IPL SEASON 18 (POWERPLAY ANALYSIS) - Bowling Analysis

IPL 2025 Powerplay Bowling Analysis

Objective

This notebook analyzes team-level bowling performance during the powerplay phase of IPL 2025 matches, focusing on run control, wicket-taking, and pace vs spin effectiveness.

Data Overview

- Dataset: IPL 2025 ball-by-ball data
- Matches analyzed: Match numbers ≤ 70
- Granularity: Delivery-level

Importing necessary python libraries

In [1]:

```
import pandas as pd
import matplotlib.pyplot as plt

# Optional settings
plt.style.use("default")
pd.set_option("display.max_columns", None)
```

Importing and checking data

In [2]:

```
df = pd.read_csv("data/ipl2025.csv")


df.head()
```

Out[2]:

	match_no	date	stage	venue	batting_team	bowling_team	innings	over	strik
0	1	Mar 22, 2025	League stage	Eden Gardens, Kolkata	KKR	RCB	1	0.1	Ko
1	1	Mar 22, 2025	League stage	Eden Gardens, Kolkata	KKR	RCB	1	0.2	Ko
2	1	Mar 22, 2025	League stage	Eden Gardens, Kolkata	KKR	RCB	1	0.3	Ko
3	1	Mar 22, 2025	League stage	Eden Gardens, Kolkata	KKR	RCB	1	0.4	Ko
4	1	Mar 22, 2025	League stage	Eden Gardens, Kolkata	KKR	RCB	1	0.5	Ko

In [3]:

```
df.columns
```

Out[3]:

```
Index(['match_no', 'date', 'stage', 'venue', 'batting_team', 'bowling_team',
       'innings', 'over', 'striker', 'bowler', 'bowler_type', 'runs_of_bat',
       'extras', 'wide', 'legbyes', 'byes', 'noballs', 'wicket_type',
       'player_dismissed', 'fielder'],
      dtype='object')
```

Runs conceded in powerplay and average runs conceded in powerplay

In [4]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Create total runs column
df["total_runs"] = df["runs_of_bat"] + df["extras"]

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Runs conceded per powerplay innings
pp_innings_runs = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .agg(
        runs_conceded=("total_runs", "sum")
    )
    .reset_index()
)

# Team-level powerplay runs conceded
pp_team_runs = (
    pp_innings_runs
    .groupby("bowling_team")
    .agg(
        innings=("runs_conceded", "count"),
        total_runs_conceded=("runs_conceded", "sum"),
        avg_runs_conceded=("runs_conceded", "mean")
    )
    .reset_index()
)

# Round average to 2 decimal places
pp_team_runs["avg_runs_conceded"] = pp_team_runs["avg_runs_conceded"].round(2)

# Sort by average runs conceded (most to least)
pp_team_runs = pp_team_runs.sort_values("avg_runs_conceded", ascending=False)

# Reset index to remove old index numbers
pp_team_runs = pp_team_runs.reset_index(drop=True)
pp_team_runs.index = pp_team_runs.index + 1

pp_team_runs
```

Out[4]:

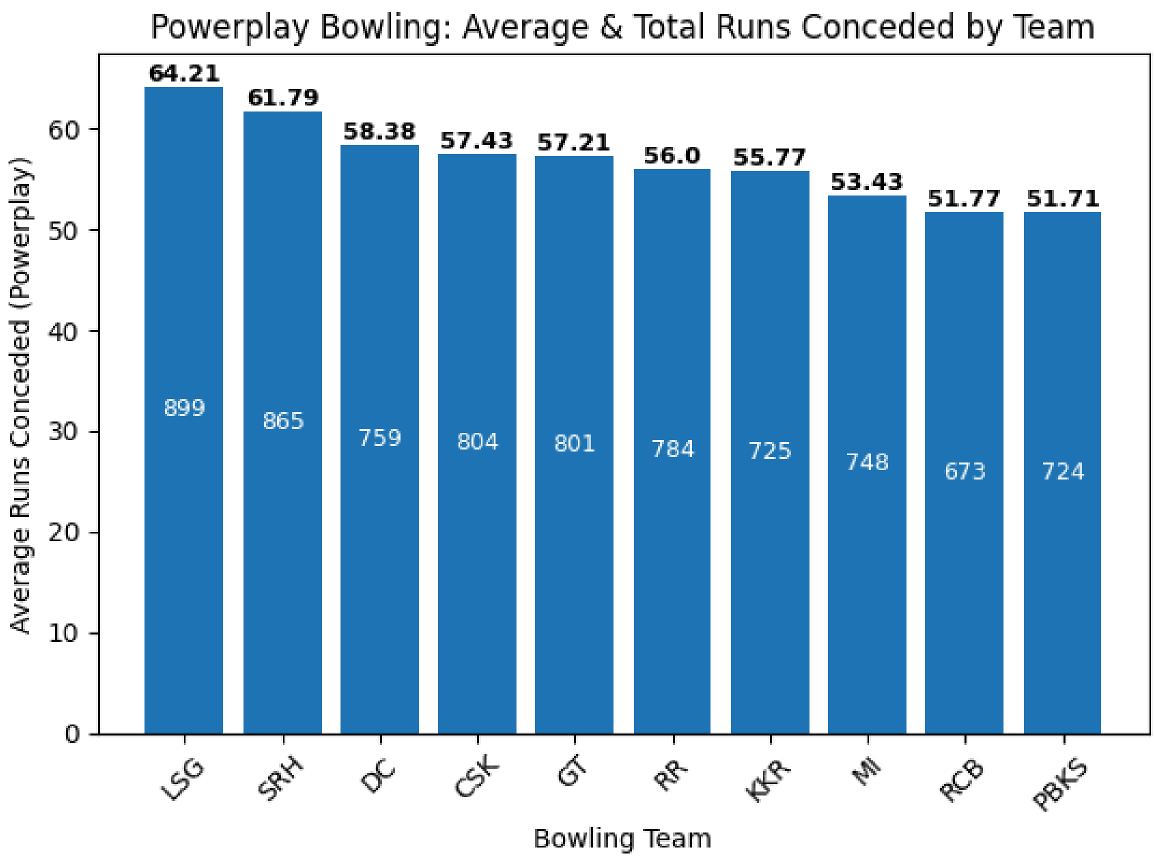
	bowling_team	innings	total_runs_conceded	avg_runs_conceded
1	LSG	14	899	64.21
2	SRH	14	865	61.79
3	DC	13	759	58.38
4	CSK	14	804	57.43
5	GT	14	801	57.21
6	RR	14	784	56.00
7	KKR	13	725	55.77
8	MI	14	748	53.43
9	RCB	13	673	51.77
10	PBKS	14	724	51.71

Bar Chart: Runs Conceded in Powerplay (by Team)

In [5]:

```
plt.figure()

bars = plt.bar(
    pp_team_runs["bowling_team"],
    pp_team_runs["avg_runs_conceded"]
)
```

```python
plt.xlabel("Bowling Team")
plt.ylabel("Average Runs Conceded (Powerplay)")
plt.title("Powerplay Bowling: Average & Total Runs Conceded by Team")

plt.xticks(rotation=45)

# Add labels (corrected)
for bar, avg, total in zip(
    bars,
    pp_team_runs["avg_runs_conceded"],
    pp_team_runs["total_runs_conceded"]
):
    height = bar.get_height()

    # Average runs on top of the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{avg}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

    # Total runs inside the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height / 2,
        f"{total}",
        ha="center",
        va="center",
        color="white",
        fontsize=9
    )

plt.tight_layout()
plt.show()
```



Dot balls in powerplay

In [6]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Legal deliveries only
pp_df["is_legal_ball"] = (
    (pp_df["wide"] == 0) &
    (pp_df["noballs"] == 0)
)

# Dot balls (legal + no runs)
pp_df["is_dot_ball"] = (
    pp_df["is_legal_ball"] &
    (pp_df["runs_of_bat"] == 0) &
    (pp_df["extras"] == 0)
)
```

```
# Innings-level aggregation
pp_innings_dots = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .agg(
        legal_balls=("is_legal_ball", "sum"),
        dot_balls=("is_dot_ball", "sum")
    )
    .reset_index()
)

# Team-level aggregation
pp_team_dotballs = (
    pp_innings_dots
    .groupby("bowling_team")
    .agg(
        innings=("dot_balls", "count"),
        total_balls=("legal_balls", "sum"),
        dot_balls=("dot_balls", "sum")
    )
    .reset_index()
)

# Metrics
pp_team_dotballs["dot_ball_pct"] = (
    (pp_team_dotballs["dot_balls"] / pp_team_dotballs["total_balls"]) * 100
).round(2)

pp_team_dotballs["avg_dot_balls"] = (
    pp_team_dotballs["dot_balls"] / pp_team_dotballs["innings"]
).round(2)

# Sort by most to least dot balls
pp_team_dotballs = pp_team_dotballs.sort_values("avg_dot_balls", ascending=False

# Index starts from 1
pp_team_dotballs = pp_team_dotballs.reset_index(drop=True)
pp_team_dotballs.index = pp_team_dotballs.index + 1

pp_team_dotballs
```

