In [3]:
```
# Import the libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [4]:
```
# Load the dataset
df = pd.read_csv(r"C:\Users\anamitra.b\OneDrive - Nihilent Limited\Desktop\Python Proj
df
```

Out[4]:

	Name	Club	Nationality	Position	Age	Matches	Starts	Mins	Goals	Assists	Passes_Att
0	Mason Mount	Chelsea	ENG	MF,FW	21	36	32	2890	6	5	
1	Edouard Mendy	Chelsea	SEN	GK	28	31	31	2745	0	0	
2	Timo Werner	Chelsea	GER	FW	24	35	29	2602	6	8	
3	Ben Chilwell	Chelsea	ENG	DF	23	27	27	2286	3	5	
4	Reece James	Chelsea	ENG	DF	20	32	25	2373	1	2	
...	...	...	...	...	...	...	...	...	...	...	
527	Lys Mousset	Sheffield United	FRA	FW,MF	24	11	2	296	0	0	
528	Jack O'Connell	Sheffield United	ENG	DF	26	2	2	180	0	0	
529	Iliman Ndiaye	Sheffield United	FRA	MF	21	1	0	12	0	0	
530	Antwoine Hackford	Sheffield United	ENG	DF,FW	16	1	0	11	0	0	
531	Femi Seriki	Sheffield United	ENG	DF	17	1	0	1	0	0	

532 rows × 18 columns

EDA and Data Cleaning

In [6]:
```
df.shape
```

Out[6]:
```
(532, 18)
```

In [13]:
```
df.info() # this also checks whether we have any null values  and the data types of ea
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 532 entries, 0 to 531
Data columns (total 18 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   Name                   532 non-null    object 
 1   Club                   532 non-null    object 
 2   Nationality            532 non-null    object 
 3   Position               532 non-null    object 
 4   Age                    532 non-null    int64  
 5   Matches                532 non-null    int64  
 6   Starts                 532 non-null    int64  
 7   Mins                   532 non-null    int64  
 8   Goals                  532 non-null    int64  
 9   Assists                532 non-null    int64  
 10  Passes_Attempted       532 non-null    int64  
 11  Perc_Passes_Completed  532 non-null    float64
 12  Penalty_Goals          532 non-null    int64  
 13  Penalty_Attempted      532 non-null    int64  
 14  xG                     532 non-null    float64
 15  xA                     532 non-null    float64
 16  Yellow_Cards           532 non-null    int64  
 17  Red_Cards              532 non-null    int64  
dtypes: float64(3), int64(11), object(4)
memory usage: 74.9+ KB
```

In [16]:
```
df.isnull().sum() # checking the missing values (there are no null values present in t
```

Out[16]:
```
Name                     0
Club                     0
Nationality              0
Position                 0
Age                      0
Matches                  0
Starts                   0
Mins                     0
Goals                    0
Assists                  0
Passes_Attempted         0
Perc_Passes_Completed    0
Penalty_Goals            0
Penalty_Attempted        0
xG                       0
xA                       0
Yellow_Cards             0
Red_Cards                0
dtype: int64
```

In [9]:
```
df.describe() # summary statistics of numerical columns
```

Out[9]:

	Age	Matches	Starts	Mins	Goals	Assists	Passes_Attempted	Pe
count	532.000000	532.000000	532.000000	532.000000	532.000000	532.000000	532.000000	
mean	25.500000	19.535714	15.714286	1411.443609	1.853383	1.287594	717.750000	
std	4.319404	11.840459	11.921161	1043.171856	3.338009	2.095191	631.372522	
min	16.000000	1.000000	0.000000	1.000000	0.000000	0.000000	0.000000	
25%	22.000000	9.000000	4.000000	426.000000	0.000000	0.000000	171.500000	
50%	26.000000	21.000000	15.000000	1345.000000	1.000000	0.000000	573.500000	
75%	29.000000	30.000000	27.000000	2303.500000	2.000000	2.000000	1129.500000	
max	38.000000	38.000000	38.000000	3420.000000	23.000000	14.000000	3214.000000	

In [11]:
```
df.describe(include='object') # summary statistics of categorical columns
```

Out[11]:

	Name	Club	Nationality	Position
count	532	532	532	532
unique	524	20	59	10
top	Joe Willock	West Bromwich Albion	ENG	DF
freq	2	30	192	178

In [14]:
```
for col in df.describe(include = 'object').columns:
    print (col)
    print(df[col].unique())
    print('-'*50) # checking out the unqiue values for each cateogrical column
```

Name
['Mason Mount' 'Edouard Mendy' 'Timo Werner' 'Ben Chilwell' 'Reece James'
 'César Azpilicueta' "N'Golo Kanté" 'Jorginho' 'Thiago Silva' 'Kurt Zouma'
 'Mateo Kovačić' 'Antonio Rüdiger' 'Christian Pulisic' 'Kai Havertz'
 'Andreas Christensen' 'Hakim Ziyech' 'Tammy Abraham' 'Marcos Alonso'
 'Callum Hudson-Odoi' 'Olivier Giroud' 'Kepa Arrizabalaga' 'Billy Gilmour'
 'Willy Caballero' 'Ruben Loftus-Cheek' 'Emerson Palmieri' 'Fikayo Tomori'
 'Ross Barkley' 'Ederson' 'Rúben Dias' 'Rodri' 'Raheem Sterling'
 'João Cancelo' 'Bernardo Silva' 'İlkay Gündoğan' 'Kevin De Bruyne'
 'Riyad Mahrez' 'Gabriel Jesus' 'Kyle Walker' 'John Stones' 'Phil Foden'
 'Oleksandr Zinchenko' 'Ferrán Torres' 'Aymeric Laporte' 'Fernandinho'
 'Benjamin Mendy' 'Nathan Aké' 'Sergio Agüero' 'Eric García'
 'Scott Carson' 'Zack Steffen' 'Liam Delap' 'Bruno Fernandes'
 'Aaron Wan-Bissaka' 'Harry Maguire' 'Marcus Rashford' 'Luke Shaw'
 'Victor Lindelöf' 'Fred' 'David de Gea' 'Scott McTominay' 'Paul Pogba'
 'Mason Greenwood' 'Anthony Martial' 'Edinson Cavani' 'Dean Henderson'
 'Nemanja Matić' 'Daniel James' 'Eric Bailly' 'Alex Telles' 'Juan Mata'
 'Donny van de Beek' 'Axel Tuanzebe' 'Brandon Williams' 'Amad Diallo'
 'Anthony Elanga' 'Timothy Fosu-Mensah' 'Shola Shoretire' 'Odion Ighalo'
 'Hannibal Mejbri' 'William Thomas Fish' 'Andrew Robertson'
 'Mohamed Salah' 'Trent Alexander-Arnold' 'Georginio Wijnaldum' 'Alisson'
 'Roberto Firmino' 'Sadio Mané' 'Fabinho' 'Thiago Alcántara'
 'Jordan Henderson' 'Nathaniel Phillips' 'Curtis Jones' 'Diogo Jota'
 'James Milner' 'Ozan Kabak' 'Joël Matip' 'Rhys Williams' 'Naby Keïta'
 'Joe Gomez' 'Xherdan Shaqiri' 'Virgil van Dijk' 'Adrián' 'Neco Williams'
 'Takumi Minamino' 'Alex Oxlade-Chamberlain' 'Divock Origi'
 'Caoimhín Kelleher' 'Kostas Tsimikas' 'Kasper Schmeichel'
 'Youri Tielemans' 'Jamie Vardy' 'Jonny Evans' 'Timothy Castagne'
 'Wesley Fofana' 'Wilfred Ndidi' 'James Maddison' 'James Justin'
 'Harvey Barnes' 'Çağlar Söyüncü' 'Marc Albrighton' 'Kelechi Iheanacho'
 'Nampalys Mendy' 'Ayoze Pérez' 'Luke Thomas' 'Ricardo Pereira'
 'Dennis Praet' 'Daniel Amartey' 'Christian Fuchs' 'Hamza Choudhury'
 'Cengiz Ünder' 'Sidnei Tavares' 'Islam Slimani' 'Demarai Gray'
 'Wes Morgan' 'Khanya Leshabela' 'Tomáš Souček' 'Aaron Cresswell'
 'Łukasz Fabiański' 'Vladimír Coufal' 'Declan Rice' 'Pablo Fornals'
 'Jarrod Bowen' 'Angelo Ogbonna' 'Michail Antonio' 'Craig Dawson'
 'Jesse Lingard' 'Issa Diop' 'Saïd Benrahma' 'Fabián Balbuena'
 'Arthur Masuaku' 'Sébastien Haller' 'Mark Noble' 'Ryan Fredericks'
 'Manuel Lanzini' 'Ben Johnson' 'Darren Randolph' 'Andriy Yarmolenko'
 'Robert Snodgrass' 'Felipe Anderson' 'Pierre Højbjerg' 'Hugo Lloris'
 'Son Heung-min' 'Harry Kane' 'Eric Dier' 'Tanguy Ndombele'
 'Sergio Reguilón' 'Toby Alderweireld' 'Serge Aurier' 'Davinson Sánchez'
 'Moussa Sissoko' 'Lucas Moura' 'Ben Davies' 'Matt Doherty'
 'Steven Bergwijn' 'Giovani Lo Celso' 'Gareth Bale' 'Harry Winks'
 'Joe Rodon' 'Dele Alli' 'Japhet Tanganga' 'Érik Lamela' 'Carlos Vinícius'
 'Dane Scarlett' 'Bernd Leno' 'Bukayo Saka' 'Granit Xhaka' 'Rob Holding'
