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Is Winning a Necessity for Financial Success in the Cycling Industry

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This thesis examines the sponsorship dollar maximization goal of cycling teams using a game theory approach to determine the best strategy for each level of team.

This Thesis is for Honors in

Economics

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X. Introduction

As the field of economics has spread in scope, it is now used in almost every field of study. Individuals, organizations, and professionals all use economics to evaluate their practices and decisions. One area that economics has expanded to study is the world of sports. One sports industry, however, has not seen much attention, and that is the professional cycling industry. Professional cycling, like all sports, is a calculated science. Every decision is precise, thought out, and calculated repeatedly. Winning does not come without meticulous planning and precision.

Professional cycling teams' financial structure causes them to implement strategies not seen in other sports and business markets. While most firms have the goal of maximizing their profit, professional cycling teams do not because they focus on providing the service of advertising. The cycling industry is almost entirely funded through sponsors and therefore cycling teams have an unusual maximization function where they are instead looking to maximize sponsorship dollars[1]. This paper will examine the framework of the cycling industry and demonstrate how that framework leads teams into three main strategies for sponsor dollar maximization.

Section II will give the read the necessary background information for cycling. This will be important as the structure of the sport sets the stage for the types of strategies teams can utilize. By understanding the race structure and race calendar it can be understood that teams have limited opportunities for Grand Tour wins. This is because there are only three ground tour races per year. The structure of the races allows for teams to maintain different goals besides just

[1] Kieran Pender. "Away from the big boys, cycling teams are struggling to survive**,"** *The Guardian,* (2018)*:* https://www.theguardian.com/sport/2018/jan/15/pro-cycling-teams-struggling-to-survive.

winning the overall race. The team structure gives the framework of individual teams and shows that, depending on the riders available, teams have different strategies available for use in races.

Section III will discuss the financial structure of cycling teams. Cycling teams have three key characteristics which make them financially unique when compared to other sports. First, according to the governing body of professional cycling (Union Cycliste Internationale) teams are not supposed to be run for profit. Teams can make small profits, but they are not supposed to be used as direct income generation for firms. Secondly, cycling teams do not have the benefit of ticket revenue from fans coming to the team's venues as races are open to the public. Finally, professional cycling teams are also not entitled to the revenue from T.V. viewership. Alongside these three unique limiting factors, professional teams have continued to have inflating budgets each year.[2] These factors are what contribute to cycling teams being dependent on sponsorship dollars.

In the cycling world, there are 18 professional teams, but there are only three major races to be won each year. This means that there must be a strategy other than winning that keeps all these teams in the business. In order to stay in business teams must be able to attract and retain sponsors as well as be able to increase the funds they get from their sponsors. This thesis will examine how these teams generate sponsor revenue and evaluate whether winning really is a necessity for financial success in the cycling industry.

[2] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016), 55.

XI. Background

Due to cycling being a less recognized sport in the United States, this section will focus on providing information as to how the sport operates. Understanding how the sport operates is key to being able to distinguish the unique game theory strategies available to professional cycling teams. The structure of and rules of the sport provide the framework for the strategies as well as the motivations for pursuing certain strategies.

Professional Cycling is an international sport with teams comprised of individuals from around the world and those teams are based around the world. The sport is governed by the UCI (Union Cycliste Internationale) who, "represents, for sporting and public institutions alike, the interests of 194 National Federations, five Continental Confederations, more than 1,500 professional riders, more than half a million licensed competitors, several million cycling enthusiasts and two billion bicycle users all over the world."[3] This thesis will focus on the 18 professional *World Tour* teams the UCI oversees.

II.I Race Structure

To understand the strategies proposed in this thesis, one must understand the structure of the road races teams compete in. Road cycling is a race where every cyclist is competing to finish the race in the shortest possible time. For single day races, this is the same as being the first one across the finish line; but in multi-day grand tours it is not the person who finishes first every day who wins, rather it is the person who finished the combined races fastest. Grand tours are 21-day races where each day the riders compete in a stage. Each stage, in and of itself, is a race. Every stage is timed and at the end of the stage every rider is given their time. That stage's

[3] "About," Union Cycliste Internationale (UCI), Last modified 2018, https://www.uci.org/inside-uci/about.

time is added to his time the day before and his time accumulates until the end of the race. Cycling is also unique in the fact that there is not just one winner but technically five winners. There is the overall winner and then the winner of four different categories of skill.

The overall winner is the person who completes the ride in the least amount of time. They are awarded the Yellow or Pink jersey, depending on the race. They receive this jersey whenever they are in the lead and get to wear the jersey for every day of the race in which they maintain that lead. This fact will be important because having a leader's jersey brings lots of publicity and T.V. air time to your team. Then there is the winner of the white jersey. This is given to the best young rider which is classified as the rider with the fastest time under the age of 23. The polka-dot jersey is awarded to the winner of the King of the Mountain classification. This rider accumulated the most amount of the points given to riders for crossing over climbs first. The green jersey is awarded to the winner of the Sprinter classification. This cyclist accumulated the most amount of the points given to the first riders crossing the finish lines and mid-stage sprint points along the race route. Finally, there is the team who wins for having the best overall time as a combination of all its riders' times.

Noting all these categories is important in establishing that professional cycling teams have multiple ways to win and that increases the number of strategies available to the teams. It is also important to note that the riders leading these classifications at the beginning of each stage get to wear the proper jersey just like the overall winner wears the yellow or pink. This affects team strategy by incentivizing them to take a lead in certain classification even if they know they cannot maintain that lead through the final stage of the tour. Teams will use this as a strategy because the more T.V. and other media press coverage they get, the more money it brings to their sponsors. This remains the central goal of cycling teams as they look to maximize money from

their sponsors, and the more money they make for their sponsors the more money they get in return.

II.II Race Calendar

While there are many races throughout the year, this thesis will focus on three major tours, called grand tours. These tours all consist of 21 individual stages, and that is what gives them the name “grand tours”. The professional cycling year starts off with the Giro d'Italia which takes place from May-June each year. Following the Giro is the Tour de France which takes place during the entire month of July. The year is wrapped up during August through September during the Vuelta a España.

It should be noted that there are many races throughout the year that range from single day events to week-long stage races. This thesis will focus on the grand tours as those present the best opportunity for long-term strategies for winning and gaining sponsor dollars.

II.III Team Structure

Like all sports, cycling teams consist of many different groups of people. All teams have a manager who oversees the team's commitments, sponsorships relations and the general operations of the team. They are also primarily in charge of hiring and firing. The manager, like every sports manager, has the responsibility of finding the best combination of people for achieving that organization's goals. Coaching in cycling is similar to other sports because there are multiple layers.

The directures sportifs are the team strategists. They are in charge of coming up with the overall game plan and the day to day objectives during races. They are the ones who determine

the strategies that will be examined for determining the best way to achieve financial success through sponsor dollar maximization. They are accompanied by coaches who organize the team's fitness. Like most sports, there are team practices but there is also a lot of individual work that needs to be done. The coaches provide workout plans for each rider to do and monitor the data the riders collect on their ride as well as organize and observe team practices.

Next, there are doctors and therapists. The doctors are in charge of the athletes' wellbeing and ensuring that none of the medications they take violate the UCI drug guidelines. The therapists assist the coaches with the training schedules and work individually with the riders. Each team also has many Soigneurs, from the French word for the "one who provides care". These members oversee feeding, clothing, messaging and escorting the riders during the races. Their job is particularly important because, on grand tours, riders' bodies will begin to shut down if they are not properly fed the exact number of calories necessary and have their health needs meticulously cared for. This is because of the endurance issues that arise with twenty-one straight days of riding. Once a rider falls out of form it is nearly impossible for the average rider to come back to peak performance during the tour.

Then, there are the riders themselves. Most professional teams are made up of thirty riders. This is because not every rider can ride in every race roster size is limited. The directurs get to choose eight of those riders to take to compete in each Grand Tour. This involves lots of strategies as each rider has different talents, and each team has different goals to achieve. For example, if the team is trying to win the Grand Tour, they will want a star rider to be accompanied by another very talented rider, who may also have a shot at winning, five solid workers, and two domestiques. Domestiques are the riders who will fall back to the team car and gather water and food to take to the rest of the team up in the main group of riders known as the

Peloton. These riders are also the ones who fall back to help bring back the team leader back into the race when they've had a crash or mechanical issue by allowing them to draft off them. Having good domestiques are just as important as having a star rider when it comes to winning grand tours.

Lastly, there are the mechanics. Teams must bring many mechanics as each rider has a bike and there are usually at least six spare bikes brought to the race. The mechanics take the bikes apart each night and put them back together after oiling and greasing all the parts. They, during the race, also ride along in a car to provide support and fix problems occurring during the stage. They are vital to the success of a team as one mechanical issue can cost you the entire race.

Table 1 (below) gives the total number of riders and staff per world tour team in 2014. This chart is important because the personnel makeup of a team affects the available strategies. By looking at the chart, the teams with the largest numbers of personnel are top professional teams. They have large budget form their sponsors to be able to afford the best riders, directeurs, doctors, and mechanics. This gives them more options when choosing a sponsor dollar maximization strategy.

Table 1: Personnel Composition of WorldTour cycling teams 2014[4]

Team	Total	Riders	Managers and sports directors	Doctors and physiotherapists	Soigneurs	Mechanics	Administration, press and support
Ag2r La Mondiale	76	30	8	15	8	9	6
Belkin	84	30	11	10	15	11	7
BMC Racing Team	92	29	10	7	15	13	18
Cannondale	70	28	8	6	5	10	13
Lampre-Merida	58	26	9	5	6	7	5
Lotto-Belisol	60	27	7	6	4	8	8
Movistar Team	57	27	6	3	6	6	9
OmegaPharma-Quick Step Cycling Team	74	30	12	10	7	8	7
Team Europcar	61	28	5	5	6	6	11
Team Katusha	71	30	10	7	3	9	12
Tinkoff-Saxo	74	29	10	5	10	9	11
Average	**70.6**	**28.5**	**8.8**	**7.2**	**10.5**	**8.7**	**7**
Percentage (%)	**100**	**40.4**	**12.3**	**10.2**	**14.8**	**12.4**	**9.9**

XII. Financing Professional Cycling Teams

The financing of professional cycling is unique when compared to other sports. This is because cycling teams have three key characteristics which limit their access to revenue sources and business goals. According to the UCI (Union Cycliste Internationale), the governing body of professional cycling, teams are not supposed to be run for profit. Teams can maintain small profits, but they are not supposed to be used as direct income generating firms. Secondly, cycling teams do not have the benefit of ticket revenue from fans coming to the team's venues as races held on the streets and are open to the public. Professional cycling teams also do not enjoy the

[4] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016), 62.

benefits of the revenue from T.V. viewership, an ever-growing source of income in other professional sporting industries[5].

These restrictions on revenue become even more significant when examining the growth of team budgets over the past twenty to thirty years. Recent studies by Ernst and Young and the UCI claims the total budget for the 40 professional teams in the WorldTour (the focus of this thesis) and ProContinential level amount to $361 million.[6] It should be noted that individual team budget information is hardly ever disclosed. This is because of the cycling industry's general lack of financial transparency.

Due to this lack of transparency data must be collected from many secondary sources such as newspaper articles, interviews, or press conferences. Reeth and Larson (2016) shifted through these sources and compiled a data source that gives a good picture of the trends of team budgets. The data can also be misleading as different figures can be reported for the same team. This issue can be seen in 2014 when *l'Equipe,* a cycling magazine, reported that the *Confidis* team had a $9 million budget. However, during an official press conference, the team manager reported the budget to be $10.7 million[7]. Furthermore, companies usually are not willing to share budget data as they do not want their competition getting any idea of their financial status or strategies for the team. However, even though this data should be taken as approximate it is relatively accurate and gives a good picture of the trend of team budgets.[8]

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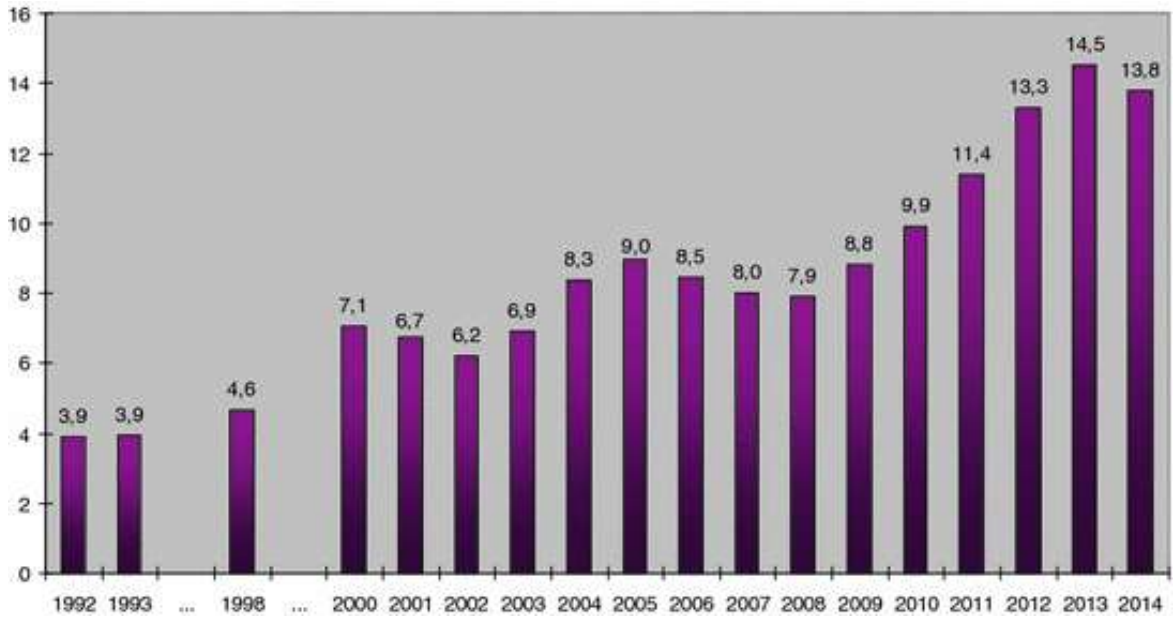
[5] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016), 56-57.
[6] "The Problem with Revenue Sharing," The Inner Ring, last modified January 22, 2014, http://inrng.com/2014/01/problem-revenue-sharing/
[7] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),57.
[8] While the budget data may not be fully accurate, it is still clear that there is an upward trend in total budget amounts. This is important to note because as more and more teams get larger budgets, they have more strategies available to them to maximize sponsor revenue.

Figure 1 below represents the evolution of the average team budget for the ten best performing teams from 1992-2014. These figures represent nominal data that is not corrected for inflation. The ten best teams were formed using a combination of UCI ranking and CQ (Cycling Quotient) team ranking. The data from 1992-2000 represents the UCI ranking system because that system made many changes to the criteria and components of rankings after 2000 which makes data from 2000-2014 inconsistent. Due to inconsistencies with the UCI ranking system, the 2000-2014 data comes from the CQ (Cycling Quotient) team ranking system is used because it is methodologically consistent and is, in general, a more accurate measurement of performance.

