Achieving Silver Level Bicycle Friendly Community Status for the City of Columbus

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Executive Summary

The overall objective of the "Columbus Bikes" capstone project is to help the city of Columbus achieve a silver level bicycle friendly community designation, or higher, from the League of American Bicyclists (LAB) within the next five years. The request for proposal for the project originally included seven objectives, the initial plan was to research and report on all seven objectives. However, the scope of the project was eventually narrowed to the following two objectives: analyzing the feasibility of doubling the CoGo bike share program and creating a bike program that targets low-income Columbus residents. Our scope was narrowed to the two aforementioned objectives to allow for focused research and to complete our research and analysis within the given time constraints.

Using a 10% annual increase in bicycle miles traveled resulting from an incremental doubling of CoGo from 2015 to 2020, we project calories burned and carbon offset to substantially increase to 9,909,466 calories and 142,475 pounds of carbon by 2020. However, other cities, most notably Boston and Washington D.C., experienced much higher benefits from doubling their respective bike share programs. Therefore, Columbus' projected benefits are based on a lower bound estimate.

The second research objective began with researching case studies of Boston, Philadelphia, and Washington D.C.'s low-income bike share programs. From this initial research, we identified Franklinton as a key area of focus for expanding the CoGo bike share programs into low-income areas of Columbus. Although there is no single recommendation to help improve bike share equity, community engagement, CoGo price adjustments, and offering a cash payment system are feasible adjustments to expand the CoGo bike share program into low-income areas.

Introduction

The overall goal of our research was to develop a recommendation plan that will allow the city of Columbus to achieve a silver level bicycle friendly community designation from the League of American Bicyclists within the next five years. A city can achieve this designation in a multitude of ways, but it is crucial for the community to evaluate and improve on the "Five Es" that have been established by the LAB (Engineering, Education, Encouragement, Enforcement, and Evaluation and Planning). In order to address these components, we decided to focus on two biking objectives that were listed under the silver-level biking objective C.3. in Green Memo III. Our first objective was to measure the impacts of doubling the CoGo bike share system, and the second objective was to develop a program to encourage biking among low-income residents. While understanding how these objectives help Columbus achieve silver level bicycle friendly community designation, our research also analyzed the environmental and health benefits resulting from expanding Columbus' bicycle programs. These benefits include: the reduction of greenhouse gases (GHGs) for the transportation sector, and the improvement of the overall well-being for the citizens of Columbus.

Objective 1: Doubling the CoGo Bike Share System

Objective 1 of our research project was to understand the impact of doubling CoGo's bike share program by 2020. A variety of methods and data sources were used to evaluate the impact of CoGo's expansion. The following sections will outline these methods and sources of data used in the analysis of Objective 1.

Methods

Data Collection

The first step to understand the impact of doubling the CoGo bike share program was to collect historical data from the CoGo program. We obtained the "2014 Q4 CoGo Quarterly Report" from Heather Bowden, which evaluates several bike share statistics including bicycle miles traveled (BMT), membership numbers, carbon offset, and calories burned.[5] This report was collected in order to quantify the current impact CoGo has in the Columbus community and was used as the foundation for our research, which will be discussed further in the data analysis section. In addition to the quarterly report, we also received the "2015 Forecast Monthly Statistics" from Kristin Edwards at CoGo, which features the projections of rides, docks, stations, and bicycles resulting from CoGo's expansion in 2015.[6] This report was used to identify the predicted changes that CoGo will have in one year of expansion, which then served as our baseline for change between 2015 and 2020.

In order to evaluate the future of Columbus' bike share expansion, it is crucial to understand the impact bike share expansions have had on other cities. To understand this component, we reached out to several cities with successful bike share programs including: Chicago, Indianapolis, Cleveland, Minneapolis, Boston, and Washington D.C. Only Boston and Washington D.C. were able to disclose information and bike share statistics. We obtained Boston's "Hubway Consolidated Data" report from Nicole Freedman, Director of Bicycle Programs.[3] Similar to Columbus' quarterly report, the Hubway report disclosed bike share statistics including: number of bicycles and stations, bicycle miles traveled, membership, usage data, and location of stations. Second, we collected information from Kimberly Lucas, the manager of Capital Bikeshare (Washington D.C.) and also from Gideon Lachman, an analyst at Motivate (owners of Capital Bikeshare).[28] Specifically, we received statistics on monthly bicycle miles traveled, carbon offset, calories burned, and number of bicycles. These data sources were

used to compile a benchmarking scenario analysis, which will be discussed in the following section under data analysis.

