Business Report: Bixi Project - Part 2 - Visual Analytics in Tableau
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May 29th, 2023

Introduction

In this report, we explore how people in Montreal, QC use Bixi bikes and identify factors that affect usage volume, popular stations, and overall business growth.

In order to gain a better understanding of the Bixi trip data, we begin with an exploratory data analysis (EDA). This help to identify any trends, patterns, or anomalies in the dataset.

Dataset: The dataset contains two years of Bixi trip data, between 2016 and 2017. The "stations" table provides information about the Bixi stations, including their code, name, latitude, and longitude. Details about each trip are contained in the "trips" table, including the trip ID, start and end dates, start and end station codes, and whether the trip was made by a member or not.

In this report, the Bixi trip data is analyzed using Tableau to derive business insights and address various questions. Data visualizations are provided to allow for interactive exploration of the dataset, enabling to uncover key trends, patterns, and relationships.

Methodology

To analyze the Bixi trip data, we utilize Tableau, a powerful data visualization tool. Tableau is connected to the Bixi MySQL database containing the trip and station data to perform calculations, aggregations, and visualizations directly within Tableau.

The analysis involves creating various visualizations and exploring different dimensions of the data, i.e. trip volumes, trip durations, station usage, and revenue. We analyze data using calculated fields, filters, and interactive features in Tableau, which provide dynamic insights and allow users to drill down into the data as needed.

Summary of Visualizations

Q1-1: Total Number of Monthly Trips by Year:

This figure contrasts the total number of monthly trips for the calendar years 2016 and 2017. The first noteworthy observation is that there was an increase in bike usage in 2017 compared to 2016, indicating changes in the popularity and demand for the Bixi service. This increase could be attributed to various factors, i.e. over time, the awareness and popularity of Bixi bikes may have increased. It is possible that more people recognized the company in 2017, leading to a higher adoption rate. Promotions, discounts, or campaigns promoting biking as a sustainable and healthy mode of transportation might have contributed to the rise in bike usage.

The second observation is differences in usage patterns between the months of the year. The summer months show the maximum usage of bikes in both years which could be attributed to several possible reasons. Summer months typically have warmer and more pleasant weather compared to other seasons.

Furthermore, summer is associated with school breaks, festivals, and events. Additionally, awareness campaigns and initiatives promoting cycling may be more active during this time, further encouraging people to use bikes.

