had a relatively short time window to collect and analyze the data. Reaching out to respondents a second time would have delayed the completion of our survey.

Another more practical way of limiting missing data was by taking advantage of the ‘required’ feature provided by most digital survey software. This feature prevented respondents from skipping over questions, but it did not eliminate the problem completely. Some respondents could have been frustrated by these restrictions and either refused to complete the survey or entered meaningless answers. It could also be argued that forcing respondents to answer questions they would prefer to leave blank is unethical. Most surveys, like the one we conducted, are completed by volunteers. Respondents should be able to quit when they want and opt out of any questions even if we, as surveyors, would prefer otherwise.

3.2 Surveying Strategy

Our surveys were distributed over a two weeklong period and finalized through a raffle to incentivize participation. The raffle consisted of five random winners (eligible by putting their email at the end of the survey) who received a free card game made by CdS, a prize that appealed to the positive marketing and advertisement of the organization. For the two manual

forms of collecting data, the in-person surveys and the posting of QR codes, three zones of Ciudad del Saber in addition to El Parque itself was targeted for data collection- the Cuadrado Central, La Plaza and autobus stations. These three zones were targeted because when considering CdS as a whole, they are the greatest contributors in terms of people traveling to and from El Parque itself once on the premises of Ciudad del Saber as shown previously in figure 2.10. In data collection with the approximate 5,000 people who visit the park specifically on the weekends, as information provided by the park manager, it was our goal to at least reach an overall response rate of 10% of this population which is 500 total responses.

For the in-person surveying, our team identified the highest-traffic times of different facilities to then begin conversations with attendees to scan printed QR codes so that they could complete the survey on their phone at their convenience. CdS staff estimated the busiest times to be after 17:00 to as late as 20:00, while specifically on the weekends the period between 9:00 and 12:00 is similarly busy due to the high volume of bikers and people using the walking trails. Although we had a rough estimate for the busiest times of the park, we wanted to survey throughout the entire day to get accurate results. To do this, we separated our days into three surveying shifts, morning, afternoon, and evening. Half the team took the morning shift, the other half took the evening shift, and we all took the afternoon shift together. In the first week the shifts were at 7:00 – 9:00, 12:00 – 14:00, and 17:00 – 19:00, while for the second week they were at 10:00 – 12:00, 14:00 – 16:00, and 19:00 – 21:00. This schedule allowed us to collect data for all times of the day without staying in the field for 14 hours every day.

For the posting of QR codes throughout the premises of the city, we printed several fliers to place around the four zones. This method was intended to continue data collection in the park that is not dependent on our team's presence. It is important to note that there are no supporting

aspects that prove this method obsolete, the social influence stands to be the demographic that is more likely to scan the code to prompt the survey (Flemming & Bowden, 2009). The demographic that QR codes was more likely to target is described as educated, younger and more technologically comfortable patrons. In the case of our project, this point stands as highly beneficial since an overwhelming majority of attendees were already characterized as such and reliably has stood consistent throughout the maturity of this park. This fact is upheld with most visitors to El Parque consisting of individuals from El Cuadrado Central- an area that consists of a school and office buildings.

The third method of data collection utilized the emailing lists which consisted of employees and residents of Ciudad del Saber which guaranteed the diverse range of people and responses that reflect the overall attitude of all different types of attendees. It was likely through this method of data collection to have a higher rate of responses of people who have not traveled to the park within the past 30 days in which case still provided useful information about El Parque's biggest competitors, such as what services that are offered that are "better" and what we could do with this organization to improve the overall experience of attendees at this park.

3.3 Variables

Throughout the duration of this project, our team had to keep in mind several variables when collecting data. "...An outcome (dependent) variable is influenced by one or more explanatory (independent) variables" (Harvard, 2022). In our situation, the dependent variable was the visitors' age, gender, and nationality, or the number of visitors attending the park. These could all vary depending on the independent variables, one of which being the time of day. Different people will attend the park at different times of day depending on their daily schedules. We kept track of the specific time and day each visitor submits their survey to determine the

peak hours of the park every day and compared it to the already determined peak hours of 5:00 pm – 11:59 p.m. Another independent variable was seasonal changes. We kept in mind that our team visited Panama during their “wet season” meaning park attendance was down due to the weather compared to the dry season. The wet season in Panama is treated the same way that Americans consider fall and winter, so traffic would be more limited. Of course, CdS itself can continue to collect data themselves continuing into the dry season if they find our methods effective. However, our findings only reflected the wet season.

The stakeholders of this project included the surrounding communities, travelers visiting Panama City, and those who oversee the park and Ciudad del Saber as a whole. Ciudad del Saber is run by its Executive President Jorge Arosemena in cooperation with a large team of 160 motivated employees. Of those employees, our project was sponsored by Vivianne Guzman (Digital Transformation Specialist) and Valeria Mendoza (Transformation Projects Specialist) who were our main forms of contact for the duration of our assignment and helped us set up meetings and answered most of our questions. Alejandro Carbonell (Director of Innovation) and Ricardo Eskildsen (Director of Finance) gave our team insight on the data already possessed by FCdS. Tony Hau Ho (Customer Service Manager) reviewed all our surveys and confirmed their validity and May Wong (Park Administrator) granted us access to the park and its services. The main goal of our project was to collect data from the visitors and staff at the park which was very convenient because we collected data directly from the stakeholders. This way our final deliverables were a direct representation of what they wanted. When collecting data, it was important to draw from all types of stakeholders. For example, we needed to make sure we were surveying both local visitors and visitors from outside the country. It was also important to amass data from the El Parque staff, who offered a unique perspective, and who are ultimately

responsible for implementing the improvements to the park. The improvements to the park will bring in more money allowing more expansions to be made to further benefit the community.

The parks' visitors include residents, employees, and students of Ciudad del Saber as well as residents of the surrounding areas and visitors from outside of Panama. Unfortunately, we could not accurately depict the demographic of the surrounding areas because the last Panama census was conducted in 2010. The 2020 census was never administered due to COVID-19, therefore, any data on the demographics of the people of Panama would not have been representative of the data that we collect this year (2022).

