Technical TASK 5 :- Exploratory Data Analysis - Sports

In this task, we will be performing exploratory data analysis on the dataset "Indian Premier League" and try to find out the most successful teams, players and factors contributing win or loss of a team. Also, Suggest teams or players a company should endorse for its products.

Task Completed for The Sparks Foundation Internship Program

Data Science & Business Analytics Internship Task_5

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Step 0: Importing Libraries needed to perform task ¶

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

Step 1 : Loading and Reading The Data Set

Data = Matches

In [2]:

```
matches = pd.read_csv("matches.csv")
matches.head()
```

Out[2]:

	id	season	city	date	team1	team2	toss_winner	toss_decision	result
0	1	2017	Hyderabad	2017-04-05	Sunrisers Hyderabad	Royal Challengers Bangalore	Royal Challengers Bangalore	field	normal
1	2	2017	Pune	2017-04-06	Mumbai Indians	Rising Pune Supergiant	Rising Pune Supergiant	field	normal
2	3	2017	Rajkot	2017-04-07	Gujarat Lions	Kolkata Knight Riders	Kolkata Knight Riders	field	normal
3	4	2017	Indore	2017-04-08	Rising Pune Supergiant	Kings XI Punjab	Kings XI Punjab	field	normal
4	5	2017	Bangalore	2017-04-08	Royal Challengers Bangalore	Delhi Daredevils	Royal Challengers Bangalore	bat	normal

Understanding the Columns:

- ID –The attributes contains the information about the unique id for a match.
- SEASON –The attribute contains the information about the year when the match has been conducted.
- CITY - The attribute hold the information about the city where the match took place.
- DATE – The attribute holds the information about the date when the match has been held.
- TEAM 1 – The attribute describes that which team is going to bat first.
- TEAM 2 – The attribute describe that which team is going to bat second.
- TOSS_WINNER – The attribute holds the information about who wins the toss in that match.
- TOSS_DECISION – The attribute contains the information about the decision (bat/field) taken by the toss winner.
- RESULT – The attribute contains information about the result (normal/tie) of the players.
- DL_APPLIED – The attribute describe whether the Duckworth Lewis (DL) rule is applied.
- WINNER – The attribute hold the information about the winner of the match.
- WIN_BY_RUNS – The attribute describe that which team had win by runs.
- WIN_BY_WICKETS – The attribute describe that which team had win by wickets.
- PLAYER_OF_MATCH – The attribute contains information about the man of the match.
- VENUE – The attribute contains information about in which place the match has been played.

- UMPIRE 1 – The attribute contain information about the names of the umpire 1.
- UMPIRE 2 – The attribute contain information about the names of the umpire 2.
- UMPIRE 3 – The attribute contain information about the names of the umpire 3.

Step 3 : Checking the dataset's information

In [3]:

```
matches.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 756 entries, 0 to 755
Data columns (total 18 columns):
 #   Column           Non-Null Count  Dtype 
---  ------           --------------  ----- 
 0   id               756 non-null    int64 
 1   season           756 non-null    int64 
 2   city             749 non-null    object
 3   date             756 non-null    object
 4   team1            756 non-null    object
 5   team2            756 non-null    object
 6   toss_winner      756 non-null    object
 7   toss_decision    756 non-null    object
 8   result           756 non-null    object
 9   dl_applied       756 non-null    int64 
 10  winner           752 non-null    object
 11  win_by_runs      756 non-null    int64 
 12  win_by_wickets   756 non-null    int64 
 13  player_of_match  752 non-null    object
 14  venue            756 non-null    object
 15  umpire1          754 non-null    object
 16  umpire2          754 non-null    object
 17  umpire3          119 non-null    object
dtypes: int64(5), object(13)
memory usage: 106.4+ KB
```

We have a few Null Values here.

In [4]:

```
matches.isnull().sum()
```

Out[4]:

```
id                   0
season               0
city                 7
date                 0
team1                0
team2                0
toss_winner          0
toss_decision        0
result               0
dl_applied           0
winner               4
win_by_runs          0
win_by_wickets       0
player_of_match      4
venue                0
umpire1              2
umpire2              2
umpire3            637
dtype: int64
```

In [5]:

```
matches.nunique()
```

Out[5]:

```
id                 756
season              12
city                32
date               546
team1               15
team2               15
toss_winner         15
toss_decision        2
result               3
dl_applied           2
winner              15
win_by_runs         89
win_by_wickets      11
player_of_match    226
venue               41
umpire1             61
umpire2             65
umpire3             25
dtype: int64
```

In [6]:

```
matches.rename(columns={'win_by_runs':'Bat_1', 'win_by_wickets':'Ball_1'}, inplace=True)
```

In [7]:

```
print("City in which most matches have been won: ",matches['city'].value_counts().idxmax())
print("Team that has won most matches: ",matches['winner'].value_counts().idxmax())
print("Player who has been man of the match most times: ",matches['player_of_match'].value_
print("Most frequent Umpire 1: " ,matches['umpire1'].value_counts().idxmax())
print("Most frequent Umpire 2: " ,matches['umpire2'].value_counts().idxmax())
```

```
City in which most matches have been won:  Mumbai
Team that has won most matches:  Mumbai Indians
Player who has been man of the match most times:  CH Gayle
Most frequent Umpire 1:  HDPK Dharmasena
Most frequent Umpire 2:  C Shamshuddin
```

1. We are going to replace the missing values with the above outputs for their respective columns.
2. Since most values are null in umpire 3 we will replace them by NA.

In [8]:

```
matches['city'].fillna(value='Mumbai', inplace=True)
matches['winner'].fillna(value='Mumbai Indians', inplace=True)
matches['player_of_match'].fillna(value='CH Gayle', inplace=True)
matches['umpire1'].fillna(value='HDPK Dharmasena', inplace=True)
matches['umpire2'].fillna(value='C Shamshuddin', inplace=True)
matches['umpire3'].fillna(value='NA', inplace=True)
```

In [9]:

```
matches.isnull().sum()
```

Out[9]:

```
id                 0
season             0
city               0
date               0
team1              0
team2              0
toss_winner        0
toss_decision      0
result             0
dl_applied         0
winner             0
Bat_1              0
Ball_1             0
player_of_match    0
venue              0
umpire1            0
umpire2            0
umpire3            0
dtype: int64
```

In [10]:

```
matches.duplicated().sum()
```

Out[10]:

```
0
```

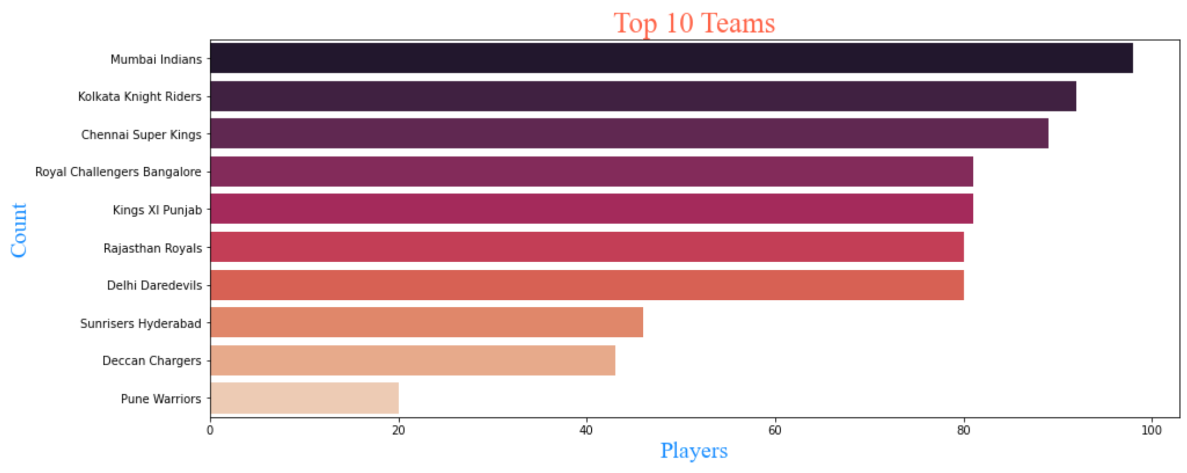
We do not have any duplicated values.