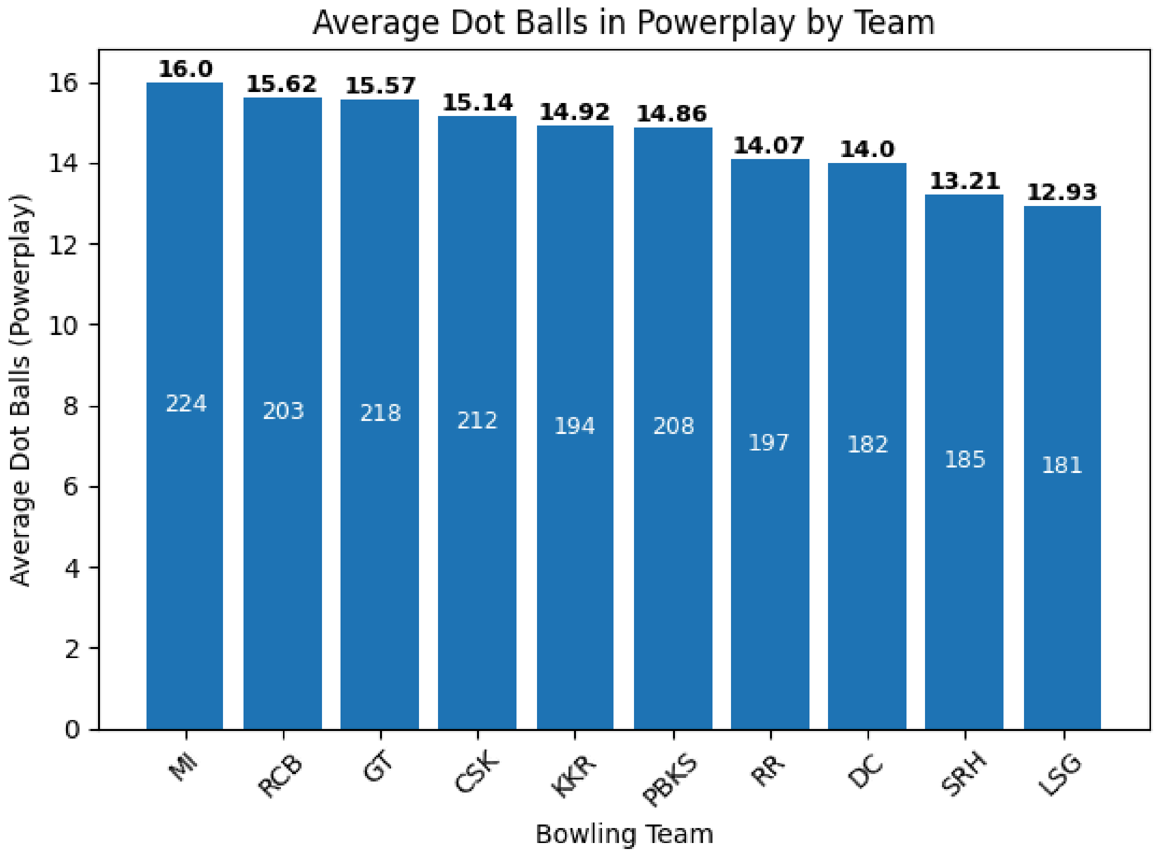
Out[6]:

	bowling_team	innings	total_balls	dot_balls	dot_ball_pct	avg_dot_balls
1	MI	14	504	224	44.44	16.00
2	RCB	13	456	203	44.52	15.62
3	GT	14	504	218	43.25	15.57
4	CSK	14	504	212	42.06	15.14
5	KKR	13	468	194	41.45	14.92
6	PBKS	14	462	208	45.02	14.86
7	RR	14	504	197	39.09	14.07
8	DC	13	468	182	38.89	14.00
9	SRH	14	504	185	36.71	13.21
10	LSG	14	504	181	35.91	12.93

Bar Chart: Average Dot Balls in Powerplay

In [7]:

```python
plt.figure()

bars = plt.bar(
    pp_team_dotballs["bowling_team"],
    pp_team_dotballs["avg_dot_balls"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Average Dot Balls (Powerplay)")
plt.title("Average Dot Balls in Powerplay by Team")

plt.xticks(rotation=45)

# Annotations (corrected)
for bar, avg_dots, total_dots in zip(
    bars,
    pp_team_dotballs["avg_dot_balls"],
    pp_team_dotballs["dot_balls"]
):
    height = bar.get_height()

    # Average dot balls on top of the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{avg_dots}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

    # Total dot balls inside the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height / 2,
        f"{total_dots}",
        ha="center",
        va="center",
        color="white",
        fontsize=9
    )

plt.tight_layout()
plt.show()
```



Sixes conceded in powerplay with average sixes conceded in powerplay

In [8]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Identify sixes
```

```
pp_df["is_six"] = pp_df["runs_of_bat"] == 6

# Innings-level aggregation
pp_innings_sixes = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .agg(
        sixes=("is_six", "sum")
    )
    .reset_index()
)

# Team-level aggregation
pp_team_sixes = (
    pp_innings_sixes
    .groupby("bowling_team")
    .agg(
        innings=("sixes", "count"),
        total_sixes=("sixes", "sum"),
        avg_sixes=("sixes", "mean")
    )
    .reset_index()
)

# Round average to 2 decimals
pp_team_sixes["avg_sixes"] = pp_team_sixes["avg_sixes"].round(2)

# Sort by average sixes conceded (most to least)
pp_team_sixes = pp_team_sixes.sort_values("avg_sixes", ascending=False)

# Index starts from 1
pp_team_sixes = pp_team_sixes.reset_index(drop=True)
pp_team_sixes.index = pp_team_sixes.index + 1

pp_team_sixes
```

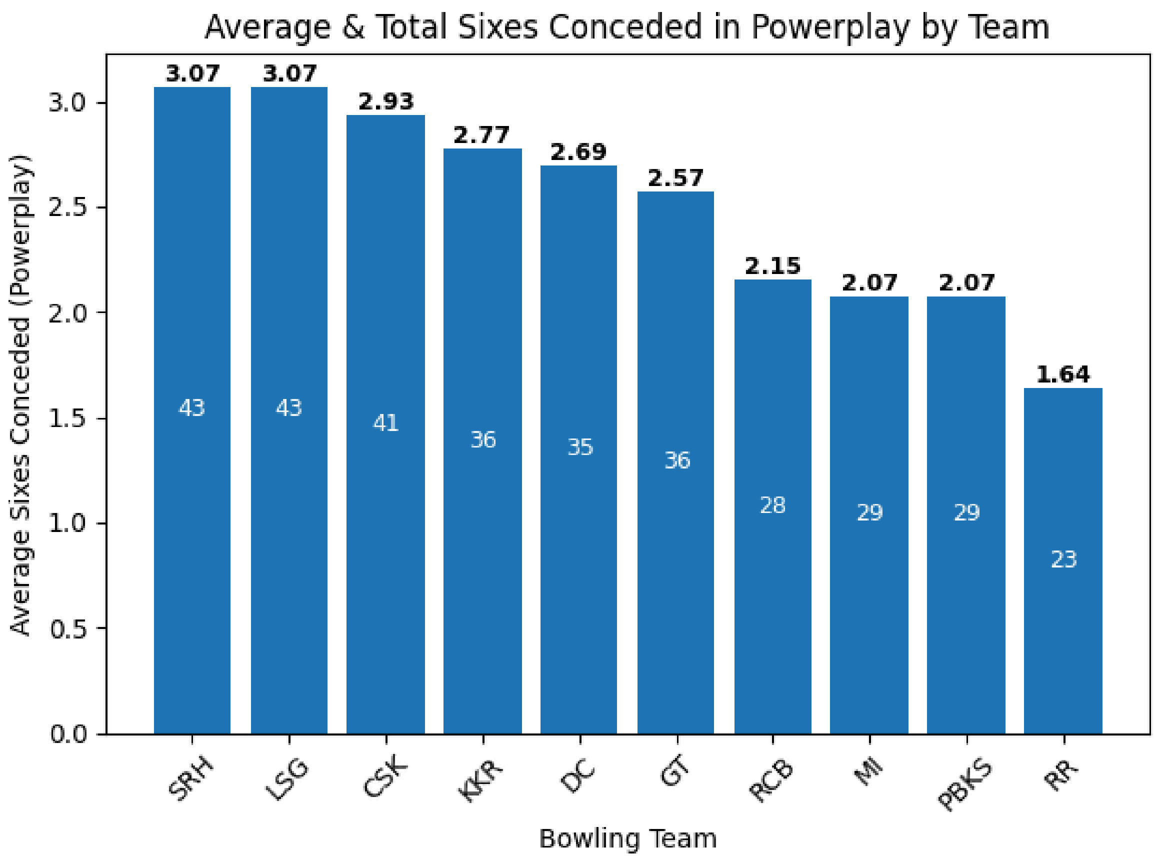
Out[8]:

	bowling_team	innings	total_sixes	avg_sixes
1	SRH	14	43	3.07
2	LSG	14	43	3.07
3	CSK	14	41	2.93
4	KKR	13	36	2.77
5	DC	13	35	2.69
6	GT	14	36	2.57
7	RCB	13	28	2.15
8	MI	14	29	2.07
9	PBKS	14	29	2.07
10	RR	14	23	1.64

Bar Chart: Sixes Conceded in Powerplay

In [9]:

```
plt.figure()

bars = plt.bar(
    pp_team_sixes["bowling_team"],
    pp_team_sixes["avg_sixes"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Average Sixes Conceded (Powerplay)")
plt.title("Average & Total Sixes Conceded in Powerplay by Team")

plt.xticks(rotation=45)

# Corrected annotations
for bar, avg_six, total_six in zip(
    bars,
    pp_team_sixes["avg_sixes"],
    pp_team_sixes["total_sixes"]
):
    height = bar.get_height()

    # Average on top of the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{avg_six}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

    # Total sixes inside the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height / 2,
        f"{total_six}",
        ha="center",
        va="center",
        color="white",
        fontsize=9
    )

plt.tight_layout()
plt.show()
```



innings without conceding a six in powerplay

In [10]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Identify sixes
pp_df["is_six"] = pp_df["runs_of_bat"] == 6

# Innings-level aggregation
pp_innings_sixes = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .agg(
        sixes_conceded=("is_six", "sum")
    )
    .reset_index()
)
```

```
# Flag innings with zero sixes
pp_innings_sixes["no_six_innings"] = pp_innings_sixes["sixes_conceded"] == 0

# Team-level aggregation
pp_team_no_six = (
    pp_innings_sixes
    .groupby("bowling_team")
    .agg(
        innings_without_six=("no_six_innings", "sum")
    )
    .reset_index()
)

# Sort by most to least
pp_team_no_six = pp_team_no_six.sort_values(
    "innings_without_six", ascending=False
)

# Index starts from 1
pp_team_no_six = pp_team_no_six.reset_index(drop=True)
pp_team_no_six.index = pp_team_no_six.index + 1

pp_team_no_six
```

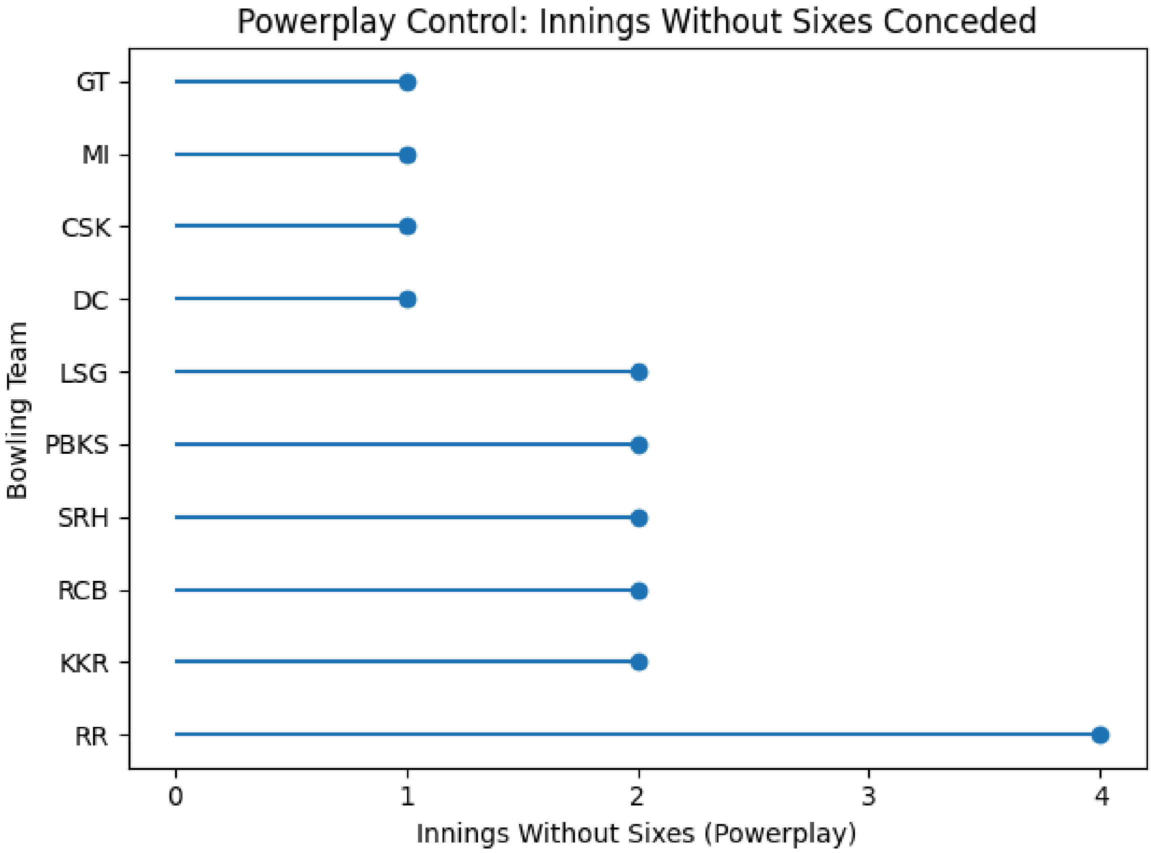
Out[10]:

	bowling_team	innings_without_six
1	RR	4
2	KKR	2
3	RCB	2
4	SRH	2
5	PBKS	2
6	LSG	2
7	DC	1
8	CSK	1
9	MI	1
10	GT	1

Chart: Powerplay Innings Without a Six (by Team)

In [11]:

```
plt.figure()

plt.hlines(
    y=pp_team_no_six["bowling_team"],
    xmin=0,
    xmax=pp_team_no_six["innings_without_six"]
)

plt.plot(
    pp_team_no_six["innings_without_six"],
    pp_team_no_six["bowling_team"],
    "o"
)

plt.xlabel("Innings Without Sixes (Powerplay)")
plt.ylabel("Bowling Team")
plt.title("Powerplay Control: Innings Without Sixes Conceded")

# Force integer x-axis ticks
max_val = pp_team_no_six["innings_without_six"].max()
plt.xticks(range(0, max_val + 1))

plt.tight_layout()
plt.show()
```



Fours conceded in powerplay with average fours conceded in powerplay

In [12]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Identify fours
pp_df["is_four"] = pp_df["runs_of_bat"] == 4

# Innings-level aggregation
pp_innings_fours = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .agg(
        fours_conceded=("is_four", "sum")
    )
    .reset_index()
)

# Team-level aggregation
pp_team_fours = (
    pp_innings_fours
    .groupby("bowling_team")
    .agg(
        innings=("fours_conceded", "count"),
        total_fours=("fours_conceded", "sum"),
        avg_fours=("fours_conceded", "mean")
    )
    .reset_index()
)

# Round average to 2 decimals
pp_team_fours["avg_fours"] = pp_team_fours["avg_fours"].round(2)

# Sort by average fours conceded (most to least)
pp_team_fours = pp_team_fours.sort_values("avg_fours", ascending=False)

# Index starts from 1
pp_team_fours = pp_team_fours.reset_index(drop=True)
pp_team_fours.index = pp_team_fours.index + 1

pp_team_fours
```

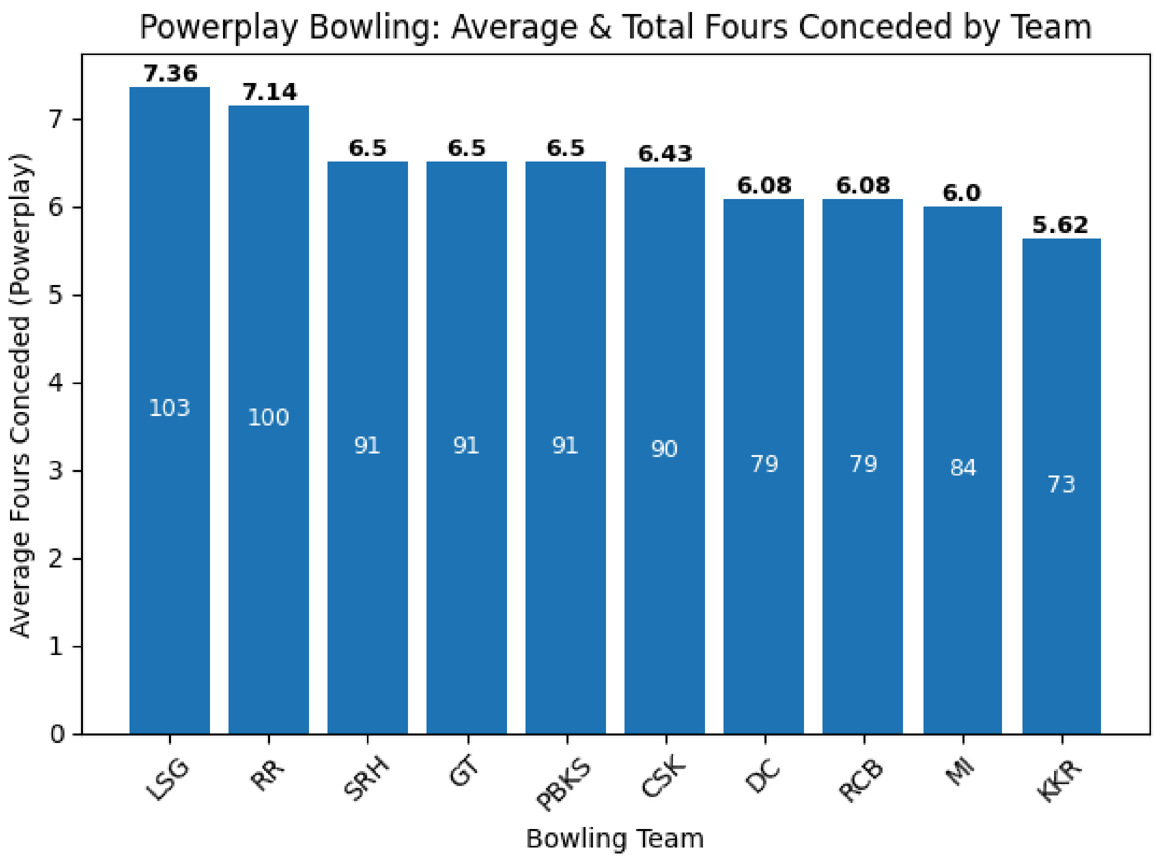
Out[12]:

	bowling_team	innings	total_fours	avg_fours
1	LSG	14	103	7.36
2	RR	14	100	7.14
3	SRH	14	91	6.50
4	GT	14	91	6.50
5	PBKS	14	91	6.50
6	CSK	14	90	6.43
7	DC	13	79	6.08
8	RCB	13	79	6.08
9	MI	14	84	6.00
10	KKR	13	73	5.62

Bar Chart: Fours Conceded in Powerplay

In [13]:

```python
plt.figure()

bars = plt.bar(
    pp_team_fours["bowling_team"],
    pp_team_fours["avg_fours"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Average Fours Conceded (Powerplay)")
plt.title("Powerplay Bowling: Average & Total Fours Conceded by Team")

plt.xticks(rotation=45)

# Annotations (SOP-compliant)
for bar, avg_four, total_four in zip(
    bars,
    pp_team_fours["avg_fours"],
    pp_team_fours["total_fours"]
):
    height = bar.get_height()

    # Average on top of the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{avg_four}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

    # Total inside the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height / 2,
        f"{total_four}",
        ha="center",
        va="center",
        color="white",
        fontsize=9
    )

plt.tight_layout()
plt.show()
```



runs conceded in boundaries in powerplay(fours and sixes)

In [14]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Identify boundary balls
pp_df["is_boundary"] = pp_df["runs_of_bat"].isin([4, 6])

# Boundary runs
pp_df["boundary_runs"] = pp_df["runs_of_bat"].where(
    pp_df["is_boundary"], 0
)

# Innings-level aggregation
pp_innings_boundaries = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .agg(
        boundaries=("is_boundary", "sum"),
        boundary_runs=("boundary_runs", "sum")
    )
    .reset_index()
)

# Team-level aggregation
pp_team_boundaries = (
    pp_innings_boundaries
    .groupby("bowling_team")
    .agg(
        innings=("boundaries", "count"),
        total_boundaries=("boundaries", "sum"),
        total_boundary_runs=("boundary_runs", "sum"),
        avg_boundary_runs=("boundary_runs", "mean")
    )
    .reset_index()
)

# Round average to 2 decimals
pp_team_boundaries["avg_boundary_runs"] = (
    pp_team_boundaries["avg_boundary_runs"].round(2)
)

# Sort by average boundary runs (most to least)
pp_team_boundaries = pp_team_boundaries.sort_values(
    "avg_boundary_runs", ascending=False
)

# Index starts from 1
pp_team_boundaries = pp_team_boundaries.reset_index(drop=True)
pp_team_boundaries.index = pp_team_boundaries.index + 1

pp_team_boundaries
```

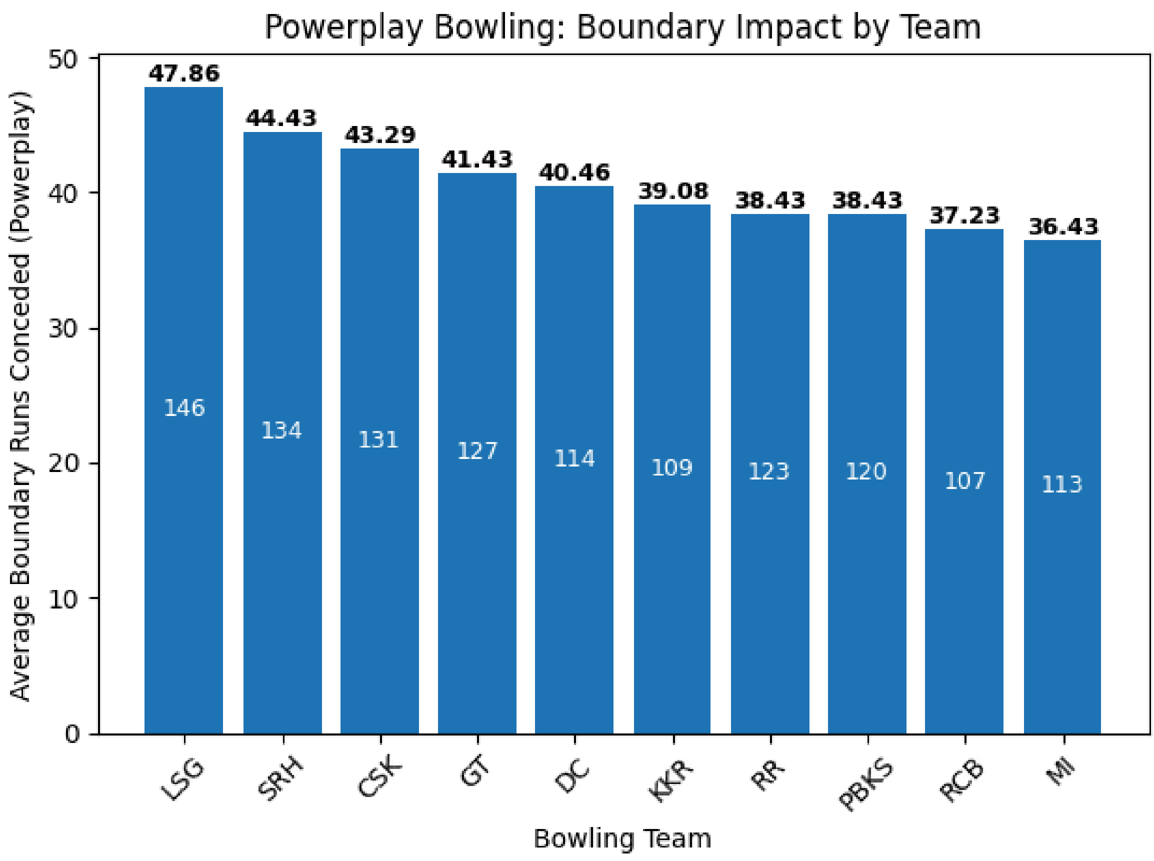
Out[14]:

	bowling_team	innings	total_boundaries	total_boundary_runs	avg_boundary_runs
1	LSG	14	146	670	47.86
2	SRH	14	134	622	44.43
3	CSK	14	131	606	43.29
4	GT	14	127	580	41.43
5	DC	13	114	526	40.46
6	KKR	13	109	508	39.08
7	RR	14	123	538	38.43
8	PBKS	14	120	538	38.43
9	RCB	13	107	484	37.23
10	MI	14	113	510	36.43

Bar Chart: Boundary Runs Conceded in Powerplay

In [15]:

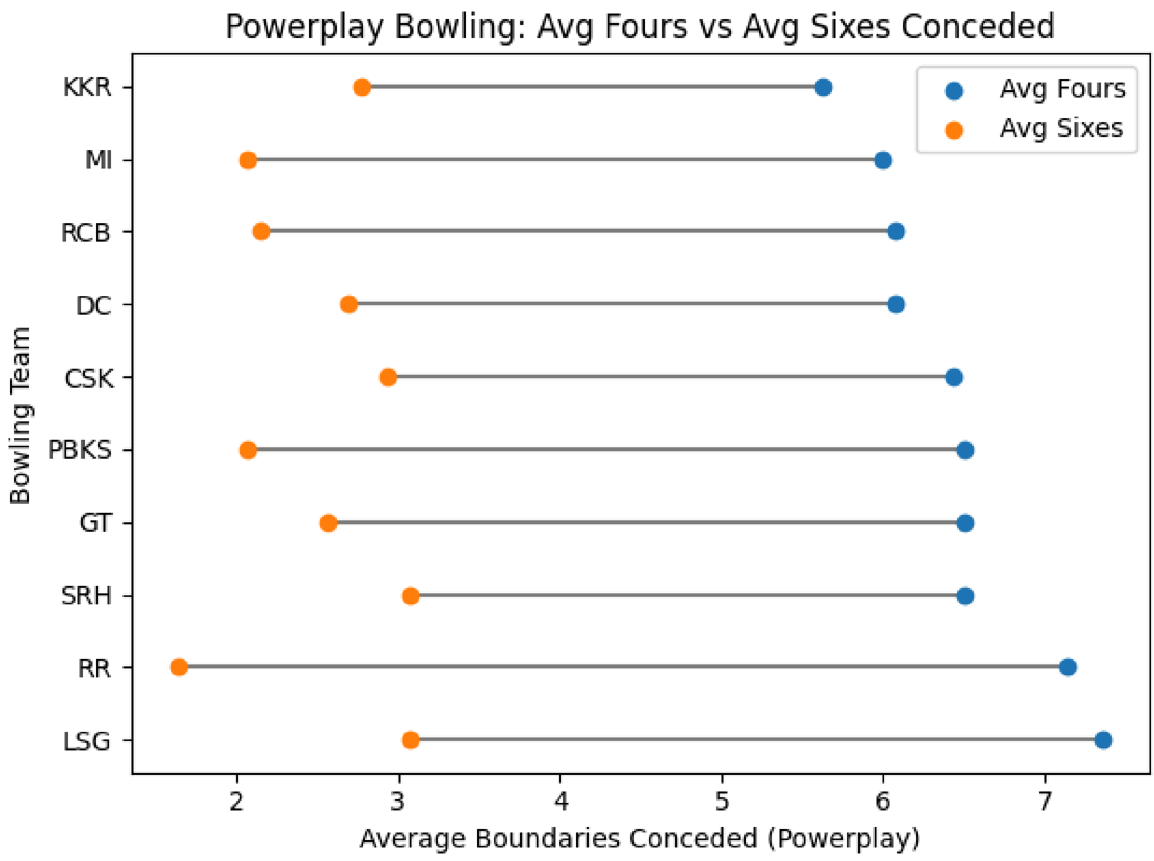
```
plt.figure()

bars = plt.bar(
    pp_team_boundaries["bowling_team"],
    pp_team_boundaries["avg_boundary_runs"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Average Boundary Runs Conceded (Powerplay)")
plt.title("Powerplay Bowling: Boundary Impact by Team")

plt.xticks(rotation=45)

# Annotations (SOP-compliant)
for bar, avg_runs, total_boundaries in zip(
    bars,
    pp_team_boundaries["avg_boundary_runs"],
    pp_team_boundaries["total_boundaries"]
):
    height = bar.get_height()

    # Average boundary runs on top
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{avg_runs}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

    # Total boundaries inside the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height / 2,
        f"{total_boundaries}",
        ha="center",
        va="center",
        color="white",
        fontsize=9
    )

plt.tight_layout()
plt.show()
```



Dumbbell Chart (Average Fours vs Sixes)

In [16]:

```
plt.figure()

# Merge averages
compare_df = (
    pp_team_fours[["bowling_team", "avg_fours"]]
    .merge(
        pp_team_sixes[["bowling_team", "avg_sixes"]],
        on="bowling_team"
    )
)

# Plot lines
plt.hlines(
    y=compare_df["bowling_team"],
    xmin=compare_df["avg_fours"],
    xmax=compare_df["avg_sixes"],
    color="gray"
)

# Plot points
plt.scatter(
    compare_df["avg_fours"],
    compare_df["bowling_team"],
    label="Avg Fours",
    zorder=3
)

plt.scatter(
    compare_df["avg_sixes"],
    compare_df["bowling_team"],
    label="Avg Sixes",
    zorder=3
)

plt.xlabel("Average Boundaries Conceded (Powerplay)")
plt.ylabel("Bowling Team")
plt.title("Powerplay Bowling: Avg Fours vs Avg Sixes Conceded")

plt.legend()
plt.tight_layout()
plt.show()
```



runs conceded in extras in powerplay

In [17]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Innings-level aggregation
```

```python
pp_innings_extras = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .agg(
        extras_runs=("extras", "sum")
    )
    .reset_index()
)

# Team-level aggregation
pp_team_extras = (
    pp_innings_extras
    .groupby("bowling_team")
    .agg(
        innings=("extras_runs", "count"),
        total_extras_runs=("extras_runs", "sum"),
        avg_extras_runs=("extras_runs", "mean")
    )
    .reset_index()
)

# Round average to 2 decimals
pp_team_extras["avg_extras_runs"] = (
    pp_team_extras["avg_extras_runs"].round(2)
)

# Sort by average extras runs (most to least)
pp_team_extras = pp_team_extras.sort_values(
    "avg_extras_runs", ascending=False
)

# Index starts from 1
pp_team_extras = pp_team_extras.reset_index(drop=True)
pp_team_extras.index = pp_team_extras.index + 1

pp_team_extras
```

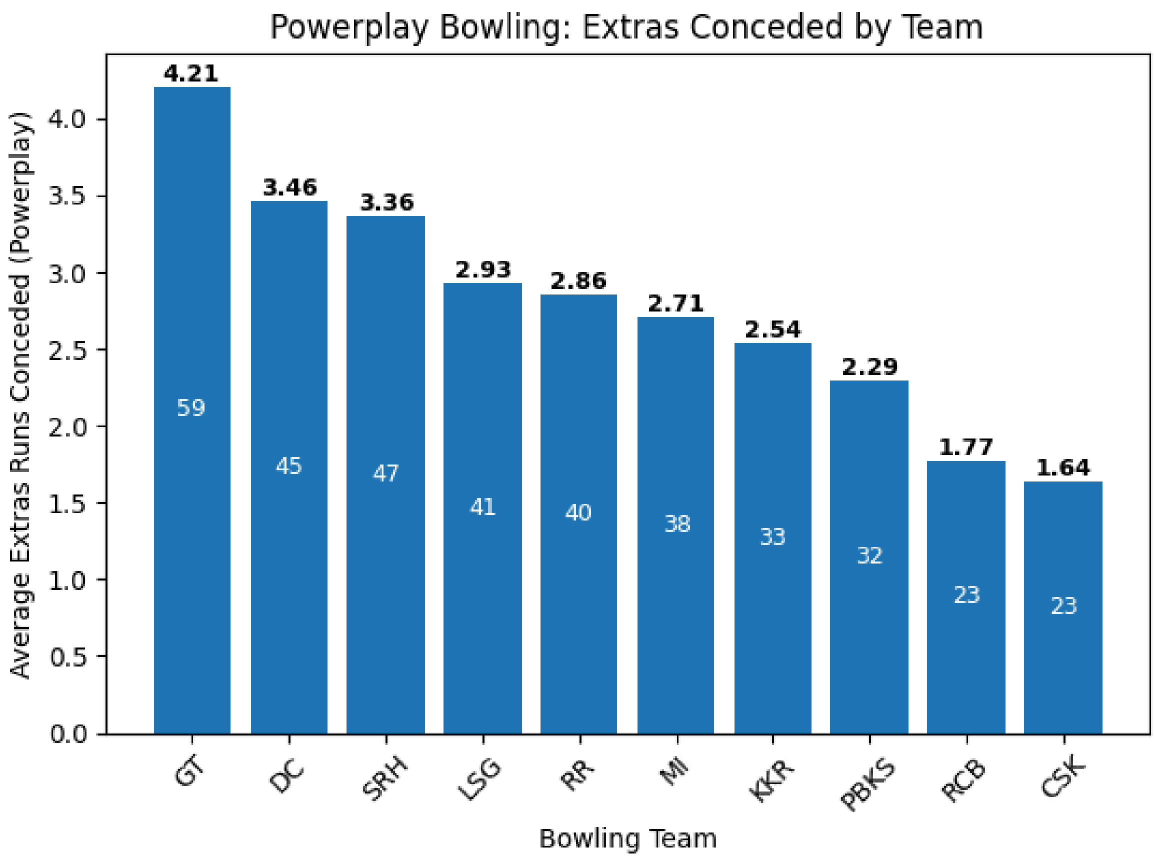
Out[17]:

	bowling_team	innings	total_extras_runs	avg_extras_runs
1	GT	14	59	4.21
2	DC	13	45	3.46
3	SRH	14	47	3.36
4	LSG	14	41	2.93
5	RR	14	40	2.86
6	MI	14	38	2.71
7	KKR	13	33	2.54
8	PBKS	14	32	2.29
9	RCB	13	23	1.77
10	CSK	14	23	1.64

Bar Chart: Extras Runs Conceded in Powerplay

In [18]:

```
plt.figure()

bars = plt.bar(
    pp_team_extras["bowling_team"],
    pp_team_extras["avg_extras_runs"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Average Extras Runs Conceded (Powerplay)")
plt.title("Powerplay Bowling: Extras Conceded by Team")

plt.xticks(rotation=45)

# Annotations (SOP-compliant)
for bar, avg_extras, total_extras in zip(
    bars,
    pp_team_extras["avg_extras_runs"],
    pp_team_extras["total_extras_runs"]
):
    height = bar.get_height()

    # Average extras on top
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{avg_extras}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

    # Total extras inside the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height / 2,
        f"{total_extras}",
        ha="center",
        va="center",
        color="white",
        fontsize=9
    )

plt.tight_layout()
plt.show()
```



economy of teams,pacers,spinners

In [19]:

```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Total runs
df["total_runs"] = df["runs_of_bat"] + df["extras"]