Figure 1: Average Budget of Top Cycling Teams (millions, 1992-2014)[9]



While the chart clearly shows that team budgets have increased over time, there are a few years and trends that should have a more in-depth examination. During the 1990s team budgets

[9] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),57.

increased only slightly from about $4.4 million to $5.6 million. This trend of a $1.1 million increase over 10 years did not hold up after the turn of the century. For the next three years, 2000 to 2003, budgets increased and stabilized around $7.7 million.

The next major increase occurred in 2005 when the UCI implemented its ProTeam formula, a license-based system for races and professional teams. This new system caused team sponsors to invest heavily to maintain status in the top division of professional road cycling. Their increased investments brought team budgets up to $10.1 million, but this increase wouldn't last as in the following few years budgets stabilized between $7.9-9 million. The years 2010 onward reveal an important new trend in professional cycling budgets. During those years, wealthy teams with budgets between $16.9 and $22.5 million entered the professional scene: *HTC-Highroad* (2009), *Katusha* (2010), *Sky* (2010), *RadioShack* (2010) and *BMC* (2011). This forced many of the existing top teams to have to find additional funding to remain competitive. This drove them to find wealthy individual or oligarch business owners to pump cash into their teams. *Quick Step* cycling team acquired Czech top industrial Zdeneck Bakala and the *Saxo Bank* team was strengthened in the same way in 2012 with the added support of Russian banker Oleg Tinkov. While these individual buys helped cycling remain competitive, they are not a stable solution for the long run. This is because they do not address the key issue facing professional teams of how to maintain sponsor investment and gain further investment. If these individuals walk away the team will have no sponsors and potentially won't be utilizing the most effective strategies for getting new sponsors.

Professional teams need to be able to attract "large (multinational) companies with long-term commitment to the sport."[10] The average budget increased from $3.6 million in 1992 to $15.5 million in 2014, which represents an almost 6% yearly increase. This is significantly more than the "2-3% inflation rates in Western countries during the last decade."[6] This increase becomes more problematic due to there not being a proportional increase in days of racing, TV viewership, or other exposures that sponsors look for. With the increase of globalization for the sport, travel and accommodation expenses have increased but the dominant cost of most professional teams, as will be discussed further in the next section, remains rider salaries. This means that in the industry today budgets need to increase 6% per year to handle wage inflation with little to no evidence of equivalent extra financial return or productivity for sponsors.

The two Belgian teams *OmegaPharma-Quick Step* and *Lotto-Belisol* are a great example of the increase in budgets. *Omega* maintained a $3 million budget in 1992 but in 2014 ran its organization with a yearly budget of $22.5 million. This represents a 9.5% increase per year and can be attributed to the addition of Zdenek Balka as a sponsor. *Lotto* invested $450,000 in 1984 and thirty years later it was reported they were investing €7 million into their cycling team representing a 10% annual budget increase. While these budget increases may not hurt teams like *Omega* and *Lotto,* their inflationary effects on average required team budgets are negative for teams who rely on commercial sponsors. This can be illustrated in the *Europcar* team not being able to renew their license in 2014 for economic reasons (a 6% deficit on an $9 million budget). These rich donors can also increase the entry barriers to the sport and could generate a crowding out effect by pushing smaller sponsors out of the sport.

[10] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),59.

III.I Costs

Cycling is much less expensive than the NFL, NBA, and FIFA teams but it does require large amounts of money to operate. While their budgets are nowhere near the size of other professional sports, they have fewer opportunities to bring in revenue to cover their costs. Salaries make up the largest portion of the budget as the riders, directeurs, coaches, and everyone else mentioned above needs to be paid. Table 2 below displays the costs for some of the major professional cycling teams currently and in the recent past. The chart also gives the percentage of the total costs each item represents to the team.

Table 2: Team Budget Breakdown[11]

	Team Sky (2011)		Team Sky (2012)		Team Sky (2013)		Us Postal (2002) (2003)		Landbouwk-rediet (2003)	
	(000 euros)	%	(000 euros)	%	(000 euros)	%	(000 euros)	%	(000 euros)	%
Rider Salaries	13,751	66	19,243	72	18,538	84	9,814	84	1,670	70
Travel and accommodation	1969	10	2100	8	2216	8	986	8	120	5
Bike equipment	1759	8	2659	10	2640	10	14	0	430	18
Research, medical and anti-doping	378	2	333	1	338	1	31	0	20	1
Office and corporate identity	453	2	501	2	570	2	446	4	70	3
PR and marketing	1356	7	1226	5	1154	4	151	1	0	0
Legal fees, registrations and transfer payments	256	1	291	1	399	1	23	0	30	1
Miscellaneous	801	4	349	1	698	3	182	2	60	3
Total	**21,723**		**26,702**		**27,551**		**11,647**		**2400**	

The rider's salaries are important to pay attention to because they make up the majority of a team's costs. Each team maintains about thirty riders and can bring eight to the grand tours. For many teams, the salaries of its riders make up 70% of the total cost. This fact validates the conclusions from earlier that the increase in team budgets over time has been mainly due to an

[11] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),63.

increase in rider's salaries. Examining rider salaries is also an effective way to determine the strategies available to a team. The riders an organization brings on to the team will have a direct impact on the strategies available to the team for maintaining and gaining sponsorship dollars.

Table 3 US Postal rider salaries in 2002 and 2003 (in US dollars)

	2002		2003		Contractual Tour de France bonuses
Armstrong, Lance	3,390,000	*52.8 %*	3,800,000	*53.2 %*	GC: 1,500,000/500,000/250,000
Heras, Roberto	853,581	*13.3 %*	1,038,231	*14.5 %*	GC: 500,000/250,000/100,000
Hincapie, George	455,000	*7.1 %*	465,000	*6.5 %*	GC: 5000 if team wins Tour Stage: 45,000/2000/1000
Rubiera, José	391,692	*6.1 %*	425,000	*5.9 %*	/
Vande Velde, Christian	252,500	*3.9 %*	250,000	*3.5 %*	GC: 1,000,000/500,000/300,000 Stage: 75,000/25,000/10,000
Landis, Floyd	60,000	*0.9 %*	215,000	*3.0 %*	Stage: 10,000/Leader's jersey: 2000 Selected: 5000
Peña, Victor	200,000	*3.1 %*	125,000	*1.7 %*	GC: 500,000/250,000/100,000 Stage: 20,000

[12]

The table above represents team *US Postal* whose strategy is to focus on Grand Tour wins. Their pay structure for the team reflects that as they spend over 50% of their allotted budget for riders on Lance Armstrong alone. This is because Lance Armstrong is a General Classification (GC) rider. He is brought on to win the entire tour for his team. *US Postal* also has one to two top contending riders, Roberto Heras and George Hincapie, who could be GC contenders if Lance should wreck or just not perform well. *US Postal* further reveals their strategies by the bonuses they have budgeted for the year. By examining the fourth column of the chart we see the potential bonus for the riders should they achieve the team goals. Lance

[12] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),65.

Armstrong has up to $1,500,000 should he win the Tour de France that year as an incentive to win. Riders like Floyd Landis, however, are not GC contenders but have bonuses for early stage wins ($10,000). It is also important to note for Floyd Landis that he gets a leader's jersey bonus of $2,000. This is because the US Postal Team wants to have the yellow jersey for as many stages as possible. This could indicate their strategy for bringing in sponsor dollars.

The gear for each rider can get very expensive. Bikes are also costly as each run around $13k and each rider has at least one bike. Bike costs are also annual and therefore buying them one year does not give you extra money in your budget the next year. The gear cyclists use is also expensive with shorts running around $300, jerseys $200, helmets $250-$400, and bad weather gear bags costing over $1000. Bad weather bags are full of fresh clothes and bad weather apparel and are kept in the team bus until cyclists need it.

The last category of costs can be summed up to travel and tour costs. When teams go on tours, they must cover travel and lodging for everyone from the riders down to the mechanics. This is particularly expense on tour in Europe as there are so many teams all competing for nice hotels which drive up the cost. When teams travel, they must also bring and drive multiple vehicles. The most expensive of those being the team bus. These buses can cost around $200,000 to purchase. They also must be transported around to all the ride locations and stocked full of snacks, coffee, and other amenities for the rides.

III.II Revenue

Cycling teams are financed almost completely through sponsorships dollars. Except for team *Sky*, all teams' sponsorship money makes up at least 98% of their budgets. Generally, title-sponsors, the ones with their names across the rider's chests, make up 70-80% of the sponsor

dollars while sub-sponsors account for 10-20%. The rest of the revenue comes from participation fees and prize money. It is important to note that no team reported any fan-based revenue or revenue from media deals.

III.III Sponsorships

Understanding the intricacies of sponsorship in professional cycling is crucial to the development of the riders' and teams' game strategies. Sponsorship dollars are the only statistically significant revenue source for professional cycling teams and therefore it is important to understand the history of sponsorship in professional cycling, the goals of the teams and sponsors and the demographic identity of the sponsors.

Sponsorship financing structure first entered the professional cycling scene at the end of the 19th century. Teams were sponsored by companies such as *Dunlop* and *Peugeot*. As professional cycling grew, the sponsors shifted to primarily consisted of cycling frame and cycling component brands who were trying to advertise their products with their team's riders. This pattern continued into the 1970s as the sport remained centralized in European countries such as Belgium, France, Italy, and the Netherlands. These country's' mid-sized businesses kept the sport going and came from a very diverse market. Team budgets remained small with minimal funds coming from food producers, beverage companies, car brands, dairy companies, and home furnishing companies. This landscape changed in the 1980s when the sport gained worldwide attention primarily from the United States, Colombia, and Australia.

The increased attention to riders and the cycling calendar brought in large multinational companies. The Japanese company *Panasonic* was the first major player to step in and funded the best team in the sport which was previously owned by *TI Raleigh*, a mid-sized local Dutch

sponsor. *Panasonic*'s move was followed in the late 1980s by other large companies like *Hitachi* and *Toshiba.* These large sponsors began to shift the cycling industry's demand for top cyclists because top cyclists could make these companies more money. In order to acquire these top cyclists, sponsors had to increase team budgets. This shift pushed the bike frame and component companies out of the sponsorship scene as they could not afford to fund the teams at levels comparable to large companies like *Panasonic*. Large companies continued to enter the cycling sponsorship market and dominated the sport as they still do today. Examining these types of companies can reveal insight into cycling teams' strategies for increased sponsorship revenue.

Each team has many sponsors, but the focus of this research will remain on a team's title sponsors. Title sponsors are the two largest sponsors whose name appears on the front of the team's jersey and are therefore most visible. Every company that is a title sponsor for a cycling team has a different clientele base. *Trek*, a mike manufacturer, has an active cycling base whereas *Mapi*, a construction company for sports stadiums, has a much different base. While the companies' consumer bases are diverse, they can be sorted into three basic categories: business-to-business (B2B), business-to-consumer (B2C), and both. In the above example, *Trek* would be a business-to-consumer sponsor while *Mapi* would be a business-to-business sponsor. Each sponsor wishes to use their cycling teams to market their brand. When examining the composition of professional team sponsors, we find business-to-consumer companies to be much more common. The UCI ProTour in 2004, 2008, and 2014, found that title sponsors were mainly business-to-consumer sponsors, representing 46.2, 50 and 40.7% of title sponsors respectively[13].

[13] See Table 4 below.

Examining the chart below will show that over 60% of sponsors in these years can be considered to be at least both B2B and B2C or just strictly business-to-consumer sponsors.

Table 4: The business-to-business and business-to-consumer makeup of professional cycling[14]

	2004 title sponsors		2008 title sponsors		2014 title sponsors	
	Number	%	Number	%	Number	%
B2B	13	33.3	8	36.4	6	22.2
B2C	18	46.2	11	50	11	40.7
B2B and B2C	8	20.5	3	13.6	10	37.1

The composition of the chart shows that cycling teams are predominantly sponsored by B2C companies. In order for these types of companies to do well, they need brand recognition from the general public. This desire for recognition will remain a focus for the cycling teams when they develop strategies for maximizing sponsorship dollars. If they are unable to bring attention to their sponsors, they will lose their sponsors and have to disband, but if they find was of getting their sponsors mass media attention, they will receive greater budgets and new sponsorship offers. The next section will lay out the strategies available to professional teams looking to maximize sponsorship dollars.

XIII. Game Strategies

After evaluating the background factors, three general game strategies are available for the riders to utilize. Due to the composition and goals of the sponsors, cycling teams will need to look to maximize their teams' brand exposure to please their sponsors. Their end goal is to maximize sponsorship dollars and the rules of the sport, their teams' talents, and their individual talents place restrictions on the available means to achieve their maximization goal. When trying

[14] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),86.

to achieve their goal of sponsorship dollar maximization cyclists have three basic strategies available to them.

The first strategy is to attempt to win the overall tour. As stated in the Race Structure section above, this means that you finish the tour with the fastest overall time. The "Tour Win" strategy is desirable because it brings both immediate and lasting benefits to your team's sponsors. Each day you are leading the race you get to wear a special jersey (yellow or pink) signaling you out to fellow riders and the media. The leading rider gets extensive coverage throughout the race as his time is essential to determine all the other riders' placings at the end of each day. At the end of each stage, the leading rider is awarded the leader's jersey for the next day during the post-stage ceremonies and has many interviews which again increase his sponsor's time in the spotlight. The sponsor does not receive this attention just during the grand tour, however. Having their rider win the tour brings them extensive coverage after the tour and moderate coverage throughout the year. This coverage comes in the form of broadcaster discussions about top riders, current year standings, predictions for the following year and pre-tour hype campaigns by the television studios.

The second general strategy for riders can be classified as the "Stage Win" strategy. This strategy involves the rider being the first one across the finishing line at the end of the day's stage. The winner of the stage receives increased tv exposure, particularly after the race, and during the next day as the commentators discuss the previous day's win and the rider's probability of winning again.

The final strategy can be classified as "special awards." This strategy involves a multitude of options such as being a part of the breakaway, winning the title of most aggressive rider for the day, battling adversity or securing a winner's jersey. The breakaway is a small group

of riders that break away from the peloton, the main body of riders, and is the leading group for the stage. While there are a many reasons for going into the breakaway, the main sponsor benefit is increased tv airtime and announcer attention. The announcers always examine all the riders of the breakaway, repeating their team names and giving some background on the riders. They do this to get the audience to believe they might have a chance to win the stage, which almost never happens. However, the tactic is effective at bringing attention to the riders and more importantly, their sponsors. This is a common tactic for new and emerging teams who have no shot at winning the tour. They will send different riders into the breakaway most days to get their sponsor's names out to the public and attract new sponsors.

