Data Analytics Internship Program 2024

Final Project Presentation

Project Name : Analysing Impact of Gender Inequality on Economic Growth
Unique ID : IBM4204
Team Name : Tech Titans
College Name : Vivekananda Institute of Professional Studies

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TEAM MEMBERS

Rupashi Maurya

Riya Verma

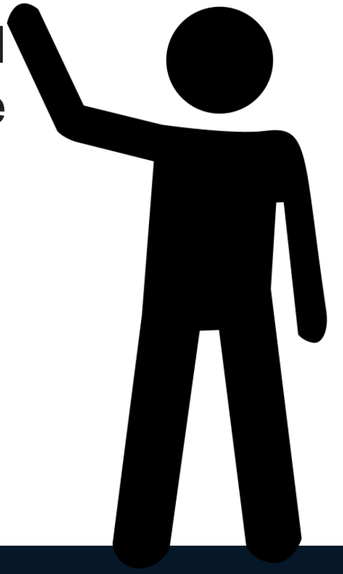
Prachi Kashyap

Ishita Sharma

INTRODUCTION

Overview of the Project

Gender inequality is a critical issue that affects various dimensions of society, including economic growth and development. In many regions, including India, disparities in education, labor force participation, political representation, and health outcomes persist, limiting the potential for comprehensive economic advancement. This project aims to analyze the impact of gender inequality on economic growth across various countries by leveraging data analytics and machine learning techniques. By examining key indicators such as female labor force participation, secondary education attainment, maternal mortality rate, and political representation, we seek to understand how gender disparities influence economic performance, measured by GNI per capita.



INTRODUCTION

Objective of the Project

The primary objective of this project is to analyze socio-economic data to understand the impact of gender inequality on economic growth and to propose data-driven strategies to promote gender equality and enhance economic development. The specific objectives are:

- To collect and analyze socio-economic data from reliable sources related to gender inequality and economic growth.
- To identify key areas where gender disparities are most pronounced and how they affect economic performance.
- To understand the temporal and spatial trends of gender inequality in relation to economic indicators.
- To develop predictive models that illustrate the potential economic outcomes of reducing gender inequality.
- To propose actionable strategies and policy recommendations to address gender disparities and promote inclusive economic growth.
- To assess the potential impact of these strategies on achieving SDG 5, SDG 8 and fostering sustainable economic development.

PROBLEM IDENTIFICATION

Problem Statement

Gender inequality continues to impede economic growth and development across the globe. Disparities in education, employment opportunities, wages, and political representation prevent women from fully participating in and contributing to the economy. This inequality not only undermines social justice but also hampers overall economic productivity and growth. Despite various initiatives and policies aimed at promoting gender equality, significant gaps persist. This project seeks to address this problem by analyzing socio-economic data to assess the extent and impact of gender inequality on economic growth, and by proposing actionable strategies to promote gender equality and inclusive economic development.

Significance of the Problem

Addressing gender inequality is crucial for unlocking the full potential of economic growth. When women have equal opportunities in education, employment, and political participation, economies benefit from increased productivity, innovation, and inclusive development. Reducing gender disparities can lead to higher household incomes, improved social well-being, and more resilient economies. Understanding and mitigating the economic impact of gender inequality is essential for achieving sustainable and equitable growth globally.

Relevant SDGs

This project addresses several Sustainable Development Goals (SDGs):

1. SDG 5: Gender Equality - Promotes gender equality and empowers all women and girls.
2. SDG 8: Decent Work and Economic Growth - Encourages inclusive and sustainable economic growth, full and productive employment, and decent work for all.

DATA COLLECTION

Data Source- Data is taken from Kaggle.

Link-https://www.kaggle.com/datasets/gianinamariapetrascu/gender-inequality-index/data and https://www.kaggle.com/datasets/iamsouravbanerjee/gross-national-income-per-capita

	Country	Human_development	GII	Rank	Maternal_mortality	Adolescent_birth_rate	Seats_parliament	F_secondary_educ	M_secondary_educ	F_Labour_force	M_Labour_force	HDI Rank (2021)	Gross National Income Per Capita (2021)
0	Denmark	Very high	0.013	1.0	4.0	1.9	39.7	95.1	95.2	57.7	66.7	6.0	60364.785950
1	Norway	Very high	0.016	2.0	2.0	2.3	45.0	99.1	99.3	60.3	72.0	2.0	64660.106220
2	Switzerland	Very high	0.018	3.0	5.0	2.2	39.8	96.9	97.5	61.7	72.7	1.0	66933.004540
3	Sweden	Very high	0.023	4.0	4.0	3.3	47.0	91.8	92.2	61.7	68.0	7.0	54489.374010
4	Netherlands	Very high	0.025	5.0	5.0	2.8	39.1	89.8	92.7	62.4	71.3	10.0	55979.411000
...	...	...	...	...	...	...	...	...	...	...	...	...	...
161	Central African Republic	Low	0.672	166.0	829.0	160.5	12.9	13.9	31.6	63.3	79.5	188.0	966.058611
162	Afghanistan	Low	0.678	167.0	638.0	82.6	27.2	6.4	14.9	14.8	66.5	180.0	1824.190915
163	Nigeria	Low	0.680	168.0	917.0	101.7	4.5	40.4	55.3	47.9	59.6	163.0	4790.284425
164	Papua New Guinea	Medium	0.725	169.0	145.0	55.3	0.0	10.8	15.5	46.3	48.1	156.0	4008.623573
165	Yemen	Low	0.820	170.0	164.0	54.4	0.3	22.4	37.5	6.0	67.6	183.0	1314.270189

166 rows × 13 columns

DATA COLLECTION

Data Description:

The Gender Inequality Index (GII) dataset provides a comprehensive measure of gender inequality across countries, capturing gender disparities in health, education, and economic opportunities. This dataset includes GII scores, as well as component scores for each indicator, for over 190 countries, in 2021.

Gross National Income Per Capita dataset contains Gross National Income Per Capita of all countries for year 2021.