When comparing the trip volumes between the two years, we observed that the month of July consistently had the maximum number of trips, while November had the minimum number of trips.
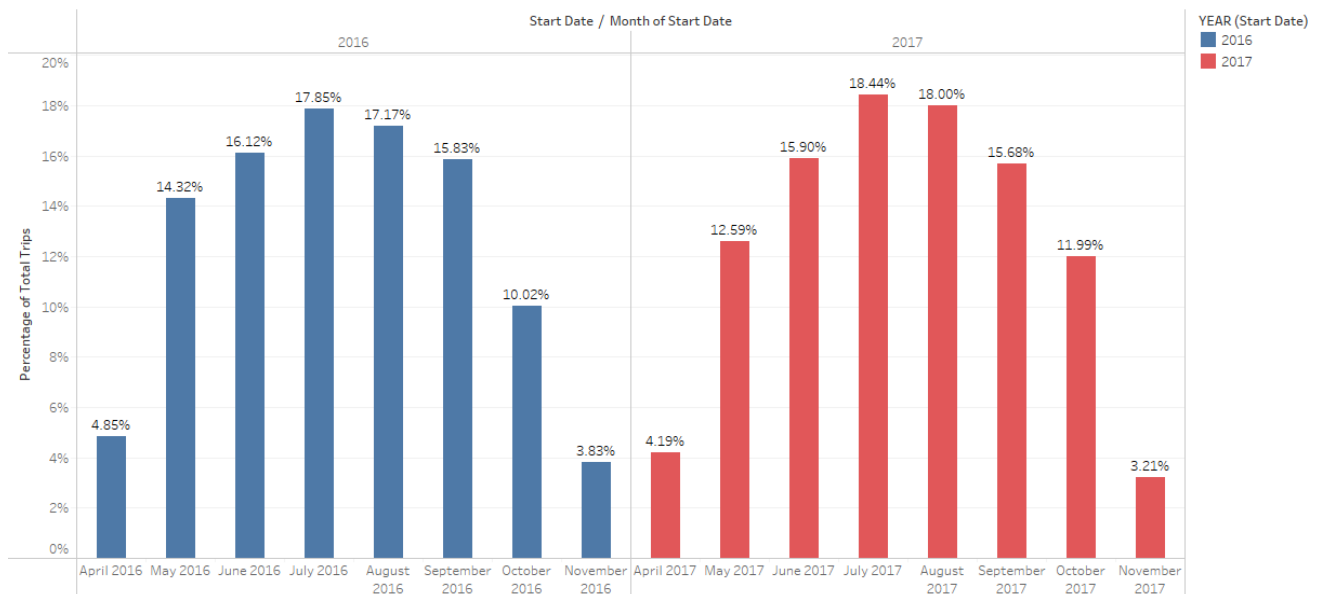
Q1-1: Total Monthly Trips for Years of 2016 and 2017
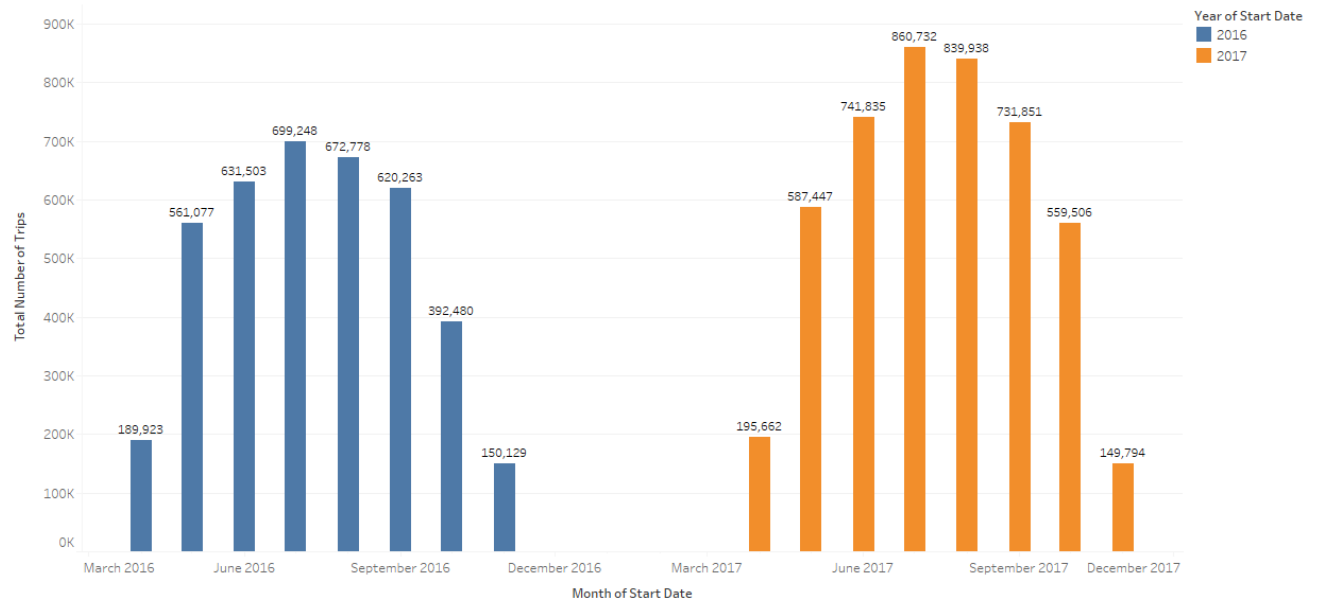
Q1-2: Monthly Proportional Usage:
This figure demonstrates the percentage of trips that occurred in each month, comparing 2016 and 2017.