Riders can also win individual recognition as the most aggressive rider and being in the breakaway is almost essential to that recognition. It is unlike a leader's jerseys as it is only awarded for one day regardless of scoring or winning, but like the leader's jersey, it comes with visual recognition. The most aggressive rider gets to wear their number with a red background the next day to signify their efforts. The strategy of seeking most aggressive rider brings increased tv attention the day you put forth the effort to receive it and after. Riders are given this award for going beyond their limits and doing something unexpected. This could be winning the stage or just being in the lead for the whole day even if they ultimately lose. During the next stage, when they have their special number, commentators will continually check in on them throughout the day, even if they are in last place.

Battling adversity is added into this category because, even though it is unusual, it brings lots of attention to the rider, his team and consequentially its sponsors. This usually involves continuing the tour after a gruesome injury or while they battle through a personal loss such as a family death. A most recent example of this occurred during the 2018 Tour de France. Lawson

Craddock, an American cyclist from Texas, broke his shoulder on the first day of the Tour de France. Instead of quitting, he soldiered on and finished the Tour de France in last place[15]. However, Craddock got almost as much press attention as Chris Froome, the overall winner of the race! While some of that attention was a result of him using his injury as a fundraiser it still brought his team, *Education First-Drapac*, media attention throughout the entirety of the tour. Obviously, this cannot be a common strategy but should be noted as there are numerous examples like Craddock's that bring attention to their teams without any prospects of winning even a stage.

The final goal associated with this strategy is gaining a leader's jersey. As stated above, there are four main race leaders. The overall leader, with the yellow or pink jersey, will not be included in this game strategy because winning the overall race is, in and of itself, a strategy. This strategy involves the leaders of the best young rider, king of the mountain and sprinters jersey. Just like the yellow jersey, these riders bring their teams increased television coverage during and directly after the race.

IV.I Fatigue

Cycling races are unique in the sense that unlike other sports you cannot maintain a single strategy throughout the competition. This is due to the sport's extreme duration of three-weeks of daily racing. During those three weeks so much can happen that effects the strategies available to the riders each day. Their own bodies fatigue; they can become ill; weather changes

[15] Roxanna Scott, "Fair area cyclist finishes last in Tour de France, but raises nearly $200,000 for cycling track," last modified July 30, 2018, https://www.khou.com/article/news/investigations/stands-for-houston/cy-fair-area-cyclist-finishes-last-in-tour-de-france-but-raises-nearly-200000-for-cycling-track/285-578497730.

and extreme temperatures affect the riders; wind patterns; and injury can all occur and negatively affect a team's strategy.

The rider's own fatigue will be the constant factor that this thesis will take into account because it is a guarantee. No rider will ever be able to go into every stage and give it their all in an attempt to win the overall race. This fact does not change a cyclist's overall goal but will affect his strategy from stage to stage. The best cyclist in the world may be able to go 100% for a few days but he cannot maintain that energy output.

Fatigue is a complex factor as it is can be affected by so many things. This thesis will try to standardize fatigue by focusing on constants. The constant factors are first being a cyclist's inability to give their max effort every day and the second is that the teams' rosters are constant and therefore no new riders can join to help relieve those racing. This second factor is important because cycling, while only producing one winner, is extremely team oriented. That is because fatigue forces you to utilize teammates to be able to maximize your physical output. Riders can save up to 30% of their energy required to maintain a certain speed by drafting off their teammates[16]. No rider in today's cycling world, however great, can win a grand tour as part of a bad team[17]. With teams being made of eight riders one's individual fatigue can be ruled out when examining a grand tour because of its insignificance compared to team fatigue. Therefore, this thesis will focus on team fatigue.

[16] Jeffery Broker, "The Science of Drafting - Easy Riding in the Slipstream," *Performance Conditioning,* https://performancecondition.com/wp-content/uploads/2012/04/Section-2-The-Science-of-Drafting-Easy-Riding-in-the-Slipstream.pdf.

[17] By examining the win data from the last twenty one years of the Tour de France no developing team has ever won the Tour de France. Jan Ullrich demonstrates this by getting two stages wins on a developing team and then finally winning the tour in 1997 when he was contracted on an elite team.

While each team is unique, for simplicity I will divide teams into three categories: elite, competitive, and developing according to their UCI team ranking. This ranking is based on a number of factors from team points to the individual points of the riders on that team[18]. By using the UCI ranking, the three categories will be uniformly measured. As an additional advantage, the measurement system has been used for long enough to collect plenty of historical data with it. This allows me to look at group of professional teams and assign them into different levels based on their UCI rank today and the historical data that indicates that levels competitive ability.

The three levels will not be evenly divided[19]. The elite level will consist of four teams who win the grand tours or are in reach of winning the grand tours regularly. The elite level teams will consist of the top four ranked UCI teams. This level was determined by looking at the data and seeing that 70% of all grand tour wins were achieved by a top four team. The competitive level will consist of ten teams who are average competitors. They may have riders who can win certain classifications; they can win stages and are competitive even though generally out of reach of overall victory. These teams will only have stage win and the special award strategies available to them. The competitive level will consist of the UCI teams ranked from 5th-14th. Finally, the last classification will be the developing level. This group of teams, like the competitive level, will only have the options of winning the day and special awards. They will be the 15th-18th place teams.

[18] Steve Maxwell, *"The UCI's complicated sporting value points system goes public," VeloNews*, 2013, https://www.velonews.com/2013/03/news/the-ucis-complicated-sporting-value-points-system-goes-public_279603.
[19] After looking at the win data a general pattern could be constructed. 70% of tour wins were by a team out of the top four so I classified those as elite. A majority of stage wins, and special awards occurred within the 5-14th ranked teams so those become competitive teams. The bottom four teams only had an inconsistency for winning as a common trait so those became known as developing teams.

Each category of teams will receive a fatigue factor that affects the expected payout of each strategy available to that team. The fatigue factor will be a percentage that affects their probability of achieving their desired outcome, based on the previous days' strategies. They are designed to represent total energy available to the rider. This is important because all the win percentages are based on a rider having 100% of his energy at the beginning of the stage. Therefore, if he is feeling 100%, he will have a x% chance of winning. However, the fatigue factor will change that percentage chance of winning. If the rider used all of his energy going for a win on one stage, he will not have 100% of his energy available the next day, therefore he must have a smaller percentage chance of winning.

Elite teams will be excluded from this fatigue factor as they have enough talented riders to prevent days with limited strategies. They achieve this due to their composition of highly talented and fit riders, which allows them to rotate fatigued riders to the back of the group to create rest days for those riders. Using our first standardization factor we know one rider cannot go all out every day. However, he can go all out one day and still have a relatively good day by conserving energy through drafting. This effect is magnified when most of a team's eight riders are the fittest riders in the sport. This makes it so that elite teams, as a whole, will not fatigue like teams with limited talent and maintain normal expected payout values for each available decision.

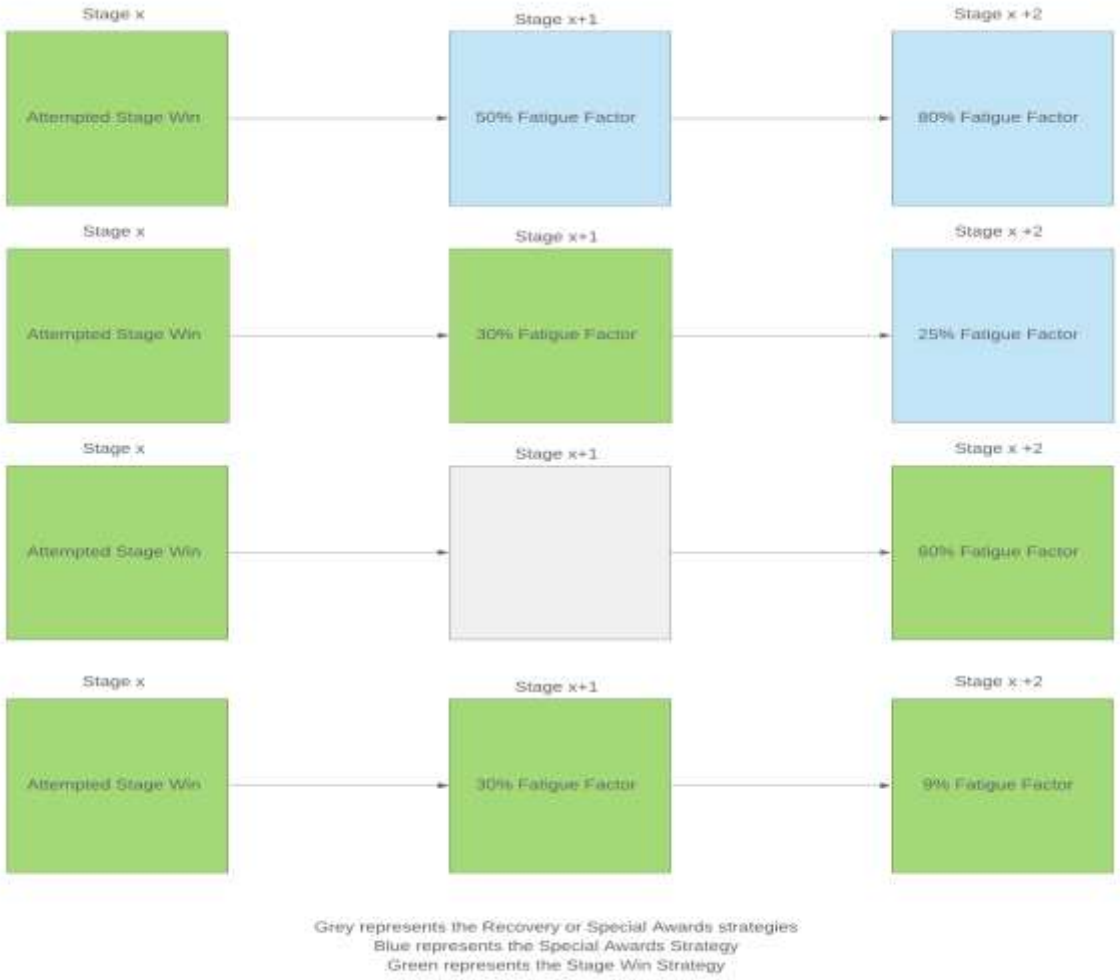
Competitive and developing teams will receive fatigue factors that are determined by their strategy from the previous days and the strategy they are pursuing that day[20]. Competitive

[20] These fatigue factors will be general estimates based off the historic win frequency data. By examining the win frequency of these professional categories estimated fatigue factors can be constructed. These values are used to represent and model the effects of fatigue and not to accurately calculate it. Team managers can use their own factors in the model as they will have better insight into their teams fatigue specifically.

teams will have a 30% fatigue factor affecting expected payoff for a stage win if on the previous day they went for a stage win. They will have a 60% fatigue factor while attempting a stage win if they went for a stage win on the stage two days prior. Fatigue will multiply if teams chose to go for stage wins on consecutive days. For example, the day after a competitive team goes for a stage win, they will suffer a 30% reduction in their expected payout. If they attempt a stage win on the next day, they will not have a 30% fatigue factor but a 9% fatigue factor (.3 x .3).

Special awards will have different fatigue factors because they require less overall work than stage wins. If a competitive team is attempting to get a special award the day after going for a stage win, they will receive a 50% fatigue factor and an 80% fatigue factor if they went for a stage win two days before the attempted special ward strategy. Special award expected payout will also have a multiplied fatigue factor if they went for stage wins consecutively on the previous two stages. They will have a 25% fatigue factor (.5 x .5).

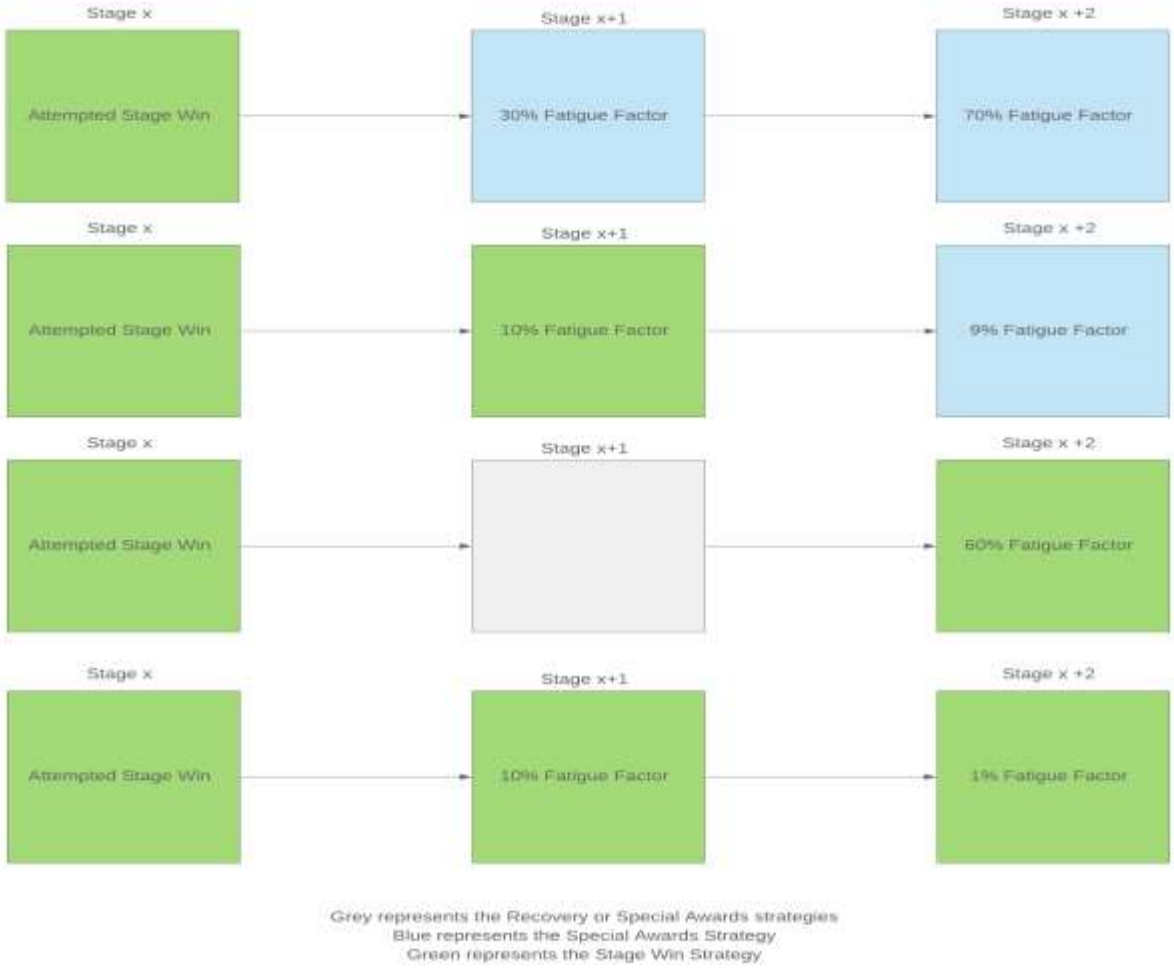
Figure 2: Competetive Team Fatigue Factors



Developing teams will have a 10% fatigue factor the first day after going for a stage win and a 60% fatigue factor two days after going for a win. Developing teams will also experience a multiplied fatigue factor of 1% (.1 x .1) when they attempt multiple stage wins in a row. They will get a 30% fatigue factor if they are attempting to get a special award the day after a stage win attempt and a 70% fatigue factor two days after a stage win attempt. Developing teams will get a multiplied fatigue factor of 9% (.3 x .3) after consecutive stage win attempts. The fatigue

factors will be applied by only after going for stage wins because of the unique characteristics of special awards.