Features:

- **Country-** Names of Countries
- **GII-** Developed by the United Nations Development Programme (UNDP), the GII measures gender inequality by analyzing health, empowerment, and labor market participation indicators.
- **Rank-** Countries Rank according to GII.
- **Maternal Mortality Ratio-** Number of deaths due to pregnancy-related causes per 100,000 live births.
- **Adolescent Birth Rate-** Annual number of births to females aged 10-14 or 15-19 years per 1,000 females in the respective age group.
- **Human Development Index-** HDI is a composite index that measures average achievement in human development taking into account three indicators: Life expectancy at birth (Sustainable Development Goal (SDG) 3), Expected years of schooling (SDG 4.3) and Mean years of schooling (SDG 4.4), Gross national income (GNI) (SDG 8.5).
- **Women Seats in Parliament, Female Secondary Education, Male Secondary Education, Female Labour Force Participation Rate, Male Labour Force Participation Rate.**
- **GNI Per Capita**

DATA PREPROCESSING

DATA CLEANING

Inspecting Data

Checking null values-

```
# Inspect the dataset
print(df.info())
```

✓ 0.0s

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 195 entries, 0 to 194
Data columns (total 11 columns):
 #   Column                 Non-Null Count  Dtype  
---  ------                 --------------  -----  
 0   Country                195 non-null    object 
 1   Human_development      191 non-null    object 
 2   GII                    170 non-null    float64
 3   Rank                   170 non-null    float64
 4   Maternal_mortality     184 non-null    float64
 5   Adolescent_birth_rate  195 non-null    float64
 6   Seats_parliament       193 non-null    float64
 7   F_secondary_educ       177 non-null    float64
 8   M_secondary_educ       177 non-null    float64
 9   F_Labour_force         180 non-null    float64
 10  M_Labour_force         180 non-null    float64
dtypes: float64(9), object(2)
memory usage: 16.9+ KB
None
```

HANDLING MISSING VALUES

Removing rows with Null Values-

```
# Handle missing values
df = df.dropna()  # For simplicity, dropping rows with missing values
```

✓ 0.0s

DATASET AFTER HANDLING MISSING VALUES

```
print(df.info())
```

✓ 0.0s

```
<class 'pandas.core.frame.DataFrame'>
Index: 170 entries, 0 to 190
Data columns (total 11 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Country                170 non-null    object
 1   Human_development      170 non-null    object
 2   GII                    170 non-null    float64
 3   Rank                   170 non-null    float64
 4   Maternal_mortality     170 non-null    float64
 5   Adolescent_birth_rate  170 non-null    float64
 6   Seats_parliament       170 non-null    float64
 7   F_secondary_educ       170 non-null    float64
 8   M_secondary_educ       170 non-null    float64
 9   F_Labour_force         170 non-null    float64
 10  M_Labour_force         170 non-null    float64
dtypes: float64(9), object(2)
memory usage: 15.9+ KB
None
```

DATA TRANSFORMATION

MERGING DATASETS

```
# Merge the datasets on the 'Country' column
df_combined = pd.merge(df, df_gdp, on='Country', how='inner')
```

✓ 0.0s Python

```
df_combined
```

✓ 0.0s Python

	Country	Human_development	GII	Rank	Maternal_mortality	Adolescent_birth_rate	Seats_parliament	F_secondary_educ	M_secondary_educ	F_Labour_force	M_Labour_force	HDI Rank (2021)	Gross National Income Per Capita (2021)
0	Denmark	Very high	0.013	1.0	4.0	1.9	39.7	95.1	95.2	57.7	66.7	6.0	60364.785950
1	Norway	Very high	0.016	2.0	2.0	2.3	45.0	99.1	99.3	60.3	72.0	2.0	64660.106220
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4	Netherlands	Very high	0.025	5.0	5.0	2.8	39.1	89.8	92.7	62.4	71.3	10.0	55979.411000
…	…	…	…	…	…	…	…	…	…	…	…	…	…
161	Central African Republic	Low	0.672	166.0	829.0	160.5	12.9	13.9	31.6	63.3	79.5	188.0	966.058611
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164	Papua New Guinea	Medium	0.725	169.0	145.0	55.3	0.0	10.8	15.5	46.3	48.1	156.0	4008.623573
165	Yemen	Low	0.820	170.0	164.0	54.4	0.3	22.4	37.5	6.0	67.6	183.0	1314.270189

166 rows × 13 columns

STANDARDIZATION (For KNN Model)

```
# Split the data into training and testing sets
X1_train, X1_test, y1_train, y1_test = train_test_split(X1, y1, test_size=0.2, random_state=42)

# Standardize the features
scaler1 = StandardScaler()
X1_train_scaled = scaler1.fit_transform(X1_train)
X1_test_scaled = scaler1.transform(X1_test)
```

FEATURE SELECTION

```
df_gdp = pd.read_csv(r"C:\Users\AKSHAT\Downloads\Gross National Income Per Capita.csv")
```
✓ 0.0s

39 columns

```
df_gdp.head()
```
✓ 0.0s

	ISO3	Country	Continent	Hemisphere	Human Development Groups	UNDP Developing Regions	HDI Rank (2021)	Gross National Income Per Capita (1990)	Gross National Income Per Capita (1991)	Gross National Income Per Capita (1992)	...	Gross National Income Per Capita (2012)	Gross National Income Per Capita (2013)	Gross National Income Per Capita (2014)	Gross National Income Per Capita (2015)	Gross National Income Per Capita (2016)	Gross National Income Per Capita (2017)	Gross National Income Per Capita (2018)
0	AFG	Afghanistan	Asia	Northern Hemisphere	Low	SA	180.0	2684.550019	2276.289409	2059.868084	...	2125.862821	2193.553936	2178.507021	2101.589319	2077.566899	2085.487571	2054.939895
1	AGO	Angola	Africa	Southern Hemisphere	Medium	SSA	148.0	4845.706901	5405.349257	2073.902390	...	7280.845666	7478.104777	7704.231949	7652.656486	7189.426672	6861.575738	6381.521946
2	ALB	Albania	Europe	Northern Hemisphere	High	ECA	67.0	4742.215529	3358.087827	3080.746654	...	11146.263030	11552.982470	11691.648290	12016.297600	12484.624200	12802.148310	13302.705960
3	AND	Andorra	Europe	Northern Hemisphere	Very High	NaN	40.0	43773.146500	43175.147600	41935.787200	...	47126.814610	46385.095200	48483.720320	49936.874540	52267.738320	52650.225760	53483.306630
4	ARE	United Arab Emirates	Asia	Northern Hemisphere	Very High	AS	26.0	102433.136000	96250.290360	93043.477370	...	57445.954750	60005.695360	62573.505310	65577.512240	66881.329740	67667.508460	67195.095230

5 rows × 39 columns

```
df_gdp  =df_gdp [['Country','HDI Rank (2021)', 'Gross National Income Per Capita (2021)']]
```
✓ 0.0s

```
df_gdp.head()
```
✓ 0.0s

3 columns

	Country	HDI Rank (2021)	Gross National Income Per Capita (2021)
0	Afghanistan	180.0	1824.190915
1	Angola	148.0	5465.617791
2	Albania	67.0	14131.110390
3	Andorra	40.0	51166.626610
4	United Arab Emirates	26.0	62573.591810

Reducing the input variable to the dataset by using only relevant data

DATA ANALYSIS

Descriptive Analysis Using describe() function