Q1-2: Percentage of Monthly Trips per Year, Between 2016 and 2017

The analysis reveals that about 50% of total trips in each year were made in summer. Moreover, there was a significant increase of 23% in bike usage, in high season, 2017 compared to 2016 and 3%, in low season.

It is important to mention that there is no available data for the months of January, February, March, and December. The absence of data for these months could be attributed to several possible reasons i.e. seasonal factors, data collection limitations, or data filtering.

Q1-3: Percentage of Member Trips per Month in 2017:
This figure displays the percentage of trips that were made by members per month for the year 2017.

Q1-3: Percentage of Trips by Members in 2017
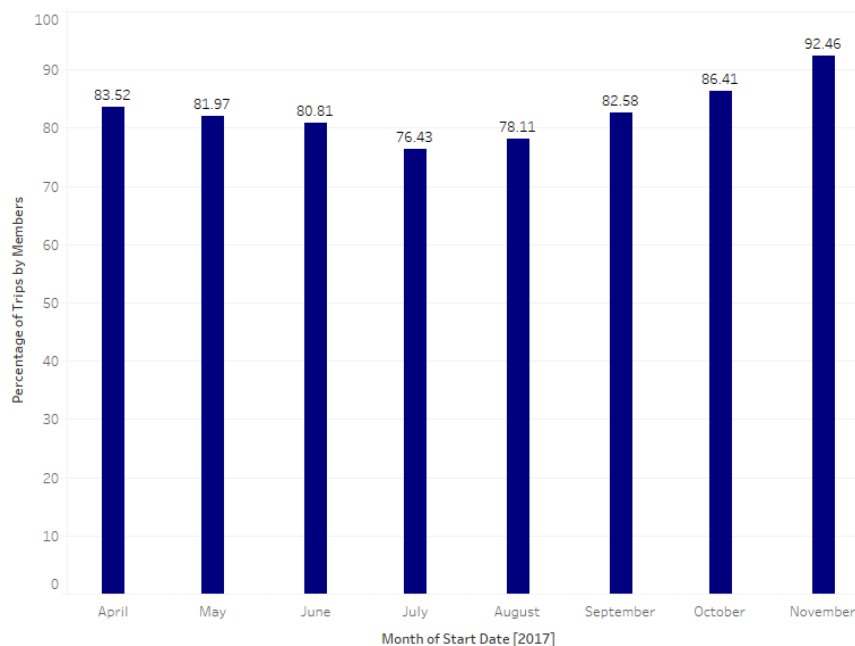
Upon analyzing the data, an interesting trend in member trip patterns was observed. Members made the maximum number of trips during the low season and the minimum number of trips during the high season.

This finding might appear surprising at first, as one might expect members to utilize the Bixi service more frequently when the weather is favorable and outdoor activities are more common. However, the opposite pattern was observed.

Members may primarily use the Bixi service for their daily commuting needs, possibly due to fewer alternative transportation options available. On the other hand, high seasons often coincide with an influx of tourists and visitors, who are more likely to utilize Bixi bikes for sightseeing and exploring the city.

Q1- 4: Top 10 Stations by Percentage of Round Trips:
This figure focuses on iidentifying the stations with a high percent of round trips.

Name of Station
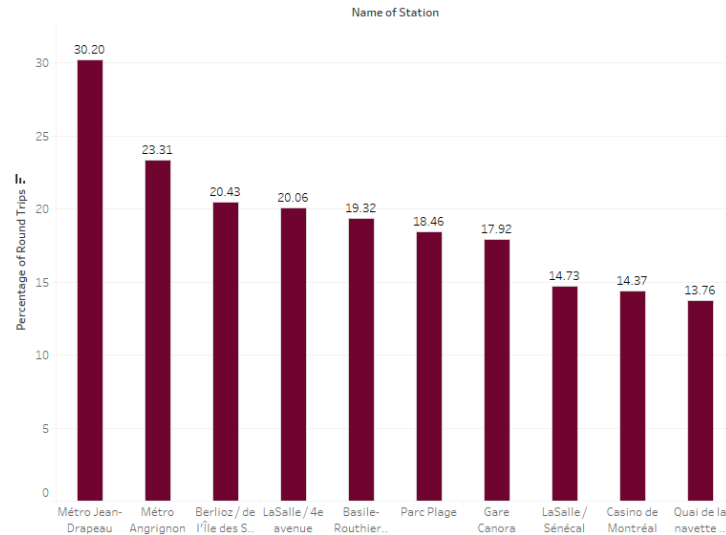
The proximity of top 10 stations with the highest percentage of round trips suggests that the surrounding area experiences a high demand for bike renting services. Identifying these stations could suggest the high demand and a potential opportunity for expanding Bixi's bike network.

