Visual Insights & Correlation Analysis on Fuel Efficiency

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1. Objective

The purpose of this analysis is to guide management in selecting fuel-efficient cars for import. Using the `mtcars` dataset, we explored the distribution of fuel efficiency (MPG) and the relationship between MPG and other vehicle characteristics.

2. Dataset Overview

- Dataset: `mtcars` (default R dataset)

- Observations: 32 cars

- Variables: 11 (mpg, cyl, disp, hp, drat, wt, qsec, vs, am, gear, carb)

- Target Variable: MPG (Miles Per Gallon) – fuel efficiency

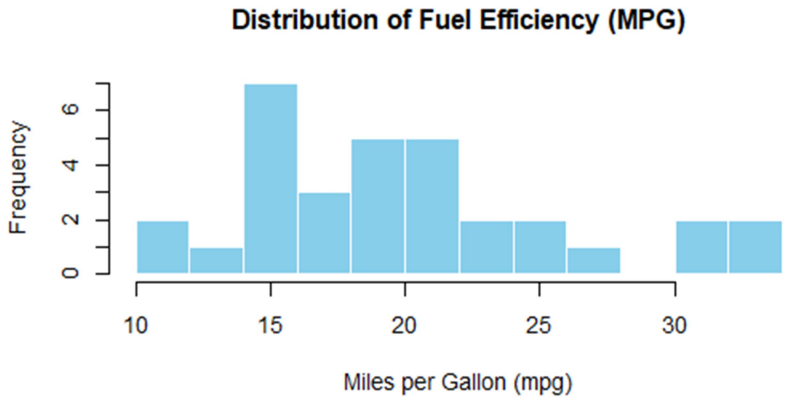
Summary Table :

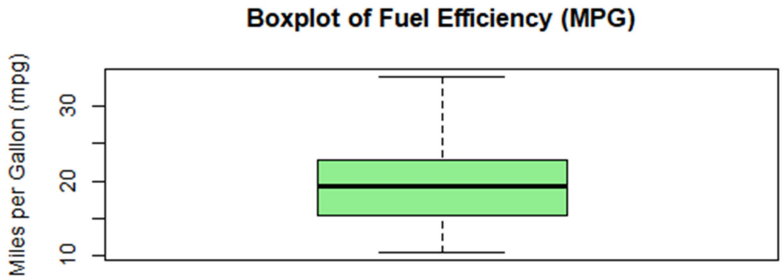
Statistic	MPG
Min	10.4
Mean	20.09
Max	33.9

Majority of cars have fuel efficiency in the 15–22 MPG range. High-MPG cars (>30 MPG) are few. Management should prioritize mid-to-high efficiency cars for cost-effective fuel consumption.

3. Distribution of MPG

Histogram / Boxplot of MPG

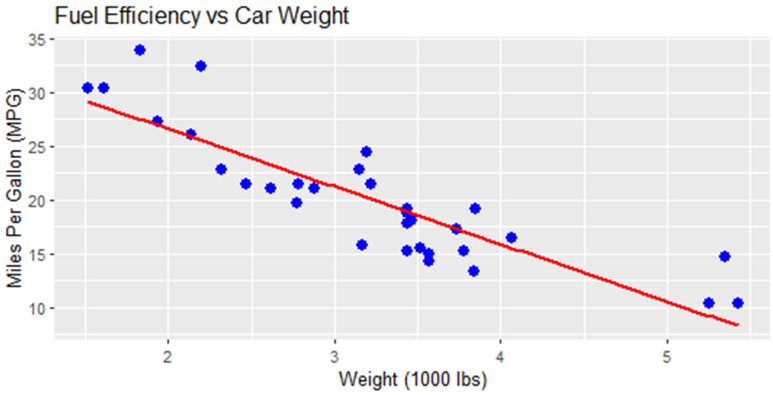




The histogram shows that most cars fall between 15–22 MPG. Boxplot highlights some high-efficiency outliers. Management takeaway: Very low MPG cars (<15) should be avoided due to high fuel consumption.

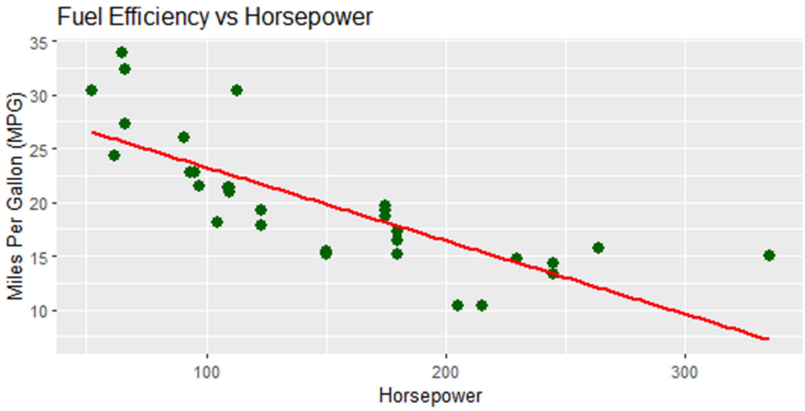
4. Relationship between MPG and Key Variables

