

# Report Business



MBAS906 Assignment 3

Final Report Business for NMSS 'Bike MS' fundraising event

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## **Executive Summary**

This final analytics report provides a detailed analysis of the National Multiple Sclerosis Society's (NMSS) Bike MS fundraising event. The report aims to address the challenges faced in attracting new participants and increasing fundraising efforts. Through descriptive, predictive, and prescriptive analytics, valuable insights have been gained to develop a strategy for success.

Descriptive analytics revealed a decline in the number of participants over the years, emphasizing the need for effective retention strategies. Team-based fundraising, especially with corporate teams, was found to be crucial for successful fundraising.

Predictive analytics offered forecasting models, showing the potential impact of increasing participant numbers on total donation amounts. This enables strategic planning for the future.

The prescriptive analysis presents a comprehensive strategy, targeting corporate donors, encouraging female participation, promoting team-based fundraising, leveraging digital marketing, engaging corporate sponsors, and enhancing team captain engagement. Continuous monitoring and evaluation will ensure effectiveness.

To achieve the mission of NMSS, the report emphasizes the importance of retaining existing participants and attracting new ones, particularly from occupational groups with strong connections to MS. By following the proposed strategy, the NMSS can work towards its goal of a world free of MS.

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## **Introduction**

The National Multiple Sclerosis Society (NMSS) is in the top 100 of largest non-profit in the United States arranged by Forbes. NMSS is dedicated to fund research and perform public awareness and education regarding Multiple Sclerosis or MS, which is more frequent in women than men, also it is typically diagnosed in patients between the ages of 20 and 50, (Zagieboylo, C). According to the vision is “A World free of MS”, while the Society’s mission is “We will cure MS while empowering people affected by MS to live their best lives”.

Individuals who have been diagnosed with Multiple Sclerosis (MS), a chronic neurodegenerative disorder affecting the nerve system, often exhibit reduced levels of physical activity due to limitations in both physical and cognitive functioning. Several studies have shown evidence in favour of the notion that including Physical Activity into one's routine might effectively aid in the management of symptoms associated with Multiple Sclerosis and perhaps decelerate the progression of the illness (Casey, 2018; Faszewski, 2019). The National Multiple Sclerosis Society has demonstrated that social support has a positive impact on promoting physical activity behaviour within group exercise settings.

The National Multiple Sclerosis Society raises funds predominantly through individual donations and "Bike MS" sponsored charity cycling events, which is the world's largest fundraising cycling campaign for MS. The event has raised over \$69 million in 2017 to support MS research, advocacy, education, and programs for individuals with MS, with over 75 rides conducted annually and nearly 80,000 participants. Teams are the primary contributors to the donation pool, contributing approximately 87% of the total amount raised. Faszewski (2020) found that Bike MS's fundraising activities promoted social engagement and support, cause awareness, fundraising, long-term physical benefits, and an overall increase in quality of life as an incentive to participate for participants and individuals with MS, emphasizing that they are not alone in confronting this issue and can live their best lives. However, since 2012, Bike MS's market share has decreased annually, as charities representing numerous distinct pathologies now rely on individual donations and bike rides. This is reflected in declining revenue and participant numbers. The retention of prior participants is still high, but the number of new participants is decreasing. Forbes reports that the NMSS experienced a loss of \$8 million in 2017. In order to maintain a fundraising advantage and remain competitive, the NMSS has partnered with Pink Diamond Consulting Group to address their data and relevant business questions to be addressed.

## **Problem statement**

The Bike MS fundraising event is facing a significant challenge in attracting a substantial number of participants, despite maintaining relatively high participant retention rates. Acquiring new supporters has proven to be particularly difficult, impeding the organization's ability to raise sufficient funds to fulfill its mission of curing MS and empowering those affected to lead their best lives.

To address this issue, the NMSS has set its focus on increasing the number of corporate donors. Currently, the event receives substantial support from large corporate teams, primarily consisting of middle-aged, white, and high-income earners. The primary business question to be addressed is how to increase the formation of new corporate teams by identifying organisations with a sizable employee base that share health and wellness objectives. In order to optimise event planning strategies, it is essential to determine which events and markets are popular with the corporate demographic.

By understanding and addressing these critical challenges, the NMSS can pave the way for successful fundraising efforts and make significant progress towards its mission of combating MS and improving the lives of those impacted by the disease.

## **Desired Result**

- Increasing the number of participations by 10%, including 5% of new participants within one year.
- Determine in two years the digital marketing opportunities for attracting new participants to increase donations through social media and other channels. Realising revenue growth within three years

## **Stakeholders Involve**

- NMSS organisation, event founders, event organisers, event participants, corporate partners, consultants, Bike MS employees, participations, support staff, Volunteer

## **Key Questions**

- What are the greatest opportunities for new corporate teams? and how can apply to market?
- What is the strongest involvement industry and occupation? and how can identify opportunities from them?
- How should the organisation respond to increasing competitive cycling charities?

## **Constraints to the Solution**

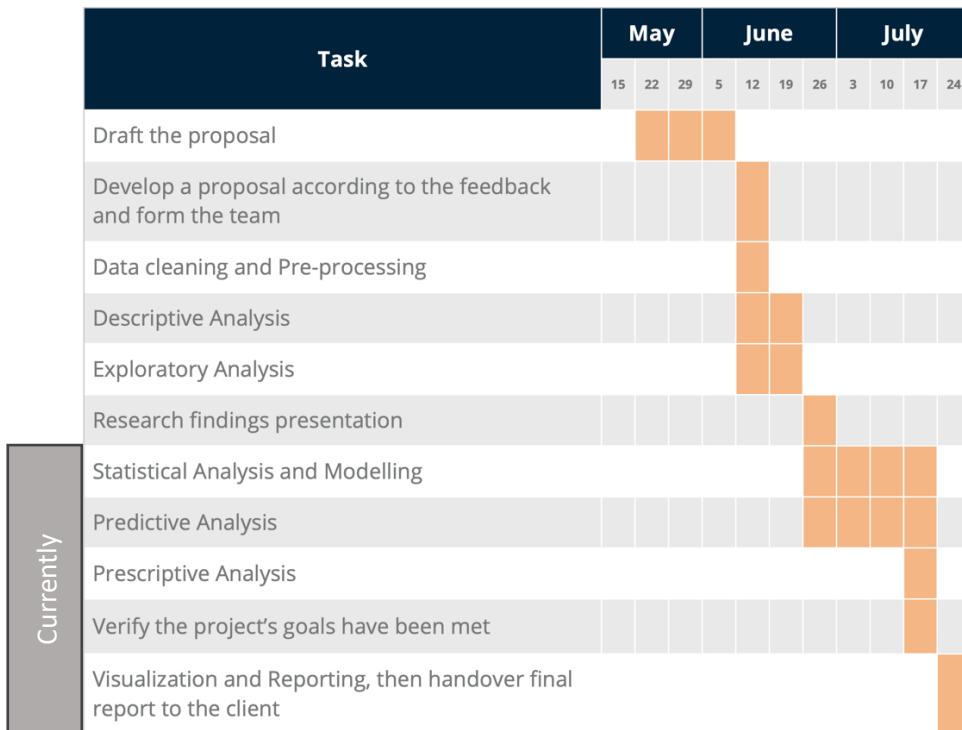
- Expenditure has limited.
- One year time to develop solving strategy.
- Cycling space has become very crowded.
- Limited database provided by the organisation.

## **Decision Criteria**

- Maximise donations per participant team.
- Increasing new participants and corporate partners
- Ease of implementation within the timeframe

## Methodology

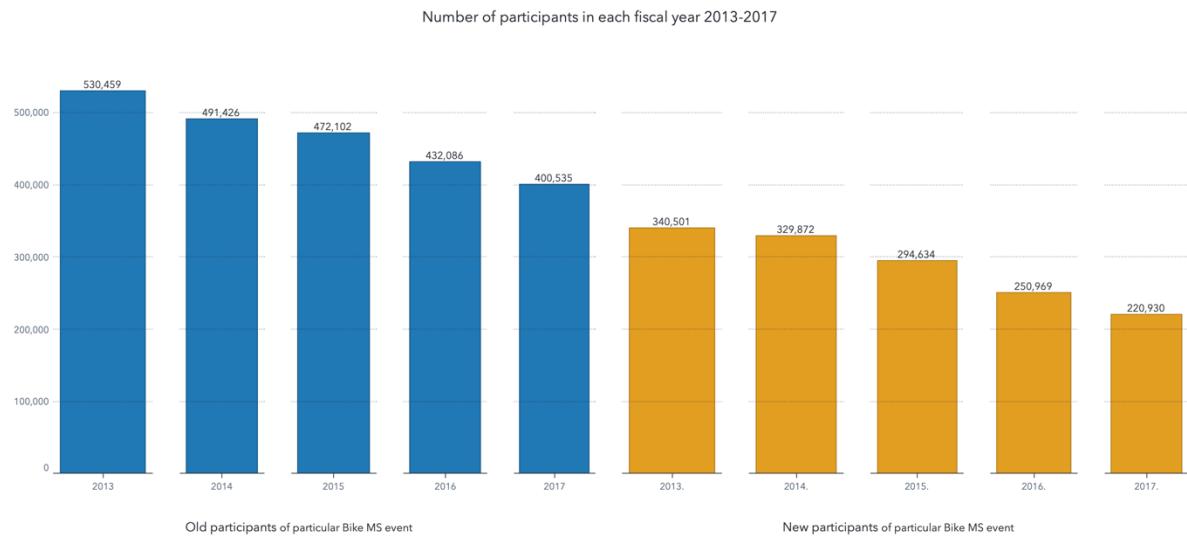
### Timeline



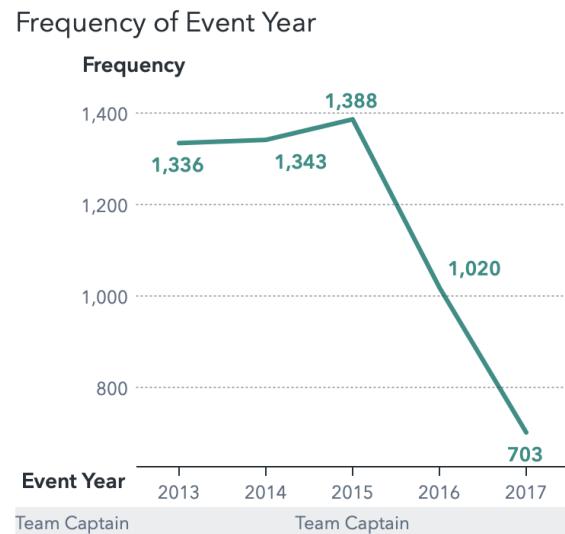
From a proposal that was previously presented to focus on marketing, it has shifted to focus on editing existing information, and develop it as a secondary matter by setting long-term three years targets increasing donations through social media and other channels. Adjusting the number of participants increasing from 8% to 10% and increased donations are the priority, that will measure in 1 year. Also, eliminate insignificant insights in the presentation by adding deeper insights that can be further developed in this final report.