Expert Informant Interviews

In order for our project to provide the best results for Columbus, we performed expert informant interviews. The first interview was with Heather Bowden, former General Manager of CoGo.[2] This interview was a key piece of our data collection because it helped us understand current CoGo initiatives and expansion plans. The second expert informant interview was with Nicole Freedman, Director of Hubway, Boston's bike share program.[12] During this interview, Nicole Freedman pointed out that site location of each bike station is a critical factor in creating a successful program. Currently, Hubway is working on a site-planning model, which creates a heat map of the city's stations on a monthly basis. This model will allow Hubway to not only better assess current usage rates of stations, but also creates a method for Hubway to evaluate future station locations. Nicole also discussed that factors of income, residential density, demand, and proximity to other forms of public transit should be considered when choosing locations. Specifically, it was important that Hubway was connected to the greater transit system in order to allow for higher usage. Overall, this interview was very beneficial because it provided background information about Boston's bike share program, while also providing key pieces of information that could be helpful when planning CoGo's expansion.

Data Analysis and Research Results

The initial strategy to analyze the feasibility of doubling Columbus' bike share program was based on analyses of historical CoGo data. However, CoGo could not provide sufficient historical data, as the program launched in July 2013. The 2015 Forecast Monthly Statistics provided by Kristin Edwards served as the foundation of our analysis and were based on a 10%

increase from 2014 ridership figures. However, the 2015 CoGo projections were based on trips, and calories burned and carbon offset calculations were based on bicycle miles traveled. As illustrated in Table 1, we multiplied the 2015 projected trip numbers by average miles per trip (provided by Motivate) to calculate projected bicycle miles traveled (BMT) for 2015. January and February 2015 bicycle miles traveled were provided by Motivate because the actual numbers had already been calculated, thus no projection was necessary. The bicycle miles traveled projections for 2016 through 2020 were calculated using the same method: a 10% increase in the previous year's bicycle miles traveled.

Table 1: Calculating 2015 Projected BMT[19]

Month	Trips	Stations Available	Average Miles 2014	BMT	Carbon Offsett (lbs.)	Calories Burned
January-15	481			710	483	30,530
February-15	257			351	239	15,093
March-15	2309		2.12	4,892	3,327	210,360
April-15	6058		2.75	16,684	11,345	717,393
May-15	7567		2.71	20,497	13,938	881,350
June-15	7344		2.73	20,062	13,642	862,666
July-15	7901		2.75	21,736	14,780	934,637
August-15	6746		2.88	19,405	13,195	834,397
September-15	8834		2.52	22,251	15,131	956,809
October-15	5796		2.78	16,123	10,963	693,270
November-15	2674		2.00	5,345	3,635	229,833
December-15	1154		1.50	1,731	1,177	74,444
Total 2015	57,121	38		149,786	101,854	6,440,782
% Change 2014	27%			27%	27%	27%

The CoGo projections for 2015 through 2020 were based on incremental increases in the bike share program, doubling from thirty to sixty stations. Eight new stations are proposed for 2015, and thirty stations currently exist. Therefore, we projected an annual average of four and a half stations to be added to CoGo between 2016 and 2020 and because of this added either four or five stations every other year. Our analysis also assumes each station includes ten bikes.

Some of the key metrics used to analyze the CoGo expansion include: bicycle miles traveled, bike stations in the system, carbon offset, calories burned, and total cost. As mentioned earlier, bicycle miles traveled were projected using a 10% increase in the previous year's numbers, following the 2015 projection provided by Motivate. Also previously mentioned, with thirty stations currently in the system and eight stations proposed for 2015, an average annual increase of four and a half stations is required for CoGo to double to sixty stations by 2020. Carbon offset and calories burned were calculated using the equations of 0.68 pounds of carbon offset per bicycle mile traveled and forty-three calories burned per bicycle mile traveled, respectively. These equations were provided by Motivate, and are consistent with the calculations used by other cities' bike share programs, such as Boston and Washington D.C. The cost figures were calculated with the assistance of Nicholas Sanna of Columbus Recreation and Parks. He estimated a cost around $4,000 per station, "includ[ing] direct and indirect labor, heavy equipment rentals, communications setup, PR/advertising, mapping and information materials, and other miscellaneous costs."[8] It is also important to note that Sanna stated CoGo experiences increasing economies of scale as it expands. Furthermore, an individual bike costs $1,070[8]. Costs were calculated using the following equation, assuming ten bikes per station:

Total cost = (Number of stations * $4,000) + (number of bikes * $1,070)

Table 2 (below) illustrates the annual totals of the benefits and costs of Columbus incrementally doubling its bike share program, with 2014 as the baseline year. Results were calculated on a monthly and annual basis between 2015 and 2020.

Table 2: CoGo Projection of Annual Total Benefits and Cost – 10% Annual Increase in BMT[18]

Year	Bicycle Miles Traveled	Carbon Offsett (lbs.)	Calories Burned	Cumulative Costs ($)
2014	*118,270*	*80,424*	*5,085,609*	$ -
2015	130,097	88,466	5,594,170	$ 117,600
2016	143,107	97,313	6,153,587	$ 176,400
2017	157,417	107,044	6,768,945	$ 249,900
2018	173,159	117,748	7,445,840	$ 308,700
2019	190,475	129,523	8,190,424	$ 382,200
2020	209,522	142,475	9,009,466	$ 441,000

Boston and Washington D.C. Scenario Analysis Results

Another piece of the analysis was comparing the results of Columbus' projection to other cities' and their experiences in doubling their bike share programs. As mentioned above, after reaching out to several municipalities, we were able to obtain significant historical data from the bike sharing programs in Boston and Washington D.C. These two cities serve as the two comparisons for Columbus.