3.4 Deliverables

At the Conclusion of data collection, our team had sufficient data to make recommendations and conclusions about the park in its entirety. We provided our sponsors with all the information we collected after our two weeks of surveying the community. We compiled the data into concise tables and graphs to easily make conclusions. From these conclusions, CdS will finally be able to answer their question of "Who is using our park?" which was shown in the demographic section of our surveys. Our team also read through all responses manually to determine the most popular ideas for additions/improvisations given by attendees and patrons. From there, we provided our sponsors with suggestions on what CdS should do to improve the park based on the voices of the community. Finally, we determined the most popular current services that the park offers and advised the park managers on what they should prioritize when considering renovations. The final plans that our team came up with were ultimately recommendations for how Ciudad del Saber can improve their park, therefore, they can choose what to do with these recommendations how they see fit.

3.5 Changes and Challenges

Throughout the course of our project, we have encountered many challenges that have forced us to come together as a team and find the best solution to the problem at hand. The first change that our team encountered occurred after our first in person meeting with our sponsors. The initial interpretation of our project's focus was that we would be collecting surveys to determine the demographic and amount of foot traffic the park was experiencing. This belief changed once we discovered that Ciudad del Saber already had data regarding traffic that was collected through antennas that tracked hotspots via cellphones. The change in focus of our project led to our group reworking our survey to target what the sponsors had wanted which was finding the interests of the visitors and seeing what services they would like improved/added regarding the park.

After our team revised the survey, we proposed a finalized google form to our sponsors. Our sponsors proposed that we use their preferred survey software Typeform which allowed us to skip certain questions based on the previous answer given. After our meeting with our sponsors, we sent our survey via email to be recreated on Typeform, however this entire process set us back one week from our initial planned date of in person surveying. Combined with our already limited schedule, the setback put our group in a much more challenging position to get our surveys and paper done. The new schedule that was heavily influenced by the survey setback had left us expecting to submit a final draft of our paper the day after survey results were finalized.

Once we had our surveys finalized by Ciudad del Saber, our sponsors put the link to the survey on quick response codes and printed out flyers for us to hang up around the park. The flyers, which again steered from our original plan as the flier used was one created on the spot by

our team of sponsors and was decided on in exchange for the flier that had already been made and presented by our group, were hung with tape. An issue occurred only two days after when our sponsors relayed to us that someone had reached out to them on the behalf of unprofessional fliers which then led to them having to be removed. To remedy this, the sponsors printed out smaller version of the flyer to be placed in a total of five small plastic stands. These stands were placed out front of the gym and in bathrooms in the park.

The biggest issue that affected our ability to collect more surveys was the lack of people in the park caused by the inclement weather during the rainy season. There were less people in the park than there would be during the dry season. We changed our in-person survey schedule, but by week two, there were growing number of repeat attendees that we had already encountered. Our biggest issue overall for in-person data collection was the language barrier between English and Spanish. When asked follow-up questions regarding the survey, it was difficult to understand what was being asked due to limited knowledge on the language and discouraged a handful people from taking the survey.

With that being said, the visitors of the park were very understanding of what we were trying to accomplish. We didn't encounter anyone who was annoyed or offended by our methods of in person surveying, nor did they seem angry that we were asking them to take time out of their day to complete our survey. Some people did deny us when we approached them, but we respectfully gave our thanks and moved on. Despite all the hurdles we faced, our methods worked extremely well and produced very interesting results.

Chapter 4: Findings

4.1 Total Responses

After our survey being live for 14 days, 10 of those days utilizing our manual surveying method, we received a total of 173 responses. From the start, we knew that not everyone who completed the survey would be an avid park visitor, therefore, we asked all our respondents “How often do you use the City of Knowledge Park facilities?” We determined that 68.8% of visitors use the park at least once a week, 11.6% being visitors who use the park every day shown in figure 4.1. This question is also where we filtered out the people who do not use the park so that we did not ask them unnecessary questions. 21 of our 173 respondents said that they have not visited the park in the past 30 days, so only 152 respondents answered questions 6-9.

Our results could also be representative of more than 173 people. We asked each person who took our survey who they go to the park with. 38 of our respondents (25%) said they go alone, however, most of the visitors come with family and or friends, meaning some answers may represent an entire group of people. 62 respondents said that they come with family and 43 said that they come with friends. Only 5 replies said that they visit the park with their club or organization and others said that they come with their coworkers or their dog.

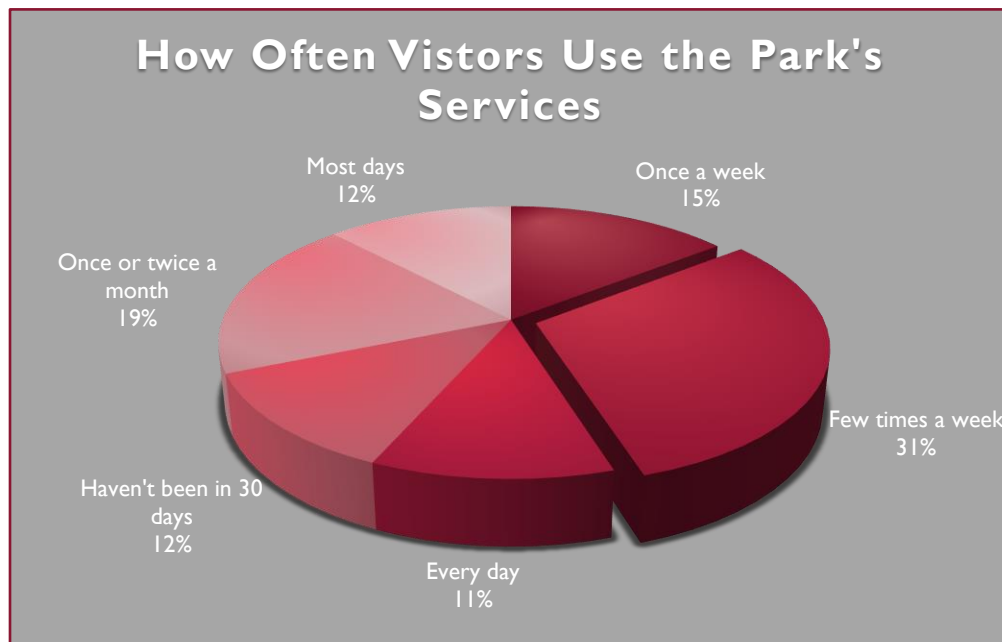


Figure 4.1: How often visitors come to El Parque

4.2 Demographic

Of the 173 responses to our survey, the highest age range found in the park was 35-44 years old with 55 responses followed closely by 45-65 with 51 responses. The 35-44 range was significant because they had the most responses while also having 11 less years of range compared to the 45-65 range. The 18 under and 65+ ranges totaled a combined 5 responses which puts an emphasis on the fact that the feedback for the park came from primarily middle-aged individuals. Since the survey was taken mainly by middle aged individuals, the feedback might not be representative of the community. Since we were unable to find data of the local age demographic, we cannot say if the age spread was an accurate representation of the community demographic.