Q2-1: Relationship between Percentage of Round Trips / Member Trips by Station:

This visualization examines the relationship between the percentage of round trips and the percentage of member trips at each station.

Q2-1: Relationship Between Percentage of Round Trips and Percentage of Member Trips by Station

Name of Station

[PercentageMemberTri..

2,391   9,170
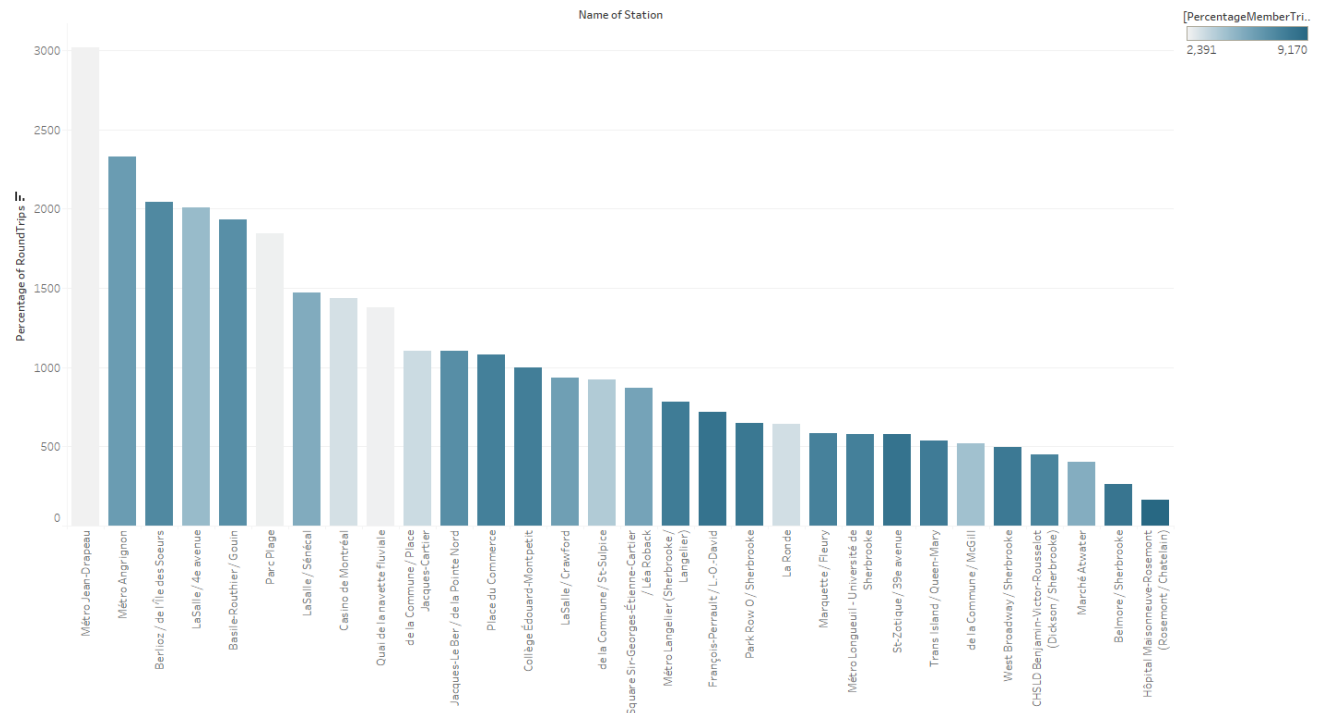
In this analysis, the relationship between the percentage of round trips and the percentage of member trips at each station was explored. We discovered an interesting correlation: stations with the highest

percentage of round trips were predominantly made by non-members, while stations with the highest percentage of member trips exhibited a lower proportion of round trips.