The historical data of the bike share programs Boston and Washington D.C. proved helpful, as data were available as early as 2011 for Washington D.C. and 2012 for Boston. We conducted several analyses of the other cities' bike share programs data to determine any possible trends and correlations between indicators. Some of the indicators we analyzed included city population, bikes available in the system, percent change in bikes, total annual members, ratio of bikes to total annual members, percent change in membership rates, and bicycle miles traveled. Through our early analysis, we concluded the most correlated metrics were number of bikes in the system and bicycle miles traveled. Consequently, those metrics were the foundation of our comparison of other cities to Columbus.

The next step in comparing Boston and Washington D.C. to Columbus was to determine when each city doubled its bike share program, and how it affected bicycle miles traveled. Washington D.C. doubled its bike share program between 2011 and 2013 and experienced an 85% increase in bicycle miles traveled throughout the program. Boston doubled its bike share program between 2012 and 2014 and experienced a 244% increase in bicycle miles traveled

throughout the program. After determining the change in bicycle miles traveled each city experienced from doubling their bike share program, and after calculating a ratio between doubling the number of bikes and the impact on bicycle miles traveled for each city, the ratios calculated from Washington D.C. and Boston's data were used to project Columbus' potential future outcomes based on Columbus' baseline data. The three graphs below illustrate Columbus' projected benefits in 2020 under a 10% annual increase in bicycle miles traveled (leftmost column), under an increase equal to that seen in Boston (middle column), and under an increase equal to that seen in Washington D.C. (rightmost column). As seen in the figures below, if Columbus were to experience results similar to Washington D.C. or Boston, the City would experience higher changes in calories burned and carbon offset.
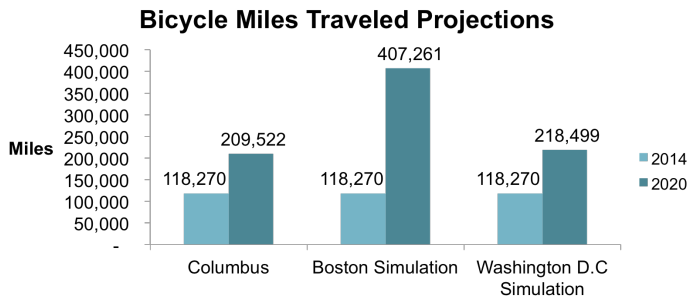
Figure 1: Bicycle Miles Traveled Predictions[19]

Bicycle Miles Traveled Projections

Figure 2: Carbon Offset Predictions[19]

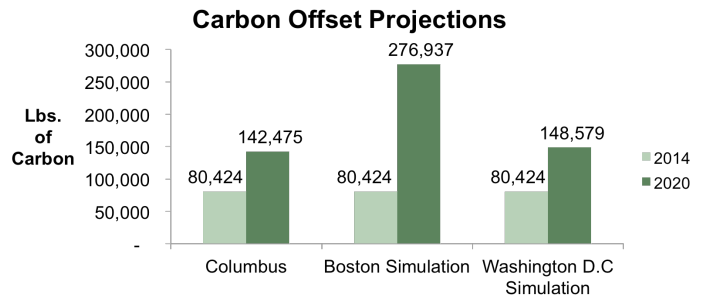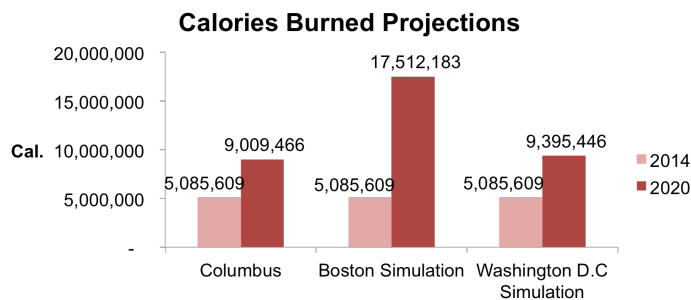**Carbon Offset Projections**

Figure 3: Calories Burned Predictions[19]

Calories Burned Projections

Although costs increase, it can be concluded that expanding bicycle programs greatly increases bicycle miles traveled, calories burned, and carbon offset. Other factors which might influence how doubling the amount of bikes affects bicycle miles traveled are transportation substitution rates, usage rates of other modes of transportation, population demographics, and location of bicycle stations.