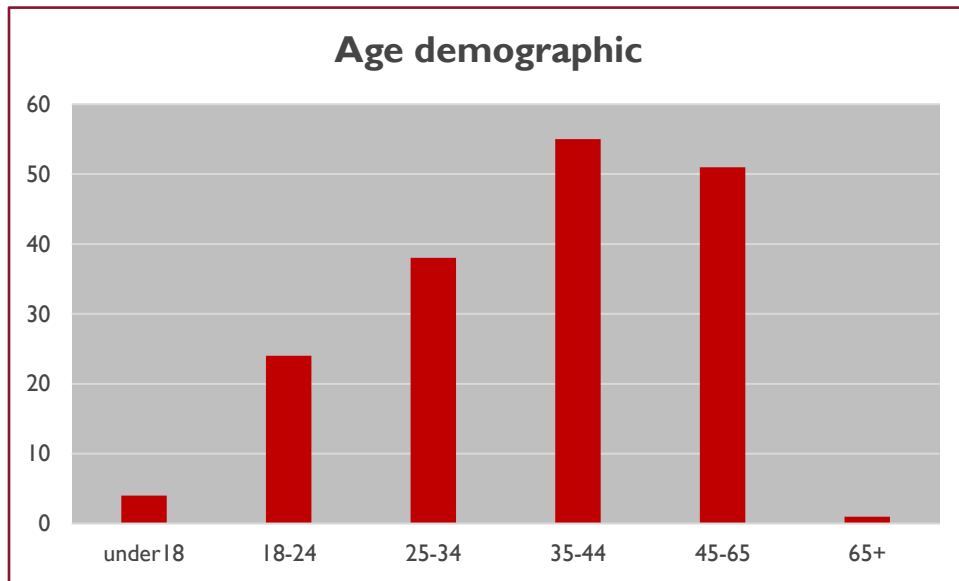


Figure 4.2: Age demographic of El Parque Visitors

Nationality was broken up into Panamanian or other which allowed users to fill in their nationality manually. Out of the 173 responses, 123 were Panamanian which was 71% of the total responses. The second and third highest nationalities were American with 11 (6.4%) and Venezuelan with 10 (5.8%). These data were expected since we were surveying in Panama nearby a small concentration of students from the United States.

Gender was broken into male, female, other, or prefer not to say. Female was the leading response with 100 responses (57.8%) and male had 73 responses (42.2%). Again, since we do not have info on the demographic of the surrounding area, it is impossible to know if the data is representative of the community as a whole or just for park visitors within our two weeks of surveying.

4.3 Relationship to Ciudad del Saber

In analyzing the type of visitors that frequent El Parque, there were two categories of attendees that comprised more than 80% of visitors. Ciudad del Saber, as it serves as a living

space just as it serves as a place of work, maintains consistent foot traffic through El Parque due to these two categories.

The visitors that attend El Parque are the largest source of foot traffic which makes up more than half of all recorded people during the time of data collection. This category consists of 52.6% of all attendees and therefore offers the insight of most foot traffic coming from people who are traveling to this area for the specific services that it offers. The second largest category of attendees is people who work at Ciudad del Saber, which is a category of people that make up a reliable source of foot traffic who attend at predictable hours that can be seen as lunch time and after work. For the people who identify as employees within CdS total 33.3% of all visitors, which shows that people who spend their time working within this facility also spend time in this area before and after their workdays. It is in this demographic where Ciudad del Saber can identify where to focus advertisement, to therefore increase overall foot traffic.

4.4 Most Popular Services

When our team first got into the field and began our observing and surveying, we expected the most used services to be the green areas, walking trails, swimming pool, and racquetball courts with the soccer fields and gymnasium following close behind. These assumptions come from the fact that we were told that the pool and racquetball courts were the two largest earners for profit per year, and the green areas/walking trail hypothesis simply came from our surveillance of the park. The 6th question of our survey asks, “What area(s) of The City of Knowledge Park have you used in the last 30 days?” allowing the respondent to select one or more of the services that El Parque offers. The final numbers half reflect our expectations, shown in figure 4.3.

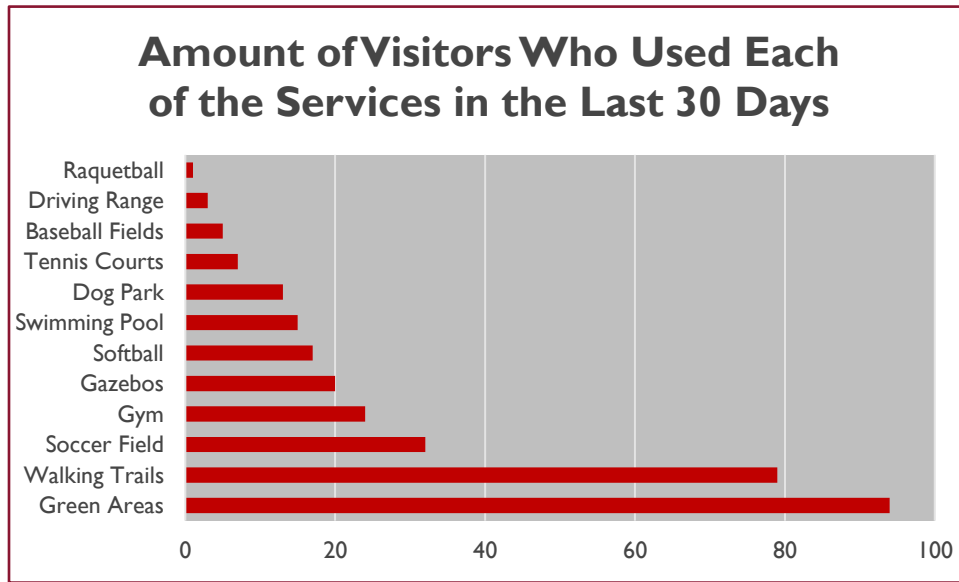


Figure 4.3: Number of visitors who used each service in the last 30 days

We were correct in assuming that the green areas and walking trails would be the favored services of the park, receiving 61.8% and 52.0% of votes respectfully. The soccer field was next, as expected, with 21.1% of responses followed by the gym with 15.8%. What we did not foresee was the racquetball courts being the least popular of all services. Of the 152 people that answered this question, only 1 responded that they used the racquetball courts within the last 30 days.