This finding suggests that there may be distinct behavioural patterns and preferences between members and non-members when it comes to round trips.

Q2-2: Distribution of Trips Duration:

This histogram graph showcases the distribution of all trips by duration in minutes.

Comparing the trip duration distributions shows that members primarily made short trips, with the majority falling within the 2-7 minute range. This suggests that members frequently use Bixi bikes for short-distance transportation, such as commuting between nearby locations or running errands within the city. The concentration of trips in this duration range indicates that members rely on Bixi as a convenient and efficient mode of transportation for short journeys.

In contrast, non-members exhibited a broader distribution of trip durations, with a wider spread across different time intervals. While non-members also made short trips, their distribution extended to longer durations as well. This variation in trip durations among non-members indicates a more diverse range of usage patterns and purposes.

Q2-2: Distribution of Trip Duration by Membership Type: Contrasting Member and Non-Member Behavior
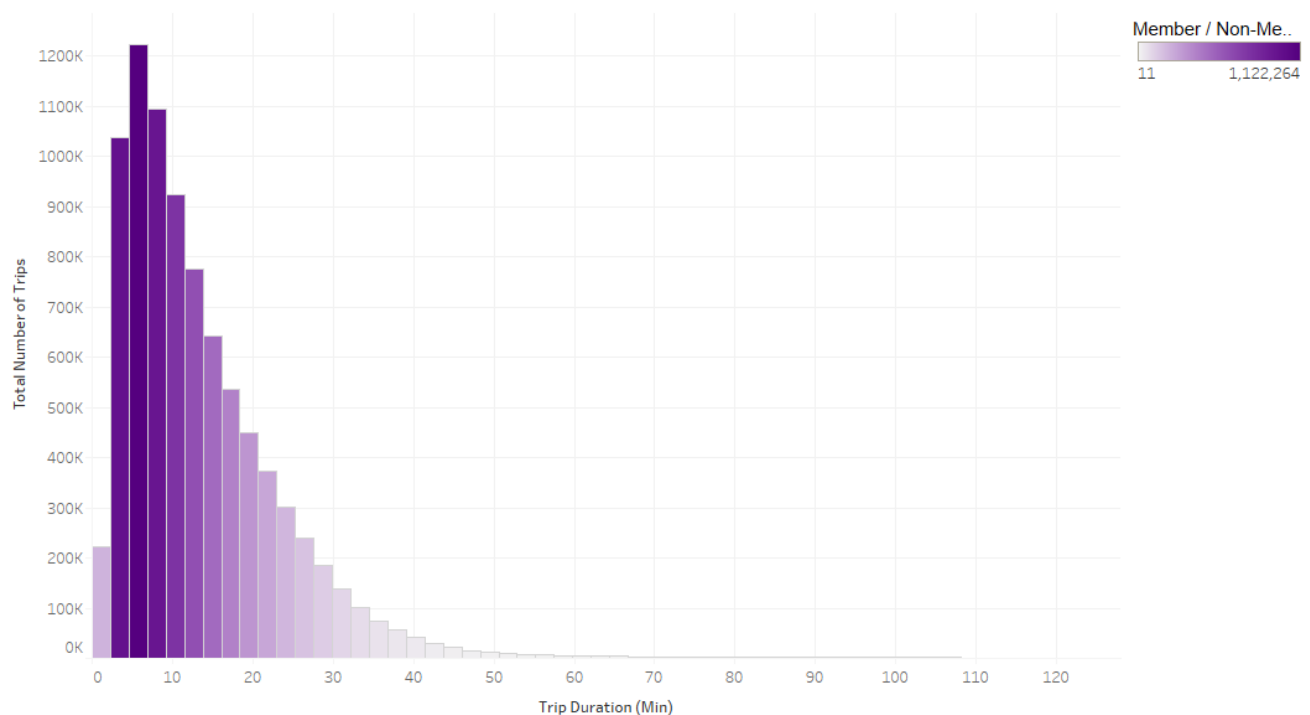
**Q2-3: The Map of Average Trip Duration per Station:**

This map visualization displays the average trip duration per station across the city. One notable observation is that stations located in the Montreal City Centre consistently exhibit shorter trip durations

compared to other areas in the city. This neighbourhood serves as a bustling hub, attracting a diverse range of individuals including shoppers, office workers, and students from renowned institutions such as McGill University and Concordia University.