```
df_combined.describe()
```

✓ 0.0s

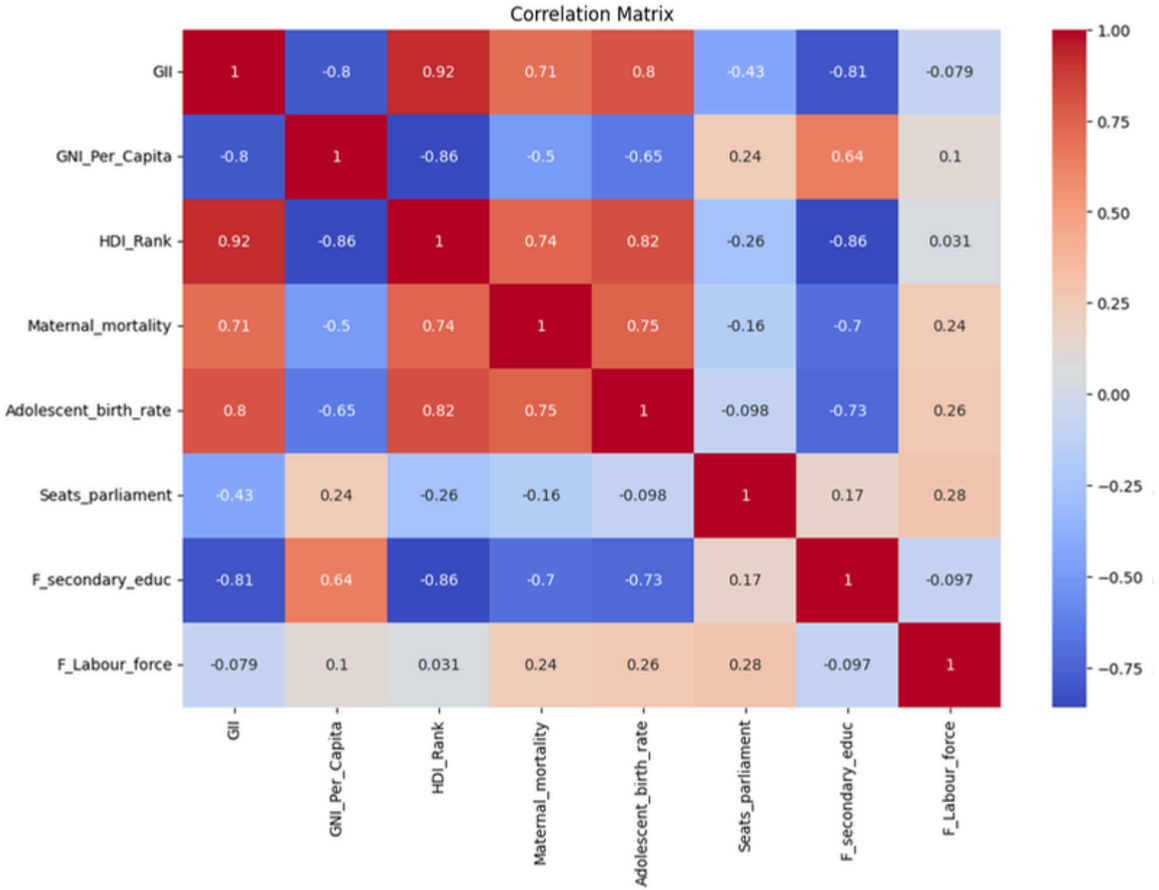
	GII	Rank	Maternal_mortality	Adolescent_birth_rate	Seats_parliament	F_secondary_educ	M_secondary_educ	F_Labour_force	M_Labour_force	HDI Rank (2021)	Gross National Income Per Capita (2021)
count	166.000000	166.000000	166.000000	166.000000	166.000000	166.000000	166.000000	166.000000	166.000000	166.000000	166.000000
mean	0.342904	85.018072	155.855422	44.689759	25.527711	62.438554	66.782530	50.321084	69.996386	94.722892	19819.711796
std	0.197911	49.370642	233.686692	39.103850	12.393721	30.004300	26.882138	15.293991	8.539242	55.849541	19879.507589
min	0.013000	1.000000	2.000000	1.900000	0.000000	6.400000	13.000000	6.000000	43.900000	1.000000	731.786709
25%	0.169500	42.250000	10.250000	10.625000	16.875000	36.875000	44.250000	42.725000	65.200000	46.250000	4580.654231
50%	0.363000	85.500000	46.000000	34.650000	24.550000	69.700000	70.750000	52.150000	69.500000	93.000000	12463.753275
75%	0.505750	127.750000	181.500000	64.725000	34.675000	91.025000	92.700000	60.375000	75.375000	143.750000	30106.038932
max	0.820000	170.000000	1150.000000	170.500000	55.700000	100.000000	100.000000	82.500000	95.500000	191.000000	90918.644710

Key Findings :

The dataset summary reveals that the average maternal mortality is approximately 155.86 per 100,000 live births, and the mean adolescent birth rate is around 44.69 per 1,000 women. Additionally, on average, women hold 25.53% of parliamentary seats, and there is a notable disparity between female and male secondary education rates, with means of 62.44% and 66.78%, respectively.

DATA ANALYSIS

Heatmap Correlation of each feature in the dataset **(Correlation Analysis)**

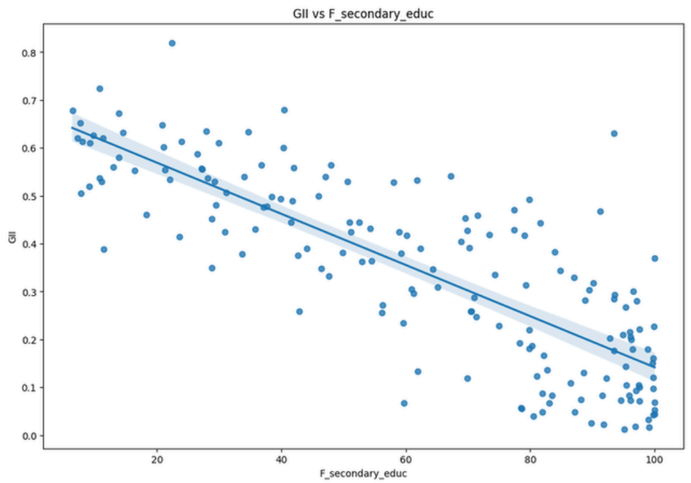