 'Pierre-Emerick Aubameyang' 'Kieran Tierney' 'Héctor Bellerín'
 'Gabriel Dos Santos' 'Alexandre Lacazette' 'Thomas Partey'
 'Emile Smith-Rowe' 'Dani Ceballos' 'Mohamed Elneny' 'David Luiz'
 'Nicolas Pépé' 'Willian' 'Pablo Marí' 'Martin Ødegaard' 'Calum Chambers'
 'Cédric Soares' 'Martinelli' 'Ainsley Maitland-Niles' 'Eddie Nketiah'
 'Mathew Ryan' 'Joe Willock' 'Sead Kolašinac' 'Reiss Nelson'
 'Shkodran Mustafi' 'Rúnar Alex Rúnarsson' 'Stuart Dallas' 'Luke Ayling'
 'Patrick Bamford' 'Illan Meslier' 'Jack Harrison' 'Ezgjan Alioski'
 'Kalvin Phillips' 'Mateusz Klich' 'Raphael Dias Belloli' 'Liam Cooper'
 'Pascal Struijk' 'Tyler Roberts' 'Rodrigo' 'Diego Llorente'
 'Hélder Costa' 'Robin Koch' 'Jamie Shackleton' 'Pablo Hernández'
 'Kiko Casilla' 'Gaetano Berardi' 'Ian Carlo Poveda' 'Niall Huggins'
 'Leif Davis' 'Michael Keane' 'Richarlison' 'Dominic Calvert-Lewin'
 'Jordan Pickford' 'Lucas Digne' 'Ben Godfrey' 'Abdoulaye Doucouré'

'Mason Holgate' 'Gylfi Sigurðsson' 'Allan' 'Yerry Mina' 'James Rodríguez'
'Séamus Coleman' 'André Gomes' 'Alex Iwobi' 'Tom Davies' 'Robin Olsen'
'Bernard' 'Fabian Delph' 'Anthony Gordon' 'Niels Nkounkou' 'Jonjoe Kenny'
'Joshua King' 'Cenk Tosun' 'João Virgínia' 'Moise Kean' 'Theo Walcott'
'Jean-Philippe Gbamin' 'Nathan Broadhead' 'Emiliano Martínez'
'Matt Targett' 'John McGinn' 'Ollie Watkins' 'Tyrone Mings' 'Ezri Konsa'
'Douglas Luiz' 'Bertrand Traoré' 'Matty Cash' 'Jack Grealish'
'Anwar El Ghazi' 'Trézéguet' 'Marvelous Nakamba' 'Ahmed Elmohamady'
'Kortney Hause' 'Jacob Ramsey' 'Morgan Sanson' 'Conor Hourihane'
'Keinan Davis' 'Carney Chukwuemeka' 'Wesley Moraes' 'Neil Taylor'
'Jaden Philogene Bidace' 'Jonjo Shelvey' 'Miguel Almirón' 'Karl Darlow'
'Federico Fernández' 'Callum Wilson' 'Joelinton' 'Isaac Hayden'
'Ciaran Clark' 'Jamal Lewis' 'Jamaal Lascelles' 'Allan Saint-Maximin'
'Jacob Murphy' 'Jeff Hendrick' 'Sean Longstaff' 'Matt Ritchie'
'Emil Krafth' 'Paul Dummett' 'Fabian Schär' 'Martin Dúbravka'
'Javier Manquillo' 'Ryan Fraser' 'DeAndre Yedlin' 'Dwight Gayle'
'Andy Carroll' 'Matthew Longstaff' 'Elliot Anderson' 'Rui Patrício'
'Conor Coady' 'Nélson Semedo' 'Rúben Neves' 'Pedro Neto' 'Adama Traoré'
'João Moutinho' 'Leander Dendoncker' 'Romain Saïss' 'Daniel Podence'
'Willy Boly' 'Rayan Aït Nouri' 'Max Kilman' 'Willian José' 'Fábio Silva'
'Raúl Jiménez' 'Fernando Marçal' 'Jonny Castro' 'Ki-Jana Hoever'
'Vitinha' 'Morgan Gibbs-White' 'Owen Otasowie' 'Rúben Vinagre'
'John Ruddy' 'Patrick Cutrone' 'Oskar Buur' 'Theo Corbeanu'
'Vicente Guaita' 'Cheikhou Kouyaté' 'Wilfried Zaha' 'Eberechi Eze'
'Luka Milivojević' 'Andros Townsend' 'Joel Ward' 'Jordan Ayew'
'Christian Benteke' 'Gary Cahill' 'Patrick van Aanholt' 'Jaïro Riedewald'
'Tyrick Mitchell' 'James McArthur' 'Jeffrey Schlupp' 'Scott Dann'
'Nathaniel Clyne' 'James McCarthy' 'Michy Batshuayi' 'James Tomkins'
'Mamadou Sakho' 'Jean-Philippe Mateta' 'Jack Butland' 'Martin Kelly'
'James Ward-Prowse' 'Jan Bednarek' 'Stuart Armstrong' 'Alex McCarthy'
'Che Adams' 'Kyle Walker-Peters' 'Ryan Bertrand' 'Jannik Vestergaard'
'Danny Ings' 'Oriol Romeu' 'Nathan Redmond' 'Jack Stephens'
'Moussa Djenepo' 'Ibrahima Diallo' 'Mohammed Salisu' 'Fraser Forster'
'Nathan Tella' 'William Smallbone' 'Shane Long' 'Yan Valery'
'Kayne Ramsey' 'Jake Vokins' 'Alexandre Jankewitz' 'Dan Nlundulu'
'Michael Obafemi' 'Caleb Watts' 'Allan Tchaptchet' 'Ben White'
'Yves Bissouma' 'Lewis Dunk' 'Leandro Trossard' 'Adam Webster'
'Neal Maupay' 'Pascal Groß' 'Robert Sánchez' 'Joël Veltman' 'Dan Burn'
'Solly March' 'Danny Welbeck' 'Adam Lallana' 'Alexis Mac Allister'
'Tariq Lamptey' 'Steven Alzate' 'Aaron Connolly' 'Jakub Moder'
'Alireza Jahanbakhsh' 'Davy Pröpper' 'Bernardo' 'Percy Tau' 'Andi Zeqiri'
'José Izquierdo' 'Reda Khadra' 'Jayson Molumby' 'Ashley Westwood'
'James Tarkowski' 'Dwight McNeil' 'Matthew Lowton' 'Nick Pope'
'Josh Brownhill' 'Chris Wood' 'Ben Mee' 'Charlie Taylor'
'Jóhann Berg Guðmundsson' 'Matěj Vydra' 'Jack Cork' 'Ashley Barnes'
'Erik Pieters' 'Jay Rodriguez' 'Robbie Brady' 'Kevin Long'
'Bailey Peacock-Farrell' 'Phil Bardsley' 'Jimmy Dunne' 'Dale Stephens'
'Josh Benson' 'Will Norris' 'Joel Mumbongo' 'Lewis Richardson'
'Alphonse Areola' 'Tosin Adarabioyo' 'Ademola Lookman' 'Ola Aina'
'Joachim Andersen' 'Andre-Frank Zambo Anguissa' 'Bobby Reid'
'Ivan Cavaleiro' 'Harrison Reed' 'Antonee Robinson' 'Mario Lemina'
'Kenny Tete' 'Aleksandar Mitrović' 'Josh Maja' 'Tom Cairney' 'Joe Bryan'
'Tim Ream' 'Josh Onomah' 'Denis Odoi' 'Michael Hector' 'Fabio Carvalho'
'Aboubakar Kamara' 'Marek Rodák' 'Maxime Le Marchand' 'Neeskens Kebano'
'Terence Kongolo' 'Tyrese Francois' 'Sam Johnstone' 'Darnell Furlong'
'Semi Ajayi' 'Matheus Pereira' 'Kyle Bartley' 'Conor Gallagher'
'Conor Townsend' "Dara O'Shea" 'Matt Phillips' 'Callum Robinson'
'Romaine Sawyers' 'Okay Yokuşlu' 'Jake Livermore' 'Grady Diangana'
'Mbaye Diagne' 'Karlan Grant' 'Kieran Gibbs' 'Branislav Ivanović'
'Filip Krovinović' 'Lee Peltier' 'Hal Robson-Kanu' 'Kamil Grosicki'

```
 'Kyle Edwards' 'David Button' 'Ahmed Hegazi' 'Charlie Austin' 'Sam Field'
 'Rekeem Harper' 'Aaron Ramsdale' 'George Baldock' 'Chris Basham'
 'Enda Stevens' 'John Egan' 'John Fleck' 'David McGoldrick'
 'Oliver Norwood' 'Ethan Ampadu' 'John Lundstram' 'Ben Osborn'
 'Oliver Burke' 'Sander Berge' 'Oliver McBurnie' 'Rhian Brewster'
 'Jayden Bogle' 'Kean Bryan' 'Jack Robinson' 'Billy Sharp' 'Max Lowe'
 'Phil Jagielka' 'Daniel Jebbison' 'Lys Mousset' "Jack O'Connell"
 'Iliman Ndiaye' 'Antwoine Hackford' 'Femi Seriki']
--------------------------------------------------
Club
['Chelsea' 'Manchester City' 'Manchester United' 'Liverpool FC'
 'Leicester City' 'West Ham United' 'Tottenham Hotspur' 'Arsenal'
 'Leeds United' 'Everton' 'Aston Villa' 'Newcastle United'
 'Wolverhampton Wanderers' 'Crystal Palace' 'Southampton' 'Brighton'
 'Burnley' 'Fulham' 'West Bromwich Albion' 'Sheffield United']
--------------------------------------------------
Nationality
['ENG' 'SEN' 'GER' 'ESP' 'FRA' 'ITA' 'BRA' 'CRO' 'USA' 'DEN' 'MAR' 'SCO'
 'ARG' 'POR' 'BEL' 'ALG' 'UKR' 'NED' 'SWE' 'URU' 'SRB' 'WAL' 'CIV' 'NGA'
 'EGY' 'TUR' 'CMR' 'GUI' 'SUI' 'JPN' 'IRL' 'GRE' 'NIR' 'GHA' 'AUT' 'JAM'
 'RSA' 'CZE' 'POL' 'PAR' 'COD' 'KOR' 'COL' 'GAB' 'NOR' 'AUS' 'BIH' 'ISL'
 'MKD' 'BFA' 'ZIM' 'SVK' 'MEX' 'CAN' 'MLI' 'IRN' 'NZL' 'MTN' 'SKN']
--------------------------------------------------
Position
['MF,FW' 'GK' 'FW' 'DF' 'MF' 'FW,MF' 'FW,DF' 'DF,MF' 'MF,DF' 'DF,FW']
--------------------------------------------------
```

In [19]:
```
# create 2 new columns
df['Mins_per_match'] = (df['Mins']/df['Matches']).astype(int)
df['Goals_per_match'] = (df['Goals']/df['Matches']).astype(float)
```

In [21]:
```
df # We can see that the two new columns have been added
```

Out[21]:

	Name	Club	Nationality	Position	Age	Matches	Starts	Mins	Goals	Assists	Passes_Att
0	Mason Mount	Chelsea	ENG	MF,FW	21	36	32	2890	6	5	
1	Edouard Mendy	Chelsea	SEN	GK	28	31	31	2745	0	0	
2	Timo Werner	Chelsea	GER	FW	24	35	29	2602	6	8	
3	Ben Chilwell	Chelsea	ENG	DF	23	27	27	2286	3	5	
4	Reece James	Chelsea	ENG	DF	20	32	25	2373	1	2	
...	...	...	...	...	...	...	...	...	...	...	