Barrier: Connection to Greater Transit System

As Columbus continues to expand the CoGo bike share system, it will create reductions in greenhouse gas emissions. However, there are several factors that need to be addressed in order for CoGo to reach a higher number of users and thus have a larger impact. First, Columbus does not yet have a diversified and connected transportation system, and therefore the bike share system is not connected to other modes of public transportation. This lack of interconnection between transit modes has a large effect on the type of riders using CoGo. There are two types of riders: casual riders who use CoGo on an as needed basis and annual registered members, who buy a yearly membership pass for CoGo.[5] In 2013, casual riders' bicycle miles traveled was 497% higher than annual registered members, while in 2014 casual riders' bicycle miles traveled were 337% higher. Additionally, the average mileage per trip for casual members were higher in both 2013 and 2014 by 2.23 miles and 2.52 miles, respectively.[5] This is expected because the majority of CoGo riders are using the bike share system for recreational purposes. However, to improve ridership figures Columbus should increase both the number of registered riders and casual riders. The National League of Cities discusses the connection of transportation in their report "Integrating Bike Share Programs into Sustainable Transportation System" stating that, "the bike share system is not intended to replace all-day bike rentals, but rather is considered a form of public transit, often complementing bus routes and subway lines".[14] Along with other

cities, the briefing discusses D.C's Capital Bikeshare program as an additional mode of transit, which has economic and environmental benefits for the entire city.[14]

Objective 2: Increasing Bike Share Equity in Low Income-Areas

Objective 2 is to develop a plan for Columbus to provide bike services to low-income communities. Through our research, we found that the best course of action (when considering the overall goal of achieving a silver level bicycle friendly community designation from the LAB) would be to expand the CoGo bike share system into low-income areas with minor program adjustments.

Methods

Case Studies

<u>Boston (Boston Bikes)</u>

The Boston, Massachusetts, Hubway bike share program was researched as a case study for several reasons. Firstly, Boston received a silver level bicycle friendly community rating by the League of American Bicyclists, which is the designation that Columbus hopes to receive. In addition, Boston's bike share equity program has proven to be successful compared to other equity initiatives throughout the United States. Lastly, Boston's bike share program involved research within low-income communities. This research uncovered elements that a bike share program needs in order to work for low-income community members; Columbus can use this information for the development of their own bike share program.

Boston, Massachusetts, established their bike share program, Hubway, in 2011 and immediately emphasized social equity as a key pillar of the program. Hubway partnered with the Boston Public Health Commission in order to provide a Hubway membership to low-income residents at a subsidized fee. The standard membership cost is $85 per year and includes

unlimited trips for up to thirty minutes for no additional fee.[1] Through funding provided by the Public Health Commission, Hubway is able to offer the same membership to qualifying low-income individuals for an annual fee of $5. Overall, about 18% of total bike share subscribers have subsidized memberships.[2] The subsidy addresses financial barriers that impede low-income individuals from benefitting from a bike share program. In addition, Boston also offers a helmet subsidy program where low-income individuals can buy helmets for a reduced price at various local businesses. By expanding hubs into low-income neighborhoods, while making participation in the bike share program affordable, Boston is working to systematically remove structural and financial barriers.

In order to assure that low-income community members participate in the subsidy program, Boston also spreads information about the bike share program to low-income community members. When speaking with Najah Shakir, the program director for Boston's Hubway program, she expressed that the biggest obstacle in increasing membership in the service is helping people to understand the purpose of bike shares.[23] In order to overcome cultural and informational barriers, Ms. Shakir emphasized the importance of community outreach. Community outreach entails partnering with community organizations and leaders, who disperse consistent and helpful information to the community. An example of how Boston conducts community outreach through a multitude of creative outlets is their "Prescribe a Bike" initiative, which is a publicity campaign that spreads information about the subsidized bike share programs to low-income individuals through their healthcare providers. Community leaders like these health care providers are vital components to the diffusion of bike share education and awareness. There are valuable lessons that the city of Columbus can learn from the city of

Boston to make bike share programs equitable, specifically regarding membership fees and outreach.

Philadelphia (Better Bike Share)

The city of Philadelphia, Pennsylvania, is another city that has plans to launch a bike share program with a stated equity dimension. Their program will launch April 23rd, 2015, under the name "Inde'go" and includes an outreach plan targeting low-income participation through partnerships with local community champions and organizations.[26] The Philadelphia bike share Strategic Business Plan states the following goals: to "reduce the environmental impact of transportation and to help Philadelphia achieve its goal of "Greenest City in America" and to develop a system that serves users in minority and low-income communities and improves their access to key destinations, such as jobs and recreation."[26] These goals are similar to Columbus' goals, which is why Philadelphia is useful as a case study. Philadelphia, similarly to Boston, has earned a Silver Level Bicycle Friendly Community rating by The League of American Bicyclists.