To begin with accessing the dataset of Bike MS Participation, Bike events, Bike teams, National Team Activity, and Bike Donations 2013-2017 through SAS Viya. Using every possibility to enhance participant engagement. It is necessary to find every connection of information. The method used is a combination to collect comprehensive and practical insights. In order to create, statistical analysis model, predictive analysis, prescriptive analysis, answer business questions, also verify the project's goals have been met.

## Descriptive Analytics

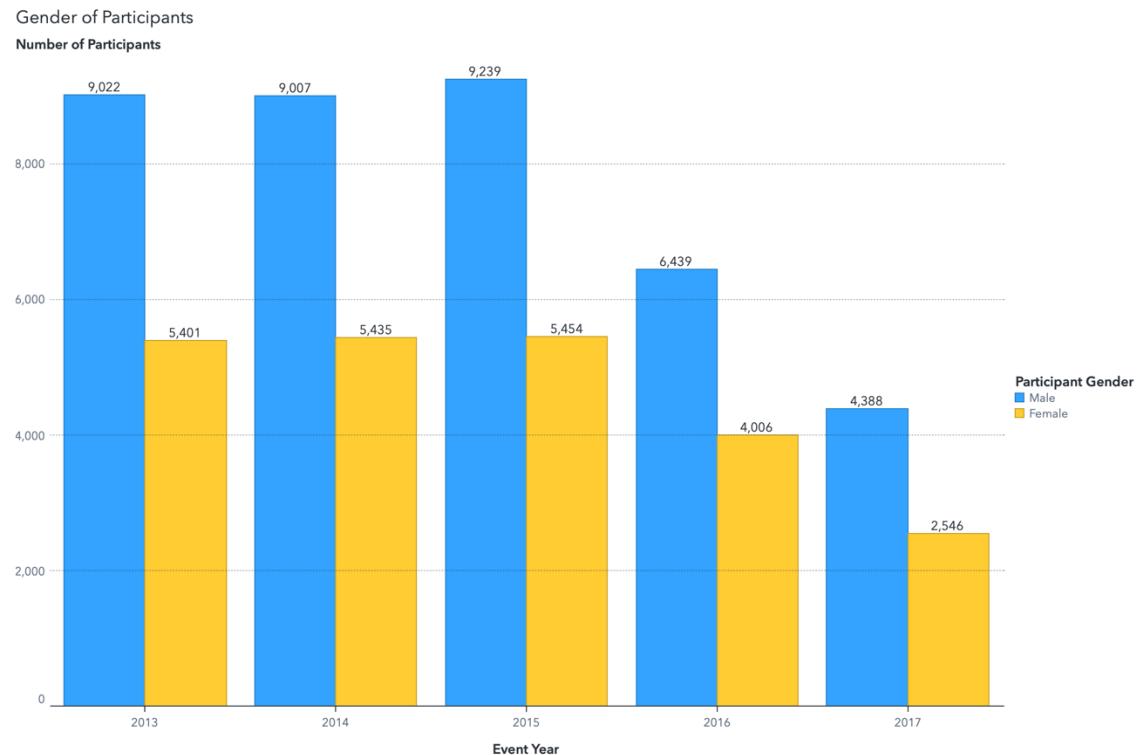


The analysis of the provided data indicates a consistent decline in the number of participants over the years. The graph clearly demonstrates this downward trend. To gain further insights, we divided the data into two categories: old participants and new participants. However, upon analysing the results, it becomes evident that the decline affected both groups similarly. As a result, we can conclude that Bike MS must devise a comprehensive strategy that addresses the needs of both existing and potential participants to reverse this decline effectively. By focusing on retaining and engaging old participants while actively attracting new participants, the organization can chart a path for sustained growth and success in the future.



In addition to the general decline in overall participation, our analysis reveals a noteworthy and distinct reduction in the number of team captains. This decline has been particularly pronounced since 2015, with a significant decrease of up to 50% observed in 2017. The decline in team captains directly impacts the organization's fundraising efforts to a considerable extent. It is crucial for Bike MS to address this issue and implement strategic measures to encourage and support team captain engagement to ensure sustainable fundraising success.

Participant Gender	Number of Participants ▾
Male	40,478
Female	24,130



As per Bike MS's briefing, the data analysis confirms that the average participant is male. Based on the bar graph presented above, it can be observed that the participation ratio of women is approximately 60% compared to men, consistently across all years. This suggests that, in general, there are more men participating in the cycling events compared to women. The organization may want to explore strategies to encourage greater female participation in the future to achieve a more balanced representation among participants.

Measure	Minimum	Lower Whisker	First Quartile	Average	Median ▾	Third Quartile	Upper Whisker	Maximum	Std Dev	Count
Total of All Confirmed Gifts(\$)	0	0	200	856.55906121	400	800	203791	203791	2490.7475857	65,499
Total Number of Donations	0	0	1	8.4621139254	5	11	552	552	12.492120779	65,499

The average confirmed gifts and number of donations per head

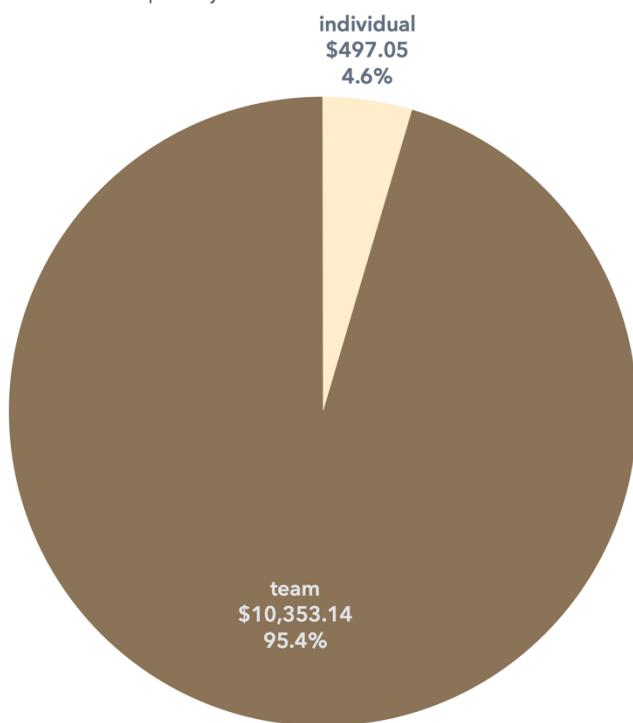
## Business Questions

### **What are the best opportunities for advancement for new corporate teams?**

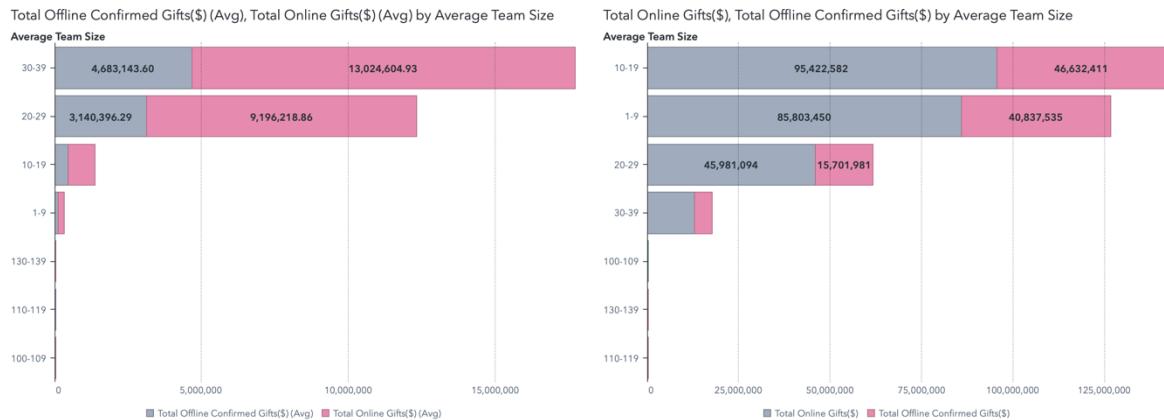
Bike MS has identified corporate teams with 10 or more members as a crucial factor in achieving a successful fundraising season. They have set goal to increasing active registration by almost 9 percent compared to 2017. In the previous year, the event recorded 74,000 riders and a total of 6,150 teams. For 2018, their target is to reach about 80,000 riders, including 40,000 new participants who have not taken part in the event within the last five years.

Further analysis revealed that an overwhelming majority, up to 99%, of the total confirmed donations are contributed by team cyclists, with only 1% coming from individual cyclists. Understanding this donation distribution pattern is crucial for Bike MS to tailor its fundraising strategies effectively and maximize contributions to support its mission.