Figure 3: Developing Team Fatigue Factors



The fatigue factors will be applied only after going for stage wins because of the unique characteristics of special awards. Special awards are usually achieved without the help of the team and the days on which points can be gained are spaced out. This is due to the maximizing potential of being out front with a smaller group of riders. The more riders going up a climb or

down the road to a sprint point the smaller the percentage is that you will pick the points up for yourself and your team. Therefore, most special awards are individual efforts as riders will leave their teams and the peloton behind to pick up points in the special award competitions[21]. The opportunities to pick up special award classification points are also intermittently placed throughout the tour. For example, there may be two sprint stages, then another five or six stages without a sprint before another sprint stage. The tours therefore naturally place recovery time into the race and make fatigue calculation unnecessary for special awards.

XIV. Decision Trees

Knowing the available strategies and fatigue factors allows decision trees to be created. While these decision trees can be applied to each rider, as they all have different physical capabilities, a more general model can be designated for the teams. These trees are necessary because if a rider or team maintains a certain strategy for one day, they may not be able to maintain it for the next day. This results in a 3- day strategy rotation for cyclists and their teams and the options for each day in that rotation are dependent on the caliber of cyclist or team. The following section will lay out the strategies for each level of team.

Teams will have to make the initial decision to go for the overall win or a cycle strategy approach. The cycle strategy approach will feature three options for teams to chose from. The first is stage wins, the second is special awards[22], and the last one is recovery. While recovery

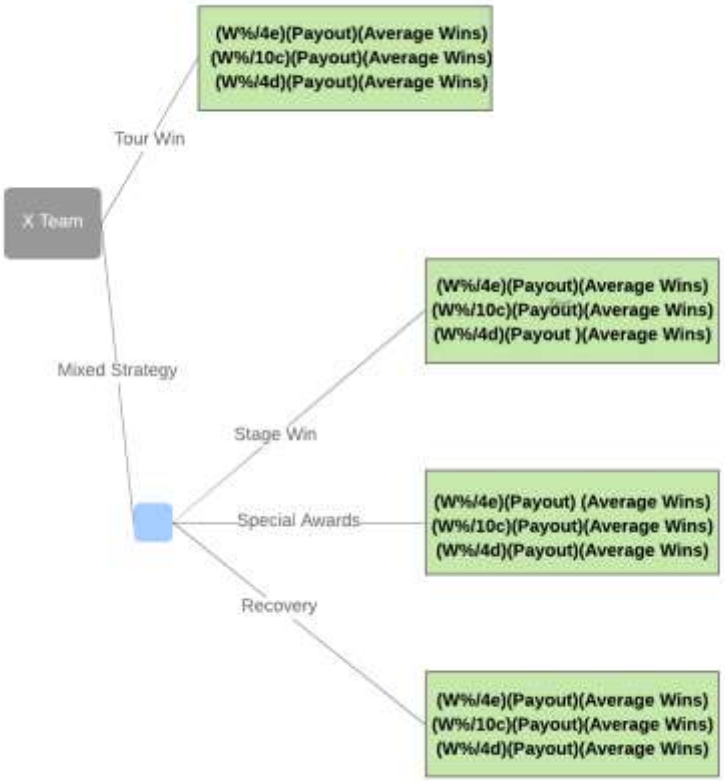
[21] It should be noted that sprint stages are very much team-oriented as the whole team will get in a line and pace the sprinter out. However, this points category has changed in recent years with the introduction of riders like Peter Sagan. He is a multidimensional sprinter who wins the green jersey in every tour because of his ability to pick up practically every sprint point throughout the race. This allows him to win the classification even without winning sprint stages. While team effort is still important, his new strategy has made the green jersey more about individual effort.

[22] While section IV outlined the third strategy as, “putting on a good show”, the model will simplify that down to special awards. This is because it is the most constant and reliably measured tactic within the “putting on a good show” strategy.

does not directly affect sponsor revenue generation it affects the expected payouts of the game through fatigue. Not every rider or team is racing for a specific goal each day of the race. Some days they are just trying to stay with the peloton and not lose time while they rest as much as possible. This does not generate revenue but gives the team a better shot of winning subsequent days. A general structure can be constructed and then applied to each level of teams.

The game theory decision tree is constructed with two main strategies available to teams, winning overall and a cycle strategy. The cycle strategy arm then expands to offer three main options to the teams: stage win, special awards, or recovery. I use these strategies for to main reason. First, because they are the must useful when it comes to maximizing sponsor dollars, and secondly, because they have the most data available to get accurate expected payout values. Figure 4 below gives the general structure and the equations I used to calculate expected payout.

Figure 4: General Format for Decision Tree[23]



After establishing the general format payout values must be assigned. To make this calculation a basic formula can be written:

1. Value = percent change of win by team category/ the number of teams in the same category (payout) (average number of category wins)

This formula will look different for each category of competitiveness as they have different numbers of teams in their level classification. For elite and developing teams the equation is:

[23] General decision tree format created using Lucidchart.com

2. Value= %W/4 (payout) (average number of category wins)

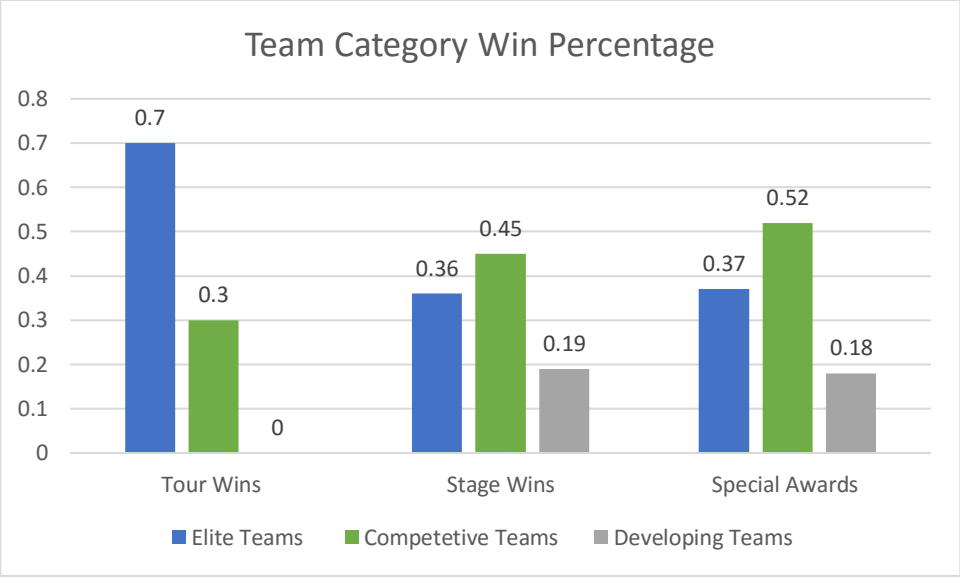
For competitive teams the equation is:

3. Value= %W/10 (payout) (average number of category wins)

In order to calculate the percentage chance of a win I collected data from the last ten years of the Tour de France[24]. I documented every tour win, stage win, and special award given and assigned them to a specific team category. To assign them to a proper category, I used the UCI rankings for the same year of the Tour I was considering and placed the winning rider's victory in one of the three team categories based on that rider's team. For example, if Lance Armstrong won a stage, I would place that as an elite team stage win since Armstrong was on a top four team. This process was repeated for every stage for the last twenty one years. At the conclusion of my data collection the following chart represents the win percentage for each team.

[24] I used the Tour de France because it is the most documented of the grand tours. With all the grand tours having 21 stages the data when taken over 20 years should be consistent with data taken from other grand tours.

Figure 5: Team Category Win Percentage Comparison Graph

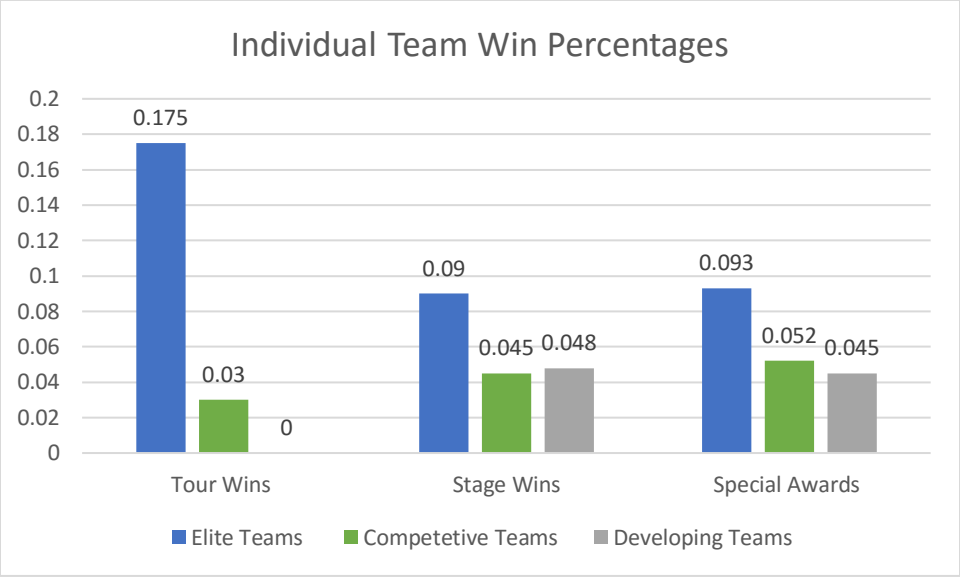


[25]

After knowing the win percentage for each team classification, the individual team win percentage can be calculated by dividing the classification percentage by the number of teams in that classification. When this is done the following percentages reflect each individual team's chance of winning. For example, we can calculate the chance of winning the Tour de France for team *Movistar*. During the 2018 season they were ranked 10th which makes them a competitive level team. Competitive teams have a 30%-win percentage and then that percentage is divided by ten because that is the number of teams in that category. That gives *Movistar* a 3% chance at winning the Tour de France. Figure 4 below gives the win percentages for all teams.

[25] Using http://futurepublishing.msgf.net/files/amf_future_publishing/project_391/The_Cyclingnews_sponsorship_report_on_professional_cycling.pdf and https://www.cyclingranking.com/teams/1998.

Figure 6: Individual Team Win Percentage Comparison Graph



Payout values can be complicated and very involved, but this thesis will utilize the Cycling News and Repucom[26] joint report for data. As stated above, cycling teams are funded by sponsors and the market is competitive. This means that the market has few to no barriers of entry and exit and therefore sponsors can leave if they feel they are no longer making money. This report gives estimates for the value of appearing in the Tour de France for sponsors. This thesis will focus on the value to sponsors for two primary reasons: this is each teams profit maximization goal and the prize money given by the race organization is statistically insignificant.

Prize money will not be considered because of the inability to consistently win and regardless of team level, it represents a very small fraction of a teams' total budgets. The prize money for winning stages and the general classification at tours is paid to the sponsors and is

[26] Since the 2013 report Repucom has joined Nielson Sports, a sports market intelligence agency. https://nielsensports.com/connected-solutions/market-intelligence/.

considered part of their revenue. For example, winning the Tour de France in 2014 netted the team $1,002,000, but with team budget greater than $20 million that amounts to less than 5% of the yearly budget.

The second factor to consider is the uncertainty of the prize money. Some years teams may bring in a significant portion of their budget but then the next year still ride well but make a fraction of the previous year. Team Sky provides a good example of this concept as they reported close to $5 million in prize money throughout the 2012 season which is about 20% of their budget. However, two years later they pulled in only $25,000 while still being just as competitive[27].

The first value we will calculate will be the payout for winning the tour. According to the report the winning team in 2013, team *Sky* generated $556 million for its sponsors[28]. This comes as a combination of television, print, and online exposure values. This value represents the payoff available to elite teams getting a grand tour win. The report also used the same value sources to calculate an $88.4 million average return to team sponsors for teams that did not win the overall tour. This thesis will assign this value to competitive level teams as they make up the bulk of teams competing in the tour. This value represents the value they brought in without winning, therefore their tour win payout must be estimated. By multiplying the value by three a $265.2 million value can be associated with this category's payout. Team Sky's value cannot simply be used to establish the value of a Tour win for every category. This is due to the elevated status and brand recognition that comes with being an elite team which in turn nets them greater

[27] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),74-75.
[28] Stephen Farrand and Steve Beckett, "Sponsorship Report on Pro Cycling 2013,"*Cyclingnews* in association with *Repucom*,http://futurepublishing.msgf.net/files/amffuturepublishing/project_391/The_Cyclingnews_sponsorship_report_on_professional cycling.pdf, 13.

media exposure value. There will be no payoff value assigned to developing teams because they have never won a tour and therefore there is no available data on potential payoff values.

Table 5: Tour Win Payoff Values (in millions)

Elite Teams	Competitive Teams	Developing Teams
$550	$265.20	$0

To calculate the payout for stage wins we will use Repucom's stage win value estimate for team FDJ-Big Matt. By winning stage eight of the 2012 Tour de France FDJ received $9.9 million in media exposure[29]. In 2012 FDJ was ranked 17th worldwide and therefore is considered a developing team. By using comparative percentages, a rough estimate of a stage win for competitive teams can be calculated. Using the average team value generated of $88.4 million divided by the number of developing team stage wins the value of each win can be estimated to be $11.05 million. The $1.15 million difference between the average and FDJ's stage win value can be ignored as the $88.4 million is used for average teams and that number would be less for developing teams. Dividing $88.4 million by the 7 stage wins of competitive teams in the 2012 Tour gives a $12.6 million value per stage win. The same procedure can be used for elite teams. Dividing the $550 million that elite teams earned that year but the six stages they won gives each stage win a $91.6 million value for sponsors.

[29] Stephen Farrand and Steve Beckett, "Sponsorship Report on Pro Cycling 2013,"*Cyclingnews* in association with *Repucom*,http://futurepublishing.msgf.net/files/amffuturepublishing/project_391/The_Cyclingnews_sponsorship_report_on_professional cycling.pdf,4.