The presence of shorter trip durations in this area can be attributed to the vibrant and dynamic nature of this district. Many individuals in this area likely use Bixi bikes for short-distance travel within the city center, such as running errands, commuting between nearby locations, or exploring the various amenities and attractions in the vicinity.

Additionally, students from McGill University and Concordia University possibly rely on Bixi bikes to navigate between campus buildings, attend classes, and explore the surrounding areas.

Q2-3: Geographic Pattern of Average Trip Duration per Station

Map based on Longitude and Latitude. Color shows AvgTripDuration.
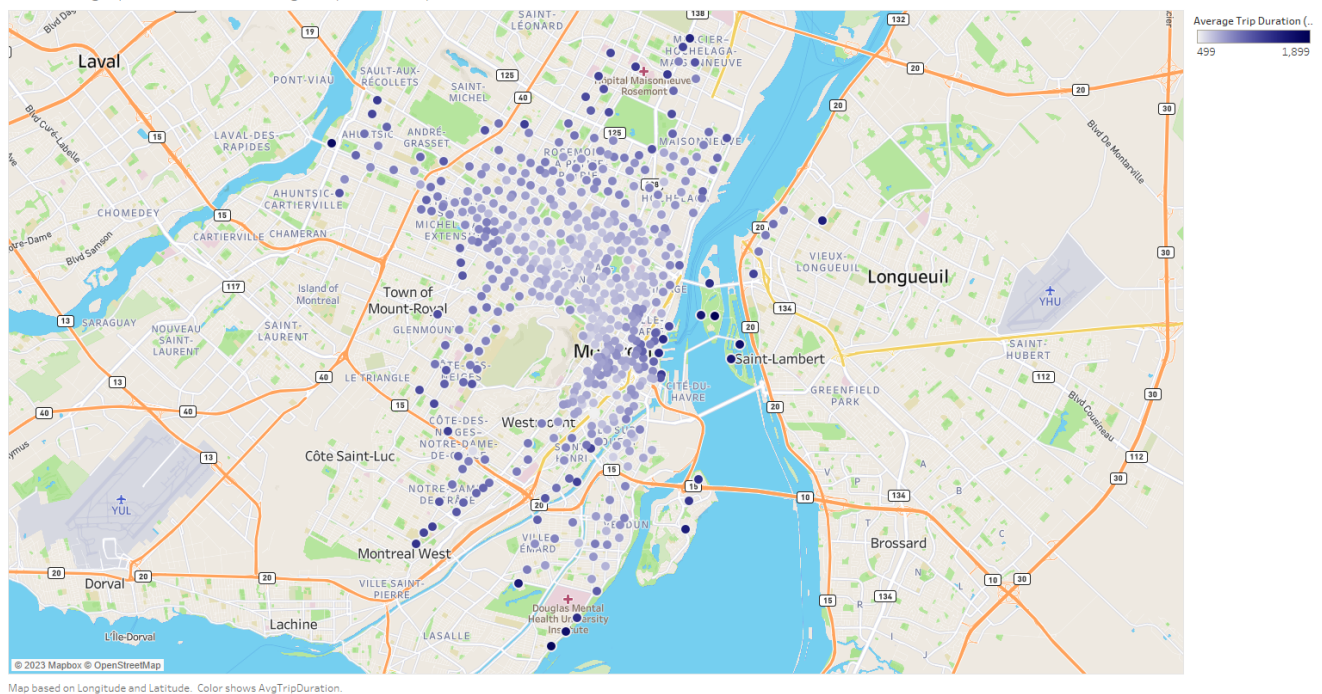
Q3-2. Revenue Analysis for Single Trips:

In order to gain a better understanding of the revenue generated by infrequent users who make single, shorter trips lasting an hour or less, we have calculated the total revenue for each pricing bucket based on the pricing model provided:

Total revenue from trips 30 minutes or less: $4,134,452
Total revenue from trips greater than 30 minutes, up to 45 minutes: $734,585
Total revenue from trips greater than 45 minutes, up to 60 minutes: $329,758

The highest percentage of revenue, 85.18%, is generated from trips that are 30 minutes or less. This indicates that the majority of revenue is derived from users who opt for short trips within the specified time limit. The competitive pricing of a $2.99 flat rate for trips lasting 30 minutes or less appeals to users looking for quick and affordable transportation options for shorter distances.

Trips that exceed 30 minutes but fall within the 45-minute time limit contribute to 15.09% of the total revenue.

Finally, trips lasting between 45 minutes and 60 minutes contribute to 6.76% of the total revenue. This lower percentage indicates that longer trips have a relatively smaller impact on the overall revenue.

Q3-2: Revenue Percentage for Single Trips by Non-Members
Up to an Hour
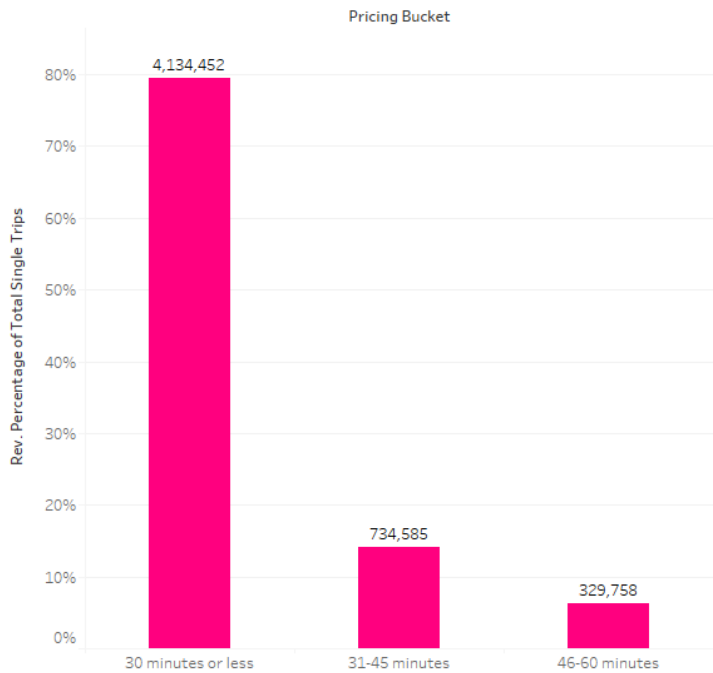
Q3-3. Revenue Generation Patterns for Single Trips of 30 Minutes or Less:
To further analyze revenue patterns, we focused on understanding when Bixi is generating the most revenue from single trips lasting 30 minutes or less. To accomplish this, we created a visualization that shows the total amount of flat rate revenue for each hour and each day of the week.