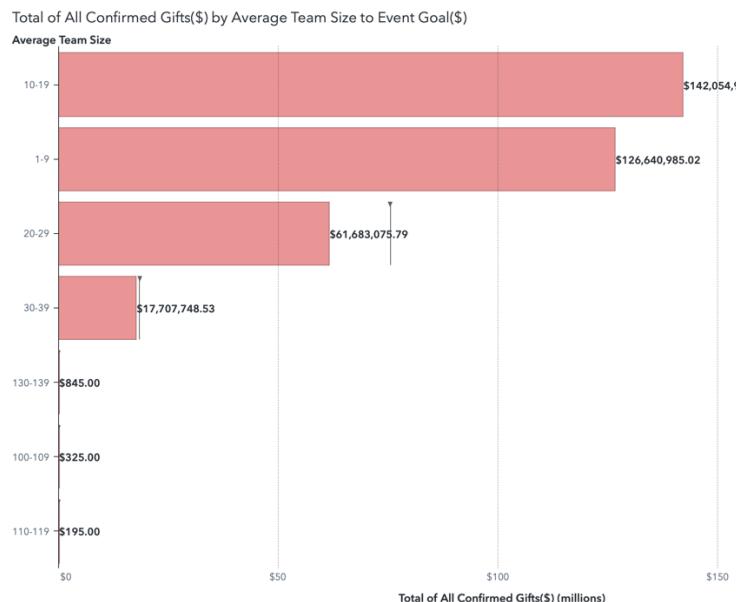
Team Total Confirmed (Avg.) by Number of Participants by team and non team

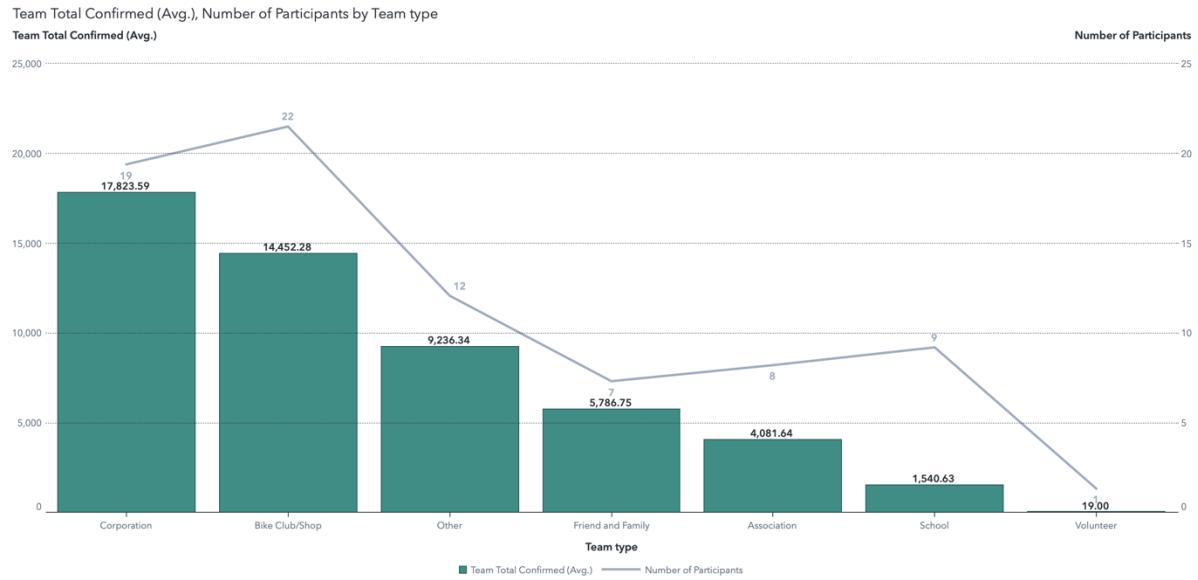


Upon analysing the average donation amounts per participant, we observed that individual cyclists donated approximately \$500 per person, while team donations averaged around \$10,300 per team. This reinforces the notion that team contributions outperform individual contributions.

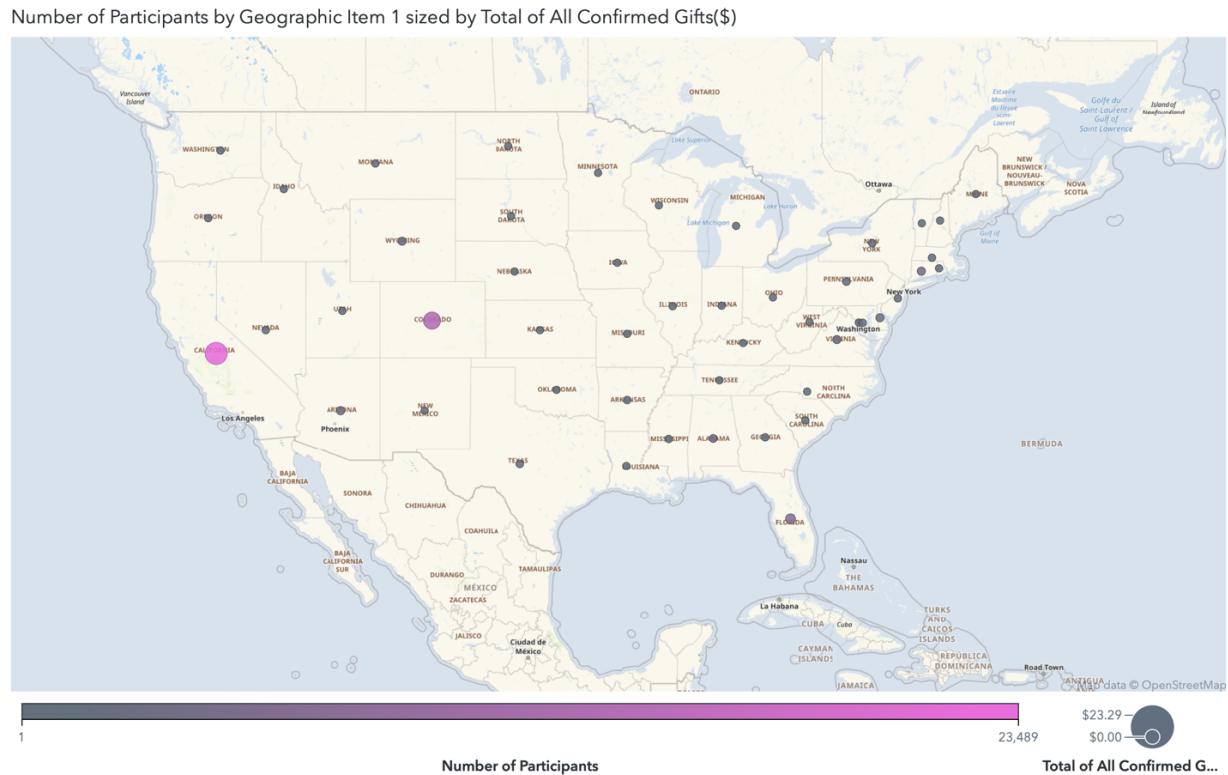


Our analysis indicates that the average team size that contributes the highest donations is within the range of 30 to 39 members per team. Notably, these teams demonstrate a remarkable ability to generate donations that align closely with the event's fundraising goals. However, when considering total donations, it becomes evident that teams with a size of 10 to 19 members perform exceptionally well. This is due to the larger number of teams within this size range, and a substantial portion of event participants show a preference for teams of this size. Understanding the dynamics of team sizes and their impact on donations can help us devise targeted strategies to further enhance fundraising success and effectively engage event participants.

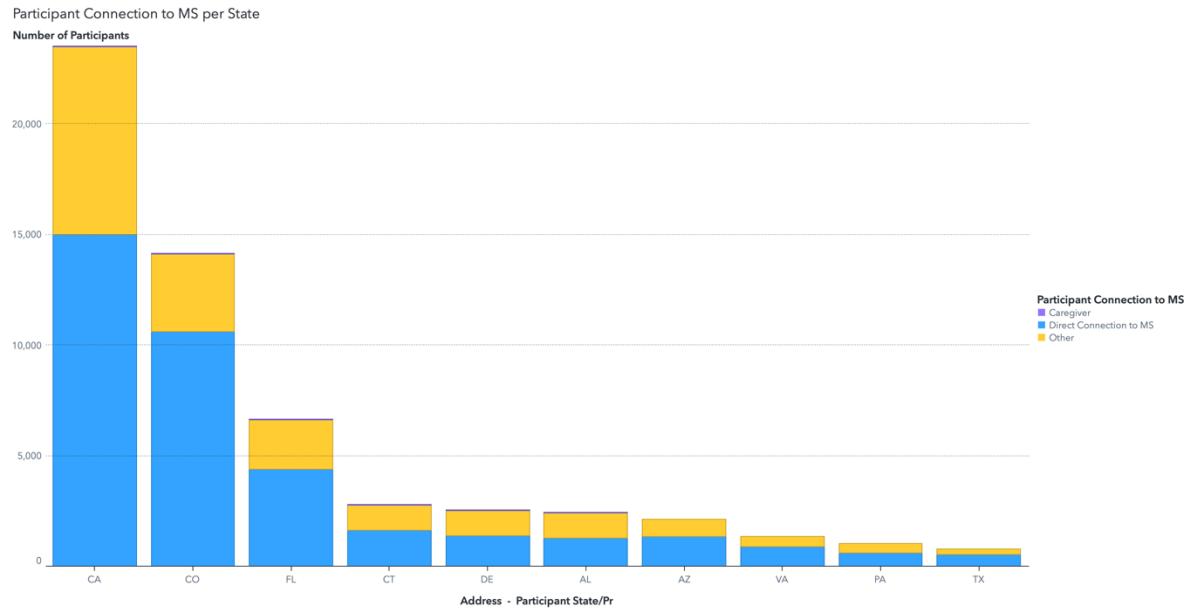




Having established that the majority of donations primarily come from teams, we shall now delve into the different types of teams participating in the event. Based on the insights from the bar chart, it is evident that corporate teams yield the highest average donation amount. Notably, this category comprises a substantial number of teams, totalling 7,960. The corresponding line graph provides valuable information regarding the average number of members within each team for each category. For instance, corporate teams and bike clubs have an average team size of 19 and 22 members respectively.