Table 6: Stage Win Payoff Values (in millions)

Elite Teams	Competitive Teams	Developing Teams
$91.60	$12.60	$9.90

Lastly, special award values must be calculated. To calculate this value to the cycling teams, we will start with the value associated with it by sponsors. Each of the special award jerseys is sponsored by a neutral sponsor. This means that the sponsor for these jerseys does not also sponsor any of the competing teams. By examining what they pay to sponsor the jersey we can come up with a minimum value. Special Award jerseys currently cost $4 million to sponsor. However, this value underrepresents the value the jersey brings to sponsors. This is due to team sponsors getting more coverage on the jersey than the jersey sponsor. For illustrative purposes, this thesis will examine the green jersey. The amount of media exposure for a sponsor is determined by its location on the jersey. The Repucom report details the exposure percentage by jersey location.

Figure 7: Sponsor brand location percentages[30]

[31]

[30] Sponsors place their brands all over the cycling kit (uniform), bike, gloves, helmet, water bottle, and the bike itself. This image represents the sponsor brand location percentages on the jersey only and ignore the other locations. That is why the percentages do not add to 100%.

[31] Stephen Farrand and Steve Beckett, "Sponsorship Report on Pro Cycling 2013,"*Cyclingnews* in association with *Repucom*,http://futurepublishing.msgf.net/files/amffuturepublishing/project_391/The_Cyclingnews_sponsorship_report_on_professional cycling.pdf, 15.

By taking the percentage of the jersey sponsor locations and the $4 million companies pay to sponsor the jersey[32], we can estimate the total value of the jersey to the team sponsor whose name will take up the rest of the jersey. Skoda sponsors the green jersey and has its name on the collar, shoulders, sides, and sleeves of the jersey (see Figure 8 below).

Figure 8: Green Jersey

[33]

Using Repucom's estimates of sponsor exposure it can be concluded that Skoda gets a maximum of 26% of the jersey. This means that $4 million dollars is the minimal value for a special awards jersey. This means the value of the jersey to team sponsors can now be calculated:

1. Value = 4,000,000/.26

[32]"French Retailer Carrefour Ends Tour De France Sponsorship," *Street and Smith's SBJ Daily*, May 30,2018.https://www.sportsbusinessdaily.com/Global/Issues/2018/05/30/Marketing-and-Sponsorship/Carrefour.aspx.
[33]Tour de France green jersey, Amazon.com, https://images-na.ssl-images-amazon.com/images/I/61cSPZAaYOL._UX522_.jpg.

2. Value = 15, 384, 615

While there is an individual day value to the jersey the total value must be used. This is because that is the value of the jersey as a whole and calculating the value by day would not work as the stage will approximately determine the value. That is because stages have very different viewer numbers. For example, stages that end with a sprint of mountain top finishes have much higher viewership than flat stages. With such different levels of viewership, the value of wearing the green jersey one day will be quite different from holding it the next. This makes it impossible to standardize the daily value and therefore unhelpful to team managers when making daily decisions. The purpose of the model and game strategies, while examined day to day, is meant for whole tour strategies. By having the whole tour value of the special award jerseys team managers can make decisions based off the expected payouts they will get from winning the jersey at the end of the race.

Before adding these values to the decision trees, they must be multiplied by the average number of stage wins in the tour that teams of each caliber receive. This is done to ensure a fair comparison of values for the game. The total value of a tour win or a special award can't be accurately broken down into daily values like stage wins can. This is because you can go for the win but just because you went for it doesn't necessarily mean you took the lead that day or got value from that one day's ride. Winning the tour is a long-term strategy and the value is a long-term value. That is why we will multiple the stage win value by the chance of achieving it and the average number of wins. Multiplying the stage win value by the average number of wins will give the total expected value of that strategy for an entire category of team. Then by multiplying by each team's win percentage you get that teams expected value. By doing this the value the team gets is representative of the value brought to the team if that is their team strategy for the

whole tour. Table 6 below will give the expected payout for all strategies available to the three classifications of teams as well as the equations that produce those values.

Table 6: Expected Payouts

	Elite Teams	
Tour Win	.175(556,000,000) =	$97,300,000
Stage Win	.09(91,600,000) (7.8) =	$64,303,000
Special Awards	.093(15,384,615) (1.1) =	$1,573,846
	Competitive Teams	
Tour Win	.03(256,200,000) =	$7,686,000
Stage Win	.045(12,600,000) (9.38) =	$5,318,460
Special Awards	.052(15,384,615) (1.47) =	$1,175,200
Stage Win (1 day after win)	(.045 x .3) (118,118,000) =	$1,541,538
Stage Win (2 days after win)	(.045 x .6) (118,118,000) =	$3,191,076
Stage Win (multiplied fatigue)	(.045 x.09) (118,118,000) =	$478,661
Special Awards (1 day after win)	(.052 x .5) (22,615,384) =	$587,600
Special Awards (2 days after win)	(.052 x .8) (22,615,384) =	$940,160
Special Awards (multiplied fatigue)	(.052 x .25) (22,615,384) =	$293,800
	Developing Teams	
Tour Win	N/A	N/A
Stage Win	.048 (39,105,000) =	$1,877,040
Special Awards	.045(8,000,000) =	$360,000
Stage Win (1 day after win)	(.048 x .1) (39,105,000) =	$187,704
Stage Win (2 days after win)	(.048 x .6) (39,105,000) =	$1,126,224
Stage Win (multiplied fatigue)	(.048 x .01) (39,105,000) =	$18,770
Special Awards (1 day after win)	(.045 x .3) (8,000,000) =	$107,760
Special Awards (2 days after win)	(.045 x .7) (8,000,000) =	$251,440
Special Awards (multiplied fatigue)	(.045 x .09) (8,000,000) =	$32,328

To explain what the table illustrates I will break down the expected payout competitive teams can expect for a stage win the day after they attempted a stage win. The individual value of a stage win for a team for this caliber is $12.6 million. This value is then multiplied by the average number of stage wins per grand tour for teams in the competitive classification. This gives a whole tour value of $118,118,000. This total value is then multiplied by the probability that team can achieve the stage win. The probability is initially 4.5%, but then must be multiplied by the 30% fatigue factor. This gives us with a probability of 1.4% being multiplied by the $118,118,000. The result is an expected payout of $1,541,538 for the stage win strategy that day.

Figure 9: Elite Team Decision Tree with Expected Payouts

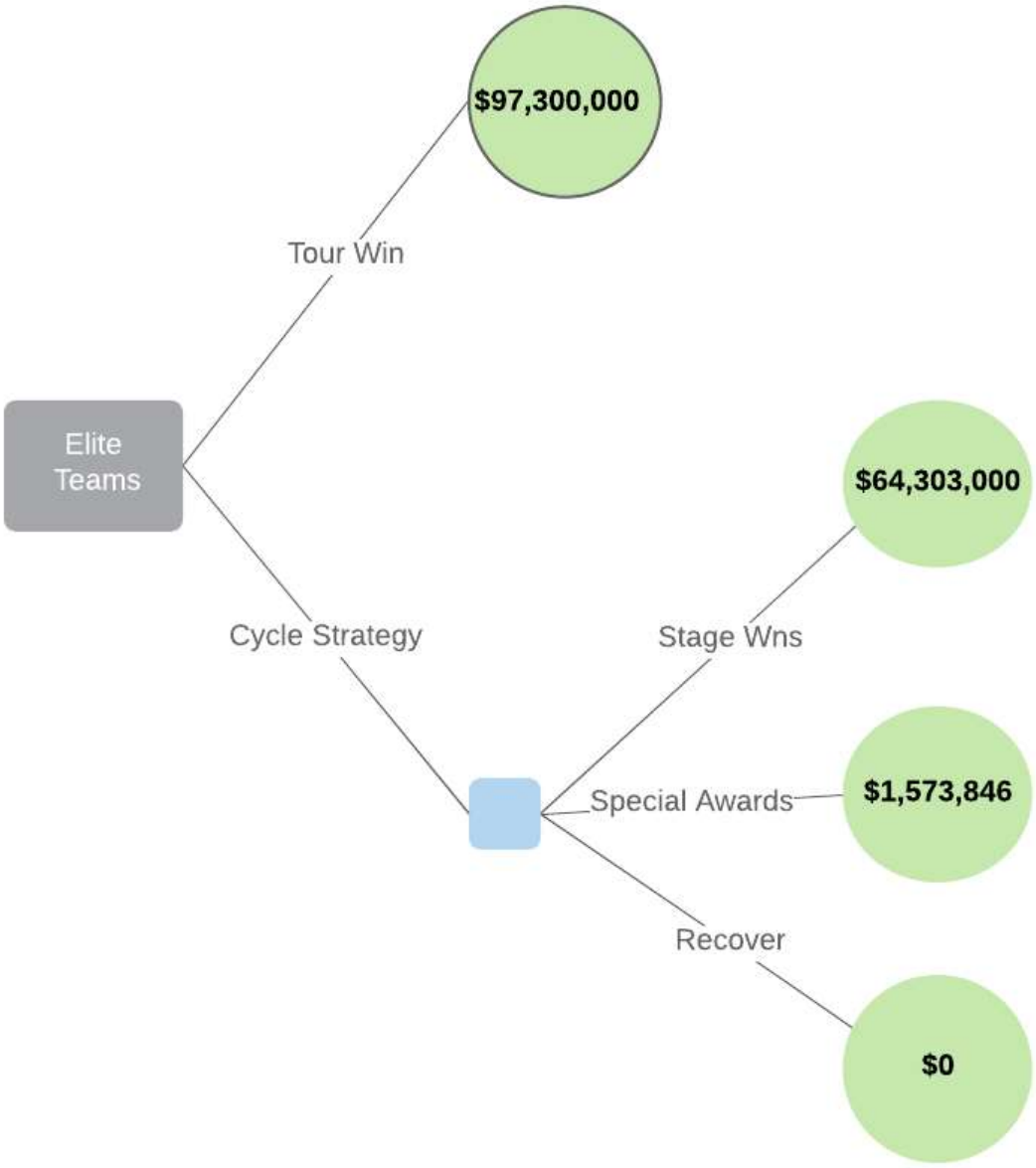


Figure 10: Competitive team decision tree with expected payoff values

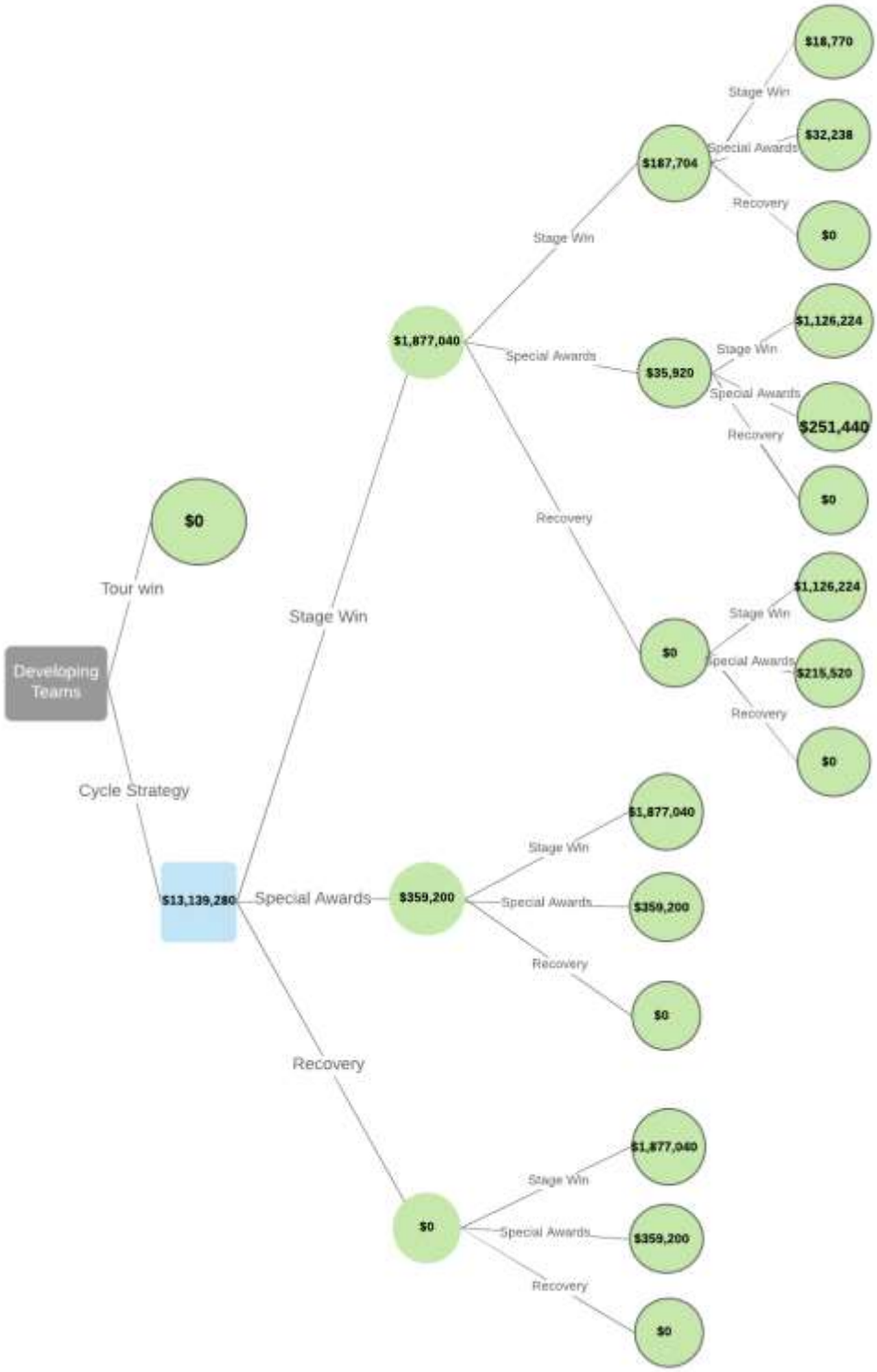
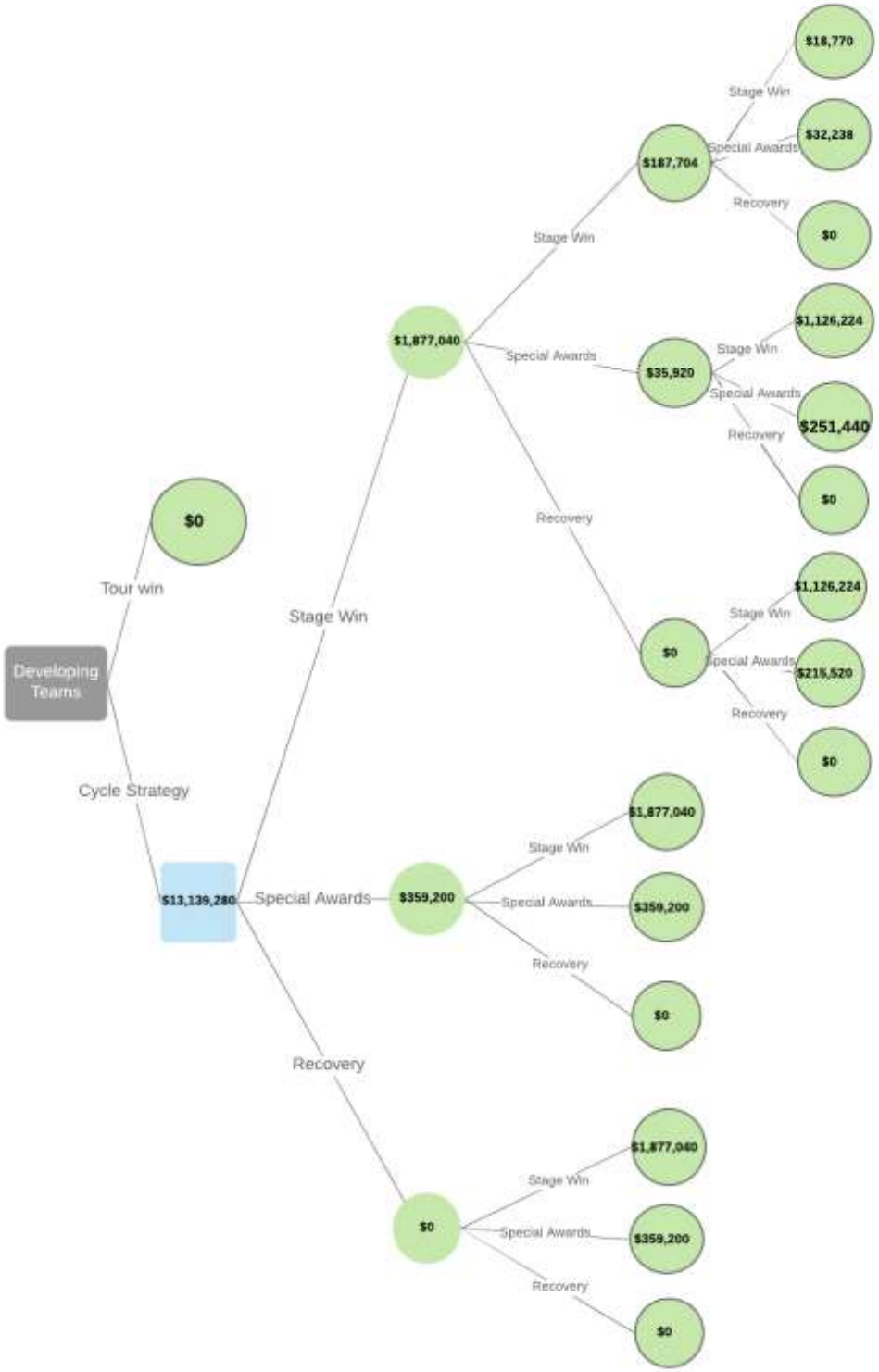