These numbers could be a result of a few different variables. First, the walking trail is where we surveyed visitors the most, since people taking a leisure stroll were most likely to not be bothered by us asking if they would take the survey. Visitors who are in the middle of a tennis match, swimming workout, basketball game, etc. are less likely to take time to answer our questions. Next, our team had to take down our flyers, so the people who did use those conflicting services could not complete the survey on their own time. Finally, during our two weeks of data collection, the swimming pool was shut down for several days for renovation, therefore, we could not survey the swimmers as much as we would have wanted to.

4.5 Busiest Days and Times

After day three of manual surveying, it was clear to see that weekends brought in a lot more visitors than the weekdays. Our team began surveying on a Saturday and gathered a total of 25 responses on the first day when it was cloudy and gloomy. We received 20 more responses the next day (Sunday) and our team had high hopes for the next two weeks. Once Monday rolled around on our first week, we realized that weekends are much busier after we got only 12 responses that day. In total, the weekends averaged 20.7 responses a day while the weekdays only brought in an average of 6.8 responses a day. Although we observed that weekends were obviously busier, our survey results did not reflect it. Question 7 on our survey asks, “Do you typically use the City of Knowledge Park during the work week, weekends, or both?” 43.4% of respondents answered “both”, 30.3% answered “During the work week”, and 26.3% answered “weekends.” The responses to this question show the visitors use the park on the weekdays more than the weekends, which was strange and could have been a result of user error. It is possible that some respondents misread the question and/or answers and selected the wrong choice, but it is unlikely. Weekends being busier is what we would expect to see since most people do not work those days, so they are less tired and have more free time.

We found that the busiest times for the park corresponds with what CdS gathered with their antennas, shown in figure 2.9. Question 8 on our survey asks, “What time of day do you usually use The City of Knowledge Park?” Most people answered, “During the afternoon/evening (5pm-11:59pm)” receiving 38.2% of responses and 34.9% of respondents said that they use the park “In the morning (4am-11:59am).” Less people use the park “During the day (12pm-4:59pm)” collecting only 27.0% of responses. These data show exactly what we predicted; that most visitors would be either at work or eating lunch mid-day, and the busier times would be

in the morning and evening when people go before or after the workday begins. The numbers also represent our observations while surveying. On the weekdays, we saw little to no people in the park in the afternoon while La Plaza was very busy. There were more people present in the park when we would go out in the mornings and evenings.

4.6 Other Parks

The 10th question of our survey is multiple choice yes/no response that asks the user “Are there any other parks that you visit regularly?” This is a question that all respondents, regardless of previous answers, were prompted with. A majority of our respondents, 57.2%, replied with “No” signifying that El Parque was their main park, which means most visitors are enjoying their experience and returning regularly. For the people that answered “Yes” to this question, the specific question that followed was a singular short answer that asked which parks they visit more frequently and why? As the two main competitors, Omar Park and Metropolitan National Park, are described it can be seen that El Parque melds the main services of each of the parks to create an environment where there is a little bit of everything.

4.6.1 Omar Park

Omar Park, El Parque’s biggest competitor, which 21.6% of visitors who answered “Yes” specifically report attending, rests in the heart of Panama City which offers itself as a much closer alternative to our target demographic that resides in the densely populated city. This park is smaller than half the size of El Parque with 50 hectares of land compared to the 120 that hold our project area; however, this is expected since Omar Park is placed directly in the center of the city. However, even with this significant size difference, Omar Park boasts a 3.2 km walking trail in comparison to the 2.2 km one that snakes through El Parque (Parque Omar, 2022).

Through that park's trails, the services such as playgrounds and sports courts are free to use recreationally which is one factor that El Parque cannot offer and is therefore appealing to be able to occupy that space, free of charge and without reservation that needs to be made in the week prior (My Guide, 2022). The last notable influential service of Omar Park is the public library that allows patrons to attend an air-conditioned environment and read books free of charge during weekdays, disregarding the fee required to rent a book (BiNal, 2019). It is the presence of these services that are offered free of charge, in an environment closer to the living spaces of our target demographic, where people desire to attend this park over El Parque.

4.6.2 Metropolitan National Park

The Metropolitan National Park is not as large of a competitor for the attendees of El Parque as Omar Park is, with only 6.8% of visitors stating that this specifically was the other park that they travel to. Despite this, the specific services and benefits of attending this park in comparison to others are worth mentioning because they help us see how El Parque compares and eventually could acquire more attendees. The Metropolitan National Park is a walking trail that stretches through the 232 hectares of land that it sits on and requires an entrance fee of a maximum of \$4 (MadAboutPanama, 2022). This park is seen more as a hiking/walking trail attraction where one can explore the biodiversity of Panama through educational posts along the trail and high points to admire the view. It is in the few yet very developed and well-portrayed services of this park where attendees who specifically are interested in hiking and exploring biodiversity can visit.

4.7 Suggested Improvements

El Parque is in place for the community's use, so it is important to take the feedback from the community into consideration when deciding on what renovations or new additions to add to the park. Of the 173 survey responses we received, 142 respondents took the time to fill out the last open-ended question asking for their opinion on what should be done with the park. This number was much higher than expected and shows how passionate the community is about improving the park. Once the survey ended, we translated the responses and ran them through an online software that provided us with word frequency and trend information. Some of the most used words were “bathrooms”, “pool”, “lighting”, “water”, “maintenance”, “dog”, and “activities”, which correlated well with observations our group made while out surveying and browsing responses