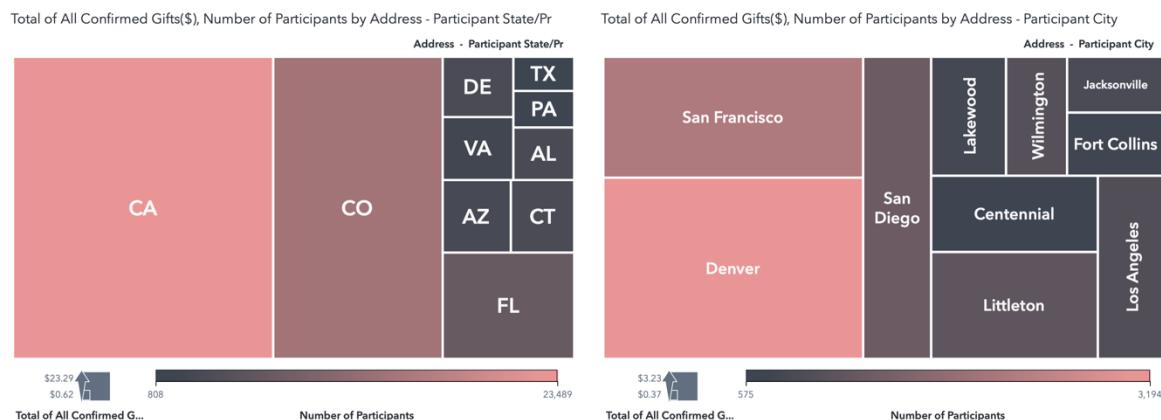


Analysing the number of participants and donation amounts in each state by Geo map, it was found that California garnered the highest level of interest from potential participants. Following closely behind was the state of Colorado.



In the state with the highest popularity for the event, there is a noteworthy prevalence of participants who have direct connections to Multiple Sclerosis (MS).

## Can we apply those opportunities to specific markets, especially our biggest events?



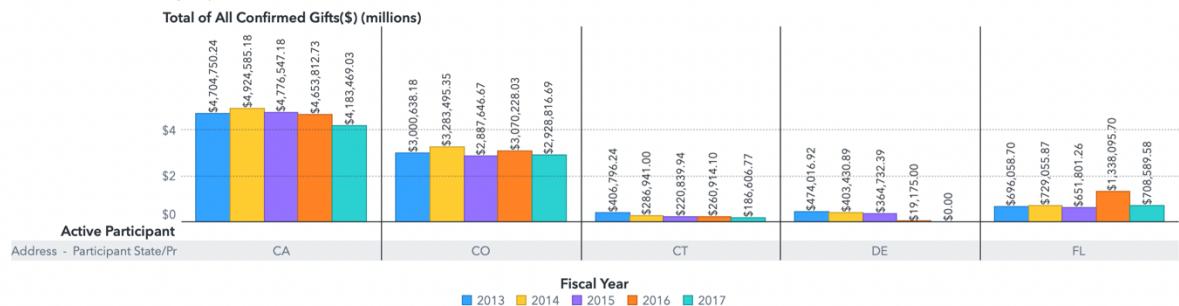
Tree map shows state and city that the most participants were participated.

From the tree map, we can observe that California (CA) has the highest number of participants, making it the state with the highest level of engagement. However, upon closer examination of the cities, Denver emerges as the city with the highest interest in participation, located in the state of Colorado (CO). Following closely behind is San Francisco, representing California's contribution to participant enthusiasm.

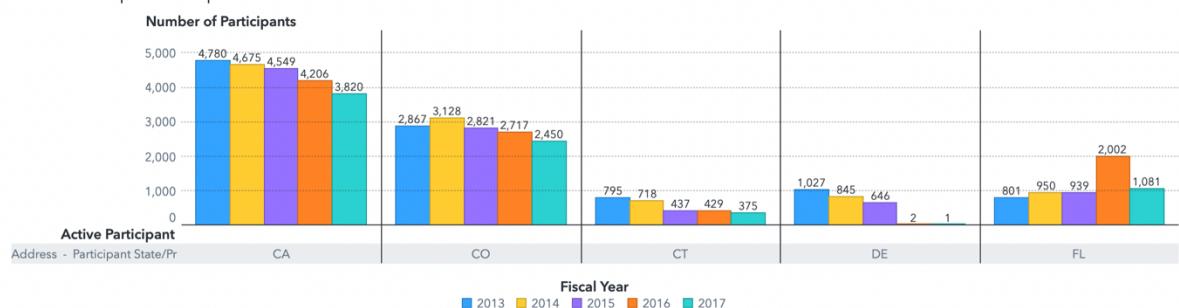
State	Employer
California (CA)	University of California
Colorado (CO)	Denver International Airport
Florida (FL)	Walmart

Furthermore, we have included a comprehensive list of the largest employers in each state for reference (refer to Figure 1 in the Appendix).

Total Funds raised by top 5 State

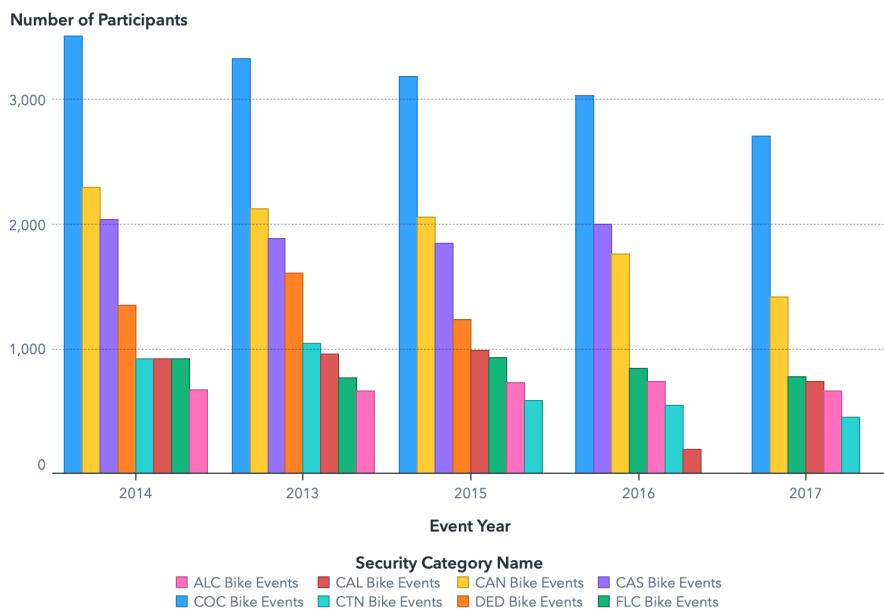


Total # Participants in top 5 State since 2013-2017



The levels of donations and participation produced by Bike MS events exhibit variability across different states and fiscal years.

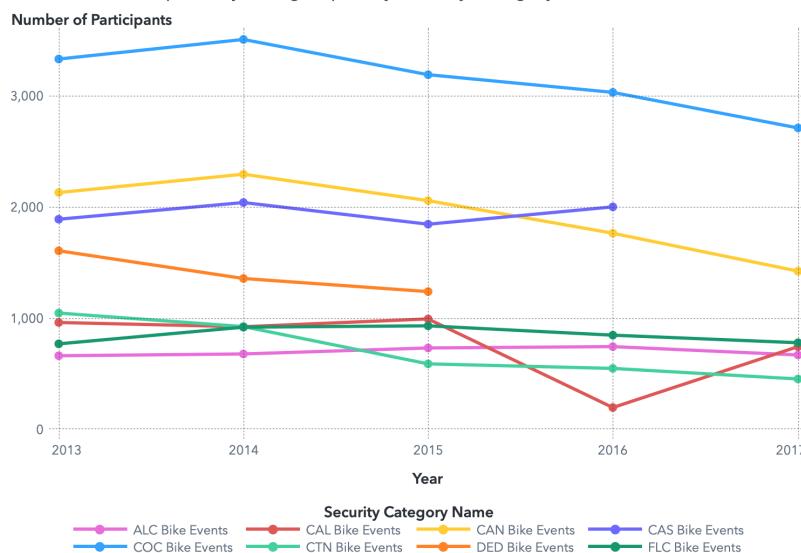
Number of Participants by Event Year grouped by Security Category Name



The number of participants generated by each Security Category Name exhibits a lack of correlation and significant variation in different years, as evident from the parallel lines below observed in the data. Most Security Category Names show a downward trend, indicating a decrease in participant numbers over time, such as COC Bike Events and CAN Bike Events. Conversely, ALC Bike Events demonstrate no significant change in the number of participants from 2013 to 2017.