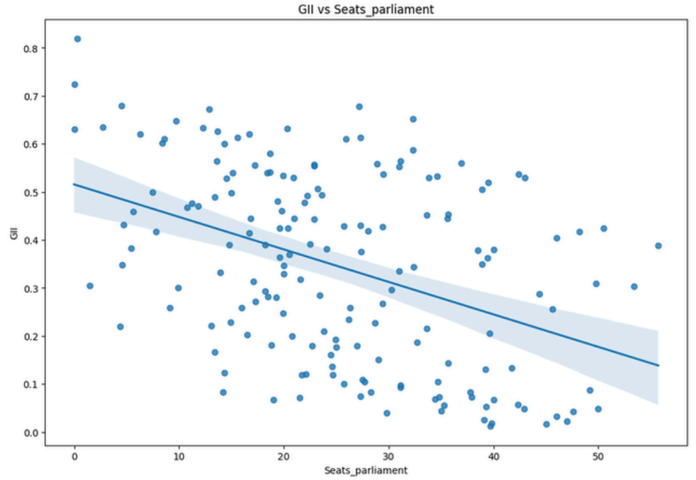
Key Findings :

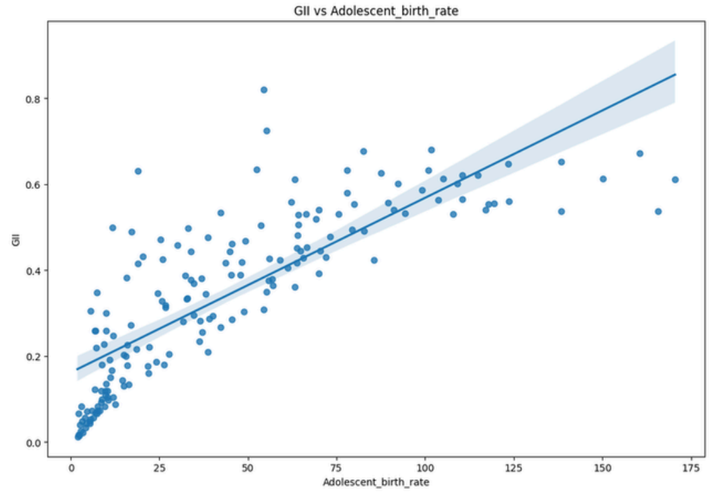
1. Gender Inequality Index (GII) and Economic Indicators:
   - GII vs. GNI Per Capita: Strong negative correlation (-0.81). Higher gender inequality is linked to lower GNI Per Capita.
   - GII vs. HDI Rank: Strong positive correlation (0.91). Higher gender inequality is linked to lower human development.
   - GII vs. Maternal Mortality: Strong positive correlation (0.78). Higher gender inequality is linked to higher maternal mortality.
2. Education and Labour Force Participation:
   - Female Secondary Education vs. GNI Per Capita: Strong positive correlation (0.61). Higher female education is linked to higher GNI Per Capita.
   - Female Labour Force Participation vs. GNI Per Capita: Positive but weak correlation (0.19). Some positive impact on GNI Per Capita.
3. Adolescent Birth Rate and Economic Indicators:
   - Adolescent Birth Rate vs. GNI Per Capita: Strong negative correlation (-0.69). Higher adolescent birth rates are linked to lower GNI Per Capita.
   - Adolescent Birth Rate vs. HDI Rank: Strong positive correlation (0.81). Higher adolescent birth rates are linked to lower human development.
4. Political Participation:
   - Seats in Parliament vs. GNI Per Capita: Weak positive correlation (0.28). Potential positive impact on GNI Per Capita.
   - Seats in Parliament vs. GII: Moderate negative correlation (-0.4). Higher political representation of women is linked to lower gender inequality.

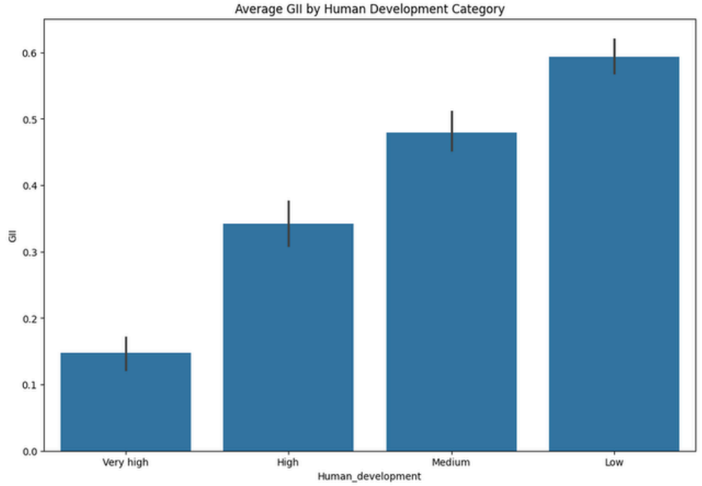
DATA ANALYSIS

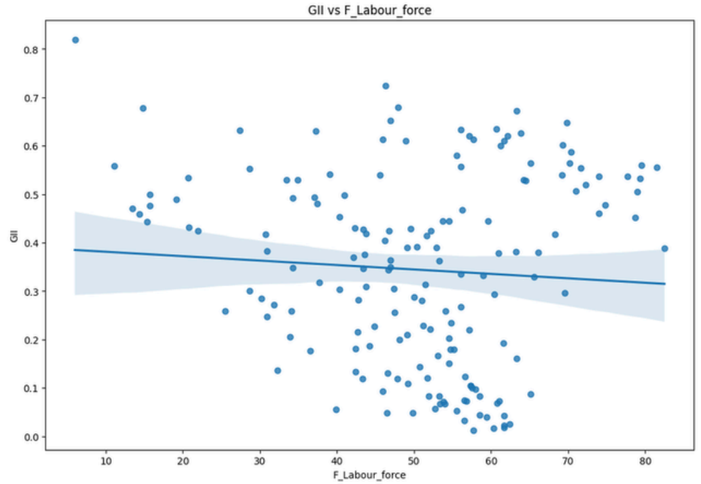
Factors Affecting GII (Using **Regression Analysis** and Bar Graph)-

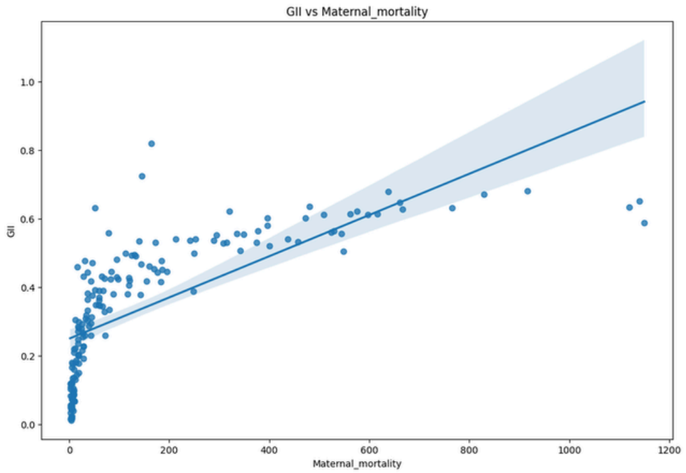












MACHINE LEARNING MODEL