4.1 MPG vs Weight (wt)



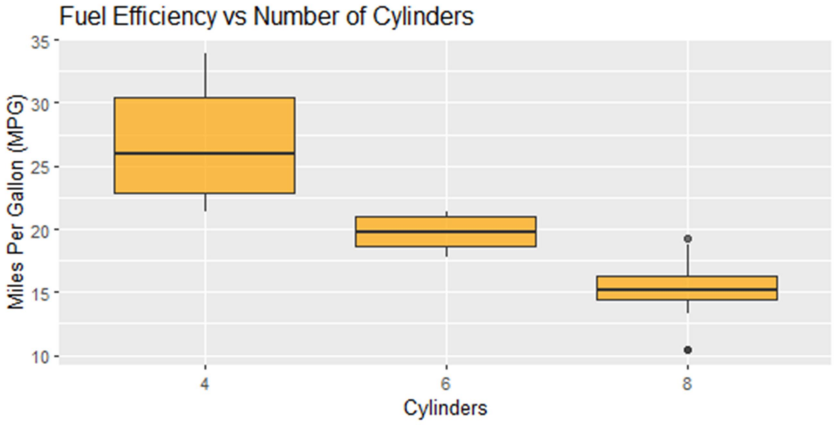
Heavier cars tend to have lower MPG. Management takeaway: Prioritize lighter cars for higher fuel efficiency.

4.2 MPG vs Horsepower (hp)



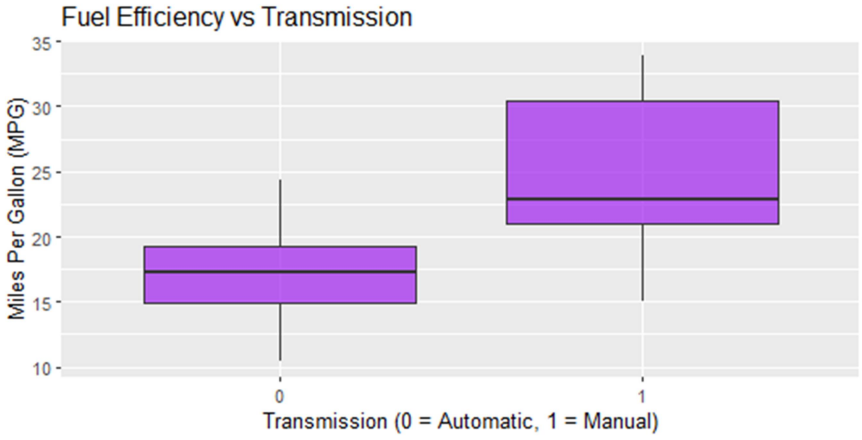
Cars with higher horsepower generally consume more fuel. Management takeaway: Avoid very high HP cars if fuel efficiency is critical.

4.3 MPG vs Cylinders (cyl)



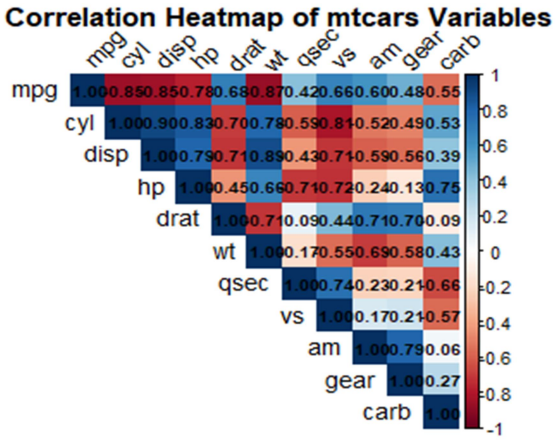
Cars with 6–8 cylinders have lower MPG than 4-cylinder cars. Management takeaway: Focus on 4-cylinder models for cost-efficient imports.

4.4 MPG vs Transmission (am)



Manual transmission cars (am=1) show higher average MPG. Management takeaway: Manual cars are preferred for fuel efficiency.

5. Correlation Analysis



Strong negative correlations with MPG: wt (-0.868), cyl (-0.852), disp (-0.848), hp (-0.776). Strong positive correlations: drat (+0.681), vs (+0.664), am (+0.600). Management takeaway: Light, small-engine, manual cars improve fuel efficiency.

6. Summary of Key Drivers of Fuel Efficiency

Variable	Correlation with MPG	Effect
Weight (wt)	-0.868	Higher weight → lower MPG
Cylinders (cyl)	-0.852	More cylinders → lower MPG
Displacement (disp)	-0.848	Larger engine → lower MPG
Horsepower (hp)	-0.776	More powerful → lower MPG
Rear axle ratio (drat)	+0.681	Higher ratio → higher MPG
Engine type (vs)	+0.664	V/S straight → higher MPG
Transmission (am)	+0.600	Manual → higher MPG

Weight, engine size, cylinder count, and horsepower are the main factors reducing MPG. Manual transmission, high drat, and certain engine types increase MPG. Management should consider these factors when making import decisions.

7. Recommendations for Management

1. Prioritize manual transmission cars for better fuel efficiency.

2. Select lightweight, small-engine cars (low weight, low displacement, 4 cylinders).

3. Avoid heavy, high horsepower, high-cylinder vehicles.

4. Use correlation heatmap and plots to quickly assess new car models.