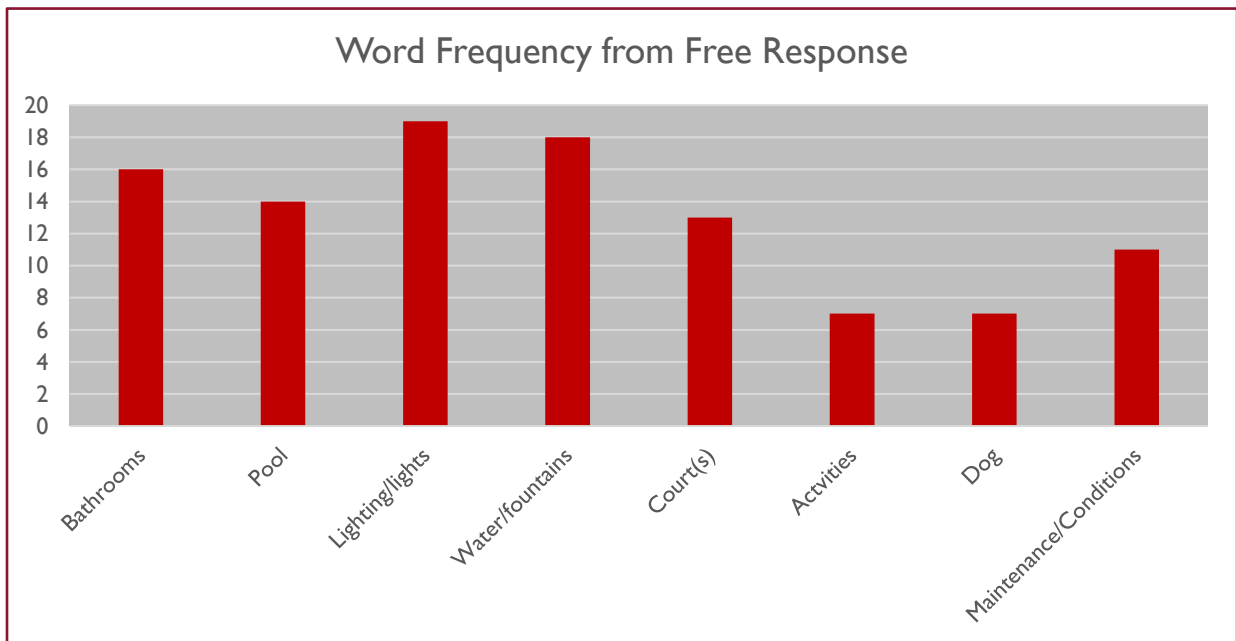


Figure 4.5: Word frequency from question 11 of survey

One of the most common criticisms of the park concerned the abundance and quality of bathrooms. Currently, there is only one bathroom in the park located behind one of the baseball fields. The park was described as dirty, run down, and in need of maintenance. Many people wanted to see the bathroom renovated and cleaned more often. Respondents also felt that the size of the park warrants more than one bathroom. One of the responses was, “More bathrooms are needed in the park and that the bathrooms that exist are in better condition. It would also be invaluable if the park trail was lit for a few hours during the early evening hours, as this is a great time for exercise.” This quote was one of many asking to see more, higher quality bathrooms. It also brings up another common criticism, the lighting.

Another common theme in the responses was the lack of lights in the park. The evenings were one of the busiest times and there was insufficient lighting for people to continue using the walking trails and green spaces after dark. The sun sets around 6:30pm all year in Panama leaving little time for activities in daylight after the typical Panamanian workday. Improved lighting in the park would enhance visitor experiences and increase available time slots for renting many of the park’s facilities.

Respondents also criticized the absence of easy to access water. While surveying we observed that many park goers come to exercise. In a hot and humid climate, it is important to stay hydrated. If someone forgets or runs out of water, it would be beneficial to have somewhere closer than the plaza to buy water. One response was, “place fountains or water dispensers around the park (translated from Spanish).” While most people suggested water fountains as a solution, other suggestions included vending machines and a snack stand.

Chapter 5: Conclusions and Recommendations

5.1 Recommendations

Based on the criticisms our team received from the park visitors, we were able to come up with several strategies for how Ciudad del Saber can improve their park. As stated in Chapter 2, CdS wants to revamp their entire park and needs to know where to begin. They have an estimate budget of \$300,000 - \$500,000 per year for park renovations. Since there is not enough time or funds to add everything the community wants, we narrowed the most important additions down to four simple renovations: Lighting, bathrooms, water access, and communication

5.1.1 Lighting

At the time of data collection, the only lights at El Parque are located at the driving range, parking lots, and baseball fields during organized games. As an overwhelming majority of the park is currently in a state without any appropriate lighting, it is consumed by near complete darkness once the sun sets year-round at roughly the same time of 18:30. With most attendees taking advantage of the services of the park during the evenings after work, lights on fields and through the walkways would encourage people to stay later and feel more comfortable if they find themselves still present after sunset. Overhead lighting located through the fields would also allow more time slots for teams/individuals to rent out spaces, which extend business hours with longer possibilities of incoming revenue. Appropriate lighting along the long walking trails, and even a smaller light in each of the larger gazebos on the property will allow attendees to return safely if they are out in the park past sunset and encourage attendees and patrons to stay later. However, the most important reason to install more lights in the park is safety. It is important that visitor feel safe when using the park and adding lights would make them feel safer in the

evenings. El Parque is a large area which is precisely why the illumination of this property is extremely determined, as seen through general safety reasons as well as through high feedback from park attendees.

In the consideration of lighting, the yearly budget allotted for renovations was weighed to determine the feasibility of this. First, in determining the number of light posts that would be needed for minimum and uniform lighting throughout the park that would provide attendees with easier visibility past dawn, 15 new light posts are a great start. According to local averages in the US and therefore likely to be skewed down in Panama as a whole, the average cost of one with the fee of installment is roughly \$2,500 (LightMart, 2022). This cost amounts to a maximum 7.5% of the yearly budget and is obtainable within reasonable bounds. With only a small amount of the budget allotted to this task, it is likely to improve attendee experience and extend operational hours of the park overall greatly.

5.1.2 Bathrooms

Across El Parque there lies two bathrooms located relatively close to each other next to the baseball field and next to the driving range. These bathrooms are not well maintained and close early in the night which led to bathrooms receiving a substantial number of requests to improve on our survey. Many people mentioned that the lack of bathrooms leads to them leaving the park earlier than intended.

The addition and upkeep of bathrooms in El Parque would significantly help the visitor's experience by upgrading the quality of life for people using the park. Our proposed plan would place a bathroom on the North East side of the park by the residential buildings as shown in figure 5.1. We recommend placing the bathroom there since the other bathrooms are on the west side of the park, allowing visitors to use a bathroom without having to walk all the way across

the park to a bathroom. The upkeep of the bathrooms is necessary as many users said that the bathrooms are dirty. A good example of this would be our QR codes being covered in hair after a day in the men's bathroom. A higher quality of cleanliness would make the users feel more comfortable while using the bathroom in the park and would lead to users staying longer at the park and having an overall better experience.



Figure 5.1: Proposed area for new restrooms

5.1.3 Water Access

At the time of data collection, there was only one water fountain in the park, and it was not in working order. The walking trail and green spaces were the park's most used facilities, and we observed people frequently using them for exercise. In Panama's consistently hot and humid climate hydration is especially important. If someone were to run out of, or forget to bring water, the nearest water fountain is located at the plaza.