Step 4 : Data Visualization

Finding Top Teams and Players

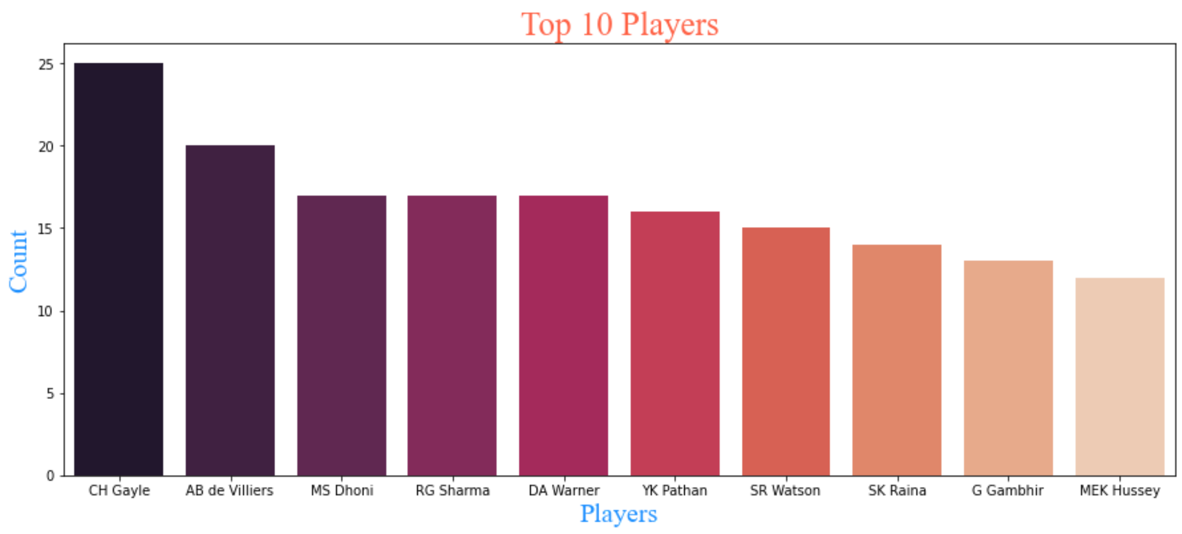
In [11]:

```
plt.figure(figsize=(15,6))
style1  = {'family': 'Times New Roman', 'color': 'Tomato', 'size': 25}
style2  = {'family': 'Times New Roman', 'color': 'DodgerBlue', 'size': 20}
sns.barplot(matches['toss_winner'].value_counts()[:10].values, matches['toss_winner'].value
plt.title('Top 10 Teams', fontdict=style1 )
plt.xlabel('Players' , fontdict=style2 )
plt.ylabel('Count', fontdict=style2 )
#plt.xticks(rotation=90)
plt.show()
```



In [12]:

```
plt.subplots(figsize=(15,6))
style1  = {'family': 'Times New Roman', 'color': 'Tomato', 'size': 25}
style2  = {'family': 'Times New Roman', 'color': 'DodgerBlue', 'size': 20}
sns.barplot(matches['player_of_match'].value_counts()[:10].index, matches['player_of_match'
plt.title('Top 10 Players', fontdict=style1 )
plt.xlabel('Players' , fontdict=style2 )
plt.ylabel('Count', fontdict=style2 )
plt.show()
```



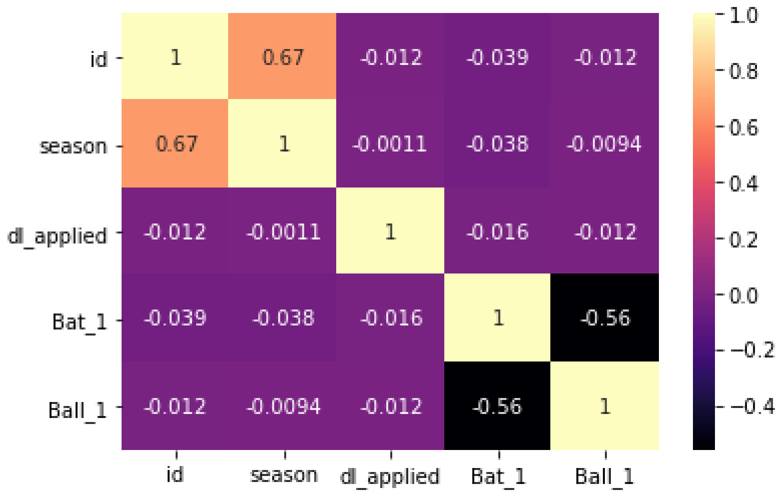
Best Team is Mumbai Indians.

Best Player is CH Gayle.

Finding the Factors Affecting the Victory

In [13]:

```
fac = sns.heatmap(matches.corr(), annot=True, cmap='magma')
```



	id	season	dl_applied	Bat_1	Ball_1
id	1	0.67	-0.012	-0.039	-0.012
season	0.67	1	-0.0011	-0.038	-0.0094
dl_applied	-0.012	-0.0011	1	-0.016	-0.012
Bat_1	-0.039	-0.038	-0.016	1	-0.56
Ball_1	-0.012	-0.0094	-0.012	-0.56	1

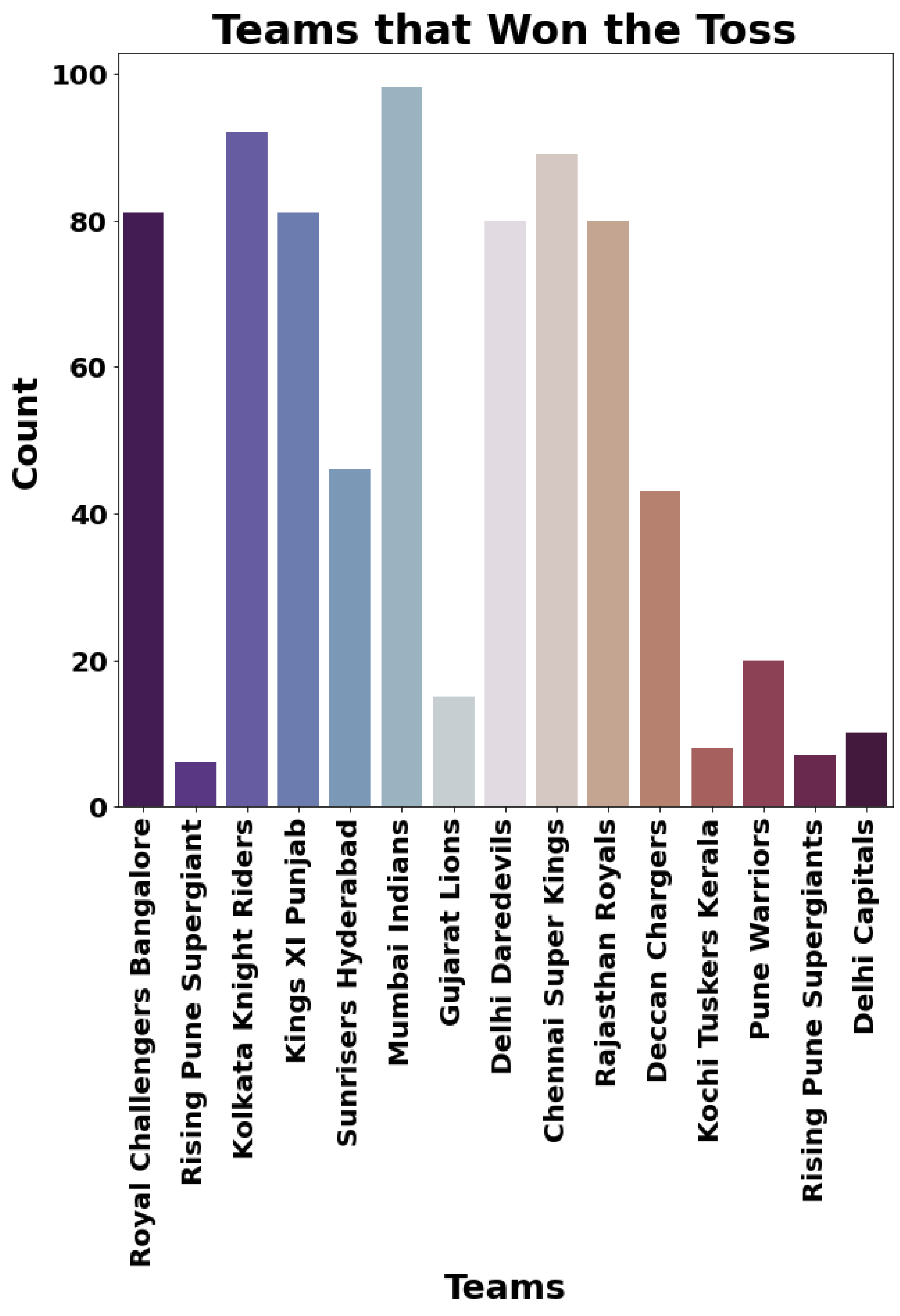
- Since, dl_applied and Season have 0 correlation to winning or loosing we can drop them.

In [14]:

```
matches = matches.drop(['dl_applied', 'season'], axis=1)
```

In [15]:

```
plt.figure(figsize=(10,10))

sns.countplot(matches['toss_winner'], data=matches, palette='twilight_shifted')

plt.xlabel('Teams', fontsize=25, fontweight='bold')
plt.ylabel('Count', fontsize=25, fontweight='bold')

plt.title('Teams that Won the Toss', fontweight="bold", size=30)

plt.xticks(rotation=90, fontweight="bold", size=20)
plt.yticks(fontweight="bold", size=20)

plt.show()
```



In [16]:

```
print('Team that won most matches by Batting First: ',matches.iloc[matches[matches['Bat_1']
```

```
Team that won most matches by Batting First:  Mumbai Indians
```

Since Mumbai Indians wins the most matches by Batting first and it also wins the Toss we can say that **Winning Toss and Batting first are a factor that affect the victory.**

Data = Deliveries

This Dataset has ball-by-ball data of all the IPL matches including data of the batting team, batsman, bowler, non-striker, runs scored, etc.