```
# Select relevant columns
df_model = df_combined[['GII', 'GNI_Per_Capita', 'HDI_Rank']]  # Adjust columns as needed


# Define the feature matrix X and the target vector y
X = df_model[['GII', 'HDI_Rank']]
y = df_model['GNI_Per_Capita']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Initialize and train the model
model = LinearRegression()
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)
```

✓ 0.0s

```
# Evaluate the model
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print(f"Mean Squared Error: {mse}")
print(f"R^2 Score: {r2}")
```

✓ 0.0s

```
Mean Squared Error: 44697439.65382441
R^2 Score: 0.8297065498094043
```

Linear Regression Model Key Findings-

- Model Performance: The Linear Regression model achieves an R^2 score of approximately 0.83, indicating that the model explains about 83% of the variance in GNI Per Capita based on GII and HDI Rank. This suggests a strong but slightly lower predictive power compared to the KNN model.
- Mean Squared Error: The mean squared error (MSE) is approximately 44,697,349, which indicates the average squared difference between the predicted and actual GNI Per Capita values. While this value is large due to the scale of GNI Per Capita, the R^2 score provides better context for the model's accuracy.
- Overall, while the Linear Regression model shows a strong relationship between the selected socio-economic indicators (GII, HDI Rank) and economic output.

MACHINE LEARNING MODEL

```python
# Define the feature matrix X and the target vector y
X = df_knn[['GII', 'HDI_Rank']]
y = df_knn['GNI_Per_Capita']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Standardize the features
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

# Initialize and train the KNN model
knn = KNeighborsRegressor(n_neighbors=5)
knn.fit(X_train_scaled, y_train)

# Make predictions
y_pred = knn.predict(X_test_scaled)

# Evaluate the model
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print(f"Mean Squared Error: {mse}")
print(f"R^2 Score: {r2}")
```

✓ 0.0s