This problem could be solved by installing water fountains or vending machines throughout the park. Water fountains would be the most convenient and free for visitors. However, vending machines would bring in revenue and can also provide snacks and more beverage options. The solution could also be taken a step further in the form of a food stand/snack shack. A food stand at the center of the park would be a great quality of life thing for visitors and would also bring in more money for other projects. The stand could include drinks, snacks, and easily prepared foods and treats: hot dogs, grilled cheese, shaved ice, popsicles, ice cream, smoothies, etc. One downside to installing a food stand is the lack of foot traffic that the park receives during the week. However, this problem could be solved by only fully opening the stand on the weekends, and leaving it closed or partially open during the week. Ideally, as upgrades are made to the park, the foot traffic during the week will increase enough to warrant keeping a food stand fully open even on the weekdays.

5.1.4 Communication

Possibly the weakest link in El Parque, the communication between Ciudad del Saber and their visitors leaves something to be desired. While in the field, our team encountered many people who were confused and had questions about reservations, operating times, prices, etc. We were asked, “What time do the tennis courts open?” and, “How do we reserve the basketball courts?” One respondent on our survey even wrote in the free response, “Improve the communication of your products and services. Greater clarity of prices and possibilities. Until very recently, I didn't know there was a racquetball court, for example” (Translated from Spanish). And although the current reservation system is being revamped, there would be no way for the people to navigate to it. The simplest and cheapest solution that our team proposed was that Ciudad del Saber make a park website.

This website would contain all information regarding the park and its assets. There could be a section for all information regarding reservation; what can be reserved, how to reserve, and the link sending the user to the new reservation system. On top of that, prices can be displayed for each service that requires payment, eliminating any confusion with how much something costs to use. We also suggested an announcements page, where CdS can organize all their activities planned to be in the park and broadcast it to their visitors. Finally, and most importantly, the website should contain a community forum. This forum would serve the same purpose as question 11 of our survey: a place where the visitors can voice their complaints and suggestions for improvements. It can also be a place to connect with peers and rate the park.

To implement a site like this would not even take up too much time. A fellow IQP group who accompanied us in Panama were tasked with making a landing page for Ciudad del Saber's study abroad students. They were able to design and create the site in the two months we were in Panama and were also sponsored by CdS. If our sponsors do not have time to make the proposed site themselves, it can be a new IQP project for future WPI students. Communicating with the people who use the park is of the utmost importance when trying to figure out how to develop it further.

5.2 Conclusions

Despite our project producing satisfying results, our final plan remains a recommendation. It is ultimately up to our sponsors and the rest of CdS to take these suggestions into consideration when making renovations to their park. Our recommendations are based solely on the data we collected from our survey and reflect not only what the visitors of the park want, but also what the park needs to keep the community happy. Of course, lighting, bathrooms, water access, and communication are not the only ways the park could be improved. There were

several other suggestions from the people that would help the park expand. Those responsible for El Parque at Ciudad del Saber are free to implement whatever improvements and/or additions to the park they see fit, however, we suggest that the four subjects we outlined remain in high priority until dealt with. Delegating the extra funds and manpower to making these improvements would cultivate a better experience for people using the parks facilities.

References

Astell-Burt T, Feng X. Association of Urban Green Space With Mental Health and General Health Among Adults in Australia. *JAMA Netw Open*. 2019;2(7):e198209. Retrieved from [doi:10.1001/jamanetworkopen.2019.8209](https://doi.org/10.1001/jamanetworkopen.2019.8209)

Beyer, K. M., Kaltenbach, A., Szabo, A., Bogar, S., Nieto, F. J., & Malecki, K. M. (2014, March 21). Exposure to Neighborhood Green Space and Mental Health: Evidence from the Survey of the Health of Wisconsin. Retrieved from <https://www.mdpi.com/1660-4601/11/3/3453/htm?h=1>

Blonsky, D., Kornblum W. (2011). *Report on the use of Central Park*. Central Park Conservancy. Retrieved from https://assets.centralparknyc.org/pdfs/institute/p2p-upelp/3.002_Report+on+the+Public+Use+of+Central+Park.pdf

Brandall, B. (2021). *NPS Survey Best Practices: The Ultimate In-Depth Guide*. Chameleon. Retrieved from <https://www.trychameleon.com/blog/nps-survey-best-practices-to-improve-engagement-guide-infographic>

Burgess, J., Harrison, C.M, & Limb, M. (1988). “People, parks and the urban green: a study of popular meanings and values for open spaces in the city”. *Urban Studies*. Retrieved from <https://www.deepdyve.com/lp/sage/people-parks-and-the-urban-green-a-study-of-popular-meanings-and-zDw6q0e70m?key=sage>

Chevalier, G. (2022). “Memories of the early years of Fort Clayton, Panama Canal Zone” *Panama Canal Early Days Portrait of the Towns Fort Clayton*. CZ Images. Retrieved from http://www.czimages.com/CZMemories/Fort_Clayton/FC_index.htm

Ciudad Del Saber. (2015). “Population.” What does the campus offer? Retrieved from <https://apps.ciudadelsaber.org/portal/en/panama/population>

Ciudad del Saber (2020, January 15). *The City of Knowledge Foundation vibrates in tune with the Panama Jazz Festival*. Ciudad del Saber. Retrieved from <https://ciudadelsaber.org/en/the-city-of-knowledge-foundation-vibrates-in-tune-with-the-panama-jazz-festival/>

Ciudad del Saber (2022, January 27). *The City of Knowledge Park: A new stage for sports and Recreation*. Ciudad del Saber. Retrieved from <https://ciudadelsaber.org/en/the-city-of-knowledge-park-a-new-stage-for-sports-and-recreation/>

Ciudad del Saber (2022, January 27). *What does the campus offer?*, Retrieved from <https://ciudadelsaber.org/en/what-does-the-campus-offer/>

Ciudad del Saber (2022, January 27). *What is the city of knowledge?*, Retrieved from <https://ciudadelsaber.org/en/what-is-city-of-knowledge/>

Dettman, L. (2021, July 13). *Following in Olmsted's footsteps: Reimagining public places to foster health, well-being: Public health newswire*. Following in Olmsted's footsteps: Reimagining public places to foster health, well-being | Public Health Newswire. Retrieved from <http://www.publichealthnewswire.org/?p=olmstead-parks>

Duffield, B.S., & Walker, S.E. (2007). *Urban parks and open spaces - an overview*. University of Edinburgh. Retrieved from <https://www.tandfonline.com/doi/abs/10.1080/01426398308706060?journalCode=clar20>

Enscore, S. I. (2000). *Guarding the gates: The story of fort clayton--its setting, its architecture, and its role in the history of the Panama Canal*. U.S. Army Corps of Engineers.