In [17]:

```
deli = pd.read_csv('deliveries.csv')
deli.head()
```

Out[17]:

	match_id	inning	batting_team	bowling_team	over	ball	batsman	non_striker	bowler	is_
0	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	1	DA Warner	S Dhawan	TS Mills	
1	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	2	DA Warner	S Dhawan	TS Mills	
2	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	3	DA Warner	S Dhawan	TS Mills	
3	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	4	DA Warner	S Dhawan	TS Mills	
4	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	5	DA Warner	S Dhawan	TS Mills	

5 rows × 21 columns

In [18]:

```
deli.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 179078 entries, 0 to 179077
Data columns (total 21 columns):
 #   Column            Non-Null Count   Dtype 
---  ------            --------------   ----- 
 0   match_id          179078 non-null  int64 
 1   inning            179078 non-null  int64 
 2   batting_team      179078 non-null  object
 3   bowling_team      179078 non-null  object
 4   over              179078 non-null  int64 
 5   ball              179078 non-null  int64 
 6   batsman           179078 non-null  object
 7   non_striker       179078 non-null  object
 8   bowler            179078 non-null  object
 9   is_super_over     179078 non-null  int64 
 10  wide_runs         179078 non-null  int64 
 11  bye_runs          179078 non-null  int64 
 12  legbye_runs       179078 non-null  int64 
 13  noball_runs       179078 non-null  int64 
 14  penalty_runs      179078 non-null  int64 
 15  batsman_runs      179078 non-null  int64 
 16  extra_runs        179078 non-null  int64 
 17  total_runs        179078 non-null  int64 
 18  player_dismissed  8834 non-null    object
 19  dismissal_kind    8834 non-null    object
 20  fielder           6448 non-null    object
dtypes: int64(13), object(8)
memory usage: 28.7+ MB
```

In [19]:

```
deli.isnull().sum()
```

Out[19]:

```
match_id                 0
inning                   0
batting_team             0
bowling_team             0
over                     0
ball                     0
batsman                  0
non_striker              0
bowler                   0
is_super_over            0
wide_runs                0
bye_runs                 0
legbye_runs              0
noball_runs              0
penalty_runs             0
batsman_runs             0
extra_runs               0
total_runs               0
player_dismissed    170244
dismissal_kind      170244
fielder             172630
dtype: int64
```

In [20]:

```
deli = deli.drop(['dismissal_kind','fielder'], axis=1)
```

Merging the two Datasets into a new Dataset and Reading it (join on match-id)

In [21]:

```
delivery=pd.merge(deli, matches, left_on='match_id', right_on='id')
delivery.head()
```

Out[21]:

	match_id	inning	batting_team	bowling_team	over	ball	batsman	non_striker	bowler	is_
0	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	1	DA Warner	S Dhawan	TS Mills	
1	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	2	DA Warner	S Dhawan	TS Mills	
2	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	3	DA Warner	S Dhawan	TS Mills	
3	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	4	DA Warner	S Dhawan	TS Mills	
4	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	5	DA Warner	S Dhawan	TS Mills	

5 rows × 35 columns

In [22]:

```
print('Shape:', delivery.shape)
print('Size:', delivery.size)
```

```
Shape: (179078, 35)
Size: 6267730
```

In [23]:

```
delivery.isnull().sum()
```

Out[23]:

```
match_id                0
inning                  0
batting_team            0
bowling_team            0
over                    0
ball                    0
batsman                 0
non_striker             0
bowler                  0
is_super_over           0
wide_runs               0
bye_runs                0
legbye_runs             0
noball_runs             0
penalty_runs            0
batsman_runs            0
extra_runs              0
total_runs              0
player_dismissed   170244
id                      0
city                    0
date                    0
team1                   0
team2                   0
toss_winner             0
toss_decision           0
result                  0
winner                  0
Bat_1                   0
Ball_1                  0
player_of_match         0
venue                   0
umpire1                 0
umpire2                 0
umpire3                 0
dtype: int64
```

In [24]:

```
delivery['player_dismissed'].fillna(value='NA', inplace=True)
delivery.isnull().sum()
```

Out[24]:

```
match_id            0
inning              0
batting_team        0
bowling_team        0
over                0
ball                0
batsman             0
non_striker         0
bowler              0
is_super_over       0
wide_runs           0
bye_runs            0
legbye_runs         0
noball_runs         0
penalty_runs        0
batsman_runs        0
extra_runs          0
total_runs          0
player_dismissed    0
id                  0
city                0
date                0
team1               0
team2               0
toss_winner         0
toss_decision       0
result              0
winner              0
Bat_1               0
Ball_1              0
player_of_match     0
venue               0
umpire1             0
umpire2             0
umpire3             0
dtype: int64
```

In [25]:

```
delivery.duplicated().sum()
```

Out[25]:

```
23
```

In [26]:

```
delivery.drop_duplicates()
```

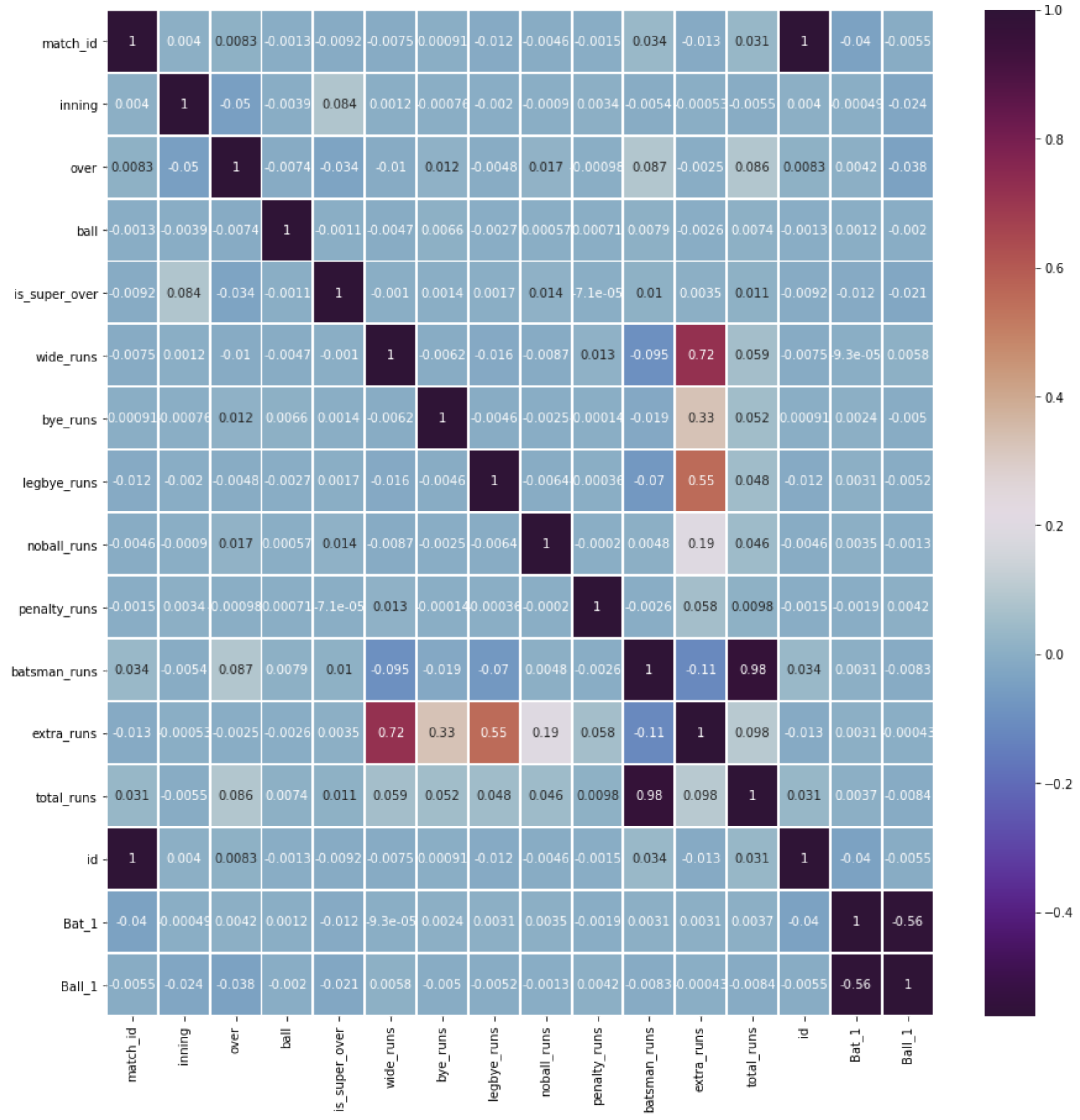
Out[26]:

	match_id	inning	batting_team	bowling_team	over	ball	batsman	non_striker	bowle
0	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	1	DA Warner	S Dhawan	TS Mil
1	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	2	DA Warner	S Dhawan	TS Mil
2	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	3	DA Warner	S Dhawan	TS Mil
3	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	4	DA Warner	S Dhawan	TS Mil
4	1	1	Sunrisers Hyderabad	Royal Challengers Bangalore	1	5	DA Warner	S Dhawan	TS Mil
...	...	...	...	...	...	...	...	...	.
179073	11415	2	Chennai Super Kings	Mumbai Indians	20	2	RA Jadeja	SR Watson	S Maling
179074	11415	2	Chennai Super Kings	Mumbai Indians	20	3	SR Watson	RA Jadeja	S Maling
179075	11415	2	Chennai Super Kings	Mumbai Indians	20	4	SR Watson	RA Jadeja	S Maling
179076	11415	2	Chennai Super Kings	Mumbai Indians	20	5	SN Thakur	RA Jadeja	S Maling
179077	11415	2	Chennai Super Kings	Mumbai Indians	20	6	SN Thakur	RA Jadeja	S Maling