527	Lys Mousset	Sheffield United	FRA	FW,MF	24	11	2	296	0	0	
528	Jack O'Connell	Sheffield United	ENG	DF	26	2	2	180	0	0	
529	Iliman Ndiaye	Sheffield United	FRA	MF	21	1	0	12	0	0	
530	Antwoine Hackford	Sheffield United	ENG	DF,FW	16	1	0	11	0	0	
531	Femi Seriki	Sheffield United	ENG	DF	17	1	0	1	0	0	

532 rows × 20 columns

In [23]:
```
# Total Goals scored in the whole season
total_goals = df['Goals'].sum()
total_goals # a total of 986 goals scored
```

Out[23]:
```
986
```

In [25]:
```
# Number of goals scored from a Penalty
penalty_goals = df['Penalty_Goals'].sum()
penalty_goals
```

Out[25]:
```
102
```

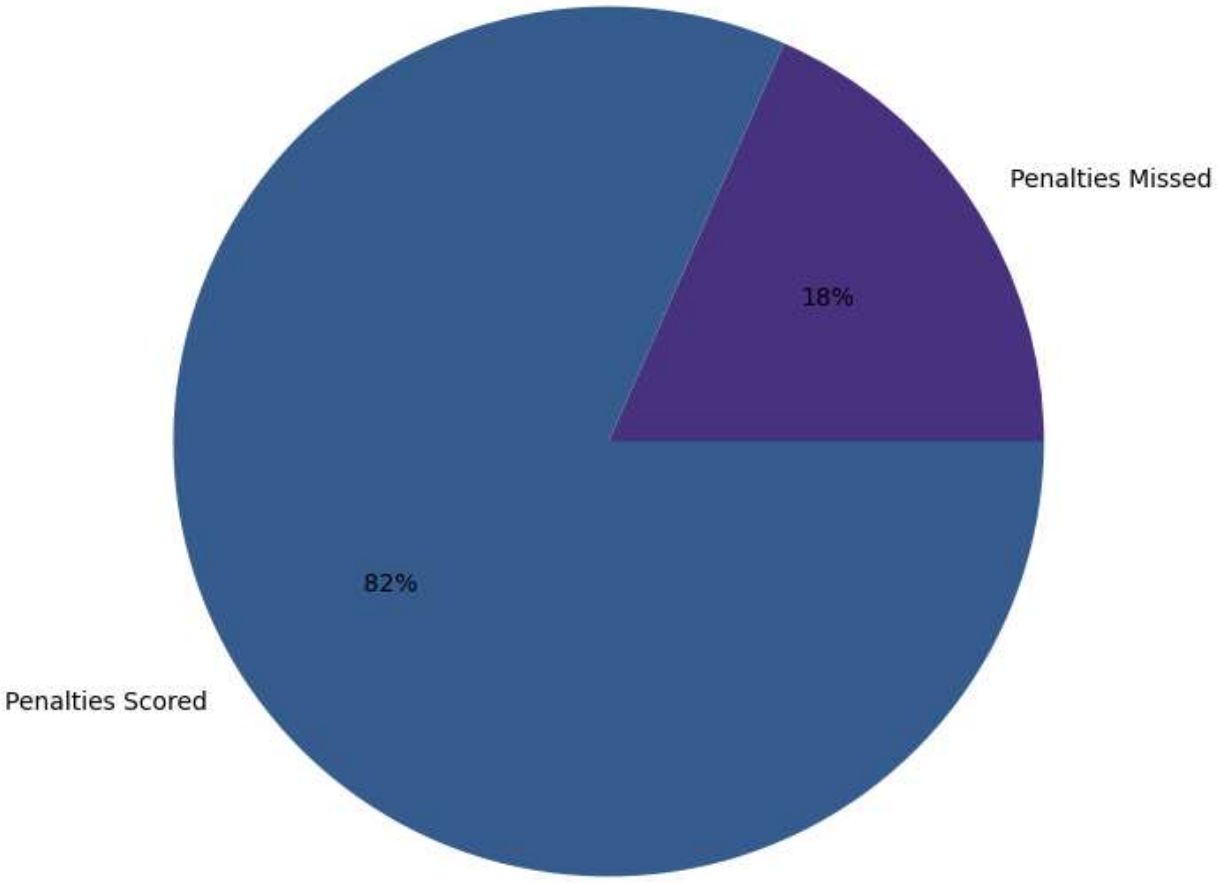
In [26]:
```
# Number of Penalties attempted
penalty_att = df['Penalty_Attempted'].sum()
penalty_att
```

Out[26]:
```
125
```

Visualizations

In [48]:
```
# Pie Chart for penalties scored vs penalties missed

plt.figure(figsize=(16,8))
penalty_not_scored = df['Penalty_Attempted'].sum() - penalty_goals
data = [penalty_not_scored,penalty_goals]
labels = ['Penalties Missed','Penalties Scored']
color = sns.color_palette('viridis')
plt.pie(data,labels = labels,colors = color,autopct = '%.0f%%')
plt.show()
```



From the above pie chart, it can be concluded that over the whole season 82% of the number of penalties have been scored.

In [32]:
```
# Number of unique postions
df['Position'].unique()
```

Out[32]:
```
array(['MF,FW', 'GK', 'FW', 'DF', 'MF', 'FW,MF', 'FW,DF', 'DF,MF',
       'MF,DF', 'DF,FW'], dtype=object)
```

In [35]:
```
# Total number of FW players
df[df['Position']=='FW'] # 81 Players played in the EPL 2020-21 season as Forwards
```

Out[35]:

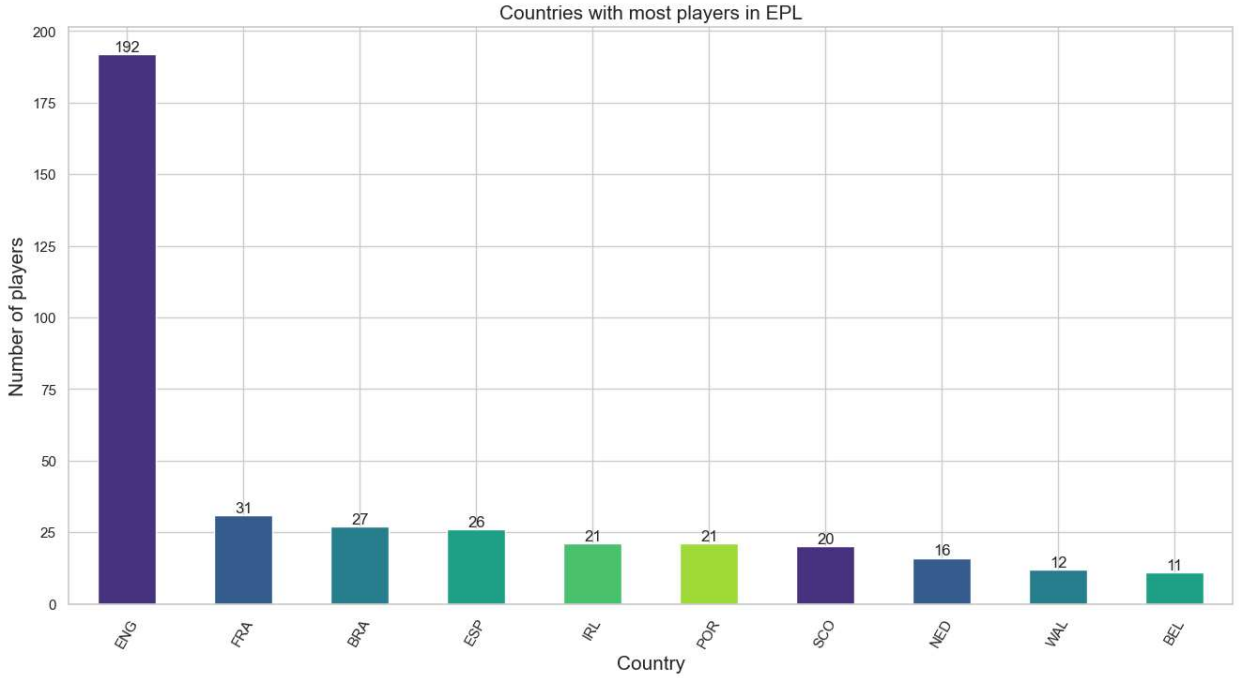
	Name	Club	Nationality	Position	Age	Matches	Starts	Mins	Goals	Assists	Passes_
2	Timo Werner	Chelsea	GER	FW	24	35	29	2602	6	8	
16	Tammy Abraham	Chelsea	ENG	FW	22	22	12	1040	6	1	
19	Olivier Giroud	Chelsea	FRA	FW	33	17	8	748	4	0	
23	Ruben Loftus-Cheek	Chelsea	ENG	FW	24	1	1	60	0	0	
30	Raheem Sterling	Manchester City	ENG	FW	25	31	28	2536	10	7	
...	...	...	...	...	...	...	...	...	...	...	
516	Oliver Burke	Sheffield United	SCO	FW	23	25	14	1269	1	1	
518	Oliver McBurnie	Sheffield United	SCO	FW	24	23	12	1324	1	0	
519	Rhian Brewster	Sheffield United	ENG	FW	20	27	12	1128	0	0	
523	Billy Sharp	Sheffield United	ENG	FW	34	16	7	735	3	0	
526	Daniel Jebbison	Sheffield United	ENG	FW	17	4	3	284	1	0	

81 rows × 20 columns

In [38]:
```
# Players from Different nations
np.size((df['Nationality']).unique()) # There a re a total of 59 nations being represe
```

Out[38]:
```
59
```

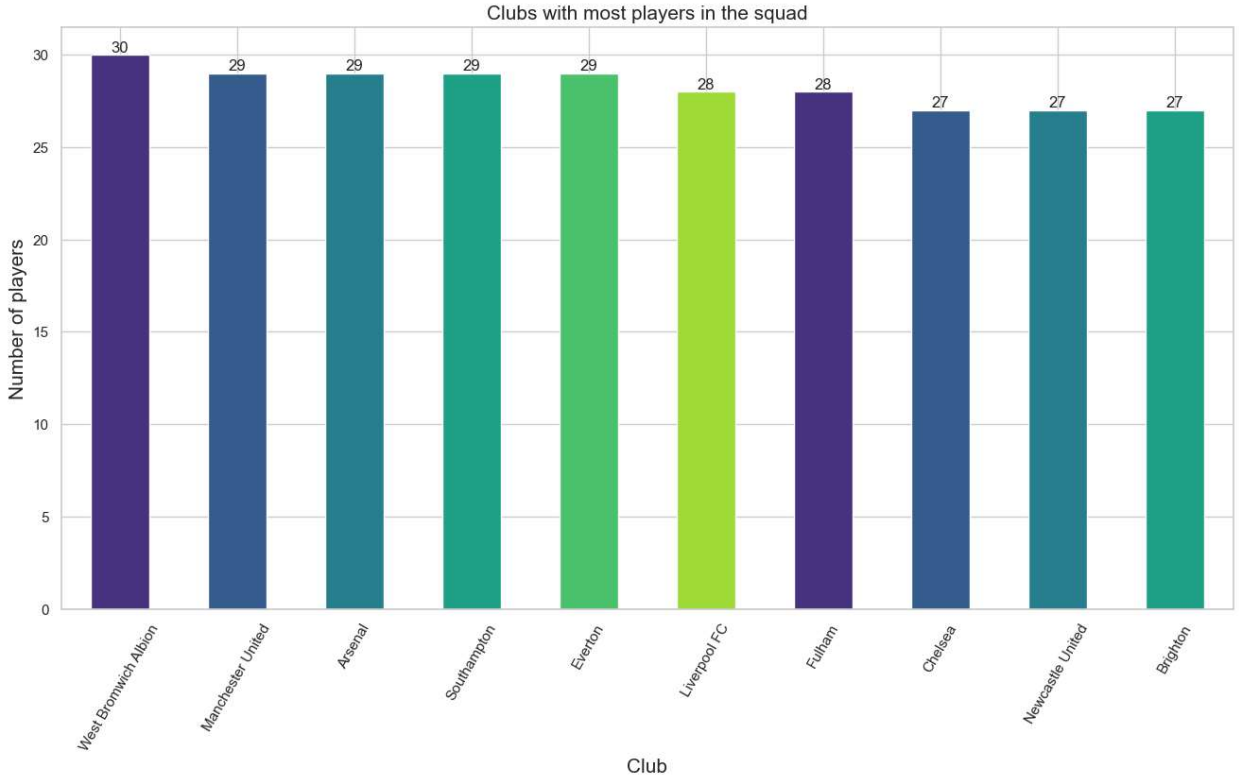
In [106…
```
# Most players from which countries
nationality = df.groupby('Nationality').size().sort_values(ascending = False)
ax = nationality.head(10).plot(kind ='bar',figsize = (16,8),color = sns.color_palette
plt.title('Countries with most players in EPL',fontsize = 15)
plt.xlabel('Country', fontsize = 15)
plt.ylabel('Number of players',fontsize = 15)
plt.xticks(rotation=60)
for bars in ax.containers:
    ax.bar_label(bars)
```



From the above bar chart it is clear most of the players are from England followed by France and Brazil.