Fleming, C.M., & Bowden, M. (2009). "Web-based surveys as an alternative to traditional mail methods". *Journal of Environmental Management*. Retrieved from <https://doi-org.ezpv7-web-p-u01.wpi.edu/10.1016/j.jenvman.2007.09.011>

Gorgas Hospital. (n.d.). *Historic American building survey* Retrieved from <https://memory.loc.gov/master/pnp/habshaer/cz/cz0000/cz0035/data/cz0035data.pdf>

Harvard Law School. (2022) "Collecting Data." *Harvard Law School*, Retrieved from <https://hls.harvard.edu/library/empirical-research-services/collecting-data/>

Inverziona (2022). *City of knowledge: a vibrant multicultural meeting point that drives research, learning, innovation, and creativity*. Retrieved 2022. From <https://inverziona.com/city-of-knowledg/>

Jaramillo, O. A. (2017, February 09). 'El interés en el parque Omar se fue con los \$35 millones'. Retrieved from https://www.prensa.com/imprensa/panorama/interes-parque-millones_0_4686281333.html

Kosnoski, J. (2011) "Democratic Vistas: Frederick Law Olmsted's Parks as Spatial Mediation of Urban Diversity" vol. 14. *Space and Culture*. Retrieved from [10.1177/1206331210389268](https://doi.org/10.1177/1206331210389268)

Leong, F.T.L, Austin, J.T. (2006) "The psychology research handbook: A guide for graduate students and research assistants". Sage Publications. Retrieved from

https://books.google.com.pa/books?hl=en&lr=&id=tb5yAwAAQBAJ&oi=fnd&pg=PA114&dq=surveys+and+questionnaires&ots=rwt6-AuPxK&sig=9FdIC4T9CVoYN8_l6u1SelOy5S4&redir_esc=y#v=onepage&q=surveys%20and%20questionnaires&f=false

Maas, J. (2006). Green Space, urbanity, and Health: How Strong is the relation? *Journal of Epidemiology & Community Health*, 60(7), 587–592. Retrieved from <https://doi.org/10.1136/jech.2005.043125>

Metropolitan Park. (n.d.). Retrieved from <http://madaboutpanama.com/panama-sights/wildlife/metropolitan-park/>

Mission. (n.d.). Retrieved from <https://www.kiwanis.org/about/mission>

Nutsford, D., Pearson, A. L., & Kingham, S. (2013). An ecological study investigating the association between access to Urban Green Space and mental health. *Public Health*, 127(11), 1005–1011. Retrieved from <https://doi.org/10.1016/j.puhe.2013.08.016>

Recreational Park Omar in Panama. (n.d.). Retrieved from <https://www.myguidepanama.com/things-to-do/parque-omar>

Takano, T. (2002). Urban residential environments and senior citizens' longevity in megacity areas: The importance of walkable green spaces. *Journal of Epidemiology & Community Health*, 56(12), 913–918. Retrieved from <https://doi.org/10.1136/jech.56.12.913>

Takemura, K., Smithson, M. (2017). *Special feature: psychological science of survey questionnaires*. *Behaviormetrika*. Retrieved from <https://doi.org/10.1007/s41237-017-0038-4>

Team, L. T. (2021, March 23). How Much Do Street Light Poles Cost? Retrieved from <https://www.lightmart.com/blog/how-much-do-street-light-poles-cost/>

Telecommunication in Panama. (n.d.). Retrieved from <https://www.worlddata.info/america/panama/telecommunication.php>

Timms, J. (2018). *The City of Knowledge: knowledge as the currency of modernity in Panama*, Retrieved from <https://www.reed.edu/anthro/assets/Timms---The-City-of-Knowledge.pdf>

van den Berg, A. E., Maas, J., Verheij, R. A., & Groenewegen, P. P. (2010). Green space as a buffer between stressful life events and health. *Social Science & Medicine*, 70(8), 1203–1210. Retrieved from <https://doi.org/10.1016/j.socscimed.2010.01.002>

Zheng, T. (2021). *What day of the week should you send your survey?* Curiosity at Work. Retrieved from <https://www.surveymonkey.com/curiosity/day-of-the-week/>

¡Estamos trabajando para ti! (n.d.). Retrieved from <https://www.parqueomar.gob.pa/>

(n.d.). Retrieved from <https://www.binal.ac.pa/binal/visitenos/horarios.html>

Appendix A: Survey Questions – Translated from Spanish

Question 1: What is your relationship with the City of Knowledge?

Answers:

- I'm a visitor
- I work at CdS
- I live at CdS
- I study in CdS
- Other

Question 2: Nationality

Answers:

- Panamanian
- Other

Question 2.5: Can you share your nationality with us?

Question 3: Gender

Answers:

- Female
- Male
- Other
- Prefer not to say

Question 4: Age

Answers:

- Under 18
- 18-24
- 25-34
- 35-44
- 45-65
- 65 or older

Question 5: How often do you use the City of Knowledge Park facilities?

Answers:

- Every day
- Most days
- Few times a week
- Once a week

- Once or twice a month
- I have not visited the park in the past 30 days

Question 6: What area(s) of the City of Knowledge Park have you used in the last 30 days?

Answers:

- Open spaces / Green areas
- Walking trails
- Soccer field
- Gym
- Gazebos
- Softball field
- Baseball field
- Swimming pool
- Dog park
- Tennis courts
- Racquetball court
- Driving range

Question 7: Do you typically use the City of Knowledge Park during the work week, weekends, or both?

Answers:

- During the work week
- Weekends
- Both

Question 8: What time do you usually visit the City of Knowledge Park?

Answers:

- In the morning (4 am – 11:59 am)
- During the day (12 pm – 4:59 pm)
- During the afternoon / evening (5 pm – 11:59 pm)

Question 9: With whom do you visit the City of Knowledge Park?

Answers:

- Alone
- Family
- Friends
- Club / Organization
- Other

Question 9.5: Can you share with us who you visit the City of Knowledge Park with?

Question 10: Are there any other parks that you visit regularly?

Answers:

- No
- Yes

Question 10.5: Which? Could you share with us the main reasons for visiting this other park?