The city of Philadelphia is working with the Bicycle Coalition of Greater Philadelphia to achieve success of bike share programs in low-income communities. When speaking with Katie Monroe, the program manager of the outreach team at Bike Coalition of Greater Philadelphia, she stressed the importance of community partners when working to help low-income individuals utilize bike share programs. "Starting with networks already in place, talking to people, listening, and letting the community tell you how a bike share system can be tailored to fit their needs rather than imposing this information is crucial."[17] Being creative and flexible with partnerships was a priority for Monroe.

To tackle the financial barrier that impedes low-income adoption, Inde'go offers a monthly membership option of $15, which includes unlimited free trips for the first hour and a four-dollar fee for all additional one-hour trips.[17] The plan also offers a cash payment program. This option allows community members to participate in Philadelphia's bike share program even without access to credit or debit cards. Roughly 17 million people across the U.S. lack access to a bank account, with a majority of this population being considered low-income.[15] Financial barriers are not limited to the cost of the program, as financial barriers also affect the logistics of payment plans and structure. Philadelphia has not yet implemented their bike share program, so the success of the cash payment option is pending. In addition, the bike share program plans to work with a community foundation to insure compensation for any bike thefts or losses. However, there is not a large concern regarding bike thefts, as the bikes have a low resale value.

Washington, D.C. (Capital Bikeshare Program)

Another city with efforts to address bike share equity is Washington, D.C. (Capital Bikeshare program). Following an extensive member survey and supplemental research, Capital Bikeshare found that the majority of bike share users were young, white, educated men. This led the program coordinators to test various methods to increase bike share equity. Washington, D.C.'s program differs from both Boston and Philadelphia, as the Capital Bikeshare program has been less successful. However, it remains important to study the successes and failures of Capital Bikeshare to find what methods would work best for Columbus. D.C. has made efforts to provide subsidized memberships to low-income individuals, but of the 200 free memberships offered, only 20 have been used.[28] In addition, the city has put stations in low-income areas, but these stations have had the lowest usage rates out of all of the bike share stations. These less successful attempts at increasing bike share equity only reiterate the need for community outreach. Without

community outreach, low-income and minority individuals are uneducated about the values of a bike share. While D.C. was not as successful with their equity initiatives, the program is important to study when researching bike share equity as lessons from the D.C. context may help other programs avoid similar failures.

League of American Bicyclists Equity Council

Some valuable insight was gained through an interview with a member of The League of American Bicyclists Equity Council Member, Neil Walker.[27] Although Neil has not worked explicitly with bike share programs he is extremely familiar with low-income individuals and their relationship with bicycling. Neil stressed the importance of education and community outreach, "What doesn't work is telling people what they need; what can work is a series of dialogues and meetings to get them informed and get their feedback."[27] In addition, he stressed that introducing a bike share to a low-income community in a top-down approach can be damaging to the future success of a program. Partnerships, buy-ins, and town hall type meetings are the best way to infiltrate a tight knit community. Lastly, Neil commented that equity has been a whole new initiative that The League of American Bicyclists has been considering, so focusing on bike share equity throughout Columbus could help boost Columbus' goal of achieving a Silver Level Bicycle Friendly Community Rating.

Financial Components

Pricing

We evaluated the cost of CoGo relative to other main transportation modes in Columbus, specifically a personal car and the COTA bus system. We determined that, even without a subsidy, CoGo is the most cost effective mode of transportation of these three transportation options. The COTA bus has several payment options; a daily pass for $4.50, a week pass for

$25.00, and a month pass for $62.00.[9] In Ohio, the average cost of owning a car in 2013 was $1,973 a year, including repairs, insurance, and average gasoline prices.[13] Comparing these prices with the yearly membership cost of CoGo, which is $75.00, CoGo is the most cost effective option. However, for a low-income community member, $75.00 is a high price to pay for a bike share service.

Considering these factors, we suggest a monthly membership option be made available for low-income residents at a price of $6 a month, which is about the cost of the yearly rate divided by twelve. This price does not reflect a subsidy value, but rather a more reasonable option that allows members to have flexibility with a CoGo membership.

Grants

Grants are an important component for bike share programs to be successful in low-income areas, and these grants can be funded by public or private sources. Different grants are available for bike share programs, ranging from environmental grants to health care grants. Nice Ride Minnesota has received three government grants in addition to five operating grant funders. There are various grants available for application at any given time, some are one-time grants while others are yearly. Some grants are available through the clean air initiative, Robinwood Johnson Foundation, and People for Bikes in addition to many other sources.[27] Each bike share case study has taken advantage of various grants available, which has allowed the programs to subsidize and educate low-income members.

Sponsorships

Sponsorships are another source of funding for successful bike share programs and allow for a bike share program and community to work together toward a common goal. Philadelphia's bike share program has taken full advantage of various types of sponsors such as: corporate title

sponsor, non-title sponsor, secondary sponsor, station capital sponsor, station operating sponsor, bicycle sponsor, on-station advertising sponsor, corporate membership, and non-financial sponsor. Through the use of sponsors, bike share systems have more financial capital available to use to increase human and cultural capital in their communities.