Figure 11: Developing team decision tree with expected payoff values



XV. Results and Analysis

Examining the decision tree for elite teams shows that winning is just too valuable of a strategy to pass up. We see that elite teams will go for the tour win even though their percentage chance at winning is low. This strategy is consistent with the historical data as elite teams have won fourteen of the last twenty one Tour de France races. However, we also notice that elite teams receive a decent amount of stage wins and special awards. This apparent inconsistency is due to the nature of the winning strategy.

Teams win the tour by having the fastest overall time. To maintain the fastest overall time these elite teams must monitor the other tour win competitors and attempt to stay in front of them. In trying to take or maintain the lead, elite teams will get some stage wins in the process. This does not mean however that getting stage wins is part of their strategy. The same process applies to the special awards strategy. One of the primary special awards the winning and elite teams receive is the best young rider jersey. This fits into the same logic that the award is not the strategy goal but a byproduct of the strategy of winning overall. The best young rider is awarded to the rider, under the age of twenty-three, with the fastest time. As teams work to get one of their members to win the race they have to stay at the front of the race and either take or maintain leads from other elite teams. By being a young rider on these teams you're already at the front of the race and have the best athletes in the sport to draft off of and work with.

The competitive team payouts indicate that these teams will focus primarily on getting stage wins throughout the tour. The data appears consistent with the stage win strategy as the competitive teams over the last twenty one years have the highest rate of stage wins with 197. These wins cannot be explained as a biproduct of another strategy like they are with elite teams,

however. That is because these teams are not getting stage wins as part of winning tours because the expected payout for winning is less, and the data does not reflect that as a strategy[34]. Competitive teams have only won 6 of the last 20 years of Tours and one of those was because they had Lance Armstrong[35].

The competitive teams have also attained the most special awards over the past twenty one years. This raises questions as the primary strategy according to the model is stage wins as they look to be the most profitable. The primary reason for this is major points opportunities for special awards can be found with stage wins. By winning certain stage wins teams can achieve their goals of a stage win while at the same time putting themselves into a good position to win a special award. With sprint and mountain stage finishes placed throughout the tour, a competitive team trying to win stages will inevitably pick up some special awards points. It should be noted that these strategies cannot be combined. While getting a win on a sprint stage can help the team's green jersey prospects, securing the green jersey will take a much more focused strategy and effort. Winning stages will not simply produce a special award for a team, but it can place some of their riders into contention for the special award.

The answer to this discrepancy may also be in the makeup of each team category. By breaking teams into elite, competitive, and developing, the majority of teams fall within the competitive category. This means that while they have the most special awards per team level those special awards are an accumulation of ten induvial team's efforts. So, while the data

[34] Going for tour wins would not be a viable long-term strategy due to the low rates of success for competitive teams.

[35] While Lance Armstrong has been stripped of all Tour wins by the UCI, I kept his win in the data set because there is no actual winner for that tour because everyone was doping. This thesis is also examining the strategies from a team perspective so while Lance was disqualified, he would never have won without the efforts of his team. That is why I kept that win in the competitive team data set.

reflects competitive teams as winning the most special awards it does not make it the most profitable strategy for a majority of competitive teams.

This suggests that special awards are potentially a secondary goal. While competitive teams may have the goal of winning stages, they may also try to pick up points in different special award categories. Then near the end of the race, they can decide whether to put efforts into securing an award as well. While according to the data this is not the primary strategy for competitive teams a more varied cycle strategy may work for teams with specialty riders. For example, if a competitive team is near the rear of competitive teams and they have a great sprinter, they may opt to go for sprint points more often than other competitive teams. This, however, does not change the overall strategy of stage wins being superior to special awards.

Lastly developing teams also had stage wins as their primary strategy. This aligns with the data as they have a higher percentage of stage wins than special awards. However, they do not appear to have a pure stage win strategy like competitive teams. Their three-day cycle appears to be stage win, stage win, special awards. This difference can be attributed to their large fatigue factor percentages that make it very unprofitable to go for a stage win repeatedly. Due to this large fatigue factor they will utilize the special awards strategy on the third day.

Their limited talent also puts stage wins as the primary goal because they can be achieved in the short term. For example, these teams could have a few riders work together and push super hard one day and get a stage win for the team. They could do this a few more times and have a few wins by the end of the tour which is what the data shows. Their inability to win consistently due to fatigue is what defines them as a developing team. Stage wins are not only more profitable but arguably easier than winning a special award as that takes constant performance and the monitoring of your competition, which developing teams may not have the capability to do. The

data also appears to support that as the developing teams average less than one special award per tour. It should also be noted that this number is so low because of the limited number of special awards and the characteristics of those awards.

At each tour there are 18+ teams competing for just three special awards. This number becomes even smaller when you examine the talent on each team. The best young rider is almost not an option for developing teams as having the best overall time in the under 23 age group is almost impossible with a poor preforming team. Even if you have the best young cyclist in the sport, having them beat the 2nd and 3rd best young cyclists for the award will be extremely unlikely depending on the caliber of team they find themselves on because of the lack of support the young cyclist can expect from his teammates. This is clear by looking at the data as the developing teams only won one best young rider award and that was with Jan Ulrich, one of cycling history's best riders.

XVI. Future Research

Ideally my model would be a repeated game. While I have set the model to represent one tour it would be more effective to run it as a repeated game. That is because the strategies teams take on this tour will affect their strategies the next year. If they follow the model and gain sponsors, they may have more income to be able to afford better riders and staff which might cause them to enter the next tour in a different classification. By doing a repeated game this potential change would be illustrated with the model.

Further research could help this paper's game theory model reflect more nuance. By gathering more data on the value brought to sponsors the expected payouts could become more accurate. These more accurate payouts might allow for further division among competitive teams. For example, teams might be subdivided into top competitive teams who are trying to just

win stages and potentially be in a position to win overall if something unexpected were to happen.

There might also be bottom tier competitive teams who may have a more varied cycle strategy when it comes to the tour. These would be teams like the one described above in the results section which might put more emphasis on special awards while still keeping stage wins as a priority. Differentiating these groups would also involve greater probability research.

One of the key aspects to the payoff values that would take some serious research is brand differentiation. This is due to the concept outlined above that not all brands are equal. When assigning values to these three categories of teams I used general values to represent each group but in reality, every team's sponsor has a different market value. For example, in American football, the Patriots brand will get more value out of a Superbowl win because they have a larger fanbase and brand recognition than, say, the Carolina Panthers. The same concept applies to cycling with teams like Sky having years of winning and recognition behind their brand before even starting the race. That results in the riders producing greater value to their sponsors with a win than the riders on the 18th best team could bring their sponsors. This research will be hard to conduct, however, as individual team sponsors will and have been reluctant to release data like this. However, individual teams can conduct their own research for their sponsors and apply that data to the model to get a more accurate game theory strategy for the tour.

Lastly, more research could be done to expand the cycle strategy approach. This can be done by including more strategies and by differentiating individual stage value. Currently this game theory uses a standardized value for stage wins. Further research could allow for each stage to receive an individual expected payout value based off of specific media value data. This is

because some stages like the final stage in Paris, have much higher audience numbers than a flat stage in the middle of the race. With more available data and research individual expected payout values could be constructed and a game theory decision tree could be created to represent all 21 of the stages instead of the three-day general cycle of stages used in this paper.

The strategies used in the game are not the only ones available to teams to generate sponsorship revenue. The background section outlined possibilities such as getting the aggressive rider award and riding in the breakaway. With further expected payout research, estimates could be achieved for the value of a minute of T.V. coverage. With this value the last twenty one years of tour racing could be examined to calculate the value teams bring to their teams while riding in the breakaway. Of course, this estimate will be further complicated when you take into account that not all stages are viewed equally. Being in the breakaway on a famous mountain stage is worth more than being in the breakaway on a random flat stage. However, I believe this would be important to examine as these strategies are frequently used by developing teams. This data could lead to a more nuanced view into developing teams' strategies that involves a more involved approach to sponsor revenue generation.

XVII. Conclusion

Professional cycling is a complex and involved sports industry. Its complexity and unique financial structure raise questions as to the best path to financial success. Research has been clear that sponsorship remains at the core of the cycling industry. Teams must maintain current sponsors while also attempting to gain new and more lucrative sponsor partnerships. With media value being the primary draw for sponsors, cycling provides three general strategies for how to attract new sponsors.

The tour win, stage win, and special award strategies give teams choices for how they will go about succeeding in the industry. While these strategies have been discussed, little to no research before this thesis has been done to evaluate the profitability of each strategy as a whole. This paper seeks to add a layer of detail to the benefit maximizing problem teams face. In order to answer the question, "Is winning a necessity for financial success in the cycling industry?", I have attained payout values for each strategy and designed a general game theory model for teams to utilize.

While I have calculated the payout value, the accuracy of my model could be aided by future research. By differentiating the payouts further, the model can be more specifically tailored to each category of team and even be broken down into more categories of teams. This would primarily be done by calculating differences in brand value or by weighing various stages differently. This would be able to give more accurate payout values, as a long-established elite team brand that wins the tour will have a greater value to its sponsors than a new elite team.

With further research the cycle strategy approach could be expanded to include more choice and give a better look at each team level's three-day cycle. This, however, will most likely not change the general strategy for teams as the most profitable options are already outlined in the model. It should also be noted that while this research would give us a better look into the strategies of teams, professional teams now already have these numbers for their teams and therefore can use the models by imputing their values into the strategies. This would be effective for them to do as the model has strong predictive power. The dominant strategies for each team, produced by the model, line up with historical data.

The model and data show that for elite teams winning grand tours is the dominant strategy for financial success in the cycling industry. The expected payout is so great that even

with a small percentage chance of securing that payout, elite teams will attempt this strategy. Competitive and developing teams show that winning is not a necessity for financial success in the cycling industry. For developing teams, winning is statistically not an option so they must try to maintain and gain financial success through stage wins and special awards. While competitive teams do have a chance at winning grand tours, that chance remains small, and therefore they also rely on a stage win strategy for their financial success.

Winning therefore is not a necessity for financial success in the cycling industry but remains a strategy and goal for teams to utilize.

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Appendix

Table 1: Personnel Composition of WorldTour cycling teams 2014[36]

Team	Total	Riders	Managers and sports directors	Doctors and physiotherapists	Soigneurs	Mechanics	Administration, press and support
Ag2r La Mondiale	76	30	8	15	8	9	6
Belkin	84	30	11	10	15	11	7
BMC Racing Team	92	29	10	7	15	13	18
Cannondale	70	28	8	6	5	10	13
Lampre-Merida	58	26	9	5	6	7	5
Lotto-Belisol	60	27	7	6	4	8	8
Movistar Team	57	27	6	3	6	6	9
OmegaPharma-Quick Step Cycling Team	74	30	12	10	7	8	7
Team Europcar	61	28	5	5	6	6	11
Team Katusha	71	30	10	7	3	9	12
Tinkoff-Saxo	74	29	10	5	10	9	11
Average	**70.6**	**28.5**	**8.8**	**7.2**	**10.5**	**8.7**	**7**
Percentage (%)	**100**	**40.4**	**12.3**	**10.2**	**14.8**	**12.4**	**9.9**

Table 2: Team Budget Breakdown[37]

	Team Sky (2011)		Team Sky (2012)		Team Sky (2013)		Us Postal (2002) (2003)		Landbouwk-rediet (2003)	
	(000 euros)	%	(000 euros)	%	(000 euros)	%	(000 euros)	%	(000 euros)	%
Rider Salaries	13,751	66	19,243	72	18,538	84	9,814	84	1,670	70
Travel and accommodation	1969	10	2100	8	2216	8	986	8	120	5
Bike equipment	1759	8	2659	10	2640	10	14	0	430	18
Research, medical and anti-doping	378	2	333	1	338	1	31	0	20	1
Office and corporate identity	453	2	501	2	570	2	446	4	70	3
PR and marketing	1356	7	1226	5	1154	4	151	1	0	0
Legal fees, registrations and transfer payments	256	1	291	1	399	1	23	0	30	1
Miscellaneous	801	4	349	1	698	3	182	2	60	3
Total	21,723		26,702		27,551		11,647		2400	

[36] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016), 62.
[37] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),63.