In [105…

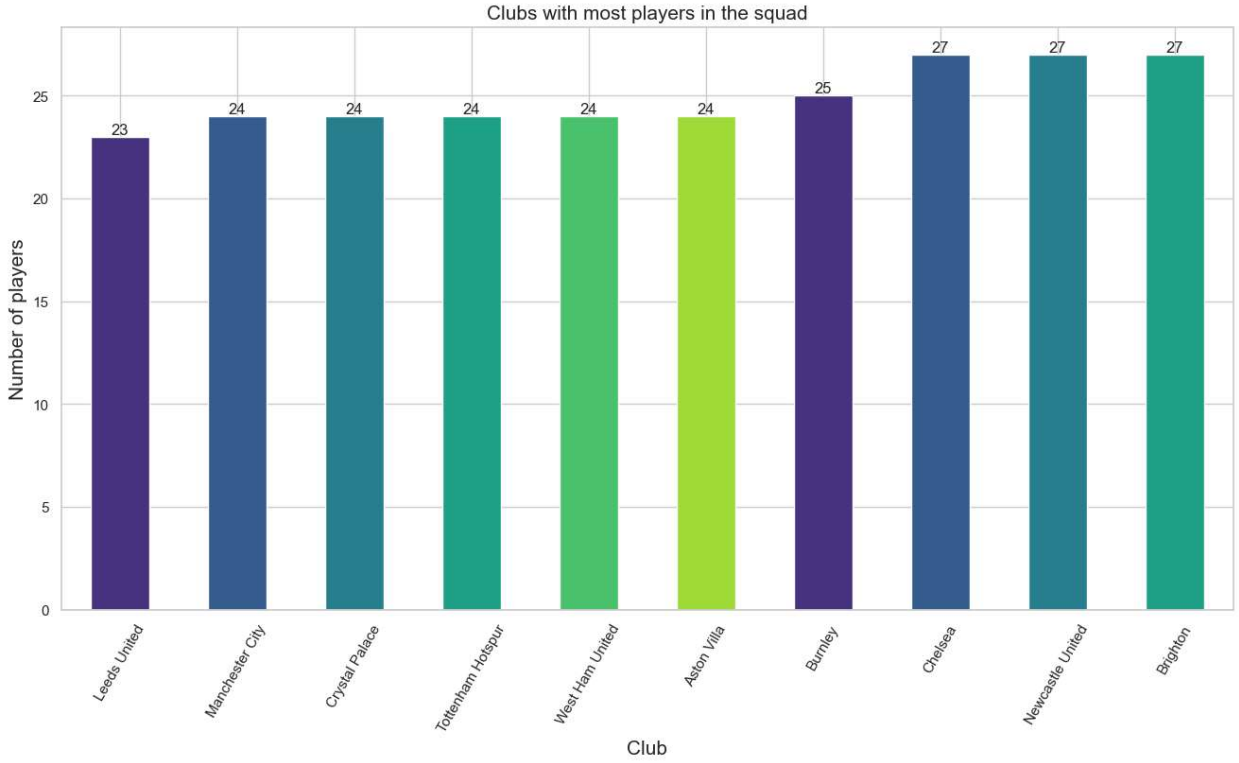
```
# Clubs with the maximum number of players in the sqaud
ax = df['Club'].value_counts().nlargest(10).plot(kind = 'bar', color = sns.color_palet
plt.title('Clubs with most players in the squad',fontsize = 15)
plt.xlabel('Club', fontsize = 15)
plt.ylabel('Number of players',fontsize = 15)
plt.xticks(rotation=60)
for bars in ax.containers:
    ax.bar_label(bars)
plt.show()
```



WBA had 30 players, followed by ManU, Arsenal, Southampton and Everton with 29 players each.

In [103…

```
# Clubs with the least players in the squad
ax = df['Club'].value_counts().nsmallest(10).plot(kind = 'bar', color = sns.color_pale
plt.title('Clubs with most players in the squad',fontsize = 15)
plt.xlabel('Club', fontsize = 15)
plt.ylabel('Number of players',fontsize = 15)
plt.xticks(rotation=60)
for bars in ax.containers:
    ax.bar_label(bars)
plt.show()
```

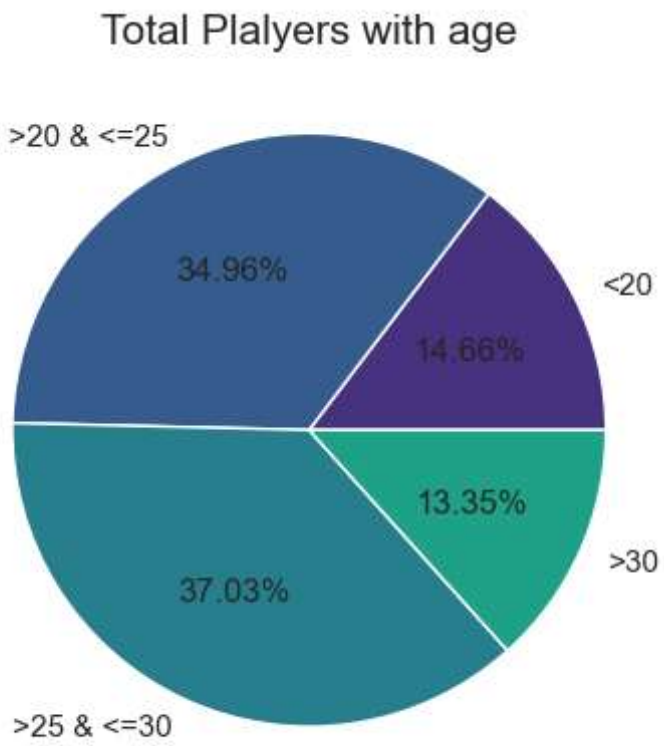


Leeds United had the least players with 23 followed by Manchester City, Crystal Palace.

In [54]:
```
# Players based on age group

under_20 = df[df['Age']<=20]
age20_25 = df[(df['Age']>20) &(df['Age']<=25)]
age25_30 = df[(df['Age']>25) &(df['Age']<=30)]
above_30 = df[df['Age']>30]
```

In [143…
```
# Pie Chart for players based on different age groups
x = np.array([under_20['Name'].count(),age20_25['Name'].count(),age25_30['Name'].count
my_labels = ['<20','>20 & <=25','>25 & <=30','>30']
plt.title('Total Plalyers with age', fontsize =15)
color = sns.color_palette('viridis')
plt.pie(x, labels = my_labels, colors=color, autopct = '%.2f%%')
plt.show()
```

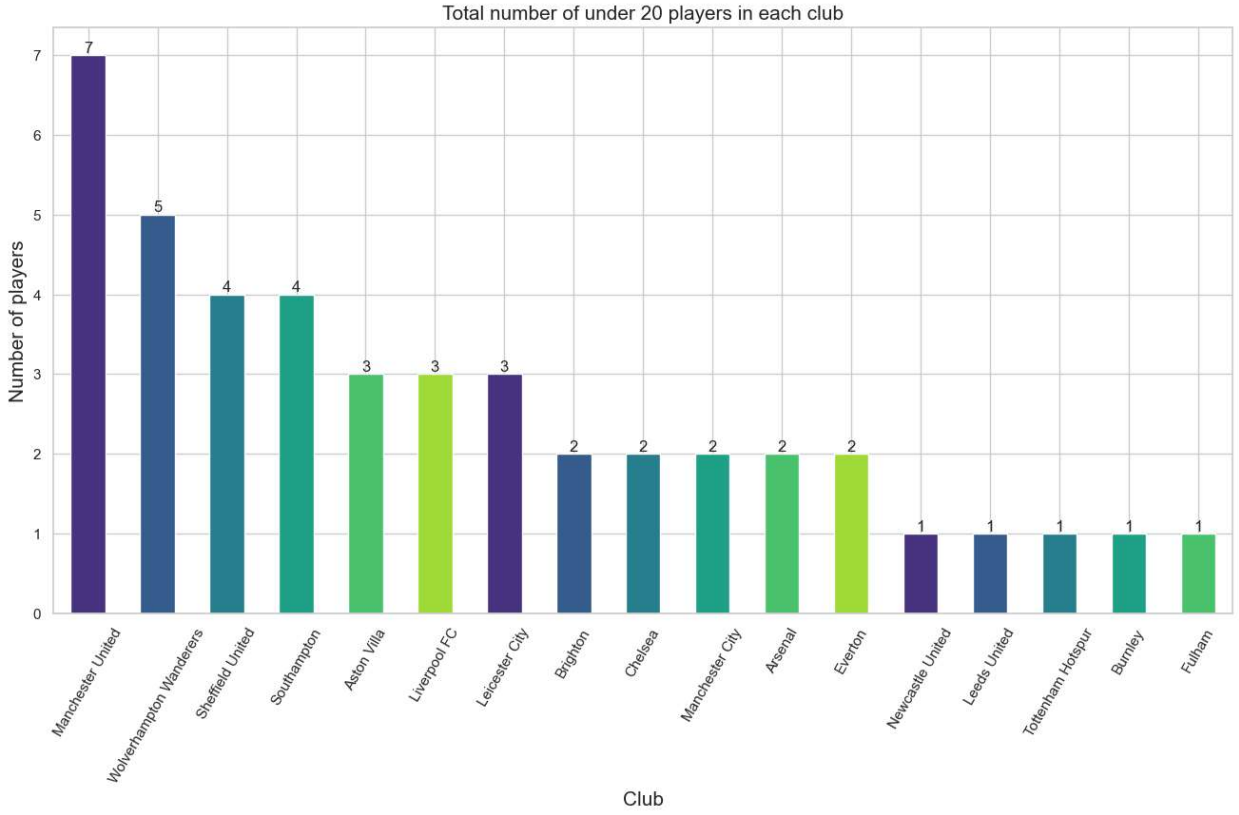


From the above graph we can conclude that the highest percentage (37%) of players in EPL 2020-21 season was in the age group 25-30. And almsot 35% of the players are aged between 20-25, which suggests a significant rise in investment on youth players with potential.