Franklinton

After finding that expanding the CoGo bike share program into low-income areas would be a good fit for both CoGo and the low-income residents of Columbus, we collected demographic information on Columbus to determine which low-income areas would be a good fit for the program. We found that the area of Franklinton had a poverty rate more than double that of Columbus[7], and we also discovered that CoGo is planning to install a bike hub in Franklinton as part of the expansion plan. We decided that Franklinton is a good match for a test program of expanding CoGo into low-income areas, and formed our low-income plan around the Franklinton community.

In order to establish contact with the area of Franklinton and learn more about Franklinton's community needs, we reached out to a community leader in the Franklinton area, Jonathan Youngman of Franklinton Cycle Works.[29] After conducting an interview with Jonathan, we were provided with the following results that helped us to understand the needs of low-income communities when developing a bike program.

Results

Community Needs

A continuous theme throughout our research was the importance of reaching out to community organizations, leaders, and members to find the best course of action for developing

a biking initiative in low-income areas. In Franklinton specifically, we found that His Place, St. John's Episcopal Church, and Gladden Community House are long standing community organizations that serve the needs of low-income Franklinton community members.[29] These organizations are valuable resources for connecting and communicating with the Franklinton community.

Through our research, we learned that the community needs of low-income Franklinton residents differ from current users of CoGo. Low-income residents are unable to pay the $75 per year fee that CoGo charges for an annual membership, as $75 is a large sum of money for those living below the poverty level.[29] However, the $6 daily fee is also unaffordable for low-income residents to pay every day, as the CoGo $6 daily membership seems to be targeted towards visitors of Columbus or more affluent community members who use CoGo recreationally.[29] We found that a possible solution would be to have a monthly membership rate, which would be an in-between option, instead of the binary options of a yearly or daily rate.

We learned that one of the most significant barriers that prevents low-income residents from biking is a concern about theft.[29] Low-income residents are less likely to purchase and own their own bikes, as they often live in more dangerous areas and they do not always have the resources to properly secure their bikes.[29] This makes the CoGo bikes share program appealing, as community members can still have access to a bike without having to be concerned about theft after they complete their ride with CoGo.

We also found that low-income residents will need an alternative way to pay for their CoGo membership, as some community members do not have access to a credit or debit card.[29] The current CoGo bike hub infrastructure does not support cash as a form of payment, so another option will need to be negotiated in order to make this form of payment feasible for low-income

residents. This could be done by partnering with local community organizations that would allow community members to exchange cash for a card that could be used for the CoGo membership payment.

Barriers

Bike shares are a feasible alternative to other modes of transportation within a city. They generate money for the city, reduce traffic, reduce greenhouse gas emissions from the transportation sector, and provide health benefits for individual users. Historically, bike share programs have been utilized by affluent residents or tourists on a casual user basis. Because bike share programs are a relatively new transportation option in U.S. cities, few are designed and implemented with low-income communities in mind. Low-income community members face structural, financial, and informational/cultural barriers when it comes to bike share programs, and thus do not reap the benefits that come from using this mode of transportation.[15]

Structural barriers exist for low-income individuals for evident reasons. Often bike share systems are operated by organizations that have costs to cover and work under the assumption that placing bike share hubs in low-income neighborhoods will yield low user levels and have higher risk of theft and/or damage.[15] Financial barriers include the upfront costs that are often too high for low-income individuals to be able to afford, and lack of access to a bank account or subsequent debit or credit card that most bike share systems require for membership. The last main barrier for low-income individuals being able to use bike share systems is a cultural/informational barrier. Bike share systems may be well known and understood in middle and upper class communities where bike share systems are located, visible, and marketed. But, because bike share hubs are seldom located in low-income communities, the lack of exposure means a lack of familiarity and knowledge. This is where outreach can play a major role in

breaking down information barriers surrounding bike share systems. Even the term "bike share" can be ostracizing to an individual.[23] Overcoming these barriers is necessary in order for the city of Columbus to make the CoGo bike share program available for all community members. Equity is a pillar of sustainability, and without adequate effort to make CoGo available for all community members, Columbus will fall short of making their transportation sector sustainable.

Final Recommendations

The recommendations that follow reflect initiatives that Columbus can take within the next five years to achieve a silver level bike friendly community rating from the League of American Bicyclists. These short-term goals will both improve Columbus' biking community and improve upon the overall sustainability of Columbus through the reduction of greenhouse gases as discussed in Objective 1 and through the development of equity initiatives as discussed in Objective 2.

Recommendation 1: Continue to expand the bike share program with a focus on expanding into low-income areas in order to increase bike share equity.

The expansion of CoGo is important in order to increase biking as a viable option for transportation in Columbus for all citizens. Based on the research expanded on in the above sections, we believe that the expansion of CoGo into a variety of Columbus neighborhoods will be a great addition to Columbus' sustainability agenda.