```
Mean Squared Error: 29240778.60148078
R^2 Score: 0.8885951161213896
```

KNN Model Key Findings-

- Model Performance: The KNN regression model achieves an R^2 score of approximately 0.89, indicating that the model explains about 89% of the variance in GNI Per Capita based on GII and HDI Rank. This suggests a strong predictive power of the selected features.
- Mean Squared Error: The mean squared error (MSE) of approximately 29,240,778 indicates the average squared difference between the predicted and actual GNI Per Capita values. This value is higher compared to the KNN model's MSE, suggesting that the Linear Regression model is less accurate.
- Overall, the model shows a strong relationship between the selected socio-economic indicators (GII, HDI Rank) and economic output, the KNN model performed better in terms of predictive accuracy.

HYPOTHESIS DEVELOPMENT

Formulated Hypothesis:

Hypothesis: Higher gender inequality negatively impacts economic growth, as measured by GNI per capita.

Implementation of policies to promote women employment and reducing gender gaps in labor force and education can have a great impact on economic performance. By analyzing data on gender disparities in education, employment, and political representation across various regions, we quantified how these inequalities hinder Economic Growth.

Rationale Behind the Hypothesis:

Economic Participation and Productivity:

Gender inequality can limit women's participation in the labor force, leading to a reduced talent pool and lower overall productivity.

Countries with higher gender equality often see higher economic growth due to better utilization of human capital.

Health and Human Development:

Higher maternal mortality and adolescent birth rates can reflect poor health infrastructure and lower overall economic productivity.

Better health outcomes contribute to a more stable and productive workforce.

Education:

Female education is linked to numerous economic benefits, including higher earning potential, improved family health, and lower birth rates.

Educated women are more likely to participate in the labor market and contribute to economic growth.

Political and Social Stability:

Higher female participation in politics and decision-making can lead to more comprehensive and inclusive policies, fostering a stable and conducive environment for economic growth.

SOLUTION DESIGN

Proposed Solution