179055 rows × 35 columns

In [27]:

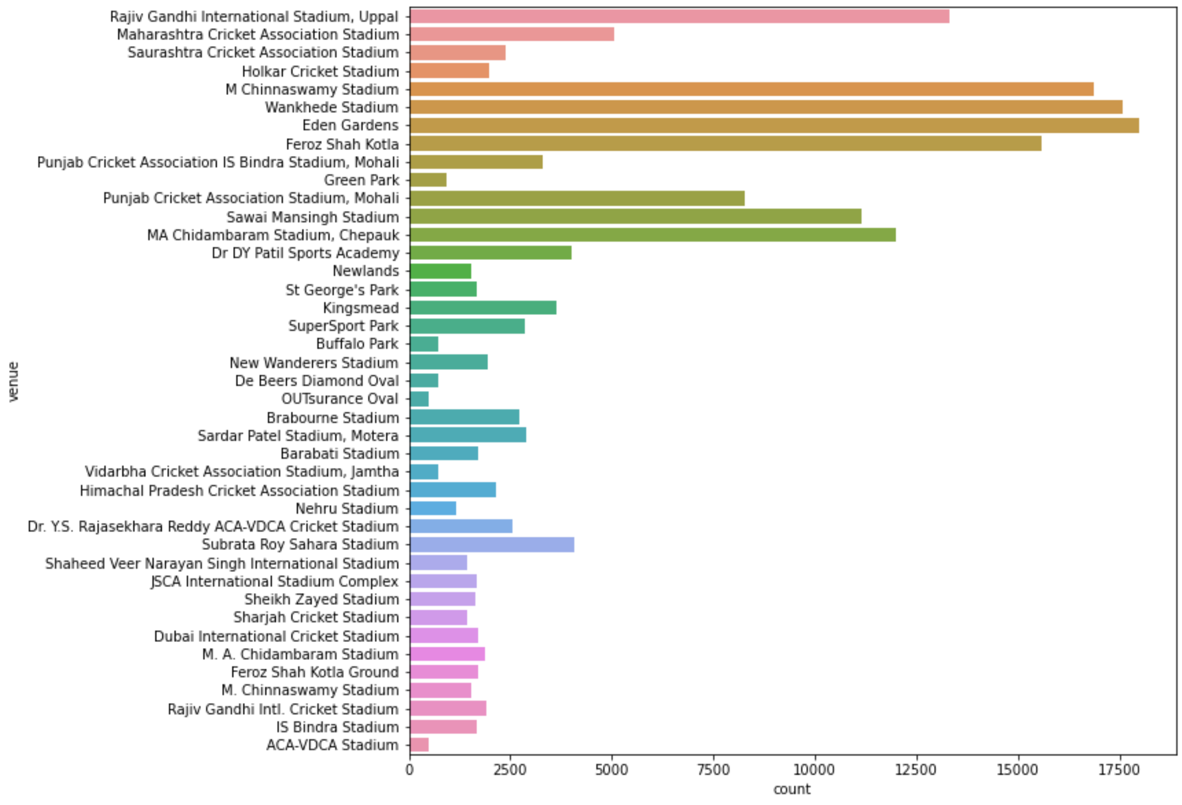
```
plt.figure(figsize=(15,15))
hm = sns.heatmap(delivery.corr(), annot=True, linewidth=1, cmap='twilight_shifted')
```



Number of Matches Played in Each Stadium

In [28]:

```
delivery.venue.value_counts()
plt.figure(figsize=(10,10))
sns.countplot(data=delivery, y='venue')
plt.show()
```



- Most matches have been played in Eden Gardens followed by Wankhede Stadium.

- Teams who win toss choose to field first

Details on Toss won by each team, Total Matches played so far, total matches being won list.

In [29]:

```
team_stats = pd.DataFrame({'Total Matches played': matches.team1.value_counts() + matches.t
                           'Total lost': ((matches.team1.value_counts() + matches.team2.valu
team_stats = team_stats.reset_index()
team_stats.rename(columns = {'index':'Teams'}, inplace = True)
winloss = team_stats['Total won'] / team_stats['Total Matches played']
winloss = pd.DataFrame({'Winloss Ratio': team_stats['Total won'] / team_stats['Total Matche
winloss= winloss.round(2)
team_stats = team_stats.join(winloss)
team_stats
```

Out[29]:

	Teams	Total Matches played	Total won	Toss won	Total lost	Winloss Ratio
0	Chennai Super Kings	164	100	89	64	0.61
1	Deccan Chargers	75	29	43	46	0.39
2	Delhi Capitals	16	10	10	6	0.62
3	Delhi Daredevils	161	67	80	94	0.42
4	Gujarat Lions	30	13	15	17	0.43
5	Kings XI Punjab	176	82	81	94	0.47
6	Kochi Tuskers Kerala	14	6	8	8	0.43
7	Kolkata Knight Riders	178	92	92	86	0.52
8	Mumbai Indians	187	113	98	74	0.60
9	Pune Warriors	46	12	20	34	0.26
10	Rajasthan Royals	147	75	80	72	0.51
11	Rising Pune Supergiant	16	10	6	6	0.62
12	Rising Pune Supergiants	14	5	7	9	0.36
13	Royal Challengers Bangalore	180	84	81	96	0.47
14	Sunrisers Hyderabad	108	58	46	50	0.54

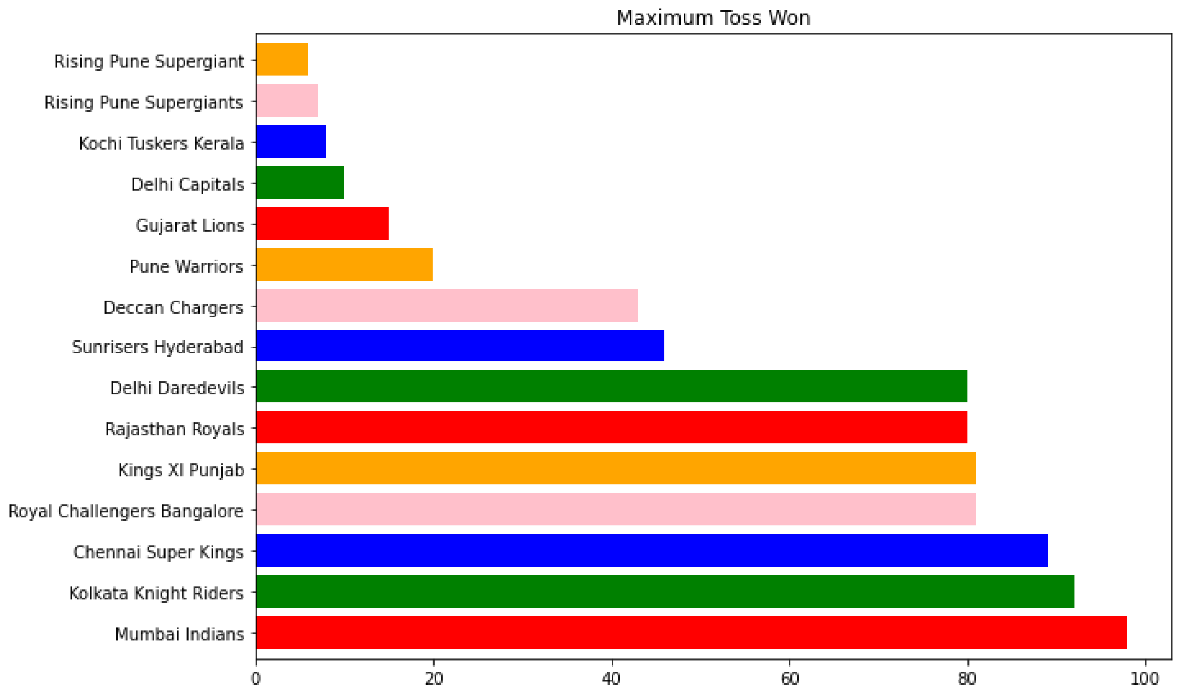
Maximum Toss Won:

In [30]:

```
plt.subplots(figsize=(10,7))
ax=matches['toss_winner'].value_counts().plot.barh(width=0.8,color=['red', 'green','blue','
plt.title("Maximum Toss Won")
```

Out[30]:

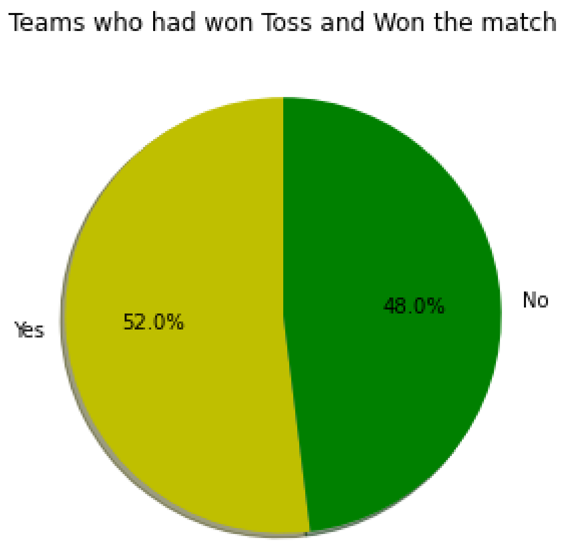
```
Text(0.5, 1.0, 'Maximum Toss Won')
```