Table 3 US Postal rider salaries in 2002 and 2003 (in US dollars)

	2002		2003		Contractual Tour de France bonuses
Armstrong, Lance	3,390,000	*52.8 %*	3,800,000	*53.2 %*	GC: 1,500,000/500,000/250,000
Heras, Roberto	853,581	*13.3 %*	1,038,231	*14.5 %*	GC: 500,000/250,000/100,000
Hincapie, George	455,000	*7.1 %*	465,000	*6.5 %*	GC: 5000 if team wins Tour Stage: 45,000/2000/1000
Rubiera, José	391,692	*6.1 %*	425,000	*5.9 %*	/
Vande Velde, Christian	252,500	*3.9 %*	250,000	*3.5 %*	GC: 1,000,000/500,000/300,000 Stage: 75,000/25,000/10,000
Landis, Floyd	60,000	*0.9 %*	215,000	*3.0 %*	Stage: 10,000/Leader's jersey: 2000 Selected: 5000
Peña, Victor	200,000	*3.1 %*	125,000	*1.7 %*	GC: 500,000/250,000/100,000 Stage: 20,000

Table 4: The business-to-business and business-to-consumer makeup of professional cycling[38]

	2004 title sponsors		2008 title sponsors		2014 title sponsors	
	Number	%	Number	%	Number	%
B2B		33.3	8	36.4	6	22.2
B2C		46.2	11	50	11	40.7
B2B and B2C		20.5	3	13.6	10	37.1

Table 5: Tour Win Payoff Values (in millions)

Elite Teams	Competitive Teams	Developing Teams
$550	$265.20	$0

Table 6: Stage Win Payoff Values (in millions)

Elite Teams	Competitive Teams	Developing Teams
$91.60	$12.60	$9.90

[38] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),86.

Historic Data Collection Excel Chart:

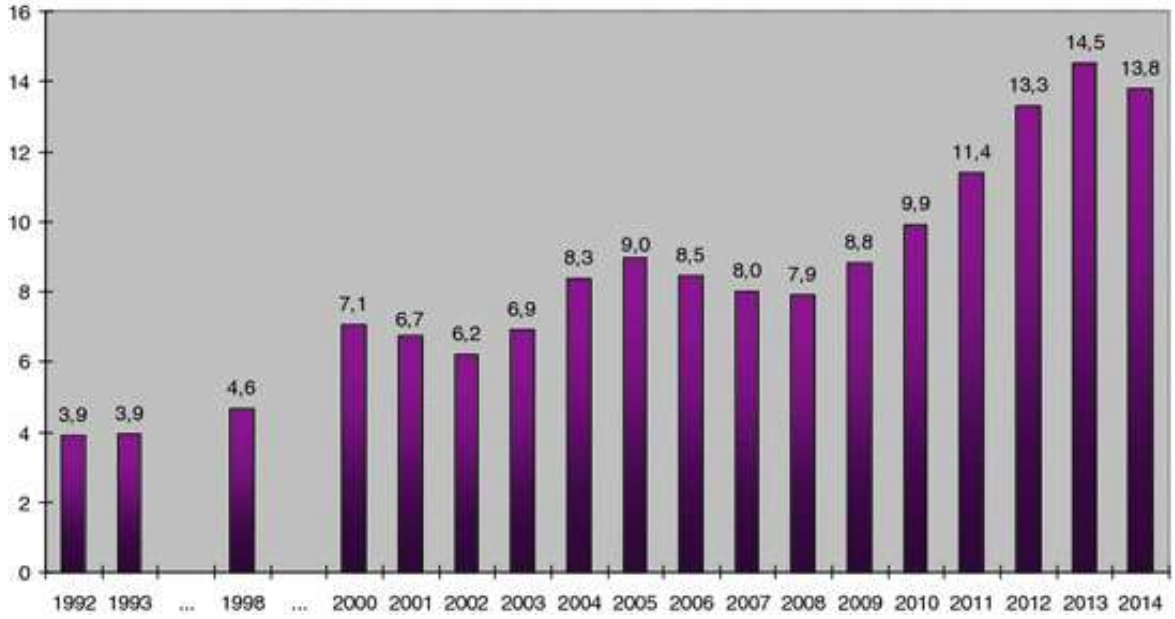
	Stage Wins	Tour Wins	Special	Stage Wins	Tour wins	Special	Stage Wins	Tour Wins	Special	Total Stages
2018	10	1	1	9	0	2	2	0	0	21
2017	9	1	2	10	0	1	2	0	0	21
2016	5	1	0	7	0	3	9	0	0	21
2015	7	1	2	12	0	1	2	0	0	21
2014	6	0	1	13	1	0	2	0	2	21
2013	10	1	2	6	0	0	5	0	1	21
2012	6	1	1	7	0	2	8	0	1	21
2011	12	0	1	6	1	0	2	0	2	21
2010	9	1	1	7	0	1	4	0	1	21
2009	13	1	1	4	0	2	4	0	0	21
2008	9	1	1	7	0	2	5	0	0	21
2007	5	1	1	12	0	1	4	0	1	20
2006	4	0	0	13	1	3	4	0	0	20
2005	9	1	2	11	0	1	1	0	0	21
2004	1	0	0	17	1	3	3	0	0	20
2003	8	1	1	9	0	1	3	0	1	20
2002	5	1	1	10	0	2	5	0	0	20
2001	5	1	1	11	0	1	5	0	1	20
2000	9	0	2	7	1	1	5	0	0	21
1999	7	0	1	9	1	1	5	0	1	20
1998	7	0	0	10	1	3	3	0	0	21
Totals:	156	14	22	197	7	31	83	0	11	434

	Stage Wins	Stage Wins	Stage Wins
Totals	156	197	83
% chance	0.36	0.45	0.19
% chance in classification	0.09	0.045	0.048
	Tour Wins	Tour wins	Tour Wins
Totals	14	6	0
% chance	0.7	0.3	0
% chance in classification	0.175	0.03	0
	Special	Special	Special
Totals	22	31	11
% chance	0.37	0.52	0.18
% chance in classification	0.09	0.052	0.45

Table 6: Expected Payouts

	Elite Teams	
Tour Win	.175(556,000,000) =	$97,300,000
Stage Win	.09(91,600,000) (7.8) =	$64,303,000
Special Awards	.093(15,384,615) (1.1) =	$1,573,846
	Competitive Teams	
Tour Win	.03(256,200,000) =	$7,686,000
Stage Win	.045(12,600,000) (9.38) =	$5,318,460
Special Awards	.052(15,384,615) (1.47) =	$1,175,200
Stage Win (1 day after win)	(.045 x .3) (118,118,000) =	$1,541,538
Stage Win (2 days after win)	(.045 x .6) (118,118,000) =	$3,191,076
Stage Win (multiplied fatigue)	(.045 x.09) (118,118,000) =	$478,661
Special Awards (1 day after win)	(.052 x .5) (22,615,384) =	$587,600
Special Awards (2 days after win)	(.052 x .8) (22,615,384) =	$940,160
Special Awards (multiplied fatigue)	(.052 x .25) (22,615,384) =	$293,800
	Developing Teams	
Tour Win	N/A	N/A
Stage Win	.048 (39,105,000) =	$1,877,040
Special Awards	.045(8,000,000) =	$360,000
Stage Win (1 day after win)	(.048 x .1) (39,105,000) =	$187,704
Stage Win (2 days after win)	(.048 x .6) (39,105,000) =	$1,126,224
Stage Win (multiplied fatigue)	(.048 x .01) (39,105,000) =	$18,770
Special Awards (1 day after win)	(.045 x .3) (8,000,000) =	$107,760
Special Awards (2 days after win)	(.045 x .7) (8,000,000) =	$251,440
Special Awards (multiplied fatigue)	(.045 x .09) (8,000,000) =	$32,328

Figure 1: Average Budget of Top Cycling Teams (millions, 1992-2014)[39]



[39] Daam Van Reeth and Daniel Joseph Larson, *The Economics of Professional Road Cycling* (New York: Springer, 2016),57.