In [102…

```
# Total number of under 20 players in each club
players_under_20 = df[df['Age']<20]
ax = players_under_20['Club'].value_counts().plot(kind = 'bar', color = sns.color_pale
for bars in ax.containers:
    ax.bar_label(bars)

plt.title('Total number of under 20 players in each club',fontsize = 15)
plt.xlabel('Club',fontsize = 15)
plt.ylabel('Number of players',fontsize = 15)
plt.xticks(rotation = 60)
plt.show()
```



From the above graph we can conclude that apart from Manchested United, no other top 6 club had significantly invested in youth for the season.

In [64]:
```
# All the players aged under 20 in ManU
players_under_20[players_under_20['Club']=='Manchester United']
```

Out[64]:

	Name	Club	Nationality	Position	Age	Matches	Starts	Mins	Goals	Assists	Passes
61	Mason Greenwood	Manchester United	ENG	FW	18	31	21	1822	7	2	
72	Brandon Williams	Manchester United	ENG	DF	19	4	2	188	0	0	
73	Amad Diallo	Manchester United	CIV	FW	18	3	2	166	0	1	
74	Anthony Elanga	Manchester United	SWE	FW	18	2	2	155	1	0	
76	Shola Shoretire	Manchester United	ENG	FW	16	2	0	11	0	0	
78	Hannibal Mejbri	Manchester United	FRA	MF	17	1	0	9	0	0	
79	William Thomas Fish	Manchester United	ENG	DF	17	1	0	1	0	0	

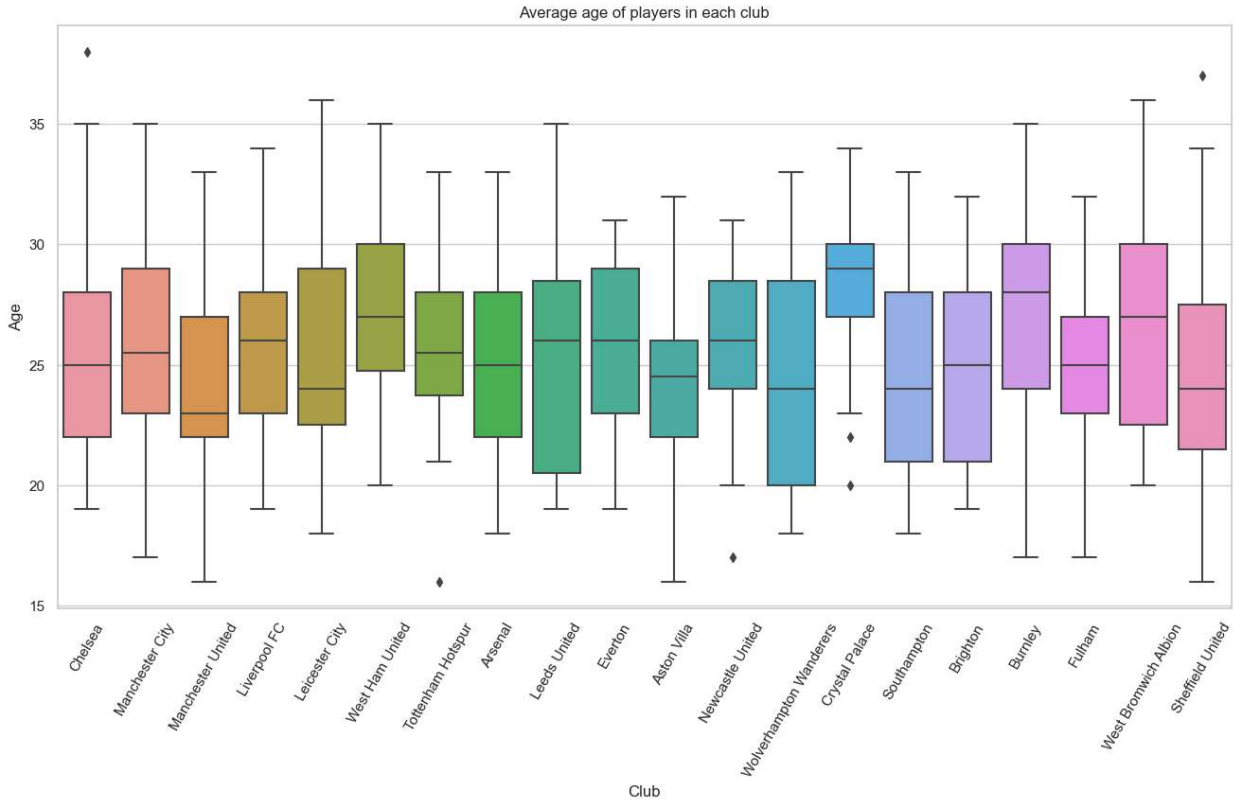
In [65]:
```
# All the players aged under 20 in Chelsea
players_under_20[players_under_20['Club']=='Chelsea']
```

Out[65]:

	Name	Club	Nationality	Position	Age	Matches	Starts	Mins	Goals	Assists	Passes_Attem
18	Callum Hudson-Odoi	Chelsea	ENG	FW,DF	19	23	10	1059	2	3	
21	Billy Gilmour	Chelsea	SCO	MF	19	5	3	261	0	0	

In [101…
```
# Average age of players in each club
plt.figure(figsize =(16,8))
ax = sns.boxplot(data = df, x = 'Club', y = 'Age')
plt.xticks(rotation=60)
plt.title('Average age of players in each club')
```

Out[101]:
```
Text(0.5, 1.0, 'Average age of players in each club')
```

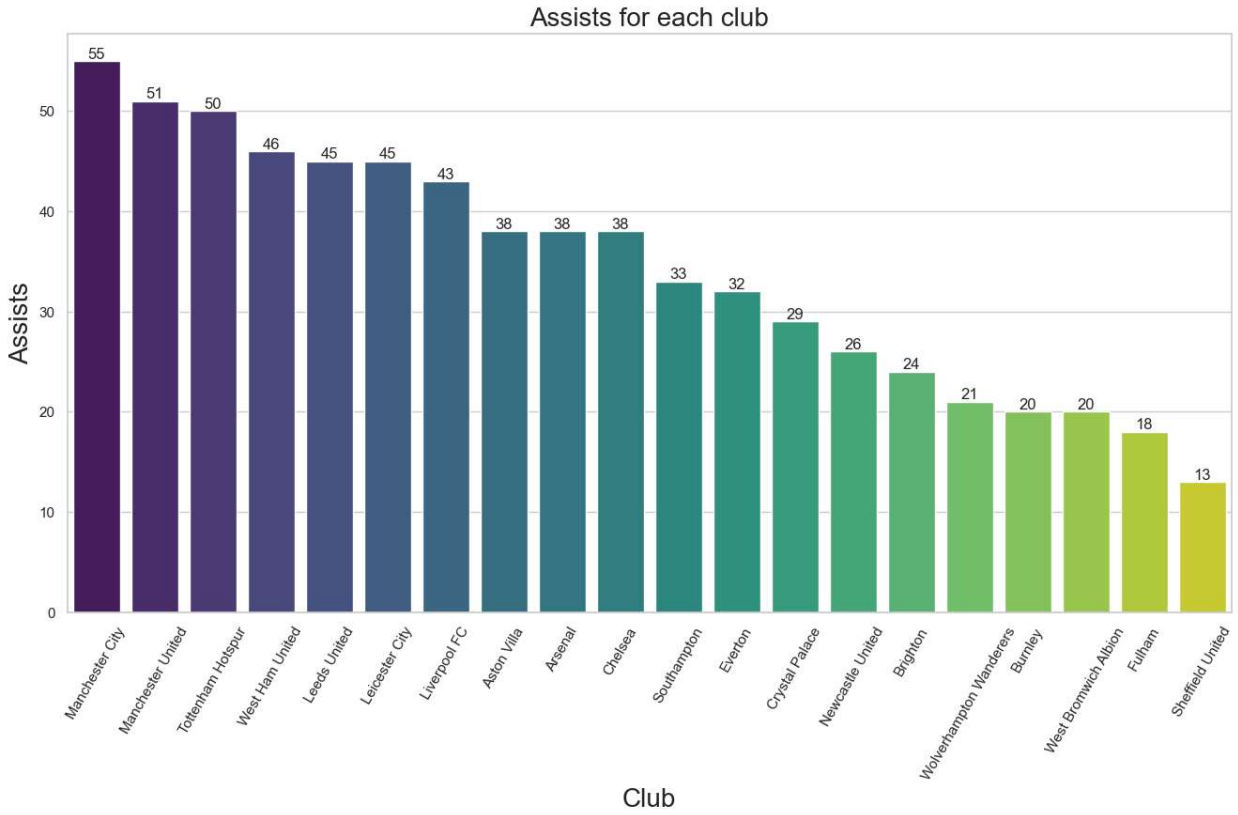


In [74]:
```
num_player = df.groupby('Club').size()
data = (df.groupby('Club')['Age'].sum())/num_player
data.sort_values(ascending = False)
```

Out[74]:
```
Club
Crystal Palace              28.333333
West Ham United             27.500000
Burnley                     27.040000
West Bromwich Albion        26.766667
Newcastle United            26.074074
Manchester City             25.708333
Tottenham Hotspur           25.625000
Chelsea                     25.592593
Leicester City              25.592593
Liverpool FC                25.571429
Everton                     25.413793
Leeds United                25.347826
Fulham                      25.035714
Arsenal                     24.965517
Sheffield United            24.814815
Brighton                    24.555556
Wolverhampton Wanderers     24.444444
Aston Villa                 24.291667
Southampton                 24.137931
Manchester United           23.862069
dtype: float64
```

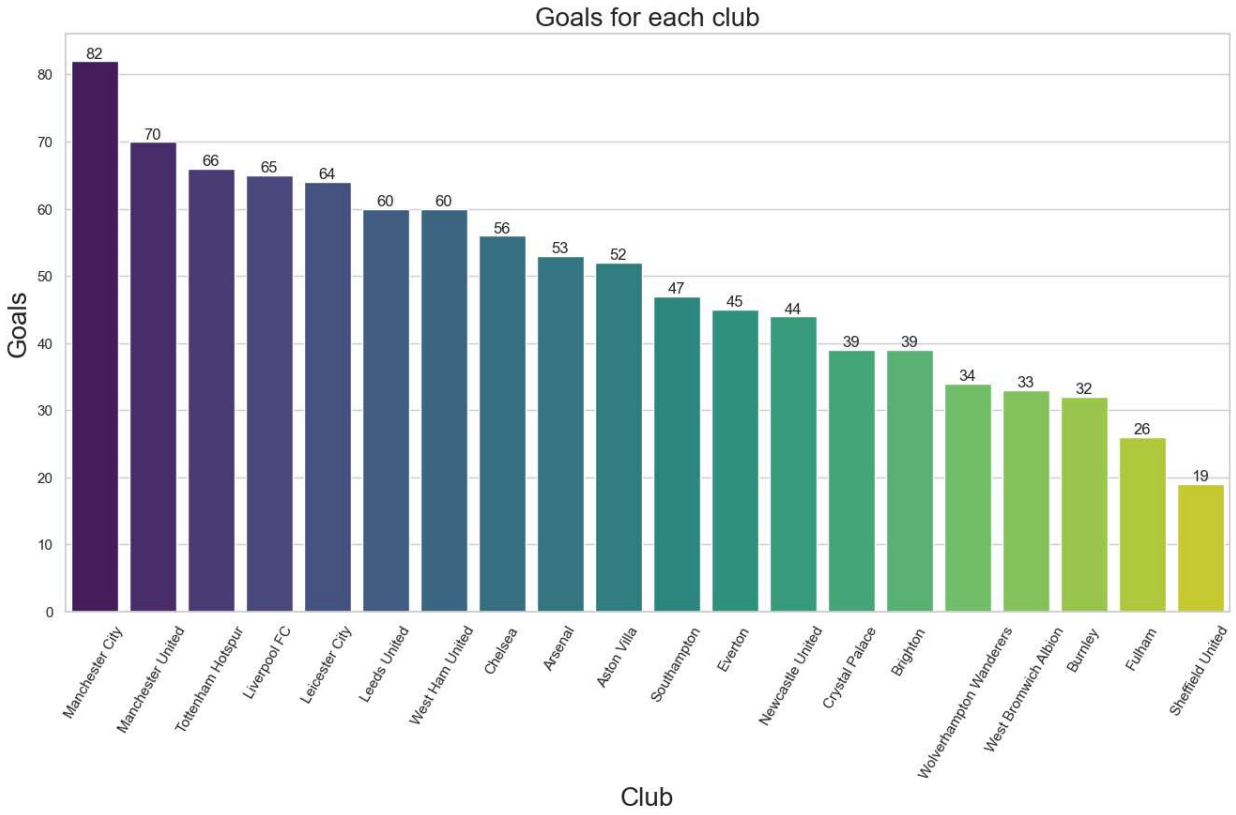
From the above plot, it is clear that Crystal Palace has the highest average age as a squad and Manchested United has the lowest average age. This supports our inference that Manchested United have a significantly higher investment in youth compared to other clubs.