Recommendation 2: Connect CoGo bike share system to other transit systems in Columbus.

In order to increase the impact of expansion for registered users, CoGo should focus on expanding bike share stations in connection with COTA routes or park and ride lots. This would allow more users to ride CoGo on a routine basis, creating links between users who may take COTA, Car2Go or other forms of communal transit to work.

Recommendation 3: Focus on community outreach efforts throughout low-income areas in order to encourage membership and provide information regarding the CoGo bike share system.

CoGo and Columbus should establish partnerships with Gladden Community House, St. John's Episcopal Church, and His Place, which are all established community centers in the Franklinton area. These organizations can serve as liaisons with the low-income Franklinton community and will be able to establish community relations that can be used to communicate the benefits of the CoGo bike share program.

Recommendation 4: Use and monitor the Franklinton area as a test zone for expanding the CoGo bike share system into low-income areas.

This is important to the success of future stations in low-income areas in order to discover best practices. Once baseline data has been gathered and analyzed from Franklinton, the addition of other stations in low-income areas will have increased likelihood of success.

Further Research

A key aspect of analyzing bike sharing programs that did not receive much focus during this project is understanding transportation substitution rates throughout Columbus, and understanding how increasing the bike sharing system impacts transportation rates. Furthermore, comparing transportation substitution rates of Columbus to those of other cities like Boston and Washington D.C. will help the City understand potential future benefits of increasing the bike share system. Additionally, while speaking with Kristen Edwards (CoGo), we were encouraged to research Minnesota's bike share program Nice Ride. Since we did not get to speak to CoGo until late in our project, we were unable to research Nice Ride thoroughly, so we recommend further research.

Second, Ohio State University's bid to Zagster (a competing bike share company) will have an effect on CoGo's expansion. With this in mind, we recommend that CoGo further analyze the demographics of their usage statistics in order to understand the age range of both casual and annual registered users. CoGo may need to focus their expansion in family-oriented areas rather than tailor the bike share system to young professionals, who remain closer to the Ohio State University campus.

Additionally, it is important to continue to research the success and impact of the CoGo bike share station in the Franklinton area. This further analysis will find whether the Franklinton station is successful and will determine whether putting a station in another low-income area is logical. Surveys and other methods of data collection from community members and businesses should be considered. If the success of the bike station in Franklinton is subpar, then further research should be completed to find other methods of integrating bike share systems in low-income communities.

Conclusion

The application to receive a bicycle friendly designation from League of American Bicyclists is flexible and leaves room for interpretation. Applicants should highlight their city's achievements in terms of the five E's, as there are multiple ways to achieve different levels of bicycle friendly designations from the League of American Bicyclists. While expanding on this flexibility, our team was able to strategically and creatively develop a plan for Columbus to reach a silver level designation in the next five years. The two objectives researched are what we propose to be the best course of action for Columbus. Doubling CoGo will effectively reduce greenhouse gas emissions and improve the health of citizens by increasing physical activity. By

promoting biking in low-income communities and implementing a financially feasible program, Columbus will increase ridership, increase biking equity, and reduce greenhouse gases. Through reaching a broader demographic, the Columbus CoGo expansion has the potential to match the data analysis results that were found in Boston and Washington, D.C. as shown in Figure 1. It should be mentioned, however, that a limitation to the city of Columbus's ability to expand to the same degree as Boston or Washington D.C. is Columbus lacking the same tourism industry as these cities. This demographic is known to use bike shares in large metropolitan areas and increase ridership figures. With that being said, Columbus's CoGo bikeshare program still has tremendous opportunity to increase ridership in citizens and tourists alike. Not only will bike ridership increase, but, in addition, these two objectives complement each other and, if implemented simultaneously, will contribute to Columbus' comprehensive sustainability agenda.

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Appendix: Data

Dataset #2: HeatherBowdenInterview.docx
Source: Heather Bowden, General Manager of CoGo. Phone: (614) 352-2649
Description: This interview with Heather Bowden provided our group information regarding potential station locations for CoGo's 2015 expansion. Some of these locations included Victorian Village, Harrison Park, and the South Campus Gateway.

Dataset #3: Hubway Consolidated Data.xlsx
Nicole Freedman, Director of Bicycling Programs Boston. Phone: (617) 918-4456
Description: Nicole Freedman provided our group with Hubway, Boston's bike share program collected statistics. This data includes information regarding stations, usage, number of bikes, bicycle miles traveled, etc. This data was used for our Boston comparison and also was used in our analysis under Dataset #19.

Dataset #5: 2014-4Q COGO Quarterly Report.xlsx
Source: Kristin Edwards, Marketing Specialist at Motivate. Phone: (614) 352-2649
Description: Kristin provided our group CoGo's quarterly report which discloses their total collection of bike share statistics including number of stations, bicycle miles traveled, usage statistics etc. This data was the baseline foundation for our entire CoGo analysis and was used to gather background information regarding CoGo.