Q3-3: Revenue from Flat Rate Charges Per Hour of Each Day of Week

StartHour	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
0	34,181	12,242	8,937	10,832	12,927	16,727	28,478
1	28,249	7,795	5,160	7,211	8,713	12,505	25,300
2	22,880	4,861	3,256	4,560	4,944	8,133	20,735
3	23,395	4,434	2,609	3,274	3,726	6,630	18,887
4	7,745	1,644	1,033	1,299	1,404	2,399	5,756
5	3,498	1,316	1,008	1,042	1,099	1,521	2,629
6	2,870	2,048	2,290	2,377	2,397	2,252	2,192
7	4,115	6,198	7,433	7,562	7,808	6,694	3,913
8	10,028	14,329	16,707	18,446	17,878	15,098	8,786
9	22,757	17,279	18,645	18,642	18,020	17,071	19,483
10	45,609	24,413	24,505	23,684	22,006	23,925	36,133
11	67,893	33,661	32,783	32,561	30,660	34,990	57,606
12	82,375	36,975	36,012	35,849	35,795	42,107	71,080
13	94,916	40,083	37,837	38,337	37,173	44,557	84,677
14	104,447	42,763	39,718	39,859	40,106	47,514	94,621
15	106,173	46,810	41,905	43,407	43,693	51,384	100,825
16	99,328	46,885	46,741	48,648	47,041	55,225	97,527
17	89,031	48,152	53,074	52,761	52,662	57,339	92,817
18	76,097	42,965	44,016	47,018	47,077	50,871	81,723
19	62,140	33,990	36,799	38,000	40,465	44,221	68,327
20	49,036	27,657	29,809	31,561	33,004	38,016	56,892
21	38,724	21,950	25,581	28,272	28,179	34,044	48,824
22	32,135	18,122	21,536	25,611	27,311	32,885	46,436
23	24,550	13,374	15,995	19,614	22,763	32,000	44,261

Total Revenue for Singl.. 1,008 — 106,173

In general, the hours between 12 PM and 6 PM show the highest revenue. This time period, corresponds to the peak usage of Bixi bikes, likely driven by commuters, students, and individuals running errands or engaging in leisure activities.

On Monday to Friday, the highest revenue is observed at 5 PM, which aligns with the typical rush hour when people are commuting back home. This peak revenue hour indicates the popularity of Bixi as a convenient mode of transportation for daily commuters.

On weekends, the revenue distribution differs from workdays. The highest revenue is observed at 3 PM, indicating that users tend to use Bixi bikes during the early afternoon on weekends. Sundays and Saturdays collectively generate the highest amount of revenue compared to workdays. In fact, the revenue on weekends is significantly higher, approximately 50% more than on workdays.

Conclusion
The data visual analysis conducted using Tableau provided valuable insights into Bixi bike usage within the period of 2016-2017. There was an increase in bike usage in 2017 compared to 2016, indicating a growing popularity and demand for the Bixi service. The summer months consistently showed the highest bike usage, which can be attributed to factors such as favorable weather, school breaks, events, and increased tourism.

Members made the maximum number of trips during the low season and the minimum number of trips during the high season. It suggests that members primarily utilize Bixi for daily commuting purposes, while non-members, including tourists and visitors, contribute to the higher usage during the high season.

Stations with a high percentage of round trips are predominantly used by non-members, while stations with a high percentage of member trips have a lower proportion of round trips.

Members primarily made short trips within the 2-7 minute range, indicating their reliance on Bixi for convenient short-distance transportation.

Stations in the Montreal City Centre neighbourhood consistently showed shorter trip durations. This can be attributed to the bustling nature of the area, with a high concentration of shoppers, office workers, and students from nearby universities.

Revenue generated from single trips of 30 minutes or less accounted for the majority of the total revenue. Shorter trips within the 30-minute time limit contributed to the highest percentage of revenue, followed by trips between 30 and 45 minutes, and trips between 45 and 60 minutes.

The hours between 12 PM and 6 PM, particularly on workdays, generate the most revenue for Bixi's flat rate charge. However, Sundays and Saturdays stand out as days with significantly higher revenue compared to workdays, indicating a surge in usage and revenue during weekends.

Based on these findings, the following recommendations can be made: Capitalize on the increased usage and revenue observed on weekends by offering special promotions and discounts targeted at

non-members, tourists, and recreational users. Emphasize the value of Bixi for leisure activities, sightseeing, and exploring the city.

Actively seek feedback from members and non-members to understand their needs, preferences, and suggestions for improving the Bixi service. This can be done through surveys, user forums, or feedback mechanisms within the Bixi app or website.

Explore partnerships with local businesses, universities, and event organizers to promote Bixi usage during peak revenue hours. This can involve joint marketing campaigns, incentives for employees or students, and collaborations with events or festivals to increase visibility and attract new users.

By implementing these recommendations, Bixi can enhance its revenue generation, user satisfaction, and overall success as a reliable and sustainable bike-sharing service.