In [97]:
```
# Total assists from each club
Assists_by_club = df.groupby(['Club'], as_index = False)['Assists'].sum().sort_values(
sns.set_theme(style = 'whitegrid', color_codes = True)
plt.figure(figsize=(16,8))
ax = sns.barplot(x='Club',y='Assists',data =Assists_by_club,palette = 'viridis')
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Club', fontsize = 20)
plt.xticks(rotation=60)
plt.ylabel('Assists', fontsize = 20)
plt.title('Assists for each club', fontsize = 20)
plt.show()
```



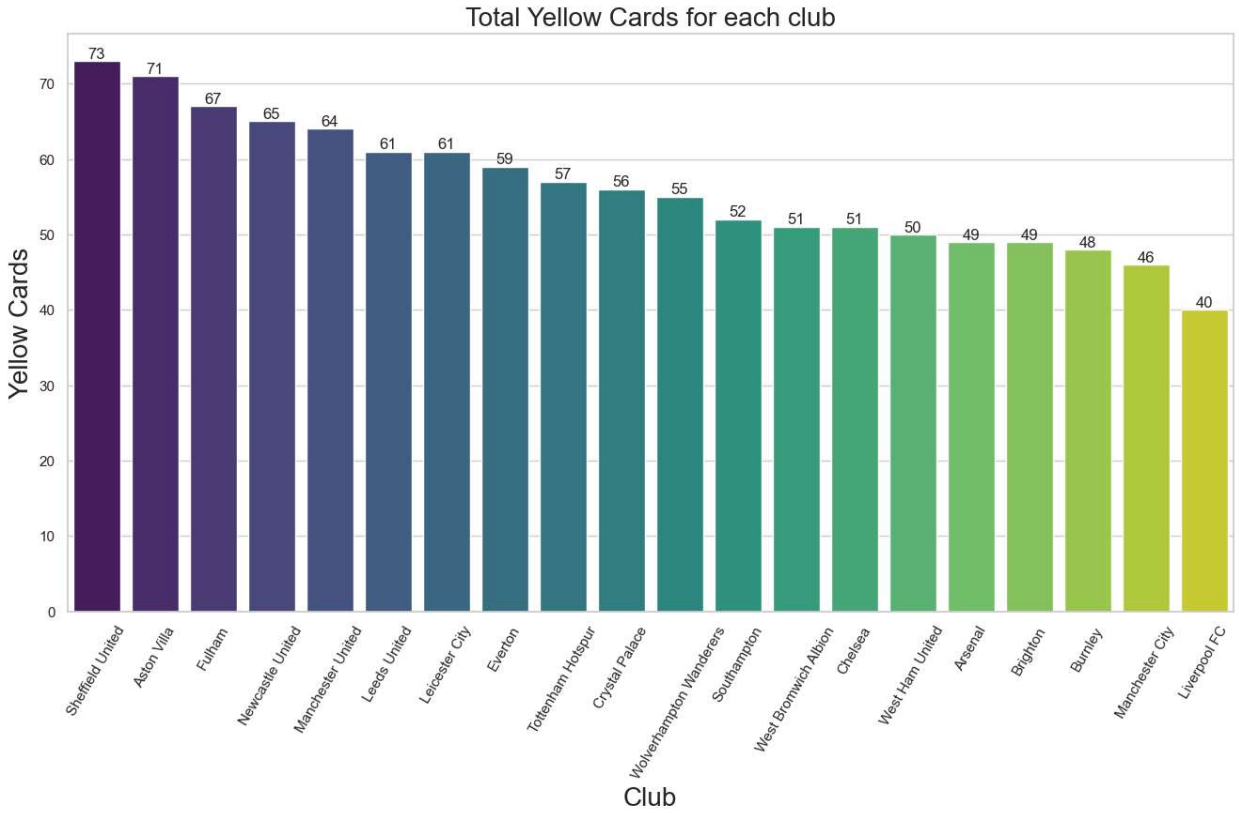
In [119…

```
# Total goals from each club
Goals_by_club = df.groupby(['Club'], as_index = False)['Goals'].sum().sort_values(by =
sns.set_theme(style = 'whitegrid', color_codes = True)
plt.figure(figsize=(16,8))
ax = sns.barplot(x='Club',y='Goals',data =Goals_by_club,palette = 'viridis')
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Club', fontsize = 20)
plt.xticks(rotation=60)
plt.ylabel('Goals', fontsize = 20)
plt.title('Goals for each club', fontsize = 20)
plt.show()
```



From the above two graphs, we can conclude that Manchester City has been the most prolific in front of goal with 82 goals and a total of 55 assists coming from the club.

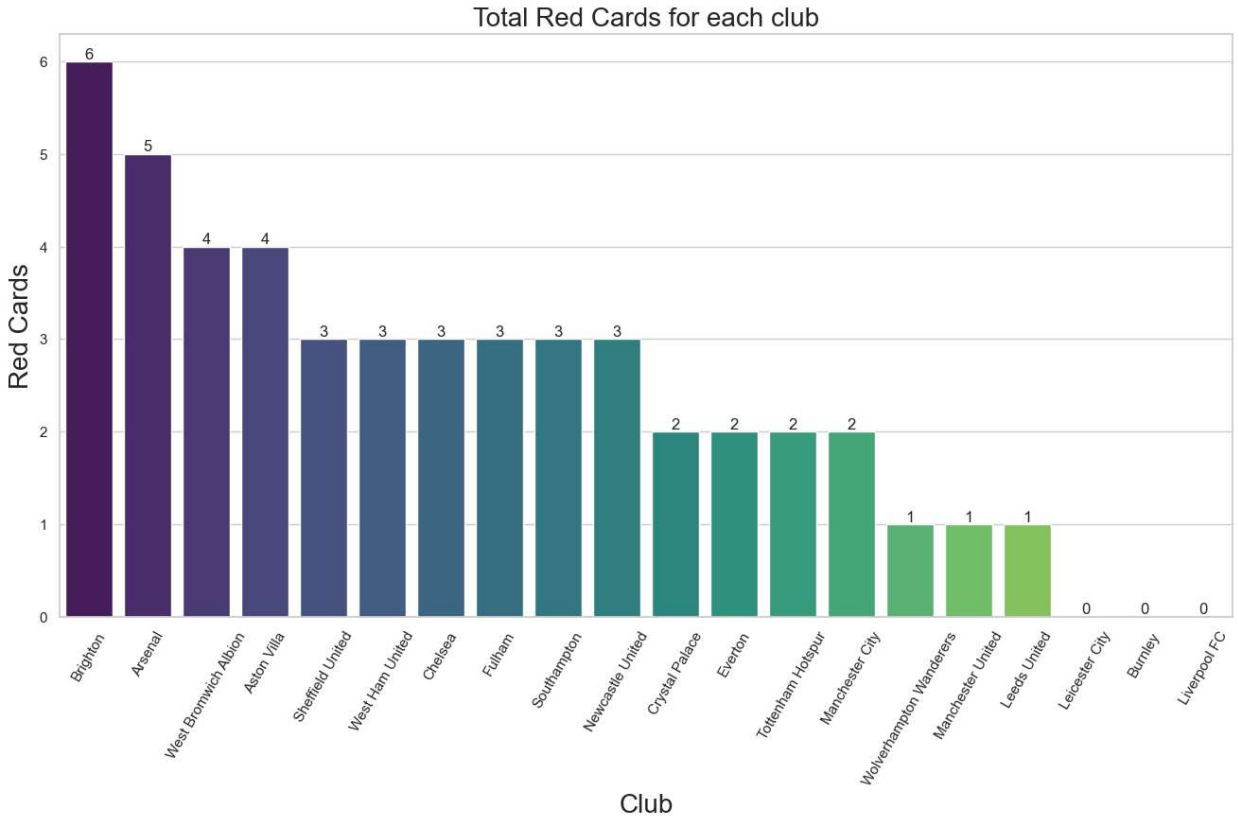
In [99]:
```
# Total yellow cards from each club
Yellow_Cards_by_club = df.groupby(['Club'], as_index = False)['Yellow_Cards'].sum().sc
sns.set_theme(style = 'whitegrid', color_codes = True)
plt.figure(figsize=(16,8))
ax = sns.barplot(x='Club',y='Yellow_Cards',data =Yellow_Cards_by_club,palette = 'viric
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Club', fontsize = 20)
plt.xticks(rotation=60)
plt.ylabel('Yellow Cards', fontsize = 20)
plt.title('Total Yellow Cards for each club', fontsize = 20)
plt.show()
```



From the above graph, it can be concluded that Sheffield United, Aston Villa and Fulham were among the most physcial teams as they have accumuated the highest number of yellow cards for committed fouls.