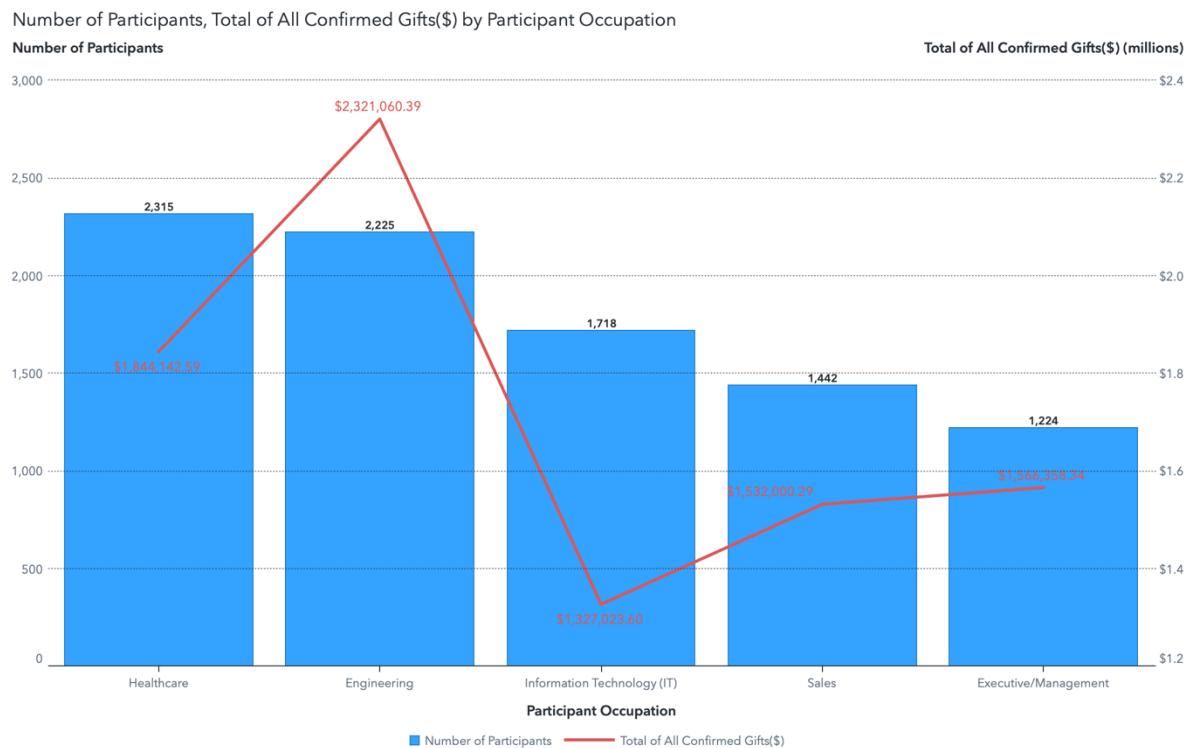
It is important to note that some events may lack numerical participant data for recent years, which could be attributed to the possibility of those events being concluded or not capturing data beyond certain timeframes.

Number of Participants by Year grouped by Security Category Name



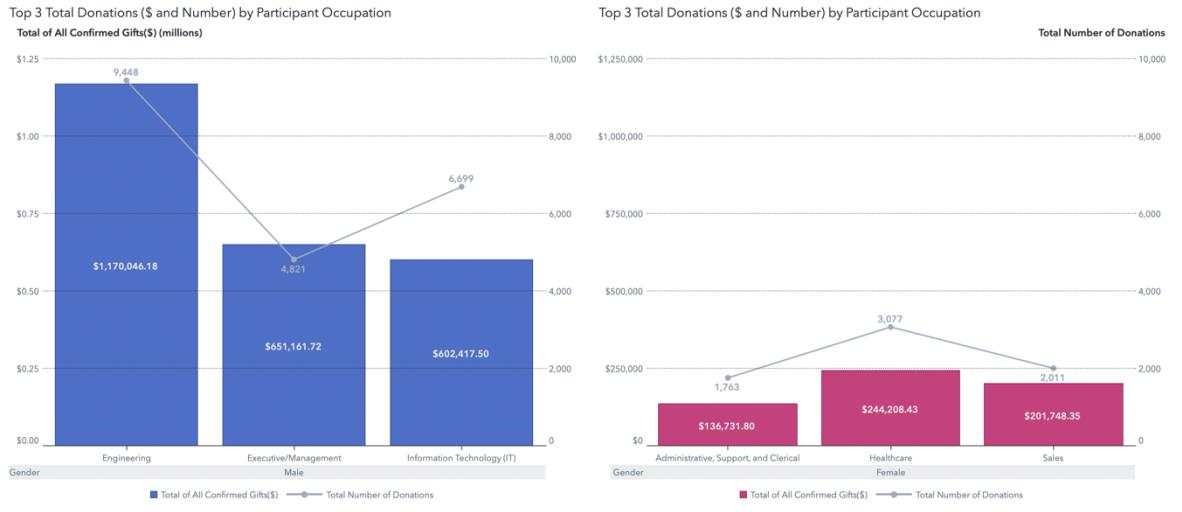
## What industries have had the strongest involvement in Bike MS and what occupations were responsible for most of our fundraising?

Engagement in Cycling Activities Multiple sclerosis (MS) can manifest in two distinct manners: active involvement as a rider or contributing via monetary donations to the fundraising efforts. The data reveals that the primary vocations of the participants consist of Healthcare, Engineering, IT, Sales, and Executive Management. Based on the analysis of the donations data, it is possible to ascertain the industries that serve as the primary contributors.



Participant Occupation	Event Year ▲				
	2013	2014	2015	2016	2017
Healthcare	527	510	604	382	251
Engineering	446	490	553	394	311
Information Technology (IT)	395	373	446	281	205
Sales	335	327	363	235	162
Education and Training	310	271	284	194	124
Executive/Management	273	285	309	189	142
Banking and Financial Services	190	189	215	121	107
Accounting	187	182	213	133	92
Consulting	173	183	228	128	124
Legal and Paralegal	173	173	158	107	84

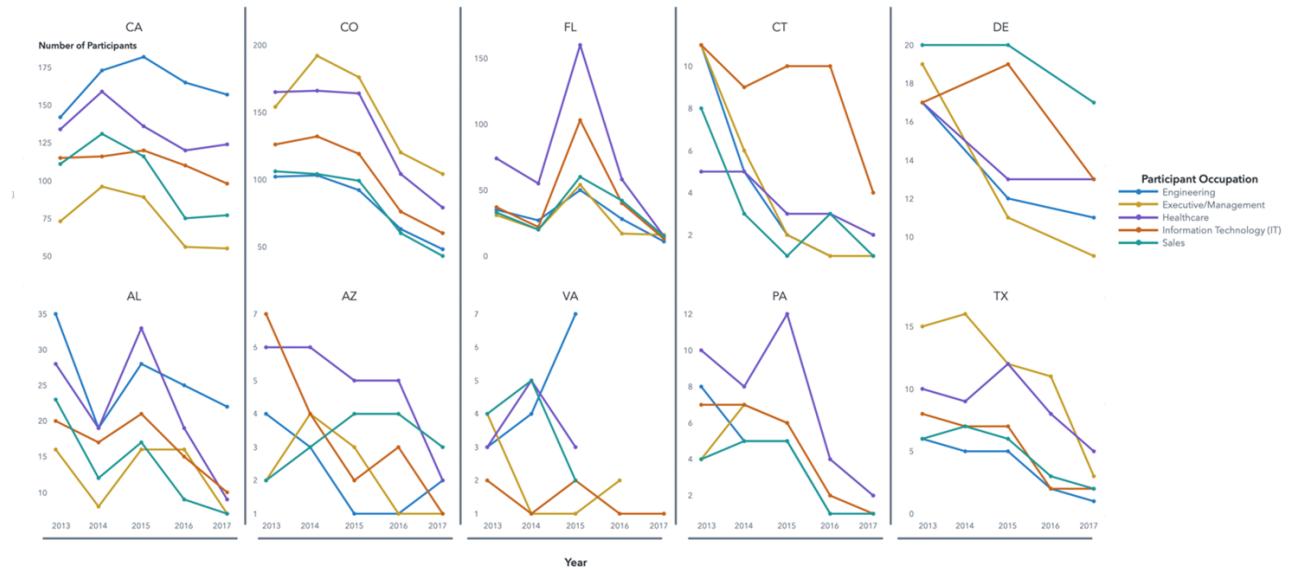
Among the top 10 occupations of participants, it is evident that the largest number of cyclists work in the healthcare industry overall. However, upon closer examination of each year, we found that the number of cyclists working in the engineering industry surpassed all others in both 2016 and 2017.



In order to gather deeper insights into corporate teams, we have chosen to analyse the data based on occupation and gender, aiming to uncover the benefits from these common factors. It was found that the occupation with the highest donations from male participants is the Engineering group, while the occupation with the highest donations from female participants is the Healthcare group.

Therefore, to retain existing participants and attract new ones, we should focus on engaging male participants from the Engineering group and female participants from the Healthcare group. This could involve partnering with relevant companies or organizations that align with the interests of these groups, in order to stimulate their interest in participating in Bike MS events or making donations.

Based on the research, when people understand the problems and empathize with others, there is a tendency for increased donation and a desire to be involved. In this case, engineers, their knowledge and understanding in research, may recognize the importance of donation and the cycling with a group of male friends can relief stress from their work. Additionally, the average income of engineers falls within the high-income bracket, (Ker, B 2017) (Figure2 in Appendix).



The time series data reveals a concerning trend wherein all major occupational industries are experiencing a decline in the states where participants list as their home state. This comprehensive insight prompts us to investigate which occupational groups require intervention in each state. By identifying and addressing these specific industries, we can implement targeted strategies to reverse the decline in participation and strengthen engagement among participants.

### **Can we tie together these industries and occupations to identify gaps/opportunities?**

To link these industries and occupations together and identify gaps and opportunities, we can conduct further analysis, such as additional segmentation and identifying potential partnerships or collaborations with companies or organizations within these industries. By setting goals for industries with high participation and donation rates, such as Engineering, Executive/Management, Information Technology for male participants and Healthcare, Administrative, and Sales for female participants, we can strategize outreach efforts and tailor our approach to engage participants from these occupational groups.

We can leverage this data to seek support and partnerships from organizations that align with the interests of these occupational groups, aiming to attract their interest and involvement in Bike MS events. Moreover, the time series data can help us identify which occupations stand out in each state, prioritizing development efforts accordingly.

To seek support from organizations, we can refer to the largest employers in each state or organizations that are relevant and of interest to these occupational groups. For example, collaborating with hospitals to attract new participants from the healthcare industry, partnering with safety equipment manufacturers to engage engineers, or working with computer component distributors to increase participation among IT professionals.

By effectively tying together these industries and occupations, we can devise targeted strategies to enhance participant engagement and maximize contributions, ultimately advancing our mission to support those affected by MS and drive critical research forward.

## What is the common denominator for top performing corporate teams?

According to the data, a connection to multiple sclerosis motivates participants and benefactors to attend this enormous fundraiser. Bike MS's mission is to support research, advocate for changes in society and politics, provide education, and support services for individuals and families affected by multiple sclerosis. If the prevalence and incidence figures are accurate, then there is no reason for participation and fundraising efforts to decrease. Let's examine the greatest common denominator shared by not only corporate teams, but all parties involved.

Total of All Confirmed Gifts(\$), Total Number of Donations by Participant Connection to MS



Upon analysing the connection to MS among participants from both corporate teams and individual participants, it becomes evident that the majority have friends with MS, followed by having relatives with MS. As shown in the treemap, the largest segment of participants is motivated by their friendship with individuals living with MS. Remarkably, this group has not only the highest number of participants but also accounts for the highest amount of donations.

## Predictive Analysis

Supervised learning models, including logistic regression (Figure3-4 in Appendix) and decision tree models (Figure5-8 in Appendix), were developed using SAS Enterprise Miner to identify the key factors contributing to a successful fundraising team. The response variable, Registration Active Status, was used to categorize participants into active and non-active individuals, aiming to understand the root factors behind their engagement. This analysis seeks to prevent such patterns from occurring among both existing and new participants to boost participation and fundraising in the current year.

The analysis was divided into two parts: an overview spanning from 2013 to 2017, and a focused examination of the years 2016 and 2017. This approach ensures that the data remains current and applicable, enabling the models to serve as valuable tools for future analysis and planning.

The BIKE\_MS\_PARTICIPANTS\_2013\_2017 dataset provided the necessary variables as predictors for the models, including Security Category Name, Total of All Confirmed Gifts (\$), Internal Event Name, Is Team Captain, Participant Goal (\$), and Participation Type Name.

To compare the performance of logistic regression and decision tree models, we used the True Positive Rate and Validation Misclassification rate as selection criteria. The results for the 2013–2017 participants data are presented in the table below,

Model	True Positive		Misclassification	
	Train	Valid	Train	Valid
Logistic Regression	98.89%	98.82%	38.61%	42.04%
Decision Tree (2 max branches per split)	97.65%	97.76%	23.87%	26.11%
Decision Tree (3 max branches per split)	99.42%	99.34%	53.32%	51.91%

Upon analysing the results, it is evident that the decision tree models outperformed the regression model in terms of predictive power. Specifically, the decision tree with a maximum of 2 branches demonstrated superior performance in Misclassification, with an error rate of only 26.11%. On the other hand, the decision tree with a maximum of 3 branches per split achieved the highest True Positive Rate at an impressive 99.42%, but also exhibited a relatively higher misclassification rate of 51.91%.

The figure below illustrates a segment of this decision tree, depicting the partitioning for participants with registration active status. These findings provide valuable insights into the effectiveness of different decision tree structures, enabling us to optimize model selection and enhance the accuracy of predictions for successful fundraising teams.



Decision tree result with max 3 branches per split (year 2013-2017)

The result for year 2016-2017 participants data, as shown in the table below.

Model	True Positive		Misclassification	
	Train	Valid	Train	Valid
Logistic Regression	99.32%	99.22%	45.90%	47.41%
Decision Tree (2 max branches per split)	99.85%	99.92%	55.49%	57.33%
Decision Tree (3 max branches per split)	99.84%	99.88%	58.66%	54.23%

Consistent with the earlier findings, the decision tree models exhibited superior predictive power in terms of true positive rates compared to the regression model. Specifically, the decision tree with a maximum of 2 branches per split achieved the highest true positive rate, impressively reaching 99.85%, albeit with a misclassification rate of 57.33%.

The figure below illustrates a section of this decision tree, illustrating the partitioning for participants with registration active status.



Decision tree result with max 2 branches per split (year 2016-2017)

### Interpretation of Results

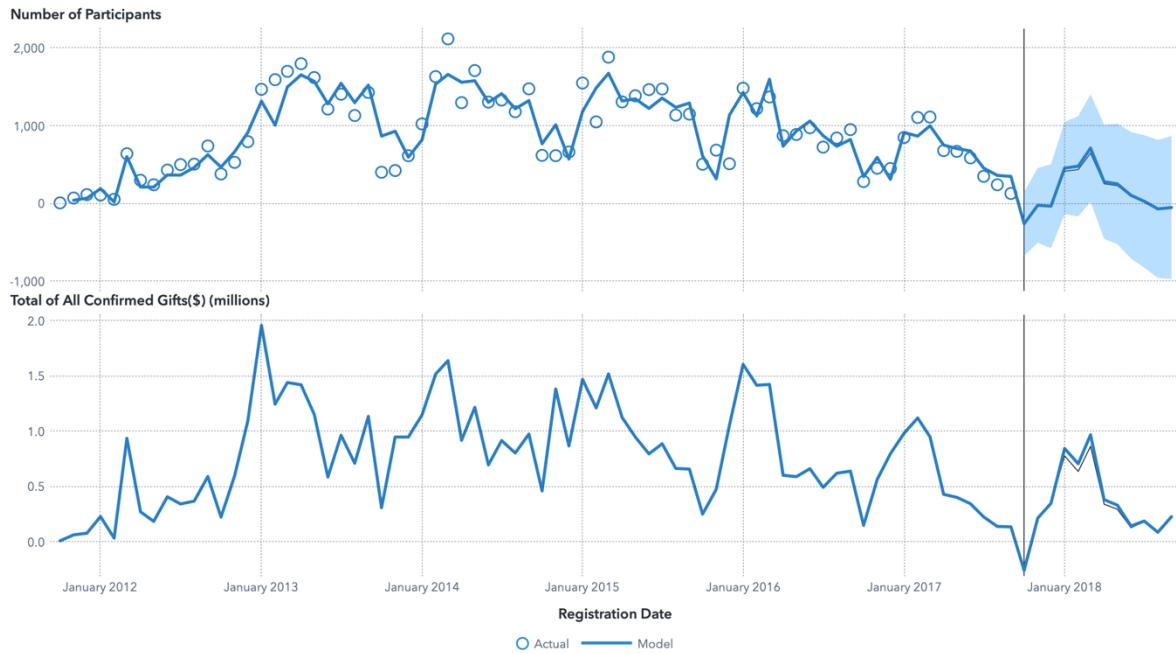
The decision tree models with a maximum of 2 branches per split demonstrated superior performance as the best models in both scenarios. Despite the decision tree models with a maximum of 3 branches per split achieving higher positive rates overall for the years 2013-2017, the crucial and undeniable factor lies in the Misclassification rate, indicating the degree of prediction errors made by our models.

Due to this vital consideration, the decision tree models with a maximum of 2 branches per split outperformed the models with 3 branches in both scenarios, particularly excelling in the overall years 2013-2017, with difference of approximately 20%.

The data was processed using 7 maximum levels, minimum leaf size of 50, predictor bin of 50, and the number of bins set at 20.

## Forecasting

Total of all donations forecast with 10% increase in number of participants over one year.



## ▼ About this forecast

95% forecast confidence.

The forecast for Number of Participants has the following contributing factor(s): Total of All Confirmed Gifts(\$)

Results	Dependent Variables Results		Forecast Summary					
Registration Date	Number of Participants (Model)	Number of Participants (Actual)	Lower Confidence Interval	Upper Confidence Interval	Baseline: Number of Participants	Total of All Confirmed Gifts(\$)	Baseline: Total of All Confirmed Gifts(\$)	
October 2017	-261	.	-671	149	-237	-260,623.03	-222405.3002	
November 2017	-23	.	-502	457	-21	213,233.87	216548.03111	
December 2017	-35	.	-575	505	-32	346,410.71	351488.26248	
January 2018	455	.	-139	1,050	414	843,667.58	777003.48838	
February 2018	479	.	-165	1,123	435	705,976.65	635857.92662	
March 2018	712	.	22	1,403	648	967,739.69	863449.65665	
April 2018	279	.	-455	1,012	254	380,169.82	339337.11544	
May 2018	253	.	-522	1,027	230	330,460.30	293486.77335	
June 2018	105	.	-708	918	96	141,709.77	126311.01596	
July 2018	29	.	-822	879	26	186,504.50	182325.37555	
August 2018	-69	.	-955	817	-63	85,288.03	95410.187618	
September 2018	-52	.	-972	868	-47	225,711.00	233303.60724	

The forecasting modelling with a 95% confidence interval, utilizing data from the years 2012 to 2017, revealed a declining trend in the number of participants, as depicted in the graph with upper and lower confidence intervals. Given this pattern, a What-if analysis was conducted using the predictive model, wherein the number of participants was hypothetically increased by 10%. This simulation aimed to understand the potential impact on the total donation amount, as per the predictions from the model.

Registration Date	The total Number of Participants (Model)	The total Number of Participants (Baseline)	Total of All Confirmed Gifts (\$)	Total of All Confirmed Gifts (\$) (Baseline)
Fiscal year 2018	1,872	1,703	3,940,537.89	3,336,230.99
	Set the goal +10%		Result +18%	

Upon performing the calculations, it was determined that increasing the number of participants by 10% % in fiscal year 2018 resulted in a significant 18% increase in the total donation amount. This insightful finding highlights the potential benefits of boosting participant numbers and emphasizes the significance of predictive modelling in forecasting the impact of different scenarios on overall donation outcomes.

## Prescriptive Analysis

To address the challenges faced by Bike MS in attracting new participants and increasing fundraising efforts, we propose a prescriptive strategy that focuses on the following key actions.

### 1. Targeting Corporate Donors

As identified in the analysis, corporate teams with 10 or more members, especially 10-19 team size, have shown to be crucial for successful fundraising. To increase the formation of new corporate teams, Bike MS should identify companies with a sizeable employee base that share health and wellness goals. A targeted marketing campaign can be launched to engage these potential corporate donors, highlighting the positive impact of their participation and contributions in supporting the mission to combat MS. Additionally, partnerships and collaborations with organizations that align with health and wellness objectives can be explored to attract corporate teams.

### 2. Encouraging Female Participation

While most participants are male, there is an opportunity to encourage greater female participation. Special campaigns and incentives can be designed to appeal to women, emphasizing the positive impact of their involvement in supporting those affected by MS. Partnering with women's organizations and businesses with a strong female employee base can also help in reaching out to this demographic.

### 3. Promoting Team-Based Fundraising

The analysis indicates that team donations significantly outperform individual contributions. To leverage this trend, Bike MS should focus on encouraging participants to join or form teams. Special rewards and recognition for top-performing teams can serve as incentives to drive team-based fundraising efforts. Organizing team-building events and fostering a sense of camaraderie among team members can also contribute to increased participation and donations.

#### **4. Leveraging Digital Marketing**

To attract new participants and increase donations, Bike MS should invest in targeted digital marketing campaigns. Social media platforms, email marketing, and online advertising can be utilized to reach a broader audience and raise awareness about the cause. Personalized content and storytelling that highlights the impact of Bike MS in the lives of those affected by MS can be powerful tools to engage potential donors.

#### **5. Engaging Corporate Sponsors**

To maximize fundraising efforts, Bike MS should actively seek corporate sponsors and partners. Companies that align with the mission and goals of the organization can be approached for sponsorships and contributions. Collaborating with major employers in each state, as identified in the largest employers list, can be a strategic approach to garner support from organizations with a substantial employee base and resources.

#### **6. Enhancing Team Captain Engagement**

The decline in the number of team captains is a concerning trend that needs attention. Bike MS should implement initiatives to support and motivate team captains, recognizing their critical role in fundraising success. Training and resources can be provided to help team captains effectively lead and engage their teams in fundraising activities.

#### **7. Monitoring and Verify Goals**

Throughout the implementation of the prescriptive strategy, regular monitoring and evaluation should be conducted to measure the impact of the actions taken. Key performance indicators, such as participant numbers, fundraising amounts, and corporate team formation, should be tracked to assess the effectiveness of the strategy. Based on the results, adjustments and refinements can be made to optimize the outcomes.

By implementing these prescriptive actions, Bike MS can work towards achieving its desired results, including increasing the number of participants by 10% and realizing revenue growth within three years. The strategy will also help in determining opportunities in digital marketing to attract new participants and maximize donations through social media and other channels in the next 2 years. The involvement of key stakeholders, including NMSS organization, event founders, corporate partners, and participants, is crucial for the successful execution of the prescriptive strategy. By adhering to the decision criteria of maximizing donations per participant team and increasing new participants and corporate partners, Bike MS can pave the way for successful fundraising efforts and make significant progress towards its mission of combating MS and improving the lives of those impacted by the disease.

## **Conclusion**

The analytics report presents valuable insights to address the challenges faced by the National Multiple Sclerosis Society (NMSS) in its Bike MS fundraising event. The analysis revealed a declining trend in participant numbers over the years, emphasizing the importance of effective retention strategies and attracting new participants. To achieve this, the proposed prescriptive strategy encompasses several key actions. Firstly, targeting corporate donors and initiating targeted marketing campaigns can foster engagement from companies with health and wellness objectives, increasing the formation of new corporate teams. Secondly, encouraging greater female participation through specialized incentives and partnerships with women's organizations can help achieve a more balanced representation among participants.

Additionally, promoting team-based fundraising and providing recognition for top-performing teams can leverage the trend of team donations outperforming individual contributions. Embracing digital marketing to reach a wider audience and tell impactful stories can attract new participants and enhance donations. Engaging corporate sponsors and collaborating with major employers in each state can boost fundraising efforts further. Lastly, supporting and motivating team captains through training and resources can strengthen their leadership role in driving successful fundraising outcomes. By continuously monitoring and evaluating the strategy's effectiveness, NMSS can work towards its desired goal of increasing participant numbers and realizing revenue growth within the next three years, while striving towards its overarching mission of empowering those affected by MS and ultimately finding a world free of the disease.

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## Appendix

Prepare data and adjustment.

New item name	Function in new the data item	Details	Classification
<b>DATASET: BIKE_MS_PARTICIPANTS_2013_2017</b>			
Total Number of Donations	New Calculated	Add two variables together, that are “Number From Participant” + “Number Not From Participant”	Measure
Event Year	Custom Category	Regroup the variables into year, based on “Event Date”: 2012, 2013, 2014, 2015, 2016 and 2017.	Category
Participant Type	Custom Category	Rename in the variables “Is Prior Participant”. From “Prior Participant” to “Yes” instead	Category
Registration	Custom Category	Rename in the variables “Is Secondary Registration”. From “Primary” to FALSE instead, and “Secondary” to TRUE	Category
Team Type	Custom Category	Regroup the variables in “Team Division”: <ol style="list-style-type: none"> <li>1. Corporation, including “Corporate”, “Corporation”, and “Organization”.</li> <li>2. Friends and Family, including “Family and friends”, “Friends and Family”</li> <li>3. Other</li> <li>4. Association</li> <li>5. School, Including “Place of Workship” and “Religious”</li> </ol>	Category

Team Captain	Custom Category	Rename in the variables “Is Team Captain”. From “General” to FALSE instead, and “Team captain” to TRUE	Category
Partition	Partition	Create new Partition with Simple random sampling method, 2 Number of partitions, and 50 Training partition sampling percentage.	Category
Geographic Item1	Geographic Item	Create new Geographic Item by “Address – Participant State/Pr” with US State Abbreviations code context.	Geography

#### **DATASET: BIKE\_EVENT\_2013\_2017**

Average Team Size	Custom Category	Regroup the variables into different team size, based on “Average Team Size”, including 1-9, 10-19, 20-29, 30-39, 100-109, 110-119, and 130-139	Category
Event Year	Custom Category	Regroup the variables into year, based on “Event Date”: 2012, 2013, 2014, 2015, 2016 and 2017.	Category
Street Address Custom	Custom Category	Regroup the variables into 169 value groups, based on “Street Address”	Category

#### **DATASET: BIKE\_TEAMS\_2013\_2017**

Total Offline Gift (\$)	New Calculated	Add two variables together, that are “Total Offline Confirmed Gifts (\$)” + “Total Offline Unconfirmed Gifts (\$)” +	Measure
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Event Year	Custom Category	Regroup the variables into year, based on “Event Date”: 2012, 2013, 2014, 2015, 2016 and 2017.	Category
Team/Individual	Custom Category	Regroup the variables into 3 groups, based on “Team Division” including, Individual Cyclists, Team, and Other.	Category
Team Type	Custom Category	Regroup the variables in “Team Division”, including Corporation, Association, Friend and Family, Other, Volunteer, School, and Bike Club/Shop.	Category

Figure



Figure1: The largest employers in each state

Source: 24/7 Wall St.

## 2016 Median Annual Salaries by Occupation Group Austin MSA

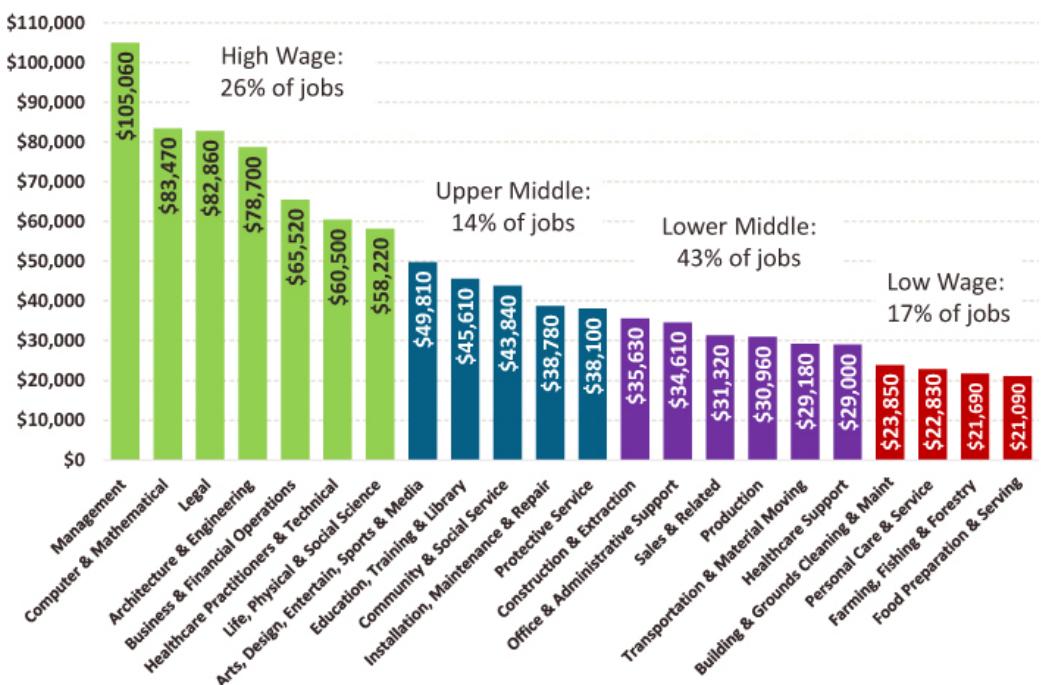


Figure2: The chart above ranks occupation by average annual income in U.S.

Source: Austin Chamber

## Logistic Regression



Figure3: Logistic regression (year 2013-2017)

The adjusted R-square of the model is 0.2061, indicating that approximately 20.61% of the variation in Registration Active Status can be explained by this model. The significant value (alpha value) at 0.01 corresponds to a 99% confidence level, suggesting that the model's results are highly reliable. Also, the presence of outlier observations through a residual plot. Out of 65,499 observations, around 26,000 falls within the reference lines, demonstrating that the logistic model is well-suited and adequately captures the data's patterns. Furthermore, the Confusion Matrix provides an overview of the observed and predicted values, offering valuable insights into the model's accuracy and predictive power.



Figure4: Logistic regression (year 2016-2017)

The adjusted R-square of the model is 0.1845, indicating that approximately 18.45% of the variation in Registration Active Status can be explained by this model. The significant value (alpha value) at 0.01 corresponds to a 99% confidence level, suggesting that the model's results are highly reliable. Also, the presence of outlier observations through a residual plot. Out of 17,886 observations used and 47,613 observations unused, around 7,054 falls within the reference lines, demonstrating that the logistic model is well-suited and adequately captures the data's patterns. Furthermore, the Confusion Matrix provides an overview of the observed and predicted values, offering valuable insights into the model's accuracy and predictive power.

## Decision Tree

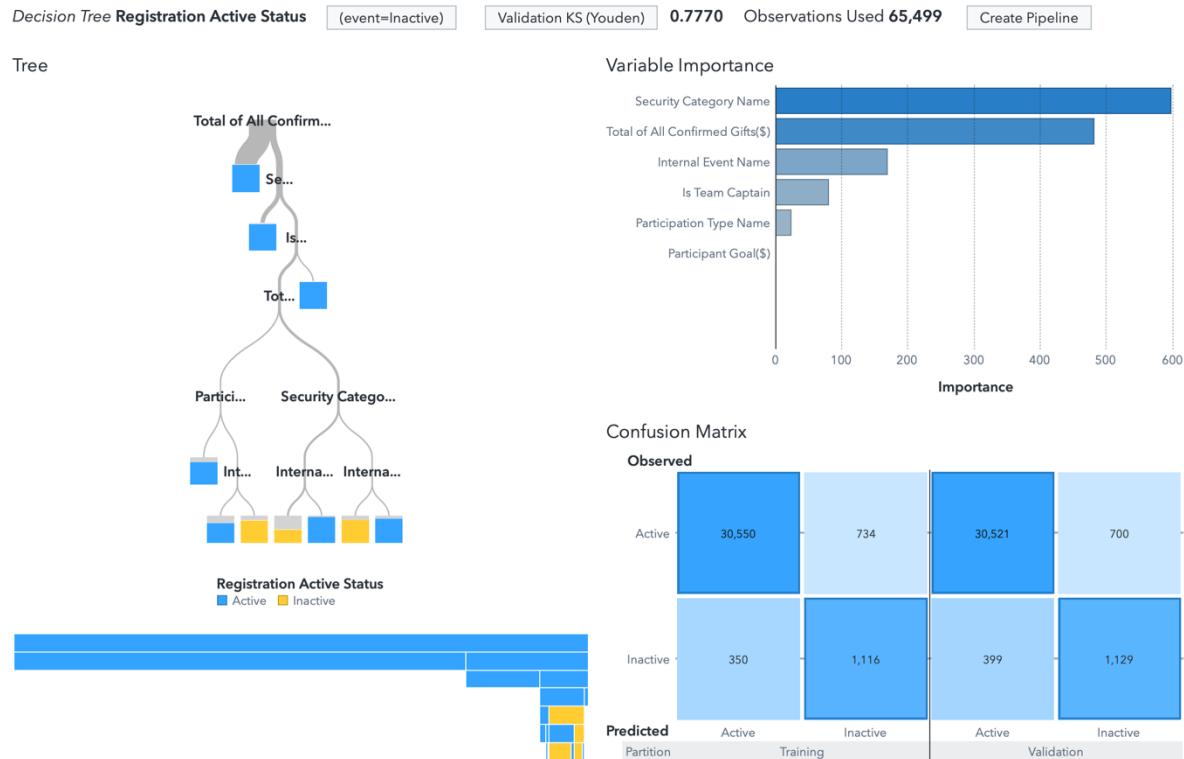


Figure5: Decision tree result with max 2 branches per split (year 2013-2017)

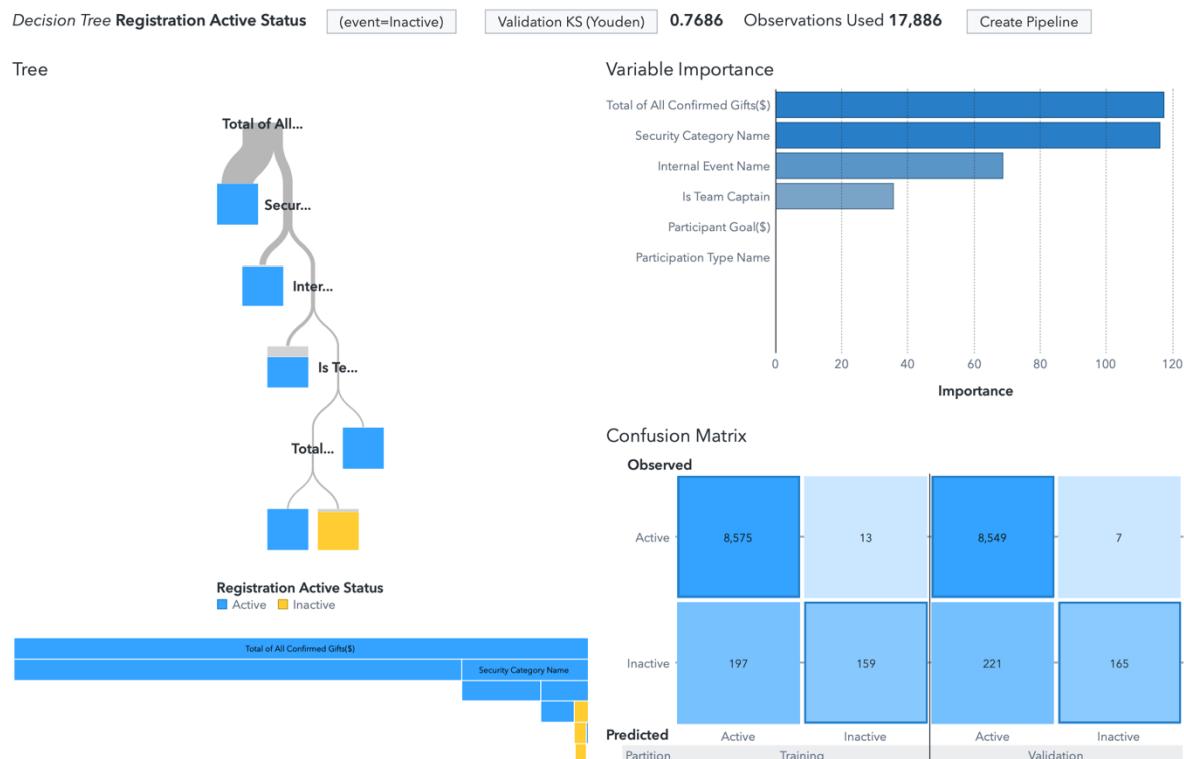


Figure6: Decision tree result with max 2 branches per split (year 2016-2017)

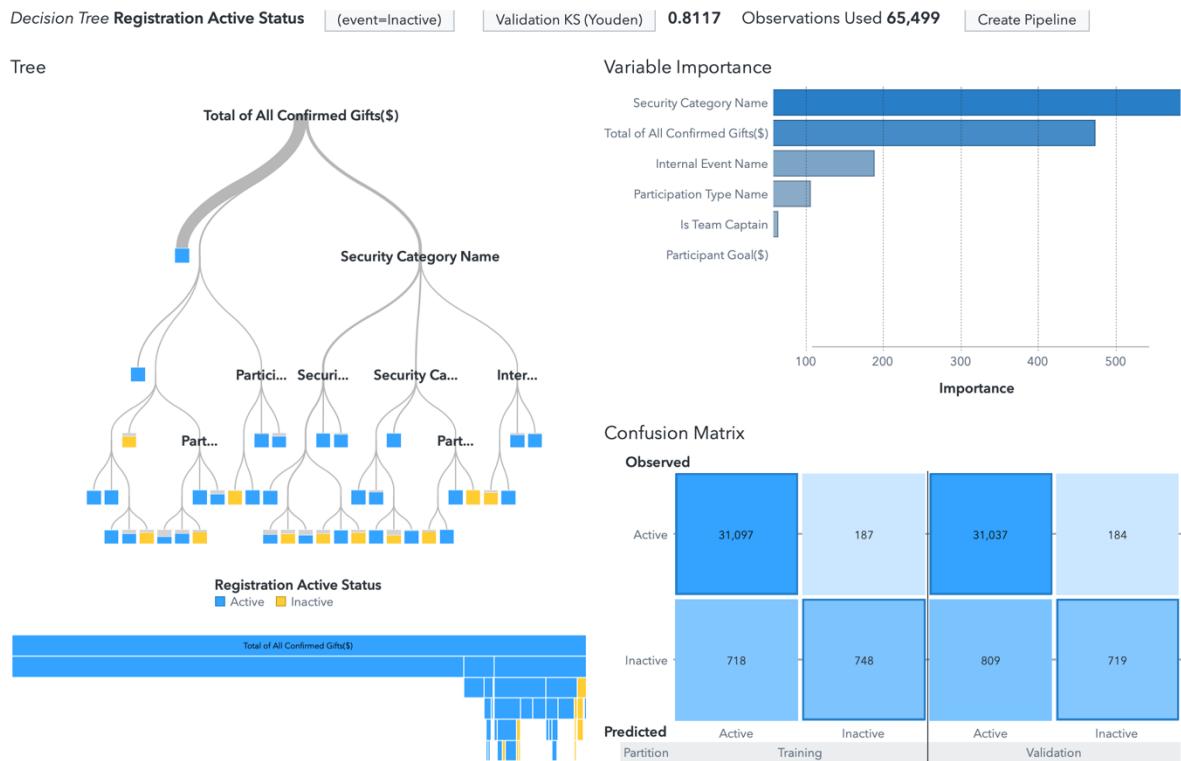


Figure7: Decision tree result with max 3 branches per split (year 2013-2017)



Figure8: Decision tree result with max 3 branches per split (year 2016-2017)