Dataset #6: HB Edits 2015 Forecasts Monthly System Stats worksheet.xlsx
Source: Kristin Edwards, Marketing Specialist at Motivate. Phone: (614) 352-2649
Description: Kristin provided our group CoGo's 2015 projections for trips based on a 10% increase in CoGo's 2014 values. These projections were the foundation for one of our CoGo projections based on a 10% annual increase in bicycle miles traveled.

Dataset #8: Pages from ALTA - Columbus OH Bike Share proposal FINAL.pdf
Source: Nicholas Sannan, Columbus Recreation and Parks. Email: NJSanna@columbus.gov
Description: This PDF details launch, operations, and equipment, cost figures associated with CoGo and was used for our cost analysis found in Dataset #18.

Dataset #10: KristenEdwardsInterview.dox
Source: Kristen Edwards, CoGo. Phone: (614) 352-2649
Description: Discussed the feasibility of a $6 monthly membership and a cash payment option in low-income areas.

Dataset #12: Interview Notes_NicoleFreedman.docx
Source: Nicole Freedman, Director of Bicycling Programs Boston. Phone: (617) 918-4456
Description: This interview with Nicole Freedman provided our group with information regarding Boston's bike share program Hubway. Specifically questions surrounded data collection, carbon emissions, types of expansion, and data analysis.
Dataset #17: Interview with Katie Monroe.docx

Source: Katie Monroe, Program Manager for outreach team at Bike Coalition of Greater Philadelphia. Phone: (215) 242-9253 ext 310
Description: This interview with Katie Monroe provided insight about the city of Philadelphia's equity bike initiative; its structure, funding, and challenges associated with bike share implementation in low-income areas.

Dataset #18: CoGo Analysis with Cost Figures
Source: Rebecca Poser and Harrison Morgenstern Email: Poser.1@osu.edu, Morgenstern.31@osu.edu
Description: This excel sheet details the projection of annual totals based on Columbus' 10% annual increase in bicycle miles traveled and outlines the associated costs based on the data from Dataset #20.

Dataset #19: Columbus Projections 2015-2020.xlsx
Source: Rebecca Poser and Harrison Morgenstern Email: Poser.1@osu.edu, Morgenstern.31@osu.edu
Description: A brief description of each tab in this sheet goes as follows:
"ProjectionColumbus_10%BMT:" Provides monthly breakdowns of carbon offset and calories burned based on a 10% annual increase in BMT through 2020
"Columbus_10%BMT_Summary:" Provides annual totals of total bikes, carbon offset, and calories burned based on a 10% annual increase in Columbus' BMT
"ProjectionColumbus_DC2011-2013:" Provides annual totals of carbon offset and calories burned based on projection that Columbus would experience similar changes in BMT that Washington D.C. did
"ProjectionColumbus_Boston:" Provides annual totals of carbon offset and calories burned based on projection that Columbus would experience similar changes in BMT that Boston did
"Summary Columbus Projections:" Summarizes the 3 projections detailed through our project.

Dataset #20: Scenario Analysis- Working Documents.xlsx
Source: Source: Rebecca Poser and Harrison Morgenstern Email: Poser.1@osu.edu, Morgenstern.31@osu.edu
Description: A working excel document detailing previous calculations and historical analyses. These calculations may or may not have influenced work described in our final project.

Dataset #24: Interview with Najah Shakir.docx
Source: Najah Shakir, Program Manager, Boston Bikes. Phone: (617) 918-4343
Description: This interview gave us a better understanding of what it takes a city like Boston or Columbus to implement bike share successfully in low-income areas. Through this interview we were able to obtain information about Boston's subsidy funding sources, outreach programs, and future work.

Dataset #27: Neil Walker Interview.dox
Source: Neil Walker, The League of American Bicyclists Equity Council. Phone: (678) 200-2182

Description: This interview with Neil Walker provided insight into what works best when trying to increase bike share equity. Additionally, Neil discusses what might help boost Columbus to Silver Level Bicycle Friendly Community rating.

Dataset #28: Membership-Estimated Miles Traveled-Estimated Calories & Carbon Offset – CaBi.xlsx
Source: Gideon Lachman, Senior Data Analyst at Motivate. Email: Gideon@motivate.com
Description: Gideon provided our group with Capital Bikeshare's statistics including total bikes, bikes in service, users, bicycle miles traveled, calories burned, and carbon offset. This data was used for our Columbus D.C. projection found under Dataset #19.

Dataset #29: JonathanYoungmanInterview.docx
Source: Jonathan Youngman, Franklinton Cycle Works Coordinator. Phone: (614) 546-6385
Description: This interview with Jonathan Youngman provided insight into the Franklinton community as well as information about how a bike program could be adjusted to fit the needs of low-income Columbus residents.