To address the impact of gender inequality on economic growth, we propose a multifaceted solution that includes policy reforms, educational programs, and economic incentives designed to improve gender equality. Key components include:

1. Policy Reforms: Implement laws and policies that promote gender equality in education, workforce participation, and political representation.
2. Educational Programs: Increase access to secondary and tertiary education for girls and women, with a focus on STEM fields.
3. Economic Incentives: Provide financial incentives for companies that demonstrate gender equality in their workforce and leadership positions.

Implementation Plan
Policy Development:
- Develop gender-focused policies aimed at reducing maternal mortality and adolescent birth rates.
- Enforce equal pay regulations and promote women's participation in high-growth industries.

Educational Initiatives:
- Invest in educational programs targeting girls and young women, particularly in underrepresented fields such as STEM.
- Provide scholarships and financial aid to encourage higher female enrollment in secondary and tertiary education.

Economic Programs:
- Create programs that support female entrepreneurs and women-owned businesses.
- Implement workplace policies that support work-life balance, such as maternity leave and flexible working hours.

Monitoring and Evaluation:
- Establish a monitoring framework to assess the effectiveness of implemented policies and programs.
- Regularly publish reports and data to track progress and make necessary adjustments.

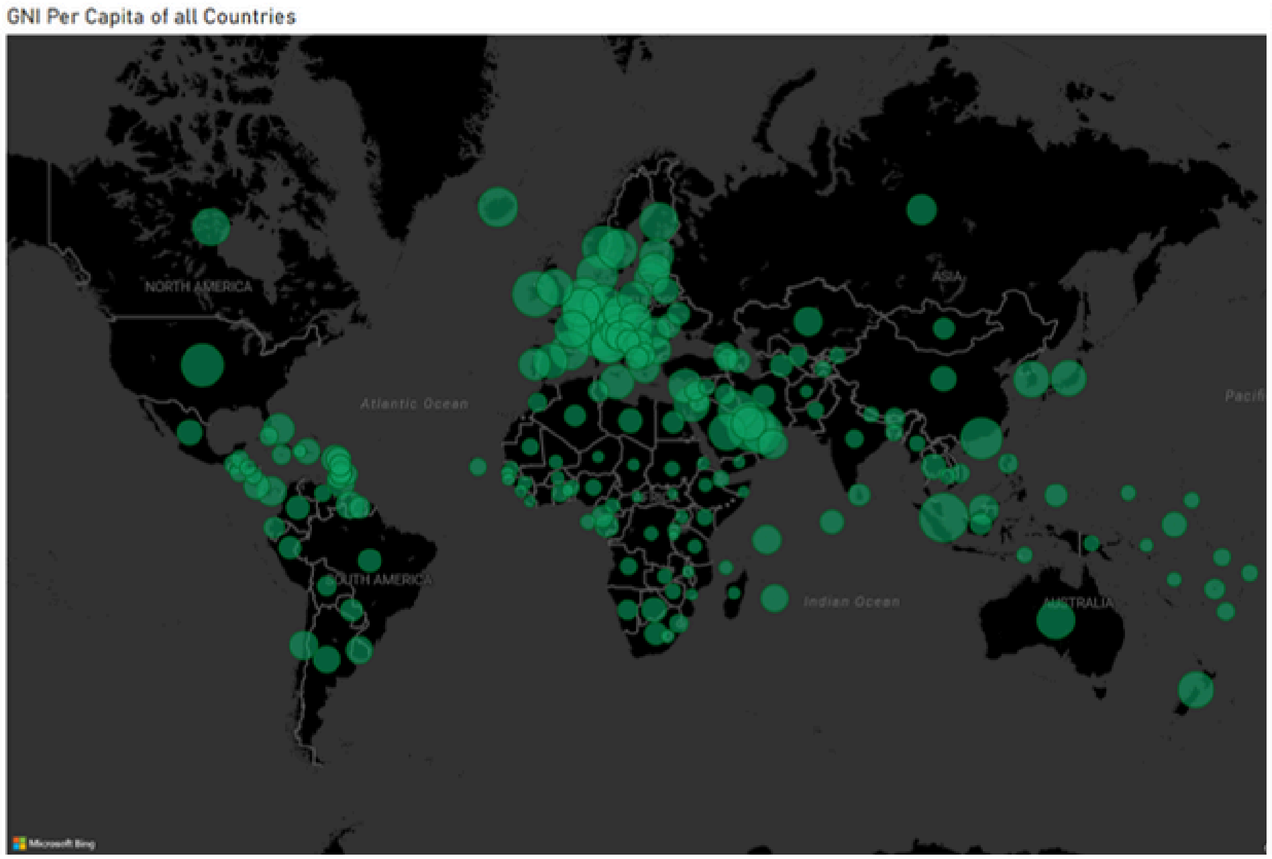
Alignment with SDGs
The proposed solution aligns with several Sustainable Development Goals (SDGs), including:

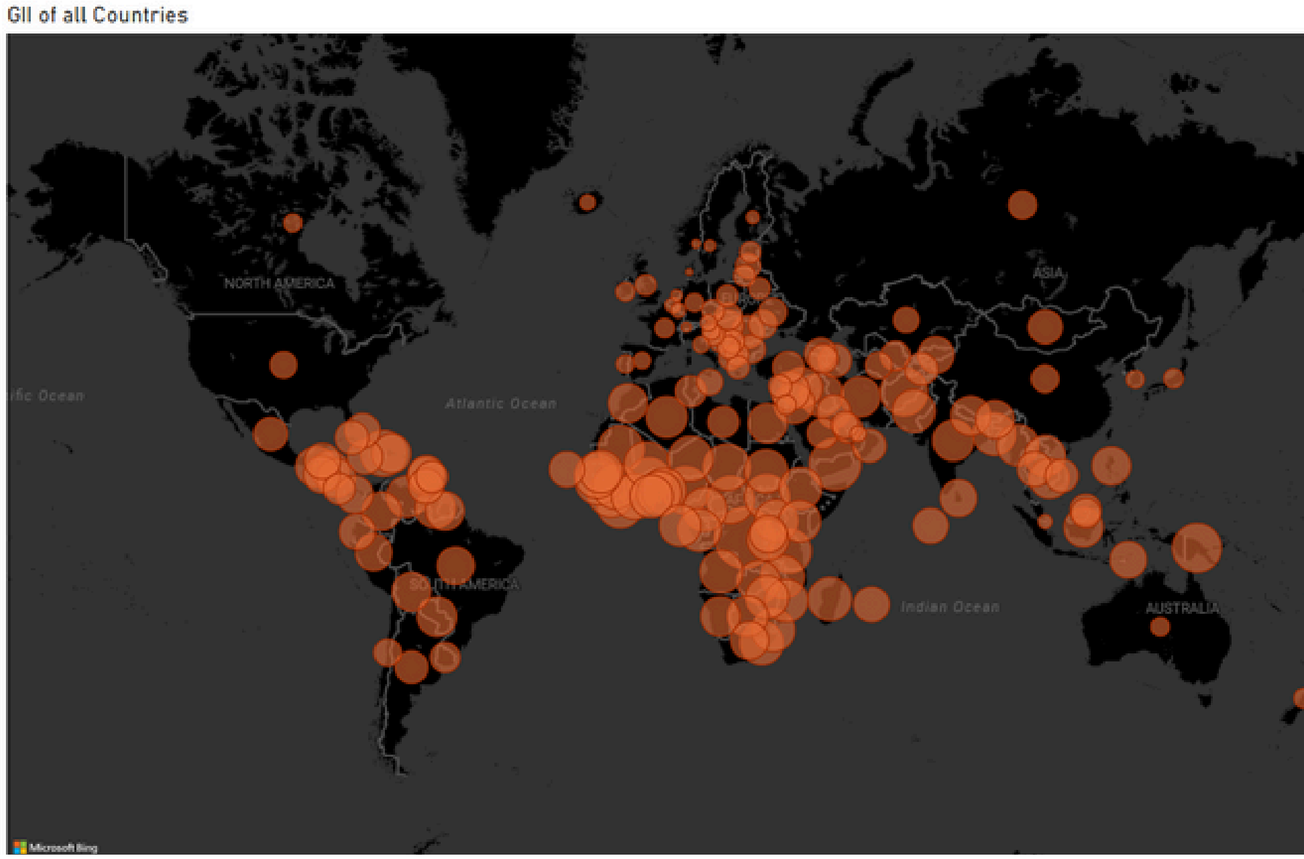
- SDG 5: Gender Equality: The core focus of the project is to achieve gender equality and empower all women and girls.
- SDG 8: Decent Work and Economic Growth: Promoting gender equality in the workforce can enhance economic productivity and growth.

By implementing this comprehensive solution, we aim to create a more equitable society where gender equality drives sustainable economic growth and development.

VISUALIZATION

Visualizing GNI Per Capita and GII Data





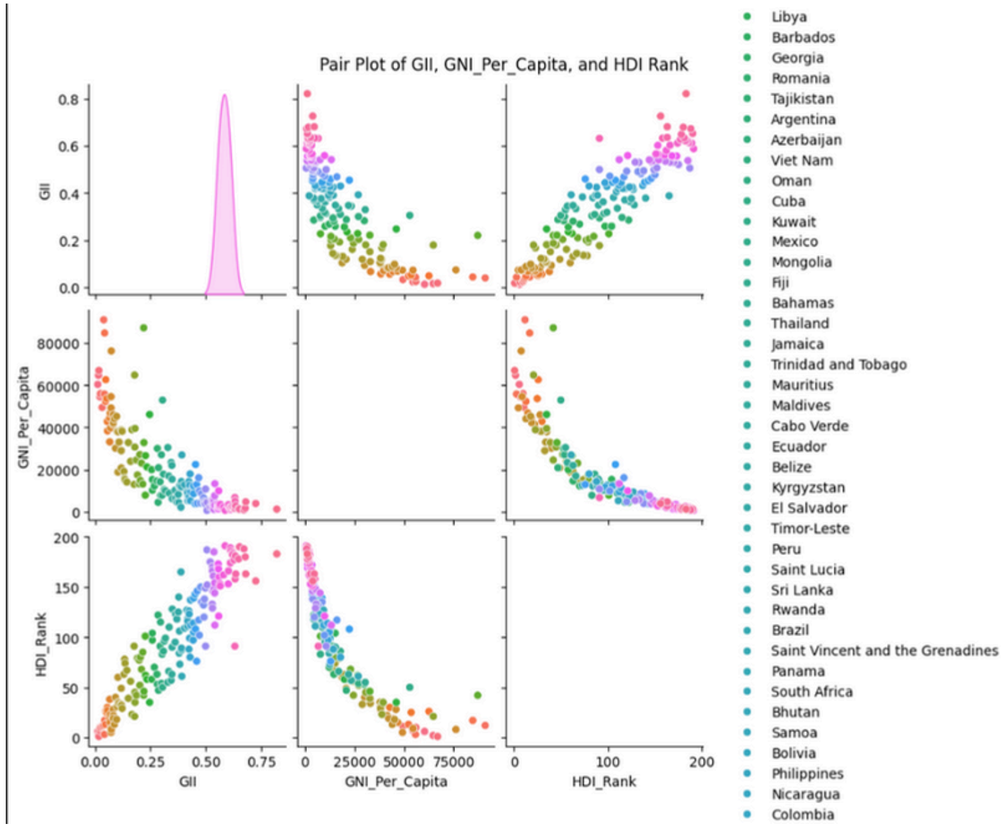
It is visible that countries with low GNI Per Capita have high GII and countries with high GNI Per Capita have low GII

VISUALIZATION

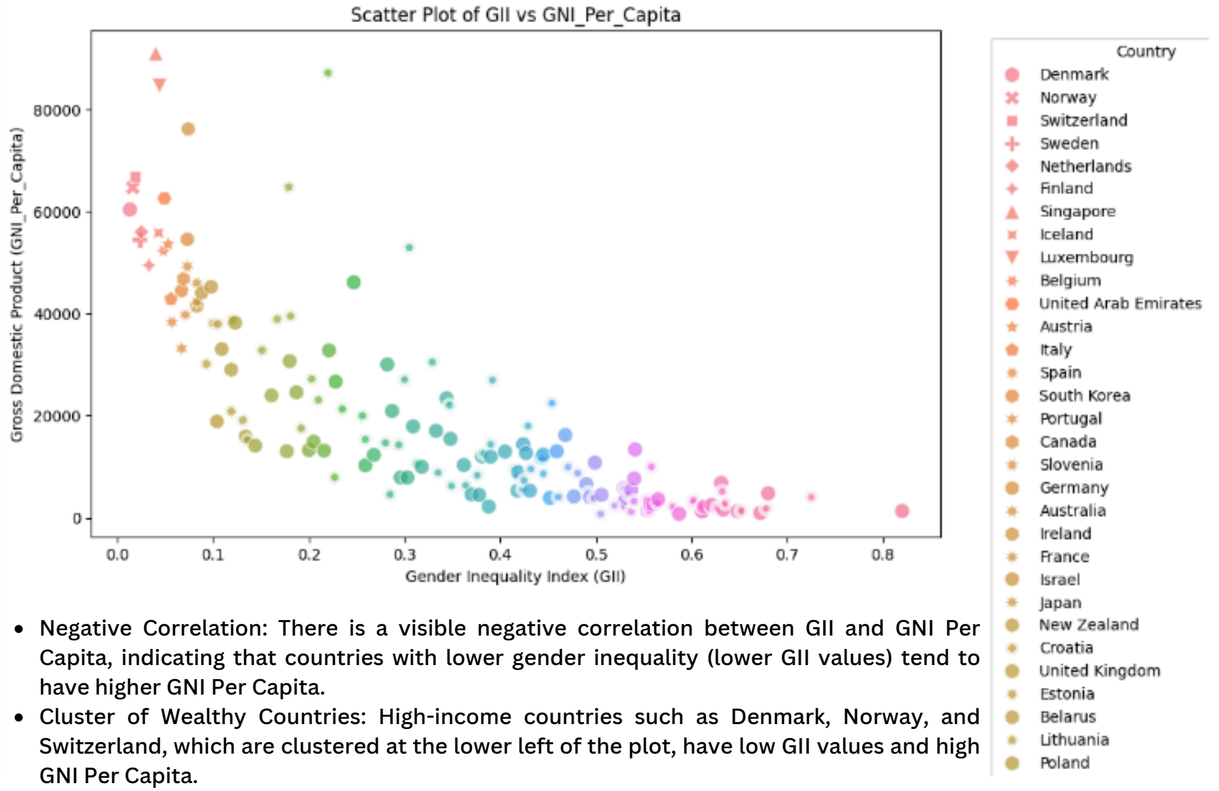
Pair Plot and Scatter Plot