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Legal deliveries
pp_df["is_legal_ball"] = (
    (pp_df["wide"] == 0) &
    (pp_df["noballs"] == 0)
)

# ---------- INNINGS COUNT ----------
innings_df = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .size()
    .reset_index(name="balls")
)

team_innings = (
    innings_df
    .groupby("bowling_team")
    .size()
    .reset_index(name="innings")
)

# ---------- PACERS ----------
pp_pace = pp_df[pp_df["bowler_type"] == "pace"]

pace_team = (
    pp_pace
    .groupby("bowling_team")
    .agg(
        pace_runs=("total_runs", "sum"),
        pace_balls=("is_legal_ball", "sum")
    )
    .reset_index()
)

pace_team["pace_overs"] = pace_team["pace_balls"] / 6
pace_team["pace_economy"] = (pace_team["pace_runs"] / pace_team["pace_overs"]).r

pace_team = pace_team[["bowling_team", "pace_economy"]]

# ---------- SPINNERS ----------
pp_spin = pp_df[pp_df["bowler_type"] == "spin"]

spin_team = (
    pp_spin
    .groupby("bowling_team")
    .agg(
        spin_runs=("total_runs", "sum"),
        spin_balls=("is_legal_ball", "sum")
    )
    .reset_index()
)

spin_team["spin_overs"] = spin_team["spin_balls"] / 6
spin_team["spin_economy"] = (spin_team["spin_runs"] / spin_team["spin_overs"]).r

spin_team = spin_team[["bowling_team", "spin_economy"]]

# ---------- OVERALL TEAM ----------
team_overall = (
    pp_df
    .groupby("bowling_team")
    .agg(
        runs=("total_runs", "sum"),
        balls=("is_legal_ball", "sum")
    )
    .reset_index()
)

team_overall["overs"] = team_overall["balls"] / 6
```

```
team_overall["overall_economy"] = (team_overall["runs"] / team_overall["overs"])

team_overall = team_overall[["bowling_team", "overall_economy"]]

# ---------- COMBINE ----------
pp_team_economy = (
    team_overall
    .merge(team_innings, on="bowling_team", how="left")
    .merge(pace_team, on="bowling_team", how="left")
    .merge(spin_team, on="bowling_team", how="left")
)

# Sort by highest to lowest overall economy
pp_team_economy = pp_team_economy.sort_values(
    "overall_economy", ascending=False
)

# Index starts from 1
pp_team_economy = pp_team_economy.reset_index(drop=True)
pp_team_economy.index = pp_team_economy.index + 1

pp_team_economy
```

Out[19]:

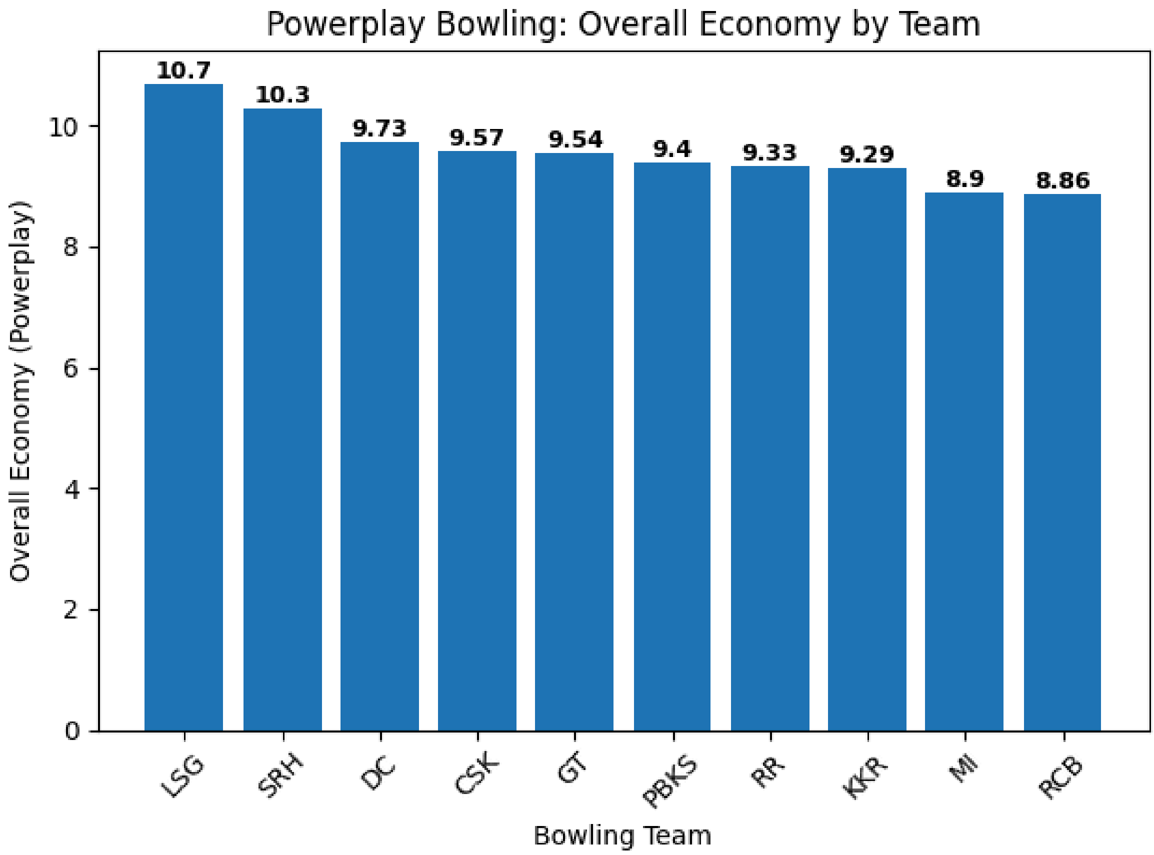
	bowling_team	overall_economy	innings	pace_economy	spin_economy
1	LSG	10.70	14	11.28	9.17
2	SRH	10.30	14	10.28	10.50
3	DC	9.73	13	10.25	8.41
4	CSK	9.57	14	9.27	11.07
5	GT	9.54	14	9.51	10.00
6	PBKS	9.40	14	9.30	10.10
7	RR	9.33	14	9.29	9.50
8	KKR	9.29	13	10.12	6.90
9	MI	8.90	14	8.71	11.00
10	RCB	8.86	13	8.82	9.40

Bar Chart: Overall Economy in Powerplay (by Team)

In [20]:

```
plt.figure()

bars = plt.bar(
    pp_team_economy["bowling_team"],
    pp_team_economy["overall_economy"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Overall Economy (Powerplay)")
plt.title("Powerplay Bowling: Overall Economy by Team")

plt.xticks(rotation=45)
```

```
# Value labels on top
for bar, econ in zip(bars, pp_team_economy["overall_economy"]):
    height = bar.get_height()
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{econ}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

plt.tight_layout()
plt.show()
```

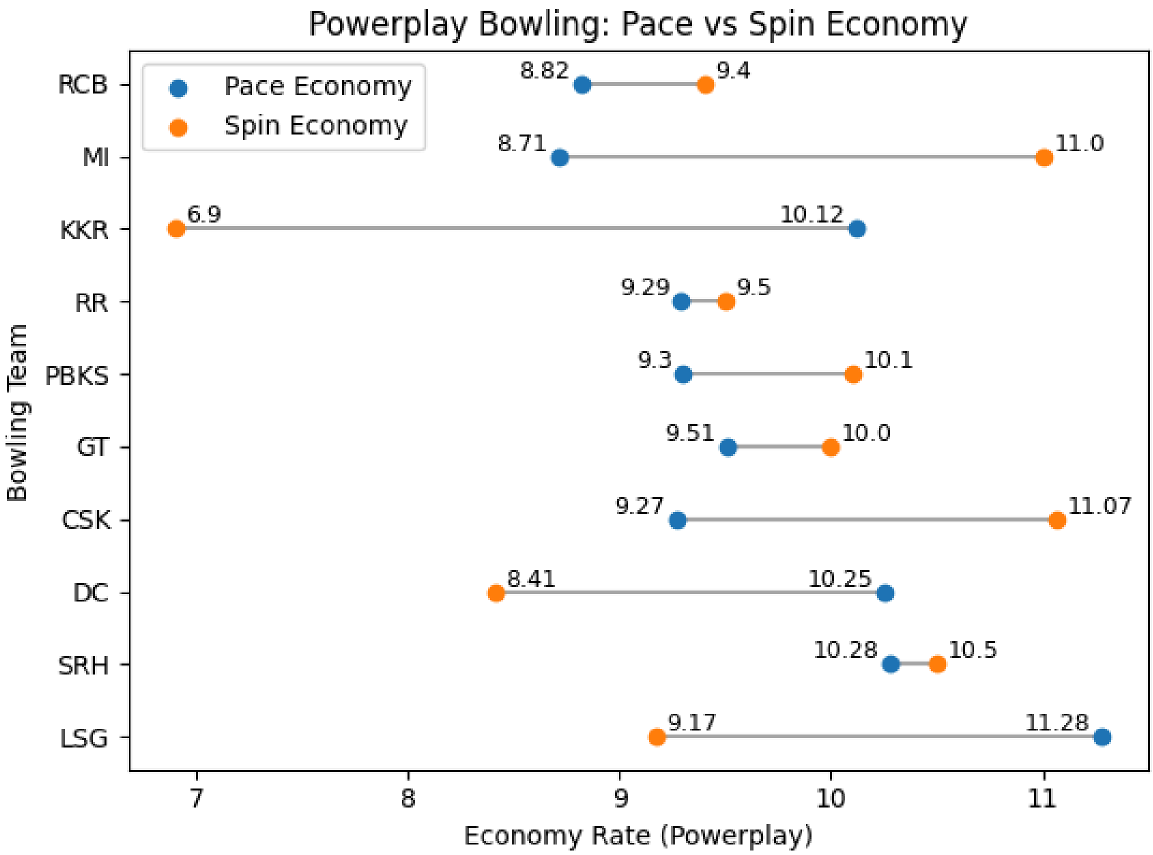


Dumbbell Chart — Pace vs Spin Economy

In [21]:

```
plt.figure()

# Draw dumbbell lines
plt.hlines(
    y=pp_team_economy["bowling_team"],
    xmin=pp_team_economy["pace_economy"],
    xmax=pp_team_economy["spin_economy"],
    color="gray",
    alpha=0.7
)

# Pace and spin dots
plt.scatter(
    pp_team_economy["pace_economy"],
```

```python
    pp_team_economy["bowling_team"],
    zorder=3,
    label="Pace Economy"
)

plt.scatter(
    pp_team_economy["spin_economy"],
    pp_team_economy["bowling_team"],
    zorder=3,
    label="Spin Economy"
)

plt.xlabel("Economy Rate (Powerplay)")
plt.ylabel("Bowling Team")
plt.title("Powerplay Bowling: Pace vs Spin Economy")

# Add values above the dumbbell, offset sideways
x_offset = 0.05  # horizontal spacing for labels

for _, row in pp_team_economy.iterrows():

    # Pace economy value (top-left)
    plt.text(
        row["pace_economy"] - x_offset,
        row["bowling_team"],
        f'{row["pace_economy"]}',
        ha="right",
        va="bottom",
        fontsize=9
    )

    # Spin economy value (top-right)
    plt.text(
        row["spin_economy"] + x_offset,
        row["bowling_team"],
        f'{row["spin_economy"]}',
        ha="left",
        va="bottom",
        fontsize=9
    )

plt.legend()
plt.tight_layout()
plt.show()
```



Powerplay Wickets by Pacers, Spinners & Overall (Team-wise)

In [22]:
```
# Load data
df = pd.read_csv("data/ipl2025.csv")


# Filter matches
df = df[df["match_no"] <= 70].copy()

# Define powerplay end over
df["pp_end_over"] = 5.6
df.loc[df["match_no"] == 34, "pp_end_over"] = 3.6

# Filter powerplay deliveries
pp_df = df[
    (df["over"] >= 0.1) &
    (df["over"] <= df["pp_end_over"])
].copy()

# Wicket definitions (final, verified)
bowler_wickets = [
    "caught", "bowled", "stumped", "lbw", "hit wicket"
]

team_wickets = [
    "caught", "bowled", "stumped", "lbw",
    "runout", "hit wicket", "retired out"
]

# Flags
```

```
pp_df["is_bowler_wicket"] = pp_df["wicket_type"].isin(bowler_wickets)
pp_df["is_team_wicket"] = pp_df["wicket_type"].isin(team_wickets)

# ---------- INNINGS COUNT ----------
innings_df = (
    pp_df
    .groupby(["match_no", "innings", "bowling_team"])
    .size()
    .reset_index(name="balls")
)

team_innings = (
    innings_df
    .groupby("bowling_team")
    .size()
    .reset_index(name="innings")
)

# ---------- PACERS ----------
pace_wickets = (
    pp_df[
        (pp_df["bowler_type"] == "pace") &
        (pp_df["is_bowler_wicket"])
    ]
    .groupby("bowling_team")
    .size()
    .reset_index(name="pace_wickets")
)

# ---------- SPINNERS ----------
spin_wickets = (
    pp_df[
        (pp_df["bowler_type"] == "spin") &
        (pp_df["is_bowler_wicket"])
    ]
    .groupby("bowling_team")
    .size()
    .reset_index(name="spin_wickets")
)

# ---------- TOTAL TEAM WICKETS ----------
total_team_wickets = (
    pp_df[
        pp_df["is_team_wicket"]
    ]
    .groupby("bowling_team")
    .size()
    .reset_index(name="total_wickets")
)

# ---------- COMBINE ----------
pp_team_wickets = (
    total_team_wickets
    .merge(team_innings, on="bowling_team", how="left")
    .merge(pace_wickets, on="bowling_team", how="left")
    .merge(spin_wickets, on="bowling_team", how="left")
)

pp_team_wickets[["pace_wickets", "spin_wickets"]] = (
    pp_team_wickets[["pace_wickets", "spin_wickets"]]
    .fillna(0)
    .astype(int)
)

# ---------- AVERAGE WICKETS ----------
pp_team_wickets["avg_wickets"] = (
    pp_team_wickets["total_wickets"] / pp_team_wickets["innings"]
).round(2)

# Sort by total wickets (most to least)
pp_team_wickets = pp_team_wickets.sort_values(
    "avg_wickets", ascending=False
)

# Index starts from 1
pp_team_wickets = pp_team_wickets.reset_index(drop=True)
pp_team_wickets.index = pp_team_wickets.index + 1

pp_team_wickets
```

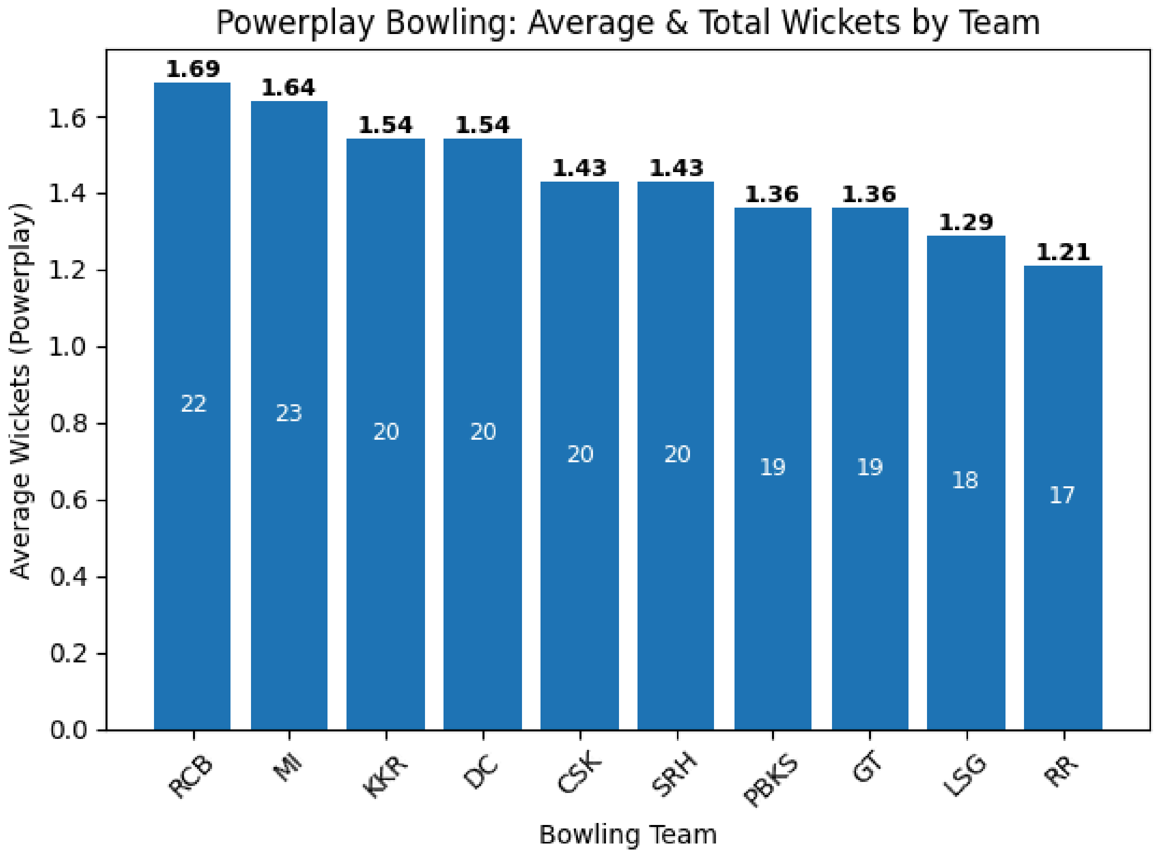
Out[22]:

	bowling_team	total_wickets	innings	pace_wickets	spin_wickets	avg_wickets
1	RCB	22	13	20	2	1.69
2	MI	23	14	22	1	1.64
3	KKR	20	13	14	6	1.54
4	DC	20	13	10	6	1.54
5	CSK	20	14	18	2	1.43
6	SRH	20	14	20	0	1.43
7	PBKS	19	14	15	4	1.36
8	GT	19	14	18	1	1.36
9	LSG	18	14	14	4	1.29
10	RR	17	14	15	1	1.21

Bar Chart: Powerplay Wickets (Average & Total)

In [23]:

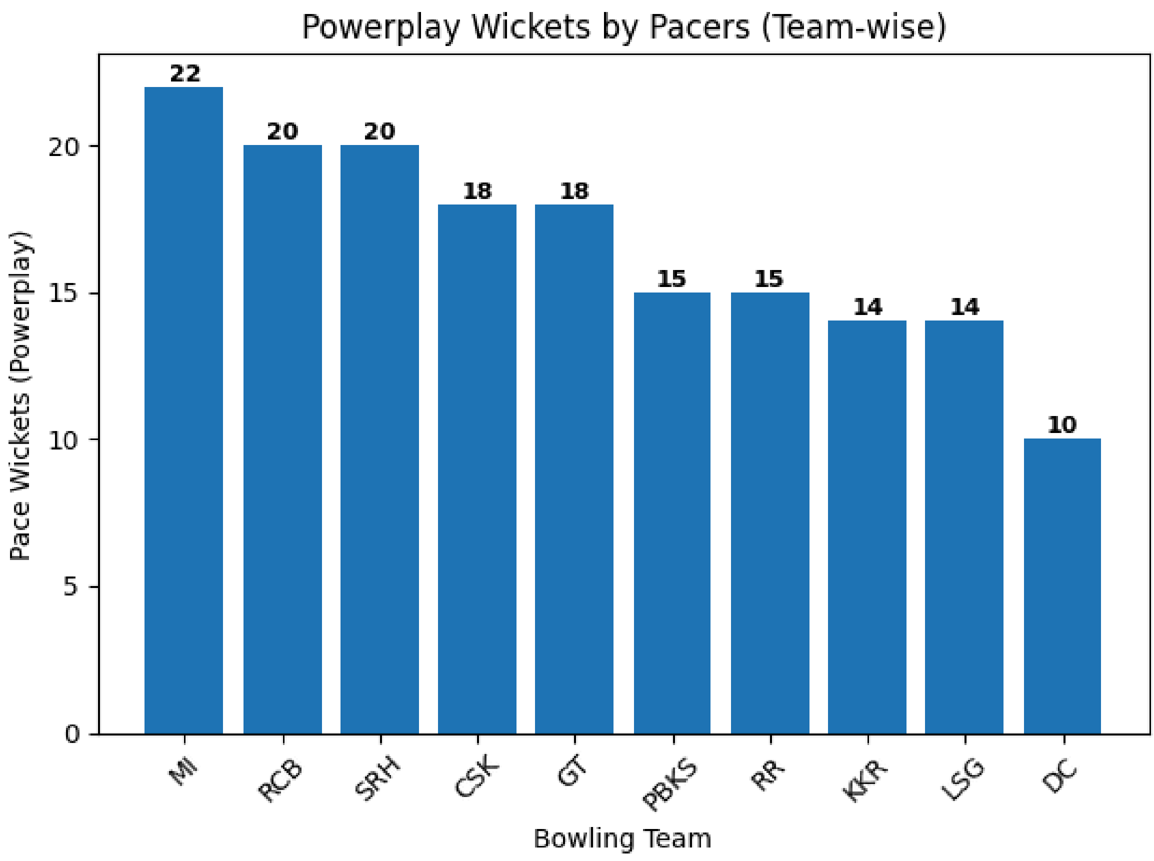
```
plt.figure()