Figure 2: Competetive Team Fatigue Factors

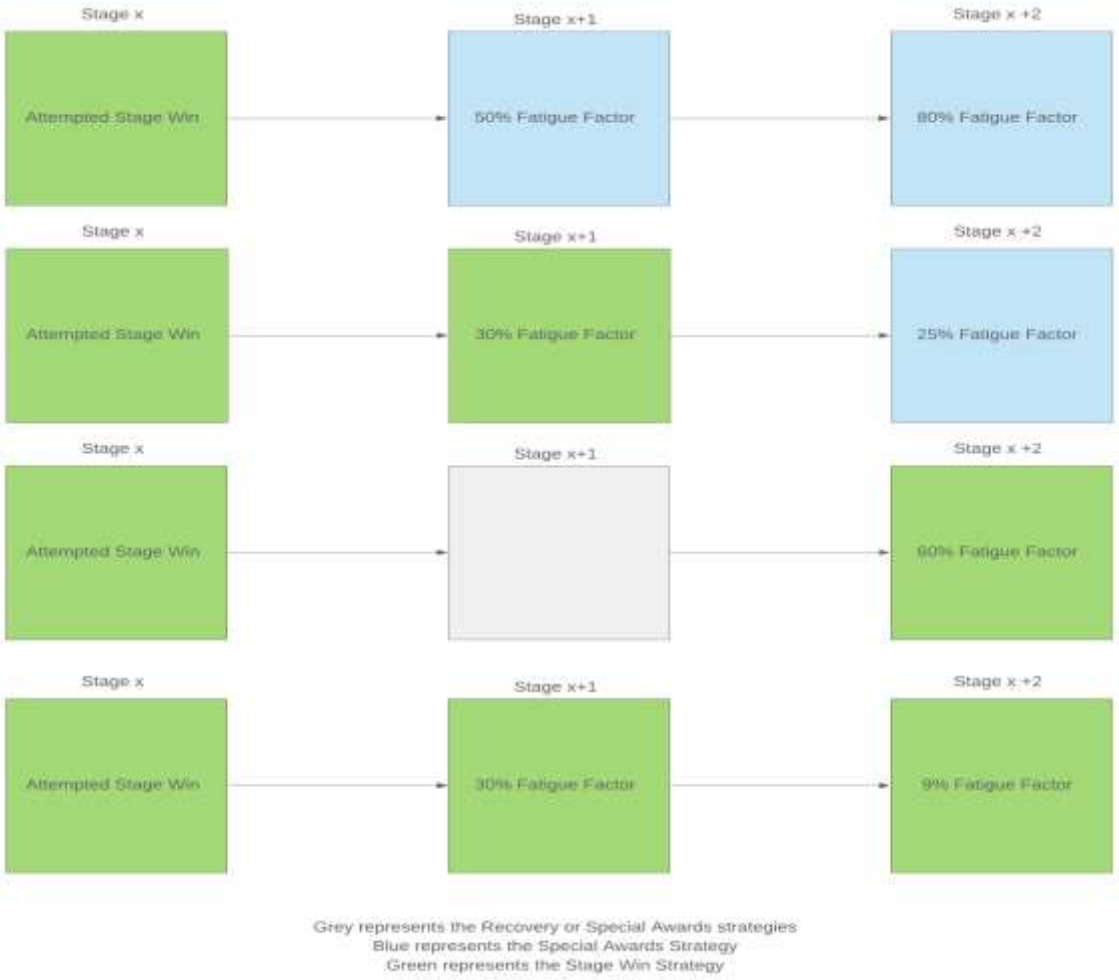


Figure 3: Developing Team Fatigue Factors

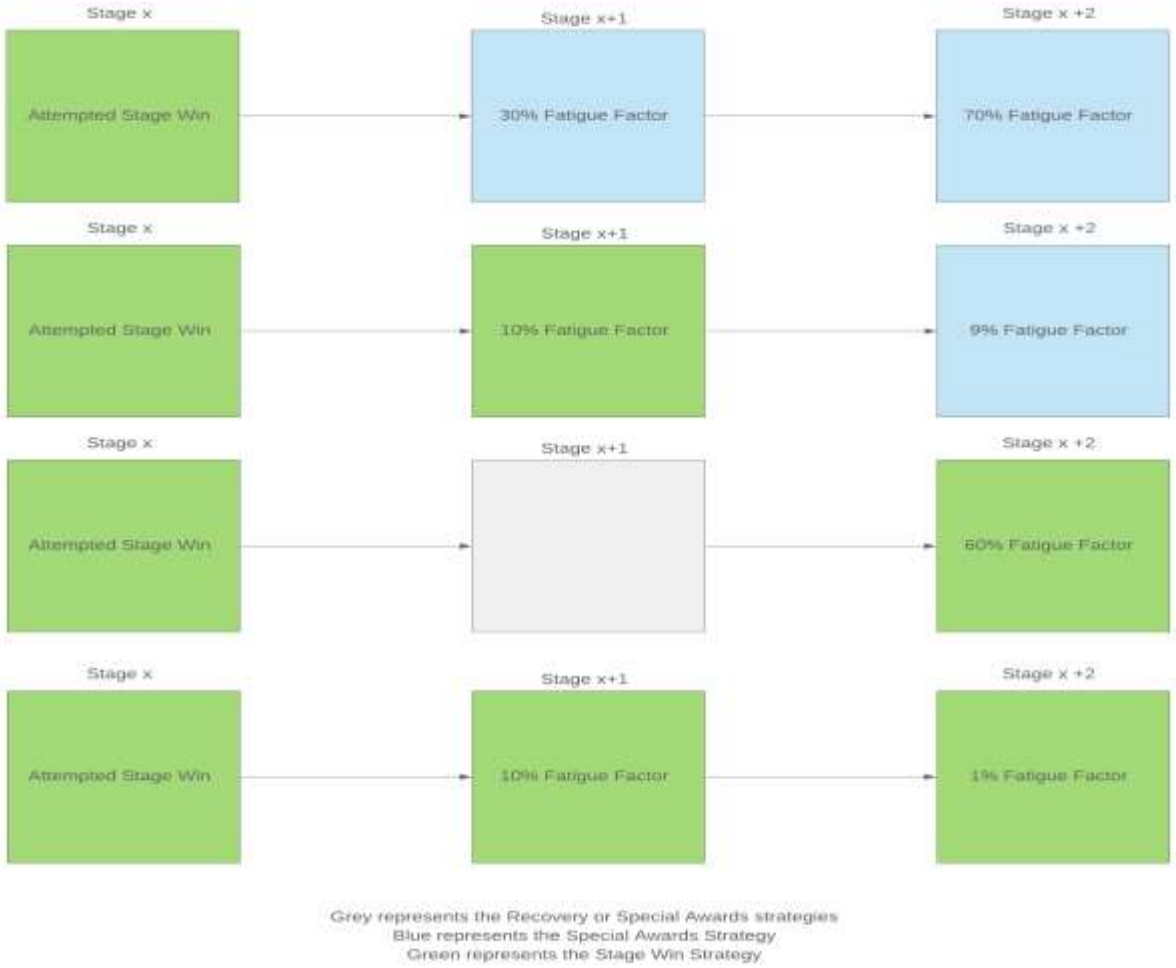
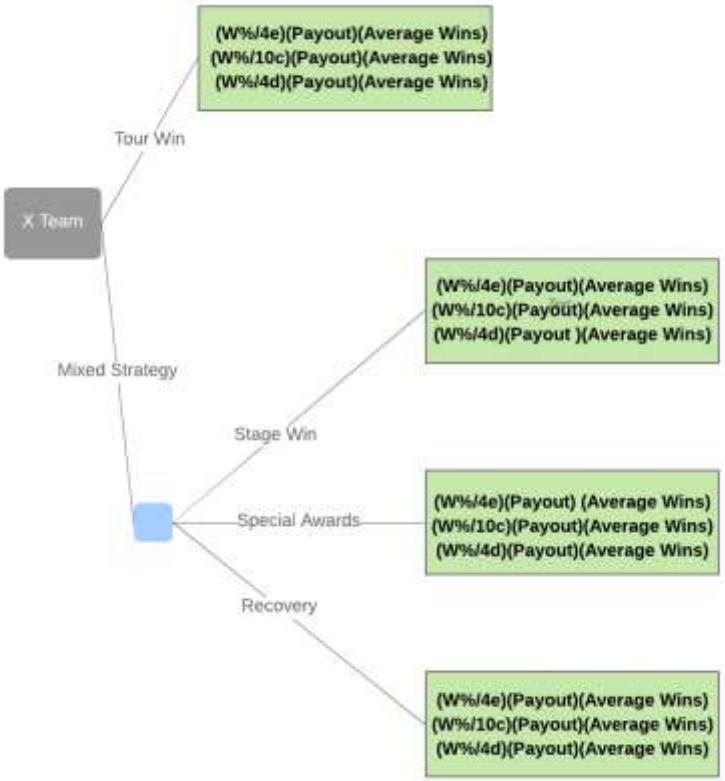
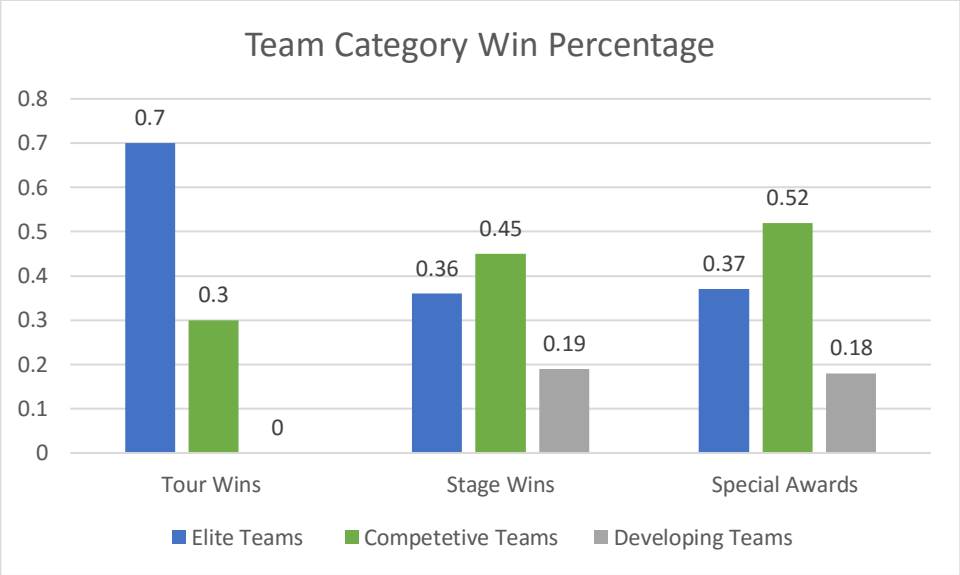


Figure 4: General Format for Decision Tree[40]



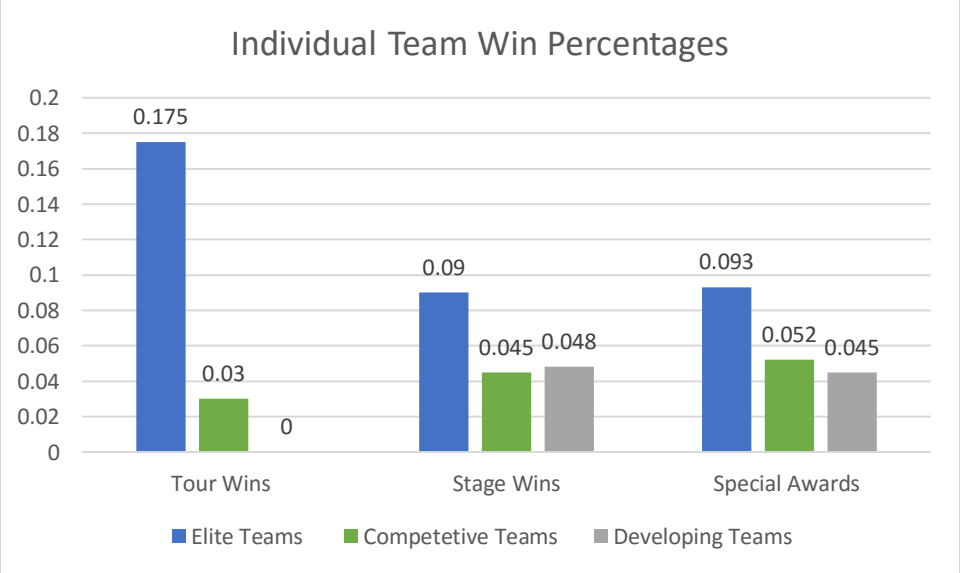
[40] General decision tree format created using Lucidchart.com

Figure 5: Team Category Win Percentage Comparison Graph



[41]

Figure 6: Individual Team Win Percentage Comparison Graph



[41]Usinghttp://futurepublishing.msgf.net/files/amf_future_publishing/project_391/The_Cyclingnews_sponsorship_report_on_professional_cycling.pdf and https://www.cyclingranking.com/teams/1998

Figure 7: Sponsor brand location percentages[42]

[43]

[42] Sponsors place their brands all over the cycling kit (uniform), bike, gloves, helmet, water bottle, and the bike itself. This image represents the sponsor brand location percentages on the jersey only and ignore the other locations. That is why the percentages do not add to 100%.

[43] Stephen Farrand and Steve Beckett, "Sponsorship Report on Pro Cycling 2013,"*Cyclingnews* in association with *Repucom*,http://futurepublishing.msgf.net/files/amffuturepublishing/project_391/The_Cyclingnews_sponsorship_report_on_professional cycling.pdf, 15.

Figure 9: Elite Team Decision Tree with Expected Payouts

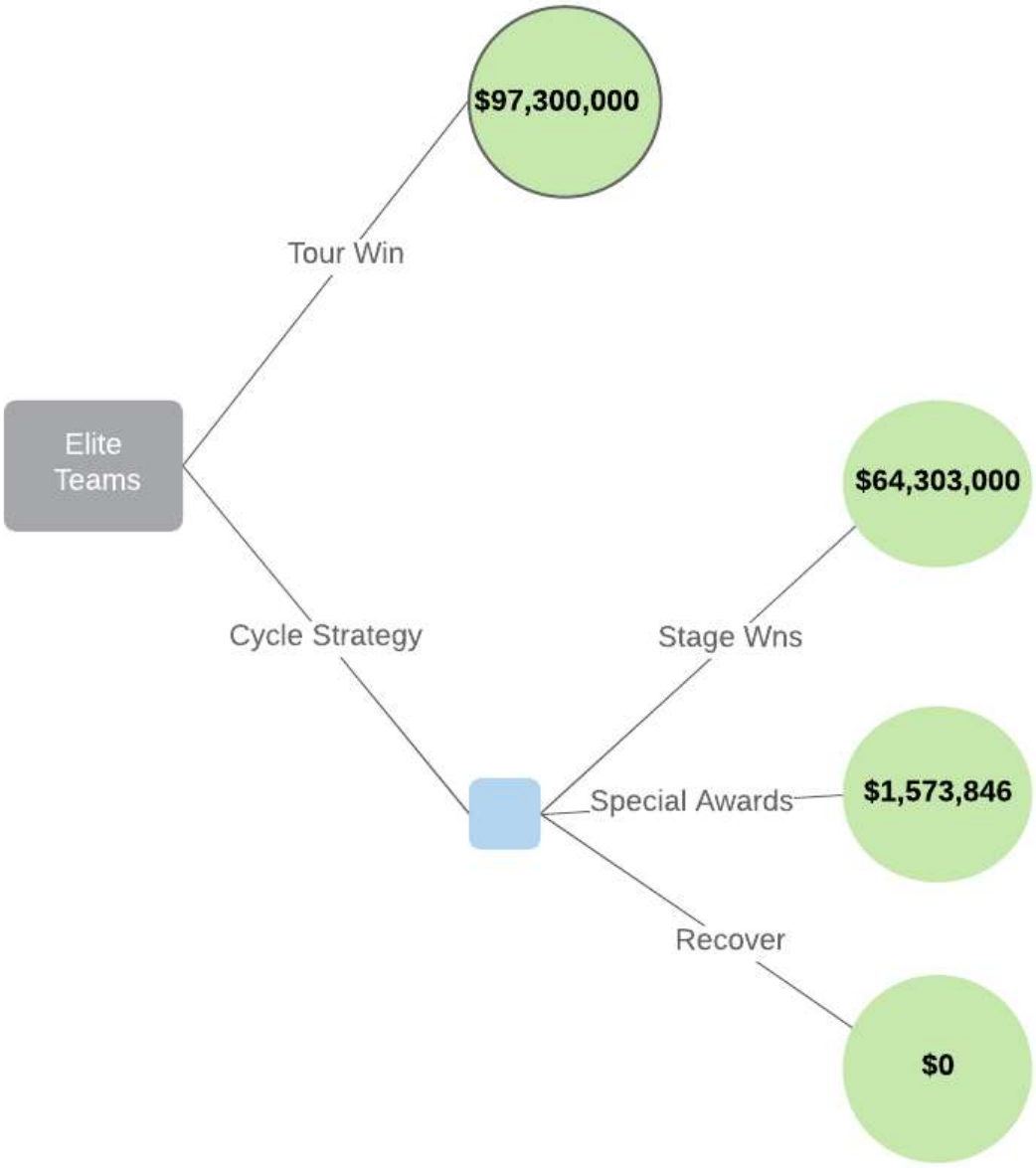


Figure 10: Competitive team decision tree with expected payoff values

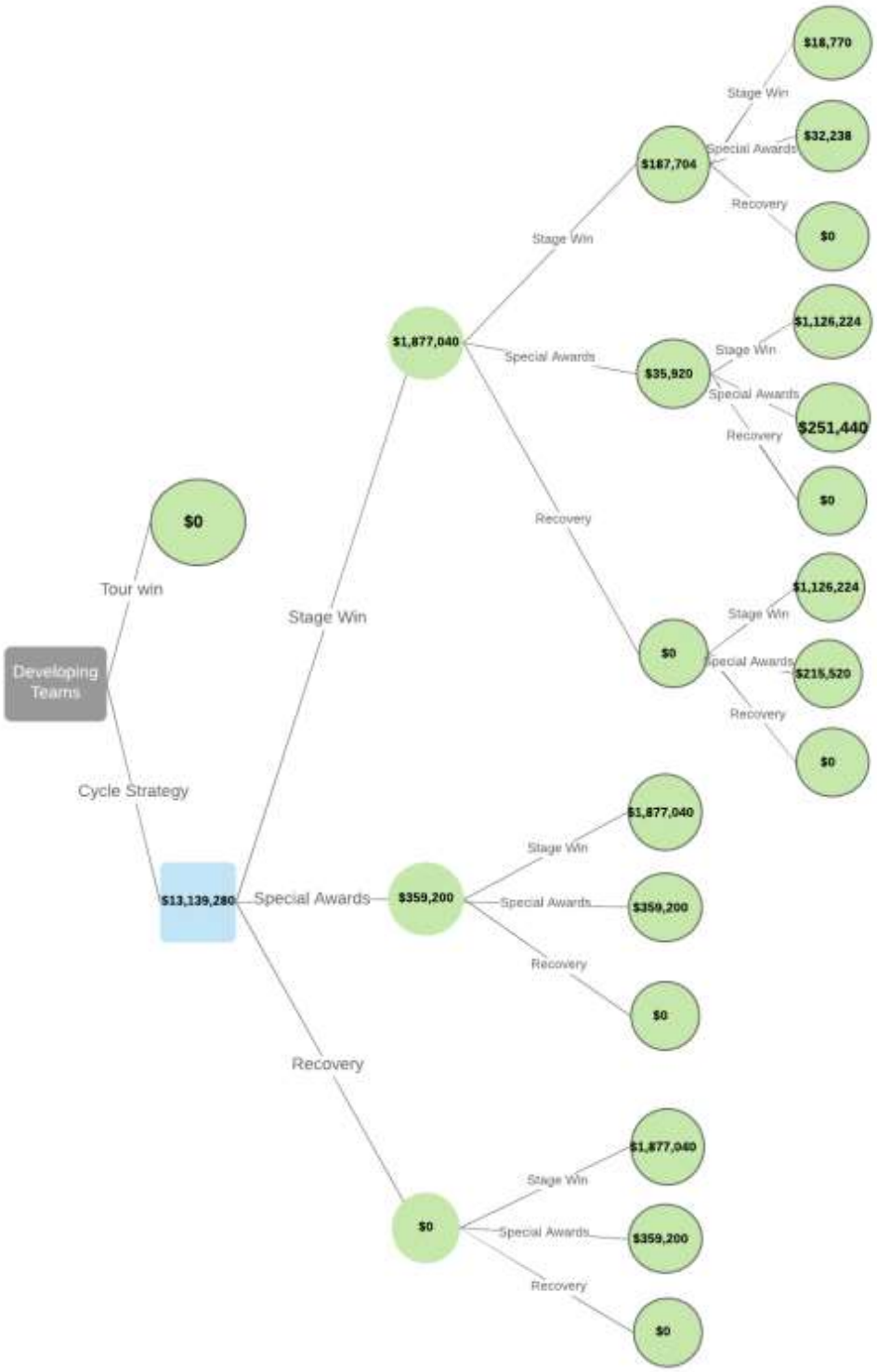


Figure 11: Developing team decision tree with expected payoff values