```
# Pair plot for multiple variables
sns.pairplot(df_combined, vars=['GII', 'GNI_Per_Capita', 'HDI_Rank'], hue='Country')
plt.suptitle('Pair Plot of GII, GNI_Per_Capita, and HDI Rank', y=1.02)
plt.show()
```

✓ 4.7s




```
# Scatter plot for GII vs GDP
plt.figure(figsize=(10, 6))
sns.scatterplot(data=df_combined, x='GII', y='GNI_Per_Capita', hue='Country',style='Country', alpha=0.7, s=100)
plt.title('Scatter Plot of GII vs GNI_Per_Capita')
plt.xlabel('Gender Inequality Index (GII)')
plt.ylabel('Gross Domestic Product (GNI_Per_Capita)')
plt.legend(title='Country',bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



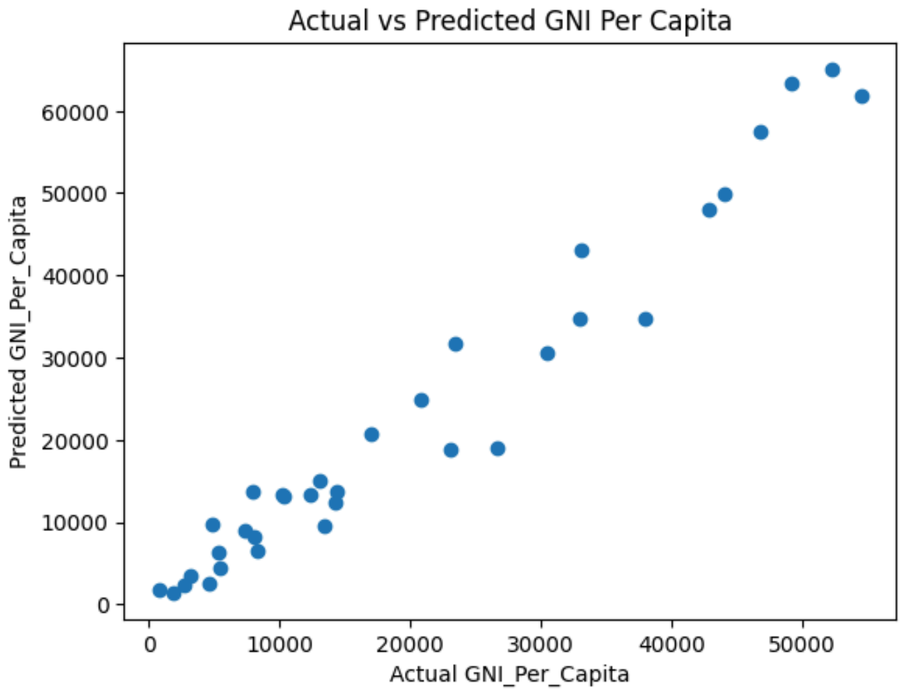
- Negative Correlation: There is a visible negative correlation between GII and GNI Per Capita, indicating that countries with lower gender inequality (lower GII values) tend to have higher GNI Per Capita.
- Cluster of Wealthy Countries: High-income countries such as Denmark, Norway, and Switzerland, which are clustered at the lower left of the plot, have low GII values and high GNI Per Capita.

VISUALIZATION

KNN Model

```
# Plotting the results
plt.scatter(y_test, y_pred)
plt.xlabel('Actual GNI_Per_Capita')
plt.ylabel('Predicted GNI_Per_Capita')
plt.title('Actual vs Predicted GNI Per Capita')
plt.show()
```

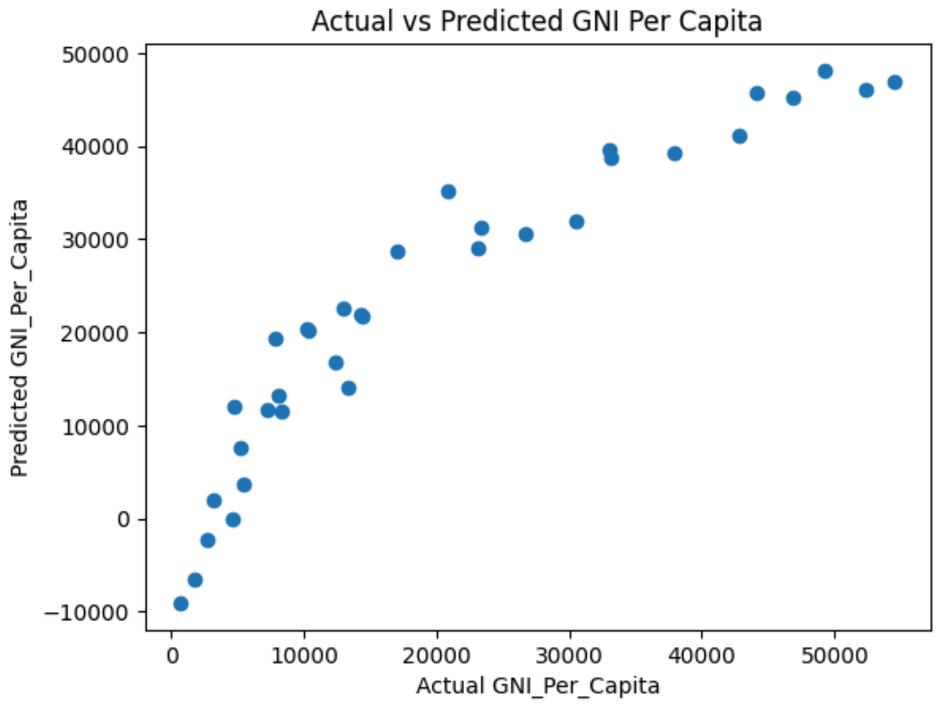
✓ 0.2s



Linear Regression Model

```
# Plotting the results
plt.scatter(y_test, y_pred)
plt.xlabel('Actual GNI_Per_Capita')
plt.ylabel('Predicted GNI_Per_Capita')
plt.title('Actual vs Predicted GNI Per Capita')
plt.show()
```

✓ 0.1s



CONCLUSION

Summary of Findings

1. Gender Inequality Index (GII) and Economic Growth:
   - Negative Correlation: There is a strong negative correlation between the Gender Inequality Index (GII) and Gross National Income (GNI) per capita. Countries with higher gender inequality tend to have lower economic growth.
2. Maternal Mortality and Economic Growth:
   - Inverse Relationship: Countries with high maternal mortality rates generally show lower GNI per capita and HDI. Reducing maternal mortality can lead to significant improvements in economic growth and development.
3. Adolescent Birth Rate:
   - Economic Burden: Higher adolescent birth rates are linked to lower economic growth. Early pregnancies often disrupt female education and labor force participation, limiting economic potential.
4. Female Education:
   - Increased female education levels correlate positively with higher GNI per capita and HDI. Educated women are more likely to participate in the labor force and contribute to economic growth.
   - Investing in female education is a crucial driver for economic development.
5. Female Labor Force Participation:
   - Economic Boost: Higher female labor force participation is associated with higher GNI per capita and HDI. Gender equality in the workforce enhances economic productivity and growth.
   - Policy Implications: Policies promoting gender equality in employment can significantly boost economic outcomes.

Future Work

- Policy Impact Analysis
  - Case Studies: Conduct case studies of specific countries or regions that have implemented successful gender equality policies to identify best practices and lessons learned.
  - Policy Simulation: Use economic modeling to simulate the potential impacts of proposed gender equality policies on economic growth and development.
- Technological Integration
  - Real-time Data Collection: Implement real-time data collection methods using mobile technology to gather up-to-date information on gender inequality indicators.

Conclusion

The findings highlight the critical role of gender equality in driving economic growth and development. Reducing gender inequality, improving female education, and increasing female labor force participation can lead to substantial economic benefits for countries. Addressing maternal mortality and adolescent birth rates is also essential for achieving sustainable economic growth.

REFERENCES

Data Sources- Data is taken from Kaggle.
Link- https://www.kaggle.com/datasets/gianinamariapetrascu/gender-inequality-index/data
and https://www.kaggle.com/datasets/iamsouravbanerjee/gross-national-income-per-capita

Tool for Analysis
The following tools and technologies will be used for data analysis:

Python: For data cleaning, analysis, and visualization, using libraries such as Pandas, NumPy, Matplotlib, and Seaborn.
Jupyter Notebooks: For documenting the analysis process and visualizations.
Scikit-learn: For developing predictive models and machine learning algorithms.
MatplotLib: For creating interactive dashboards and visualizations to present the findings.
Power BI: For creating interactive visualizations to present the findings.

Additional References
https://www.drishtiias.com/daily-updates/daily-news-analysis/india-s-progress-in-gender-equality : To study about gender inquality index and other issues relalted to gender gap