bars = plt.bar(
    pp_team_wickets["bowling_team"],
    pp_team_wickets["avg_wickets"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Average Wickets (Powerplay)")
plt.title("Powerplay Bowling: Average & Total Wickets by Team")

plt.xticks(rotation=45)

# Annotations (SOP-compliant)
for bar, avg_wkts, total_wkts in zip(
    bars,
    pp_team_wickets["avg_wickets"],
    pp_team_wickets["total_wickets"]
):
    height = bar.get_height()

    # Average wickets on top of the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{avg_wkts}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

    # Total wickets inside the bar
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height / 2,
        f"{total_wkts}",
        ha="center",
        va="center",
        color="white",
        fontsize=9
    )

plt.tight_layout()
plt.show()
```



Bar Chart: Powerplay Wickets by Pacers

In [24]:

```
# Sort by pace wickets (high to low)
pace_df = pp_team_wickets.sort_values(
    "pace_wickets", ascending=False
)

plt.figure()

bars = plt.bar(
    pace_df["bowling_team"],
    pace_df["pace_wickets"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Pace Wickets (Powerplay)")
plt.title("Powerplay Wickets by Pacers (Team-wise)")

plt.xticks(rotation=45)

# Labels on top
for bar, val in zip(bars, pace_df["pace_wickets"]):
    height = bar.get_height()
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{val}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )

plt.tight_layout()
plt.show()
```

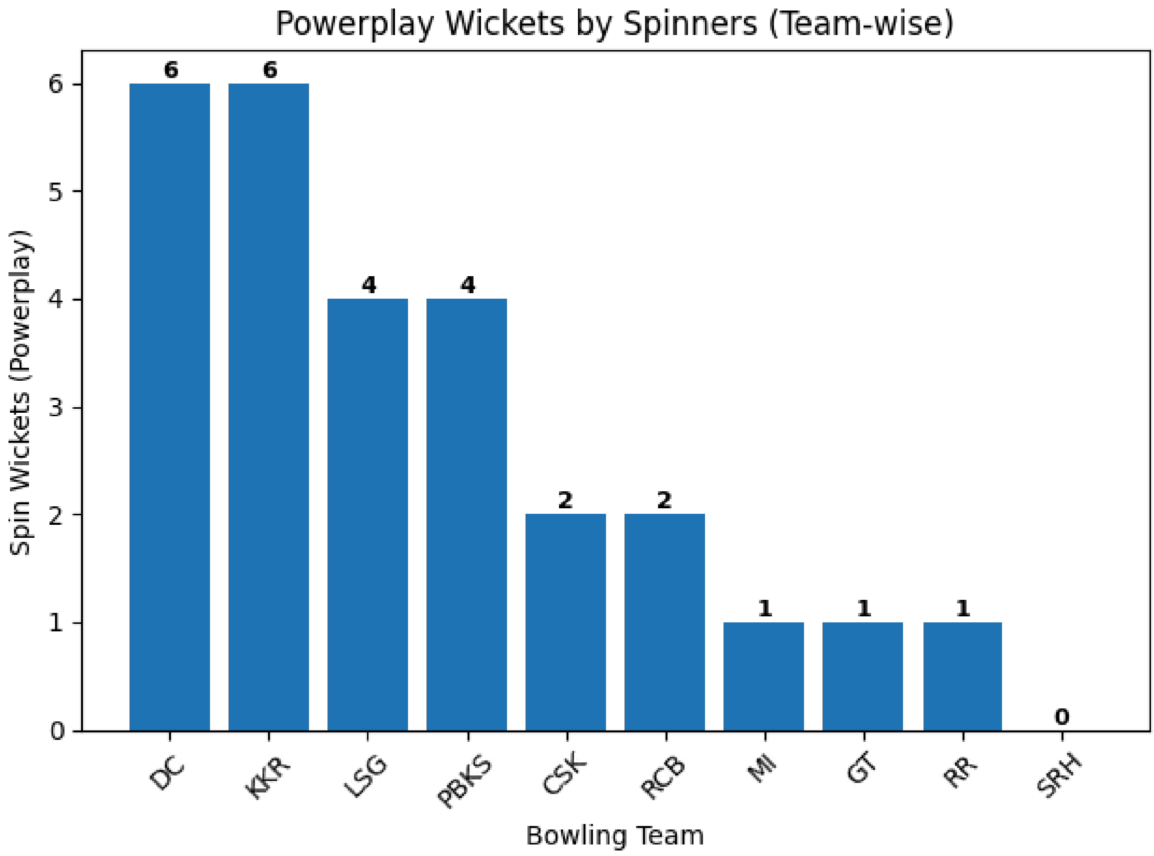


Bar Chart: Powerplay Wickets by Spinners

In [25]:

```python
# Sort by spin wickets (high to low)
spin_df = pp_team_wickets.sort_values(
    "spin_wickets", ascending=False
)

plt.figure()

bars = plt.bar(
    spin_df["bowling_team"],
    spin_df["spin_wickets"]
)

plt.xlabel("Bowling Team")
plt.ylabel("Spin Wickets (Powerplay)")
plt.title("Powerplay Wickets by Spinners (Team-wise)")

plt.xticks(rotation=45)

# Labels on top
for bar, val in zip(bars, spin_df["spin_wickets"]):
    height = bar.get_height()
    plt.text(
        bar.get_x() + bar.get_width() / 2,
        height,
        f"{val}",
        ha="center",
        va="bottom",
        fontsize=9,
        fontweight="bold"
    )
```

```
plt.tight_layout()
plt.show()
```


Powerplay Wickets by Spinners (Team-wise)
Spin Wickets (Powerplay)
Bowling Team
DC
KKR
LSG
PBKS
CSK
RCB
MI
GT
RR
SRH