As you know in cricket toss plays a mojor role , the team which wins the toss has a heigher advantage. mumbai indians has won maximum no.of toss in IPL

In [31]:

```
Tosswin_matchwin=matches[matches['toss_winner']==matches['winner']]
slices=[len(Tosswin_matchwin),(len(matches)-len(Tosswin_matchwin))]
labels=['Yes','No']
plt.pie(slices,labels=labels,startangle=90,shadow=True,explode=(0,0),autopct='%1.1f%%',colo
plt.title("Teams who had won Toss and Won the match")
fig = plt.gcf()
fig.set_size_inches(5,5)
plt.show()
#The Chances of the team winning, if it has won the toss are reasonably high.
#Toss favours to the victory of team
```



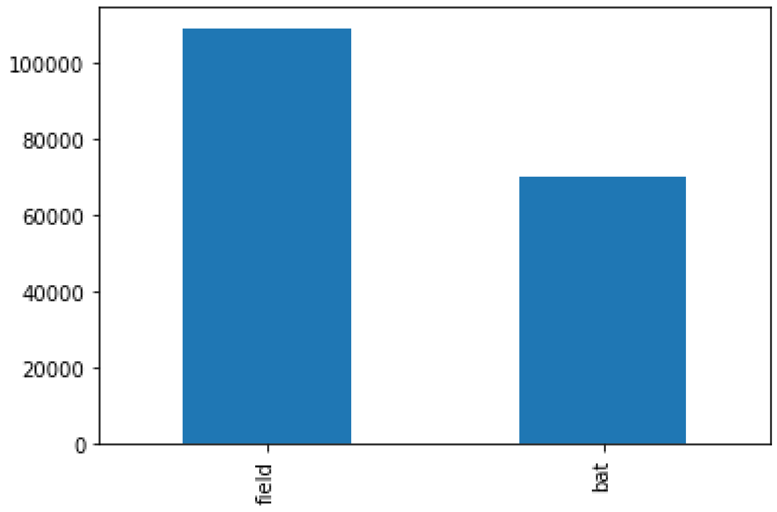
Deciding Whether to Bat or Field After Winning the Toss

In [32]:

```
ts=delivery.toss_decision.value_counts().plot(kind='bar')
ts
```

Out[32]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1f6d8cb0f40>
```



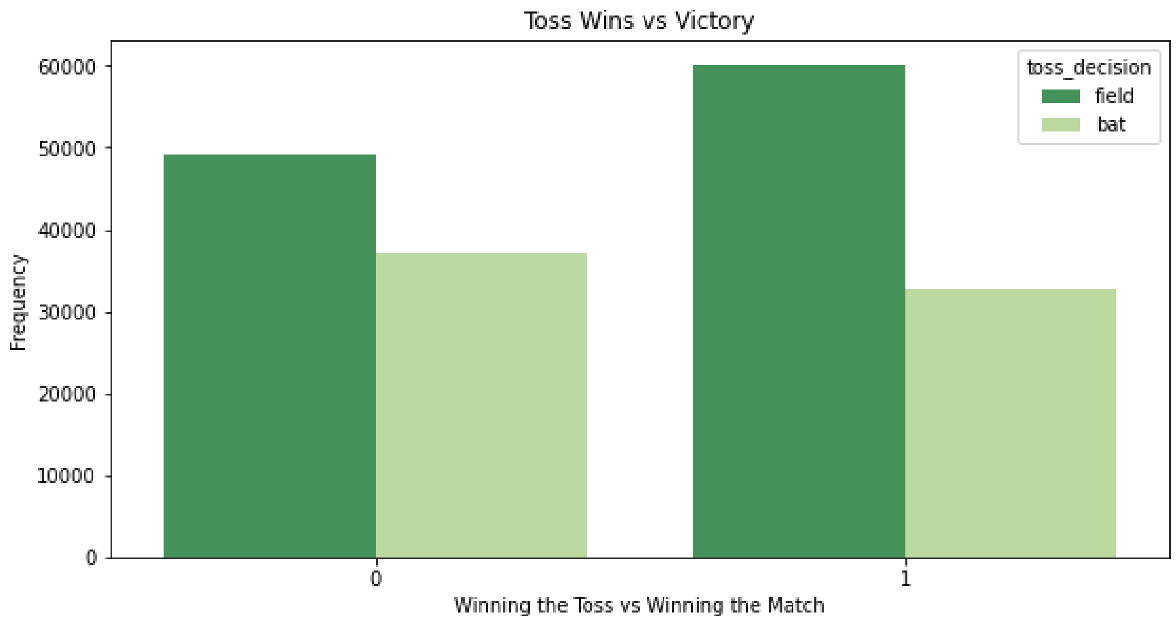
Relation between Winning toss and victory

In [33]:

```
delivery['team_toss_win']=np.where((delivery.toss_winner==delivery.winner),1,0)
plt.figure(figsize=(10,5))
sns.countplot('team_toss_win', data=delivery, hue='toss_decision', palette='YlGn_r')
plt.xlabel("Winning the Toss vs Winning the Match")
plt.ylabel("Frequency")
plt.title("Toss Wins vs Victory")
```

Out[33]:

```
Text(0.5, 1.0, 'Toss Wins vs Victory')
```



- Teams who choose to field after winning the toss have high chances of winning.

Batsmen overview

In [34]:

```
batsmen = delivery.groupby("batsman").agg({'ball': 'count','batsman_runs': 'sum'})
batsmen.rename(columns={'ball':'balls', 'batsman_runs': 'runs'}, inplace=True)
batsmen = batsmen.sort_values(['balls','runs'], ascending=False)
batsmen['batting_strike_rate'] = batsmen['runs']/batsmen['balls'] * 100
batsmen['batting_strike_rate'] = batsmen['batting_strike_rate'].round(2)
batsmen.head(10)
```

Out[34]:

	balls	runs	batting_strike_rate
batsman			
V Kohli	4211	5434	129.04
SK Raina	4044	5415	133.90
RG Sharma	3816	4914	128.77
S Dhawan	3776	4632	122.67
G Gambhir	3524	4223	119.84
RV Uthappa	3492	4446	127.32
DA Warner	3398	4741	139.52
MS Dhoni	3318	4477	134.93
AM Rahane	3215	3850	119.75
CH Gayle	3131	4560	145.64

In [35]:

```
#utility function used later
def trybuild(lookuplist, buildlist):
    alist = []
    for i in buildlist.index:
        try:
            #print(i)
            alist.append(lookuplist[i])
            #print(alist)
        except KeyError:
            #print('except')
            alist.append(0)
    return alist
```

In [36]:

```
TopBatsman = batsmen.sort_values(['balls','runs'], ascending=False)[:20]
TopBatsman
```

Out[36]:

	balls	runs	batting_strike_rate
batsman			
V Kohli	4211	5434	129.04
SK Raina	4044	5415	133.90
RG Sharma	3816	4914	128.77
S Dhawan	3776	4632	122.67
G Gambhir	3524	4223	119.84
RV Uthappa	3492	4446	127.32
DA Warner	3398	4741	139.52
MS Dhoni	3318	4477	134.93
AM Rahane	3215	3850	119.75
CH Gayle	3131	4560	145.64
AB de Villiers	2977	4428	148.74
KD Karthik	2890	3688	127.61
AT Rayudu	2681	3326	124.06
SR Watson	2639	3614	136.95
PA Patel	2444	2874	117.59
MK Pandey	2425	2872	118.43
YK Pathan	2334	3241	138.86
JH Kallis	2291	2427	105.94
BB McCullum	2272	2893	127.33
Yuvraj Singh	2207	2765	125.28

In [37]:

```
alist = []
for r in delivery.batsman_runs.unique():
    lookuplist = delivery[delivery.batsman_runs == r].groupby('batsman')['batsman'].count()
    batsmen[str(r) + 's'] = trybuild(lookuplist, batsmen)
    try:
        alist.append(lookuplist[r])
    except KeyError:
        alist.append(0)
TopBatsman = batsmen.sort_values(['balls','runs'], ascending=False)[:20]
TopBatsman.head(10)
```

Out[37]:

	balls	runs	batting_strike_rate	0s	4s	1s	6s	3s	2s	5s	7s
batsman											
V Kohli	4211	5434	129.04	1493	482	1741	191	11	293	0	0
SK Raina	4044	5415	133.90	1381	495	1695	195	11	266	1	0
RG Sharma	3816	4914	128.77	1390	431	1589	194	5	205	1	1
S Dhawan	3776	4632	122.67	1455	526	1473	96	18	205	3	0
G Gambhir	3524	4223	119.84	1351	492	1358	59	15	249	0	0
RV Uthappa	3492	4446	127.32	1382	436	1295	156	13	206	4	0
DA Warner	3398	4741	139.52	1254	459	1213	181	18	271	2	0
MS Dhoni	3318	4477	134.93	1111	297	1383	207	14	304	0	2
AM Rahane	3215	3850	119.75	1198	405	1308	74	15	214	1	0
CH Gayle	3131	4560	145.64	1423	376	919	327	3	83	0	0

In [38]:

```
#Build a dictionary of Matches player by each batsman
played = {}
def BuildPlayedDict(x):
    #print(x.shape, x.shape[0], x.shape[1])
    for p in x.batsman.unique():
        if p in played:
            played[p] += 1
        else:
            played[p] = 1

delivery.groupby('match_id').apply(BuildPlayedDict)
import operator
```

In [39]:

```
TopBatsman['matches_played'] = [played[p] for p in TopBatsman.index]
TopBatsman['average']= TopBatsman['runs']/TopBatsman['matches_played']

TopBatsman['6s/match'] = TopBatsman['6s']/TopBatsman['matches_played']
TopBatsman['6s/match'].median()

TopBatsman['4s/match'] = TopBatsman['4s']/TopBatsman['matches_played']
TopBatsman['4s/match']
TopBatsman
```

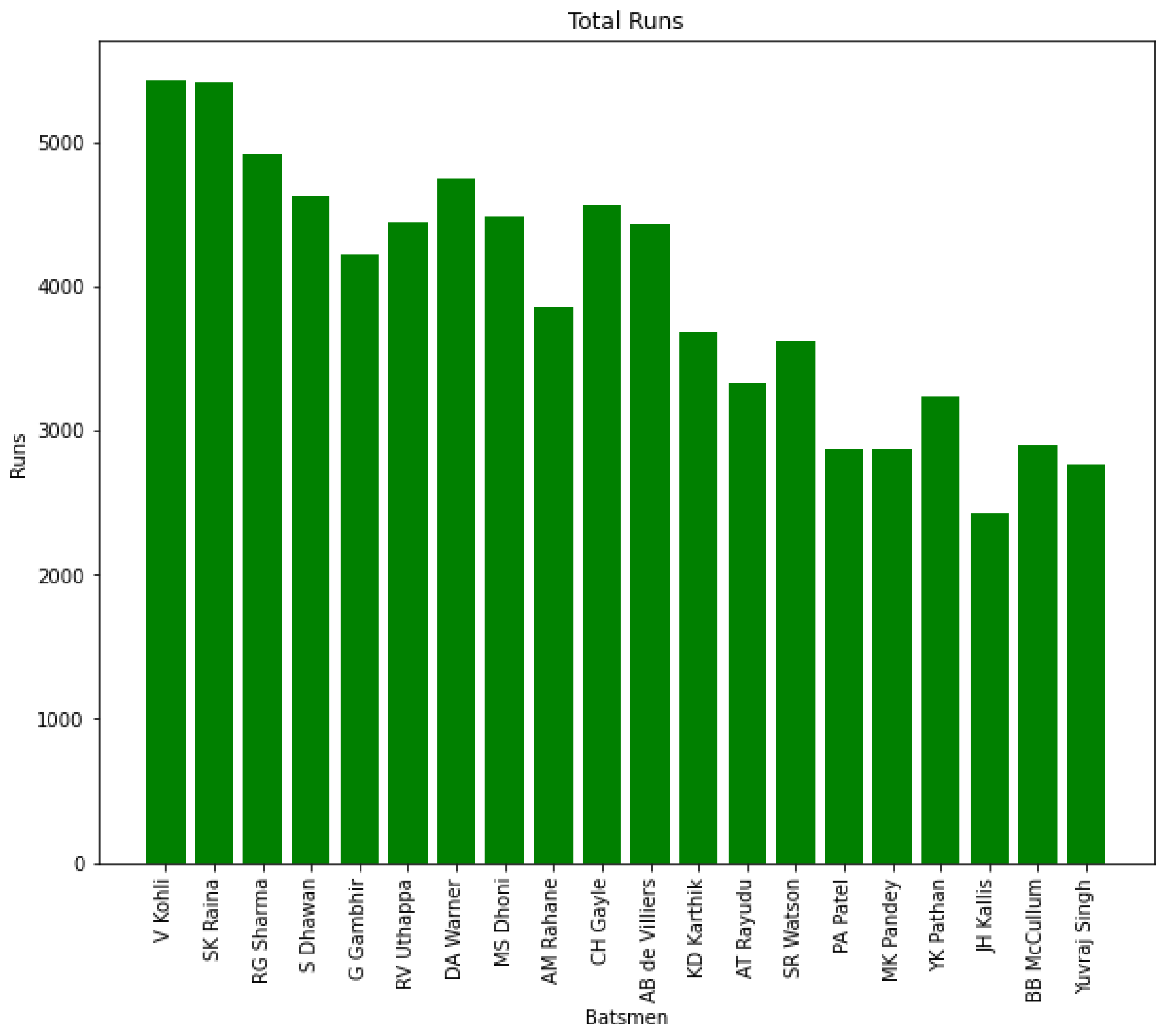
Out[39]:

	balls	runs	batting_strike_rate	0s	4s	1s	6s	3s	2s	5s	7s	matches_pl
batsman												
V Kohli	4211	5434	129.04	1493	482	1741	191	11	293	0	0	
SK Raina	4044	5415	133.90	1381	495	1695	195	11	266	1	0	
RG Sharma	3816	4914	128.77	1390	431	1589	194	5	205	1	1	
S Dhawan	3776	4632	122.67	1455	526	1473	96	18	205	3	0	
G Gambhir	3524	4223	119.84	1351	492	1358	59	15	249	0	0	
RV Uthappa	3492	4446	127.32	1382	436	1295	156	13	206	4	0	
DA Warner	3398	4741	139.52	1254	459	1213	181	18	271	2	0	
MS Dhoni	3318	4477	134.93	1111	297	1383	207	14	304	0	2	
AM Rahane	3215	3850	119.75	1198	405	1308	74	15	214	1	0	
CH Gayle	3131	4560	145.64	1423	376	919	327	3	83	0	0	
AB de Villiers	2977	4428	148.74	940	357	1231	214	15	220	0	0	
KD Karthik	2890	3688	127.61	1013	358	1201	101	6	208	3	0	
AT Rayudu	2681	3326	124.06	947	278	1179	120	1	156	0	0	
SR Watson	2639	3614	136.95	1100	344	875	177	9	132	2	0	
PA Patel	2444	2874	117.59	1061	366	831	49	8	128	1	0	
MK Pandey	2425	2872	118.43	889	253	1024	76	8	173	2	0	
YK Pathan	2334	3241	138.86	856	264	892	161	5	156	0	0	
JH Kallis	2291	2427	105.94	982	255	888	44	8	113	1	0	
BB McCullum	2272	2893	127.33	1022	293	720	129	3	103	1	1	
Yuvraj Singh	2207	2765	125.28	967	218	750	149	3	120	0	0	

Total runs by each batsmen

In [40]:

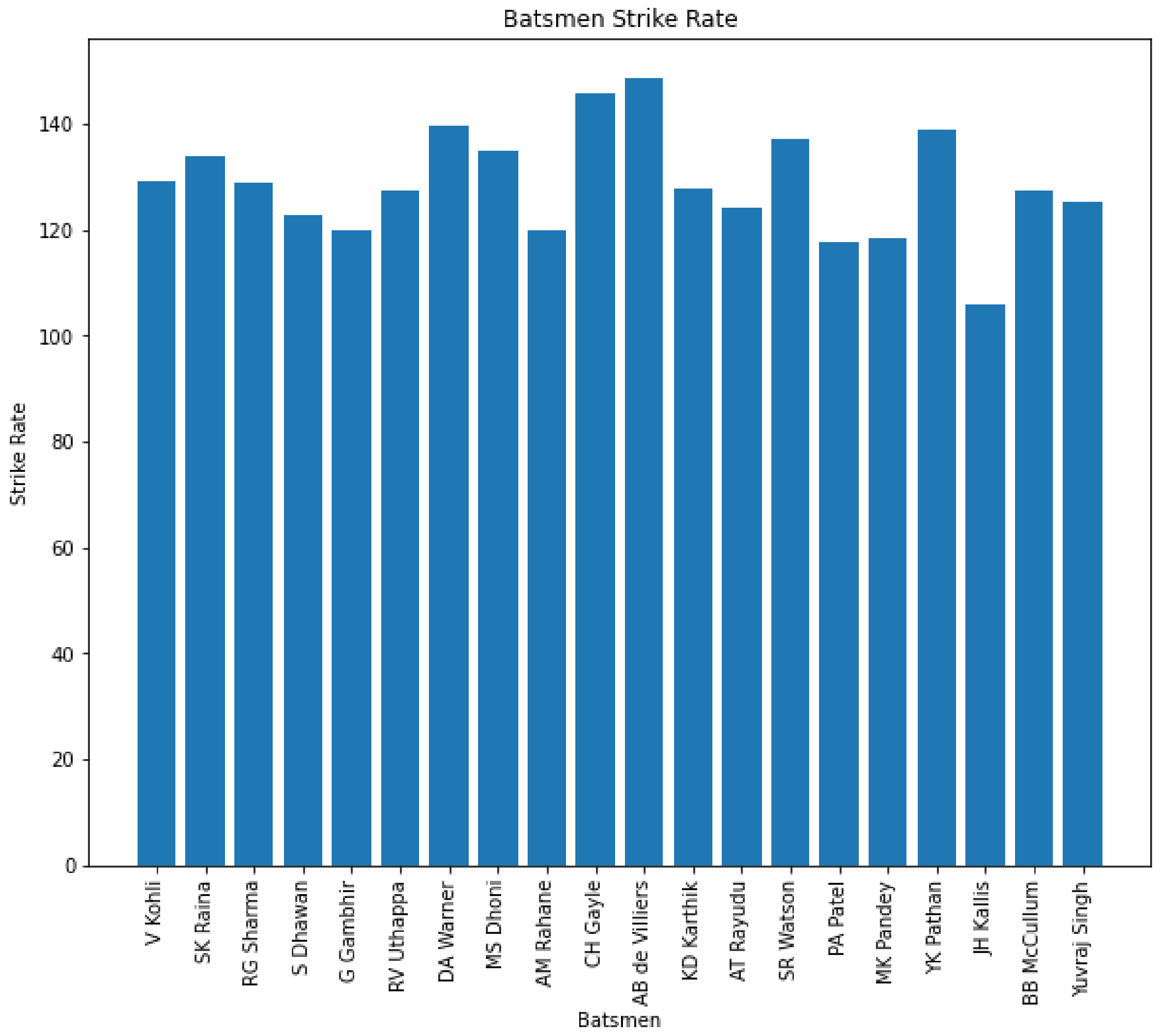
```
plt.figure(figsize=(10,8))
plt.bar(np.arange(len(TopBatsman)),TopBatsman['runs'],color='g')
plt.xticks(ticks=np.arange(len(TopBatsman)),labels=TopBatsman.index,rotation=90)
plt.xlabel('Batsmen')
plt.ylabel('Runs')
plt.title('Total Runs')
plt.show()
```



Each batsmen strike rate

In [41]:

```
plt.figure(figsize=(10,8))
plt.bar(np.arange(len(TopBatsman)),TopBatsman['batting_strike_rate'])
plt.xticks(ticks=np.arange(len(TopBatsman)),labels=TopBatsman.index,rotation=90)
plt.xlabel('Batsmen')
plt.ylabel('Strike Rate')
plt.title('Batsmen Strike Rate')
plt.show()
```



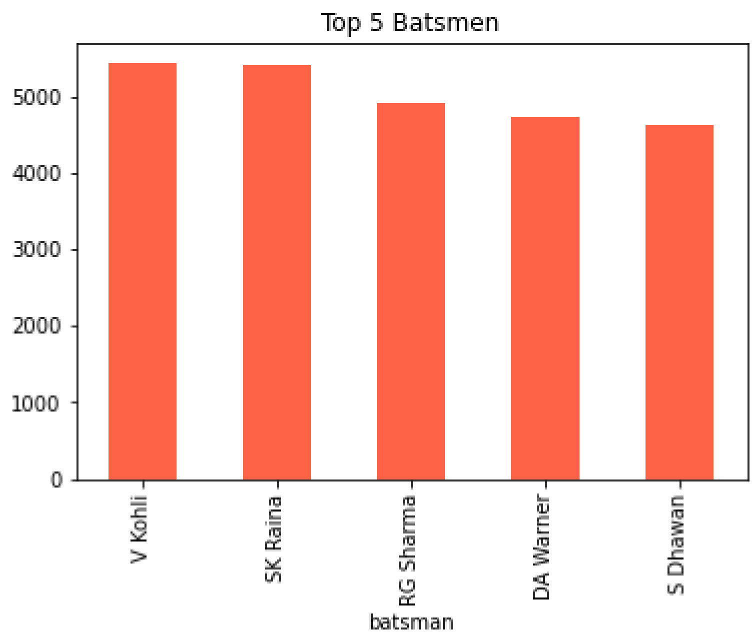
Top 5 Batsmen

In [42]:

```
delivery.groupby('batsman')['batsman_runs'].agg("sum").sort_values(ascending= False).head()
plt.title("Top 5 Batsmen")
```

Out[42]:

```
Text(0.5, 1.0, 'Top 5 Batsmen')
```



- Virat Kohli and S.K Raina Scored the most runs, so probability is that in whichever team they are that team has high chances of winning by runs.
- It is an important factor for a batsman in an T20 league to maintain a good strike rate. AB de Villiers and CH Gayle have almost equal strike rates.

Bowler information

In [43]:

```
bowler_wickets = delivery.groupby('bowler').aggregate({'ball': 'count', 'total_runs': 'sum'
bowler_wickets.columns = ['runs','balls','wickets']
TopBowlers = bowler_wickets.sort_values(['wickets'], ascending=False)[:20]
TopBowlers
```

Out[43]:

	runs	balls	wickets
bowler			
Harbhajan Singh	3451	4050	3451
A Mishra	3172	3850	3172
PP Chawla	3157	4153	3157
R Ashwin	3016	3391	3016
SL Malinga	2974	3511	2974
DJ Bravo	2711	3733	2711
B Kumar	2707	3264	2707
P Kumar	2637	3342	2637
UT Yadav	2605	3640	2605
SP Narine	2600	2939	2600
RA Jadeja	2541	3221	2541
Z Khan	2276	2860	2276
DW Steyn	2207	2454	2207
R Vinay Kumar	2186	3043	2186
SR Watson	2137	2751	2137
IK Pathan	2113	2711	2113
I Sharma	1999	2682	1999
A Nehra	1974	2537	1974
PP Ojha	1945	2399	1945
RP Singh	1874	2417	1874

In [44]:

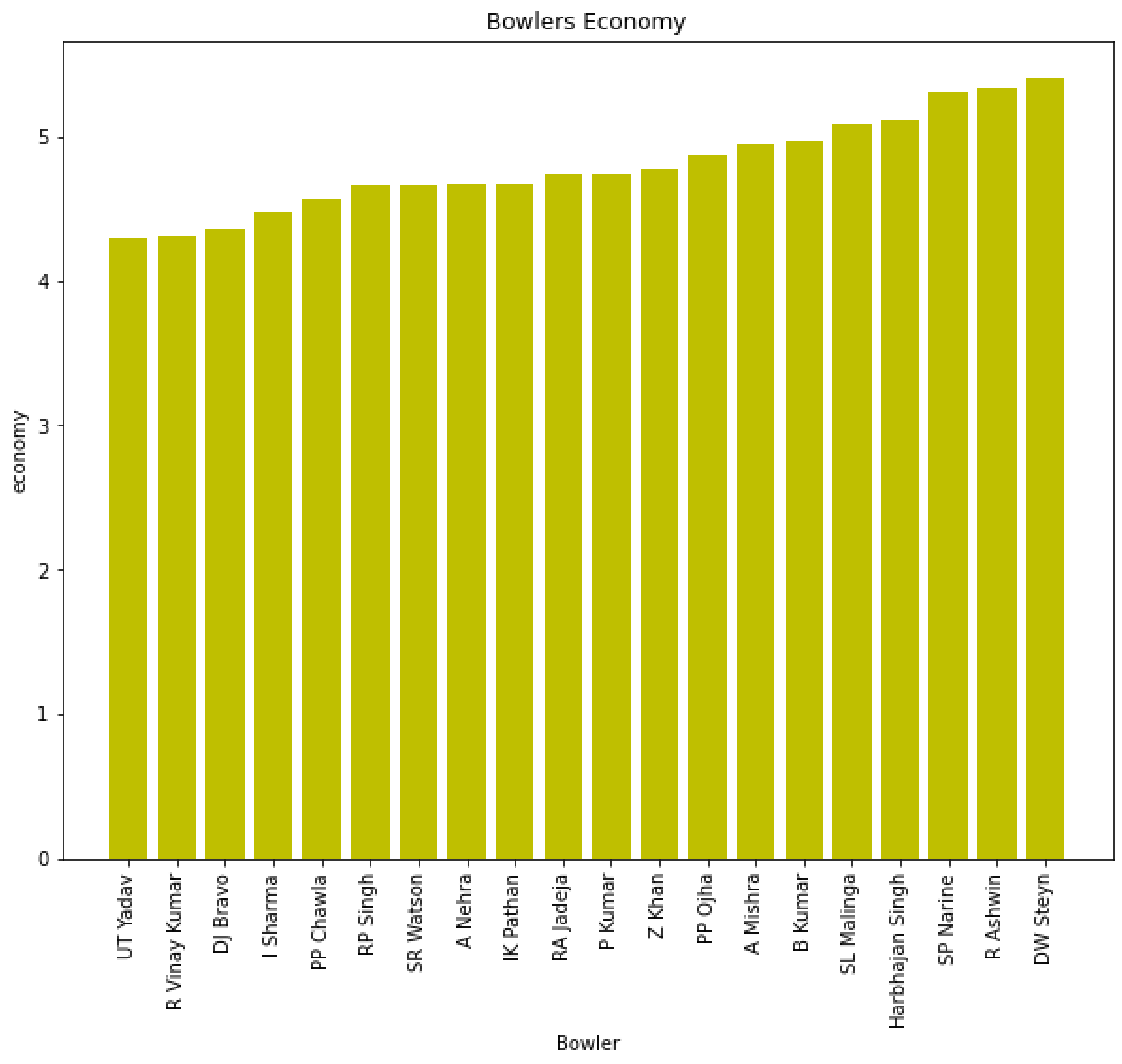
```
TopBowlers['economy'] = TopBowlers['runs']/(TopBowlers['balls']/6)
TopBowlers = TopBowlers.sort_values(['economy'], ascending=True)[:20]
TopBowlers
```

Out[44]:

	runs	balls	wickets	economy
bowler				
UT Yadav	2605	3640	2605	4.293956
R Vinay Kumar	2186	3043	2186	4.310220
DJ Bravo	2711	3733	2711	4.357353
I Sharma	1999	2682	1999	4.472036
PP Chawla	3157	4153	3157	4.561040
RP Singh	1874	2417	1874	4.652048
SR Watson	2137	2751	2137	4.660851
A Nehra	1974	2537	1974	4.668506
IK Pathan	2113	2711	2113	4.676503
RA Jadeja	2541	3221	2541	4.733313
P Kumar	2637	3342	2637	4.734291
Z Khan	2276	2860	2276	4.774825
PP Ojha	1945	2399	1945	4.864527
A Mishra	3172	3850	3172	4.943377
B Kumar	2707	3264	2707	4.976103
SL Malinga	2974	3511	2974	5.082313
Harbhajan Singh	3451	4050	3451	5.112593
SP Narine	2600	2939	2600	5.307928
R Ashwin	3016	3391	3016	5.336479
DW Steyn	2207	2454	2207	5.396088

In [45]:

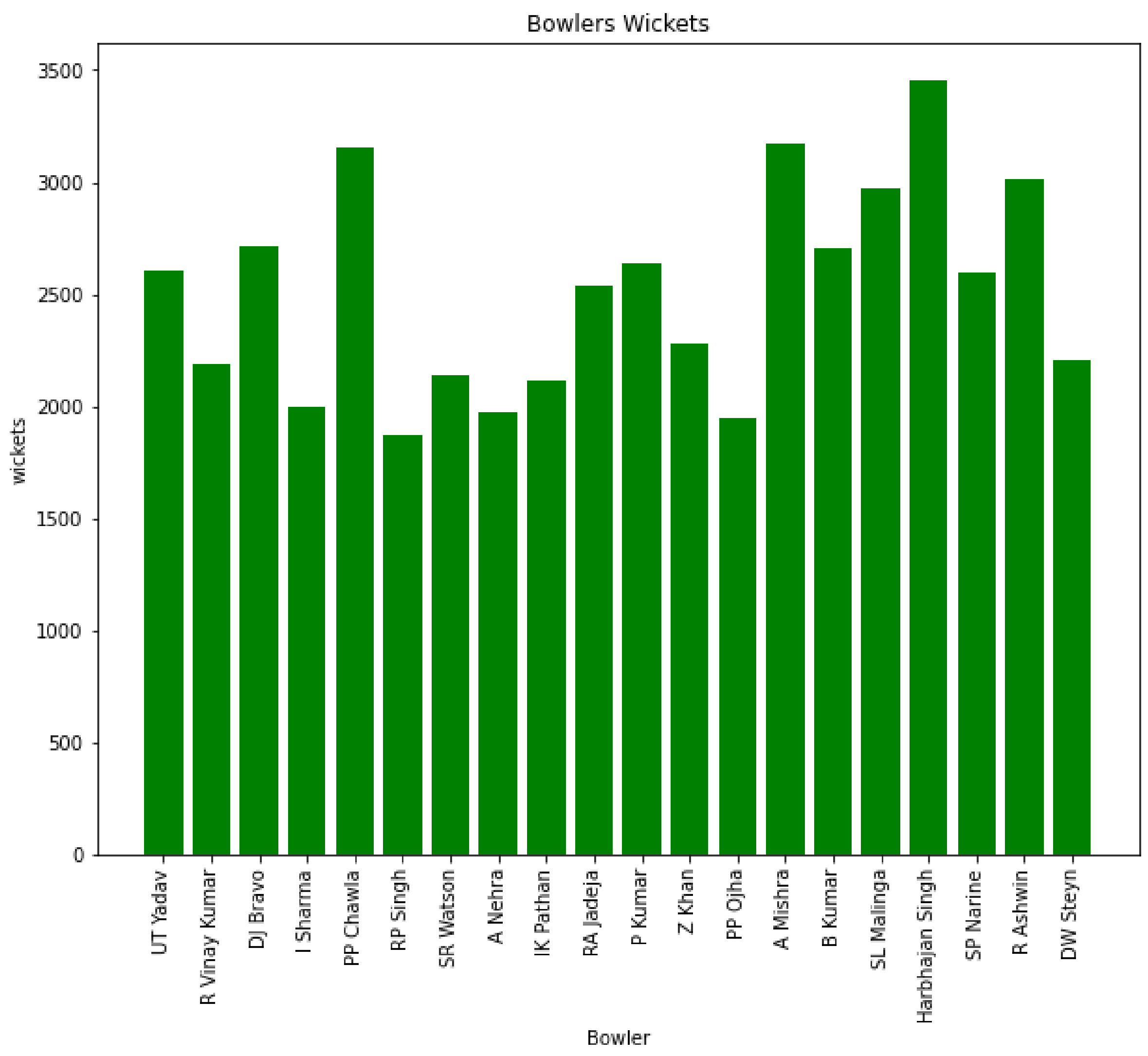
```
plt.figure(figsize=(10,8))
plt.bar(np.arange(len(TopBowlers)),TopBowlers['economy'],color='y')
plt.xticks(ticks=np.arange(len(TopBowlers)),labels=TopBowlers.index,rotation=90)
plt.xlabel('Bowler')
plt.ylabel('economy')
plt.title('Bowlers Economy')
plt.show()
```



Wickets taken by a bowler

In [46]:

```
plt.figure(figsize=(10,8))
plt.bar(np.arange(len(TopBowlers)),TopBowlers['wickets'],color='GREEN')
plt.xticks(ticks=np.arange(len(TopBowlers)),labels=TopBowlers.index,rotation=90)
plt.xlabel('Bowler')
plt.ylabel('wickets')
plt.title('Bowlers Wickets')
plt.show()
```



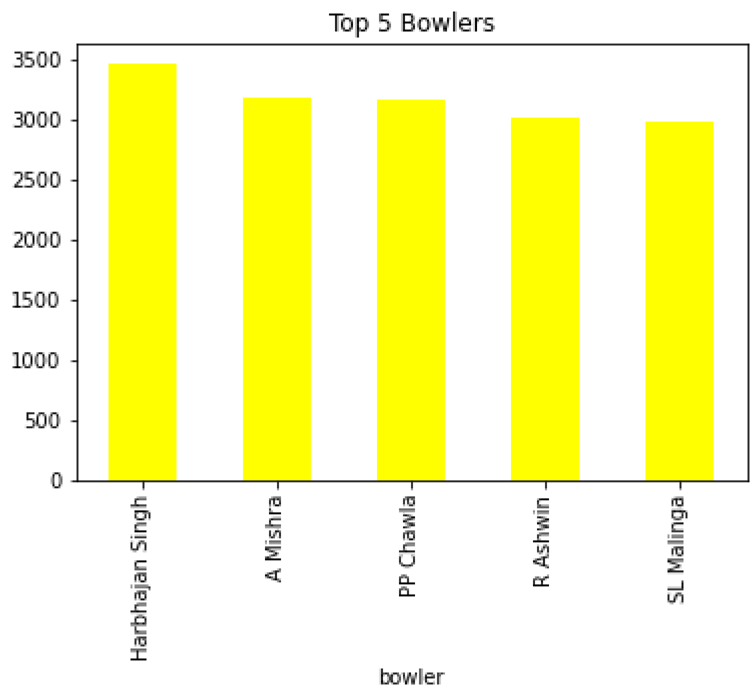
Top 5 Bowlers

In [47]:

```
delivery.groupby('bowler')['player_dismissed'].count().sort_values(ascending=False).head(5)
plt.title("Top 5 Bowlers")
```

Out[47]:

```
Text(0.5, 1.0, 'Top 5 Bowlers')
```



- Harbhajan Singh and A Mishra took the most wickets, so probability is that in whichever team they are that team has high chances of winning by wickets.

Conclusion

1. Best Team is Mumbai Indians.
2. Best Player is CH Gayle.
3. Winning Toss and Batting first are a factor that affect the victory.
4. Most matches have been played in Eden Gardens followed by Wankhede Stadium.
5. Teams who win toss choose to field first.

6. Teams who choose to field after winning the toss have high chances of winning.
7. Virat Kohli and S.K Raina Scored the most runs, so probability is that in whichever team they are that team has high chances of winning by runs and comapnies can also hire them to endorse products of batting.
8. Harbhajan Singh and A Mishra took the most wickets, so probability is that in whichever team they are that team has high chances of winning by wickets and comapnies can also hire them to endorse products of bowling.
9. Top Players like, CH Gayle, AB de Villiers, MS Dhoni, and DA Warner can be hired by many companies to endorse their products as they have a huge fanbase.

Thankyou!