In [100…

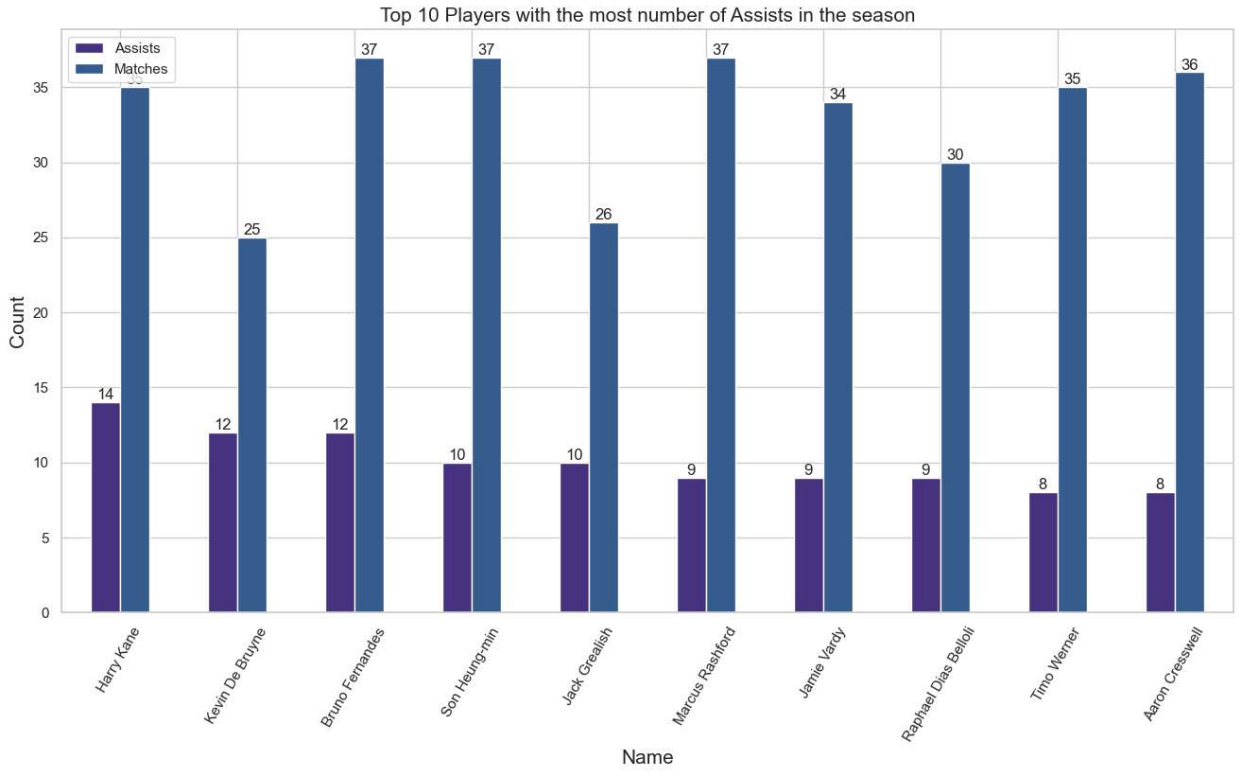
```
# Total red cards from each club
Red_Cards_by_club = df.groupby(['Club'], as_index = False)['Red_Cards'].sum().sort_val
sns.set_theme(style = 'whitegrid', color_codes = True)
plt.figure(figsize=(16,8))
ax = sns.barplot(x='Club',y='Red_Cards',data =Red_Cards_by_club,palette = 'viridis')
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Club', fontsize = 20)
plt.xticks(rotation=60)
plt.ylabel('Red Cards', fontsize = 20)
plt.title('Total Red Cards for each club', fontsize = 20)
plt.show()
```



From the above graph, it can be concluded that Brighton and Arsenal had the most number of red cards, indicating a sense of indiscipline amongst the team.

In [116…

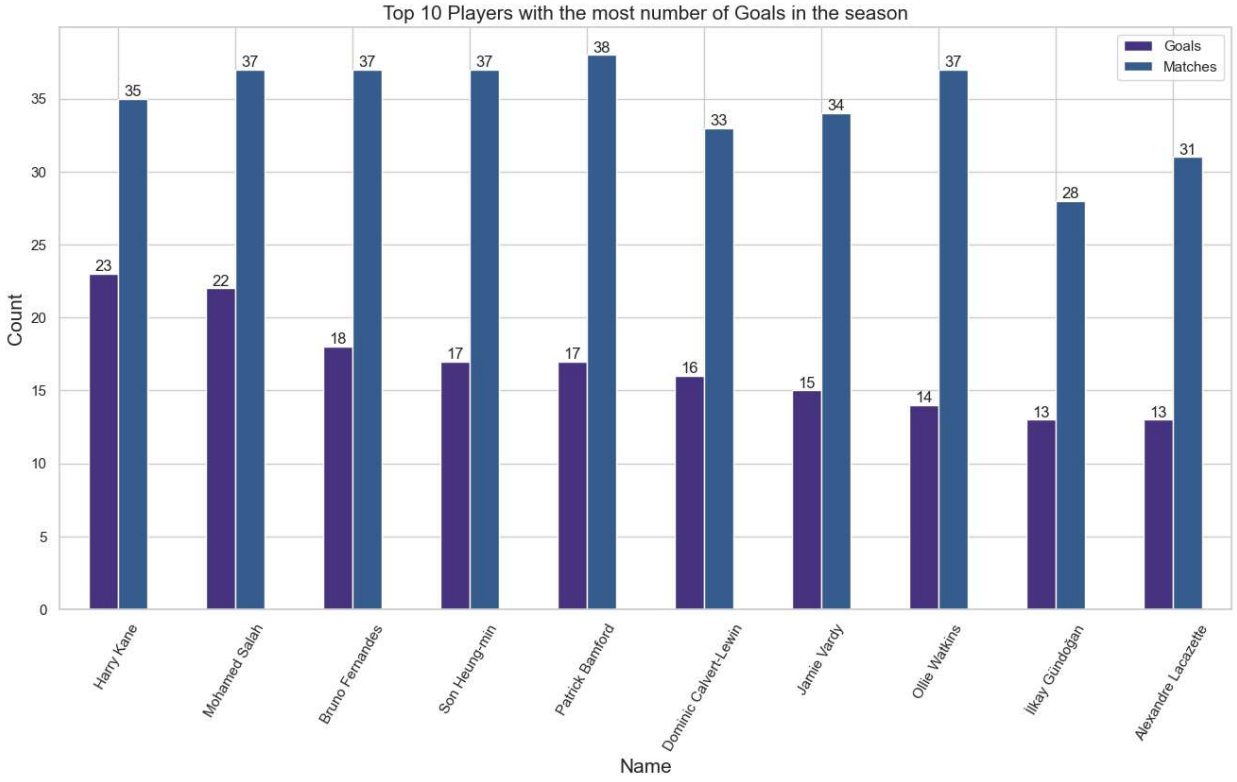
```
# Players with the most number of Assists in the season
ax = top_10_assists = df[['Name','Club','Assists','Matches']].nlargest(n = 10, columns
plt.xticks(rotation = 60)
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Name', fontsize = 15)
plt.ylabel('Count',fontsize = 15)
plt.title('Top 10 Players with the most number of Assists in the season',fontsize = 15
plt.show()
```



The above graph shows the top 10 playes with the most assists in the season. Hary Kane leads the chart followed by KDB and Bruno Fernandes.

In [117…

```
# Players with the most number of Goals in the season
ax = top_10_goals = df[['Name','Club','Goals','Matches']].nlargest(n = 10, columns = '
plt.xticks(rotation = 60)
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Name', fontsize = 15)
plt.ylabel('Count',fontsize = 15)
plt.title('Top 10 Players with the most number of Goals in the season',fontsize = 15)
plt.show()
```

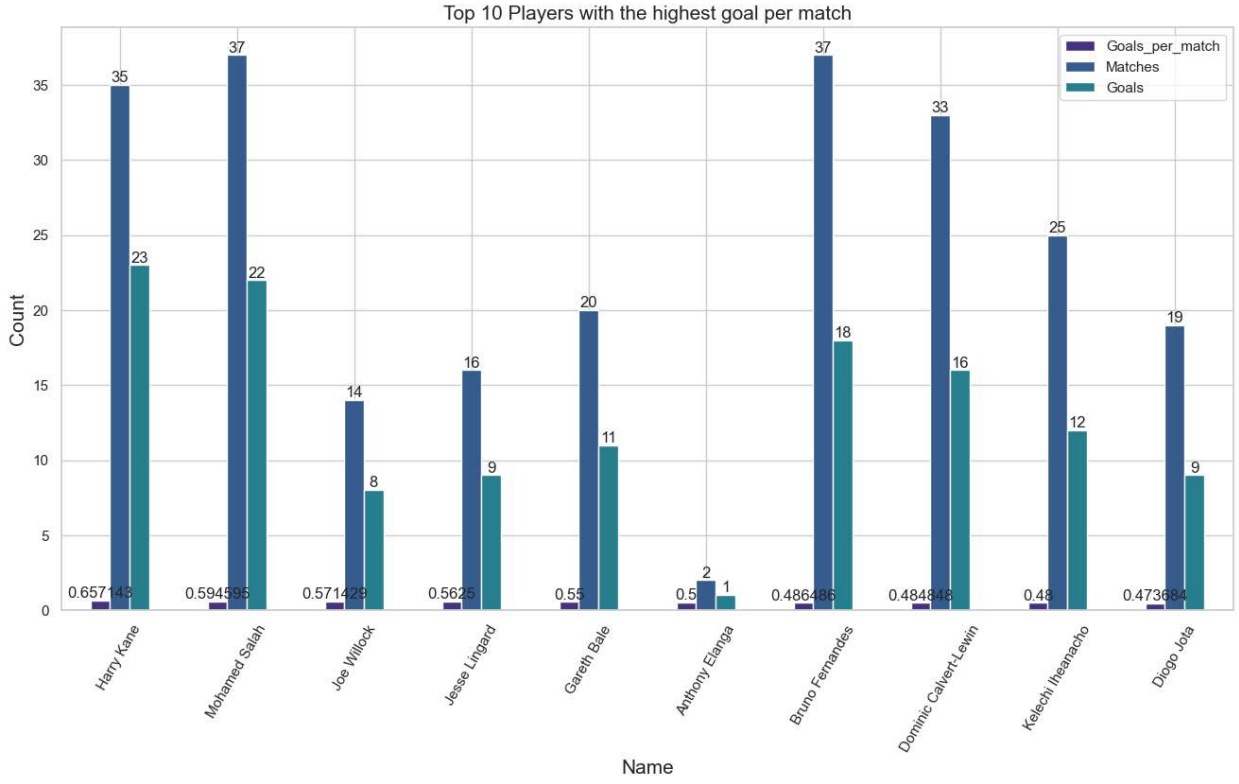


The above graph shows the top 10 playes with the most goals in the season. Hary Kane leads the chart followed by Mohammed Salah and Bruno Fernandes.

So in terms of being prolific in front of goal or having the highest goal contrinutions in the season, Harry Kane leads the chart followed by Bruno Fernandes.