Question 11: Would you suggest any changes to our current facilities or services at the City of Knowledge Park? Do you think it needs a service or installation that it does not currently have?

Question 12: Thanks for getting here! As a gesture of our thanks, we will be raffling off 5 sets of Sustainable Development Goals cards among people who choose to participate in our raffle. If you would like to participate, please leave us your email below. The winners of the survey will be announced on the Instagram of the City of Knowledge Park (parquecds) on September 30

Appendix B: Final Survey Results – Translated from Spanish

Question 1: What is your relationship with the City of Knowledge?

Answers:

- I'm a visitor – 91 replies (52.6%)
- I work at CdS – 57 replies (32.9%)
- I live at CdS – 24 replies (13.9%)
- I study in CdS – 9 replies (5.2%)
- Other – 8 replies (4.6%)

Question 2: Nationality

Answers:

- Panamanian – 123 replies (71.1%)
- Other – 40 replies (28.9%)

Question 2.5: Can you share your nationality with us?

Question 3: Gender

Answers:

- Female – 100 replies (57.8%)
- Male – 73 replies (42.2%)
- Other – 0 replies
- Prefer not to say – 0 replies

Question 4: Age

Answers:

- Under 18 – 4 replies (2.3%)
- 18-24 – 24 replies (13.9%)
- 25-34 – 38 replies (22.0%)
- 35-44 – 55 replies (31.8%)
- 45-65 – 51 replies (29.5%)
- 65 or older – 1 reply (0.6%)

Question 5: How often do you use the City of Knowledge Park facilities?

Answers:

- Every day – 20 replies (11.6%)
- Most days – 21 replies (12.1%)
- Few times a week – 53 replies (30.6%)
- Once a week – 25 replies (14.5%)

- Once or twice a month – 33 replies (19.1%)
- I have not visited the park in the past 30 days – 21 replies (12.1%)

Question 6: What area(s) of the City of Knowledge Park have you used in the last 30 days?

Answers:

- Open spaces / Green areas – 94 replies (61.8%)
- Walking trails – 79 replies (52.0%)
- Soccer field – 32 replies (21.1%)
- Gym – 24 replies (15.8%)
- Gazebos – 20 replies (13.2%)
- Softball field – 17 replies (11.2%)
- Baseball field – 5 replies (3.3%)
- Swimming pool – 15 replies (9.9%)
- Dog park – 13 replies (8.6%)
- Tennis courts – 7 replies (4.6%)
- Racquetball court – 1 reply (0.7%)
- Driving range – 3 replies (2.0%)

Question 7: Do you typically use the City of Knowledge Park during the work week, weekends, or both?

Answers:

- During the work week – 46 replies (30.3%)
- Weekends – 40 replies (26.3%)
- Both – 66 replies (43.4%)

Question 8: What time do you usually visit the City of Knowledge Park?

Answers:

- In the morning (4 am – 11:59 am) – 53 replies (34.9%)
- During the day (12 pm – 4:59 pm) – 41 replies (27.0%)
- During the afternoon / evening (5 pm – 11:59 pm) – 58 replies (38.2%)

Question 9: With whom do you visit the City of Knowledge Park?

Answers:

- Alone – 38 replies (25.0%)
- Family – 62 replies (40.8%)
- Friends – 43 replies (28.3%)
- Club / Organization – 5 replies (3.3%)
- Other – 4 replies (2.6%)

Question 9.5: Can you share with us who you visit the City of Knowledge Park with?

Question 10: Are there any other parks that you visit regularly?

Answers:

- No – 99 replies (57.2%)
- Yes – 74 replies (42.8%)

Question 10.5: Which? Could you share with us the main reasons for visiting this other park?

Question 11: Would you suggest any changes to our current facilities or services at the City of Knowledge Park? Do you think it needs a service or installation that it does not currently have?

Question 12: Thanks for getting here! As a gesture of our thanks, we will be raffling off 5 sets of Sustainable Development Goals cards among people who choose to participate in our raffle. If you would like to participate, please leave us your email below. The winners of the survey will be announced on the Instagram of the City of Knowledge Park (parquecds) on September 30 – 90 replies

Appendix C: Survey Flyer



AYÚDANOS A MEJORAR EL PARQUE CIUDAD DEL SABER Y PARTICIPA PARA GANAR UN JUEGO

¡Hola! Desde la Fundación Ciudad del Saber agradecemos tu apoyo para completar esta breve encuesta sobre el Parque Ciudad del Saber. Para completarla, puedes escanear este QR:



Estaremos rifando 5 juegos de cartas de los Objetivos de Desarrollo Sostenible entre las personas que elijan participar en nuestra tómbola, dejando su email al llenar la encuesta. Los ganadores/as de la tómbola serán anunciados en el Instagram del Parque Ciudad del Saber (parquecds) el 30 de septiembre.



Appendix D: Project Calendar

Calendar Key:

Team Meeting	Advisor Meeting	Sponsor Meeting	Writing / Research	Data Collection
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September							
	Su	Mo	Tu	We	Th	Fr	Sa
		29	30	31	1	2	3
		11:30 - 55 Jim/Grant				11:00 - Valeria meet	
		12 - 1 Marketing				Survey rewrite	
		1:15 Recap and plan				Survey Test	
	4	5	6	7	8	9	10
		11:30					
		Scout Park	received foot traffic data		11:00- Survey Meeting		
						Lit review 1 is due	
	11	12	13	14	15	16	17
		11:30			11		Matt/Dylan
					Post QR Codes		
						Lit review 2 is due	All
							Livi/Parker
	18	19	20	21	22	23	24
7:00-9:00am	Matt/Dylan	Matt/Dylan	Matt/Dylan	Matt/Dylan	Matt/Dylan	Matt/Dylan	Matt/Dylan
		11:30			11	Revised methods	
12:00-2:00pm	All	All	All	All	All	All	All
						Peer eval	
5:00-7:00pm	Livi/Parker	Livi/Parker	Livi/Parker	Livi/Parker	Livi/Parker	Livi/Parker	Livi/Parker
	25	26	27	28	29	30	
9:00-11:00am	Livi/Parker	Matt/Dylan	Livi/Parker	Matt/Dylan	Livi/Parker		
		11:30			11		
2:00-4:00pm	All	All	All	All	All	Full draft report	
7:00-9:00pm	Matt/Dylan	Livi/Parker	Matt/Dylan	Livi/Parker	Matt/Dylan		