In [121…

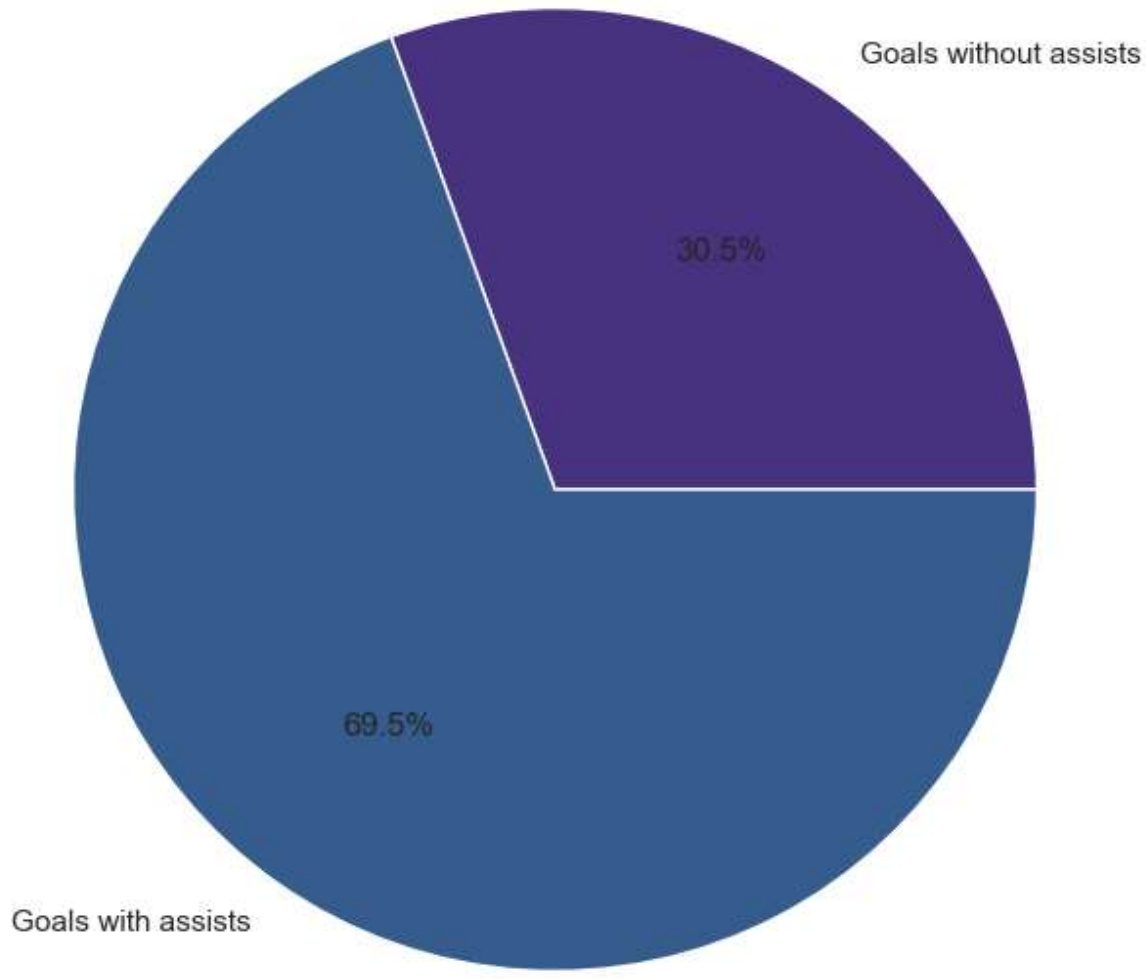
```
# Goals per match
ax = top_10_goals_per_match = df[['Name','Goals_per_match','Club','Matches','Goals']].
plt.xticks(rotation = 60)
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Name', fontsize = 15)
plt.ylabel('Count',fontsize = 15)
plt.title('Top 10 Players with the highest goal per match',fontsize = 15)
plt.show()
```



From the above graph, we can conclude that Harry Kane has been the most prolific players in terms of scoring goals, with a ratio 0.65 goals per match, followed by Salah at 0.59 goals per match.

In [141…

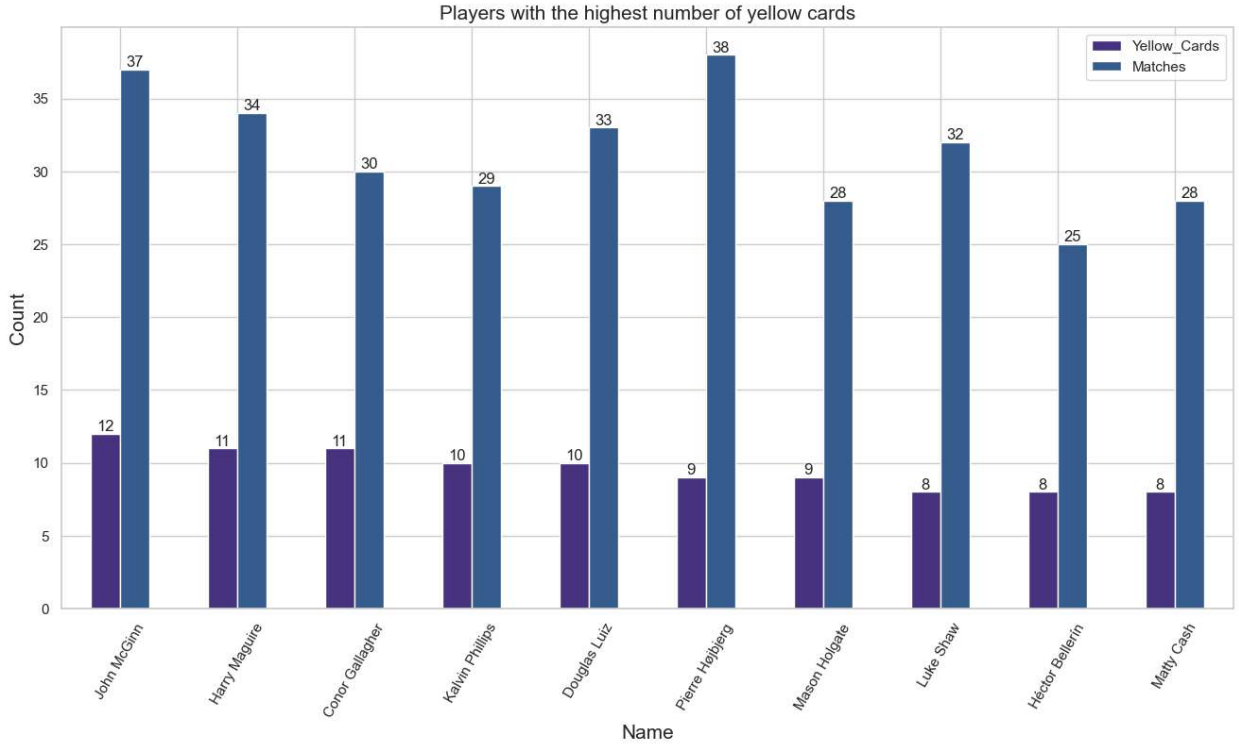
```
# Goals with assist and without assist
plt.figure(figsize=(16,8))
assists = df['Assists'].sum()
data = [total_goals - assists, assists]
labels = ['Goals without assists','Goals with assists']
color = sns.color_palette('viridis')
plt.pie(data, labels= labels, colors = color, autopct = '%.1f%%')
plt.show()
```



From the above pie chart, it is clear that almost 70% of the goals scored in the season were provided by an assist.

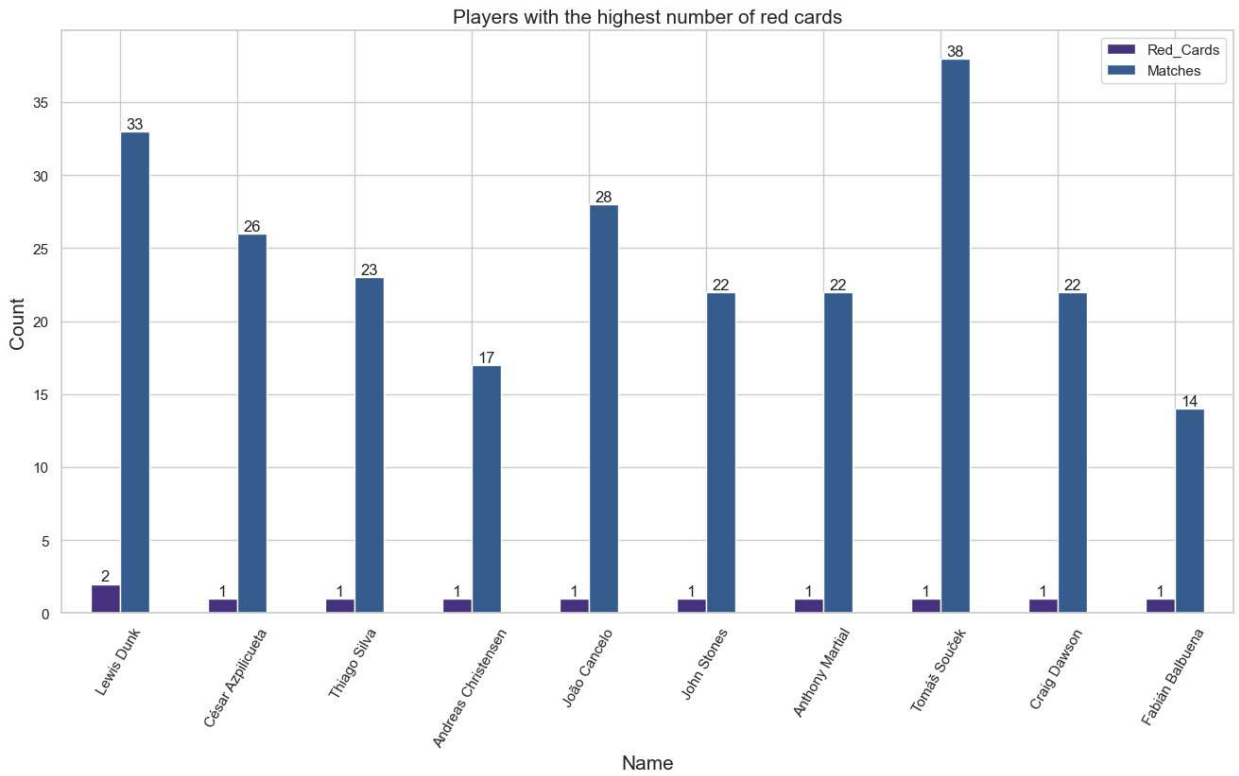
In [139…

```
# top 10 players with most yellow cards
ax = top_10_players_with_yellow = df[['Name','Yellow_Cards','Matches']].nlargest(n = 1
plt.xticks(rotation = 60)
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Name', fontsize = 15)
plt.ylabel('Count',fontsize = 15)
plt.title('Players with the highest number of yellow cards',fontsize = 15)
plt.show()
```



In [140…

```
# top 10 players with most red cards
ax = top_10_players_with_red = df[['Name','Red_Cards','Matches']].nlargest(n = 10, col
plt.xticks(rotation = 60)
for bars in ax.containers:
    ax.bar_label(bars)
plt.xlabel('Name', fontsize = 15)
plt.ylabel('Count',fontsize = 15)
plt.title('Players with the highest number of red cards',fontsize = 15)
plt.show()
```



In [ ]: