

A VISUAL ANALYTICS STUDY ON GLOBAL SOCIAL AND ECONOMIC INDICATORS

Aditi Reddy Doma
Graduate Student, MS in Data Science
Rochester Institute of Technology
ad7977@rit.edu

Sai Kiran Gopu
Graduate Student, MS in Data Science
Rochester Institute of Technology
sg2755@rit.edu

Nishant Sulgudle
Graduate Student, MS in ITA
Rochester Institute of Technology
ns6344@rit.edu

Abstract—This report offers an exploratory review of global indices using metrics of governance, inequality, societal trust. Using R and Tableau different types of patterns and trends were visualised and interpreted in different countries. By examining possible applications for socioeconomic research and policy-making, the study provides useful information derived from noted patterns and trends

I. INTRODUCTION

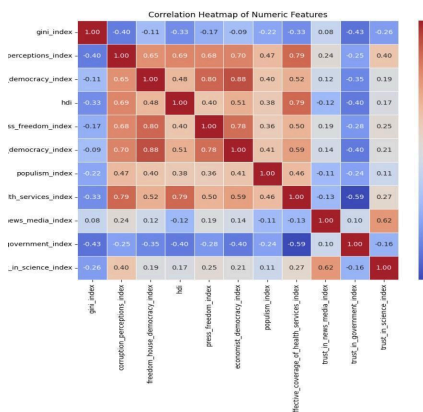
This study looks at various indices in an effort to find trends and connections that can help researchers, policymakers, and social scientists solve problems including public trust, government effectiveness, and inequality. Global indices that offer important insights into governance and societal well-being include the Gini Index, the Corruption Perceptions Index and the Democracy Indices are used. A complete understanding of socio-economic standards are ensured by the incorporation of data-driven insights.

II. EXPLORATORY ANALYSIS

A. Dataset Description and Potential Use Cases

Each row represents a country. With factors including the Human Development Index (HDI), Freedom House and Economist Democracy scores, the Corruption Perceptions Index, the Gini Index (income inequality), and indexes showing popular trust in the government, media, and science. Examining the relationships between governance quality, societal trust, and development results, it can aid comparative policy research. Researchers and policymakers could use this data to find groups of nations that have populist, democratic, or developmental traits.

B. Patterns and Trends Observed from the Correlation Heatmap



The correlation heatmap revealed several statistically significant relationships between development, trust, and governance-related indicators:

- Positive Correlation Between HDI and Democracy Indices:** The Freedom House Democracy Index ($r = 0.88$) and the Economist Democracy Index ($r = 0.78$) showed a high positive correlation with the Human Development Index (HDI). This implies that improved health, economic, and educational achievements are typically linked to democratic governance.
- Democracy and Anti-Corruption Linkages:** The notion that more democratic nations are often thought to be less corrupt was supported by the Corruption Perceptions Index has a high positive association with democracy metrics ($r = 0.65$ – 0.69).
- Trust in Government vs. Institutional Confidence:** There was a negative correlation between trust in government and trust in news media ($r = -0.59$) and science ($r = -0.24$). This implies that confidence in other institutions, including the media and science, may also be eroded in settings where trust in leadership is eroding.
- Populism and Perceived Corruption:** The Corruption Perceptions Index and the Populism Index showed a moderately positive association ($r = 0.47$), indicating that growing populist sentiment may be connected to perceptions of pervasive corruption and discontent with traditional governance.
- Press Freedom as a Governance Indicator:** Press freedom demonstrated a strong positive correlation ($r = 0.78$) with the Democracy Index and the Freedom House Index, underscoring the importance of a free press for democratic accountability and transparency.
- Strong Association Between Healthcare and Human Development:** The Effective Health Service Coverage Index and HDI also had a substantial positive connection ($r = 0.79$), suggesting that countries with more robust healthcare systems tend to have greater levels of overall human development.
- Negative Correlation Between Income Inequality**

and Trust in Government: There was a moderately negative association ($r = -0.43$) between the Gini Index and the Trust in Government Index. This suggests a pattern whereby nations with higher income disparity also typically have lower levels of public confidence in their leaders.

C. Cited External Insights

Several external studies reinforce the observations made in this analysis and provide valuable context:

- **Our World in Data (2019):** The article "*Human Development Index (HDI)*" [1] provides a comprehensive overview of the HDI, its methodology, and global trends over time. This resource supports our use of HDI as a central indicator for evaluating cross-country differences in development. It reinforces our findings that HDI effectively captures disparities in education, income, and health, making it a reliable benchmark for comparing socio-economic progress.
- **Santander Insights (2023):** The paper "Democracy and trust in governments" [2] examines the intricate connection between public trust and democratic institutions. It emphasizes how more freedom of speech and openness in democracies can occasionally reveal institutional flaws, resulting in decreased levels of public trust. This immediately confirms our boxplot analysis results, which show that nations with higher democracy scores typically have lower levels of public confidence. This suggests that as democracies mature, the public may become more skeptical and scrutinized.
- **Post on corruption (2016):** "How do you measure corruption?" is the article. Transparency International "does its best" [3] describes the Corruption Perceptions Index's methodology and how useful it is for evaluating the effectiveness of governance. This supports our use of the CPI to understand governance issues in nations with low democracy scores and high populism.
- **Press Freedom as a Catalyst for Accountable Governance (2024):** The relationship between press freedom and the effectiveness of governance is examined in the paper "The Socio-Economic Impact of Press Freedom on Governance" [4]. This corroborates our finding that the Press Freedom Index and the Democracy Index have a strong correlation in fostering accountability and transparency.

These studies support the validity of our dataset-driven research by offering strong evidence for the trends we have seen and demonstrating the connections between governance, trust, and societal well-being.

III. VISUALIZATIONS

A. R Visualization: Mean HDI by Country Bar Chart

The bar chart was generated using R's ggplot2 and viridis color scale. It illustrates the Mean Human Development Index (HDI) for each country, sorted in descending order of HDI.

This bar chart highlights significant correlations:

- The greatest mean HDI scores are found in nations with the highest life expectancy, INCOME, and educational attainment, like the US, Switzerland, and Norway.
- Middle-ranked countries with modest HDI scores such as Egypt, Morocco, and India show signs of growth in their development.
- According to development indicators, countries like Afghanistan, Sudan, and Chad are near the bottom, indicating persistent difficulties.

This visualization emphasizes the stark global development disparities and provides a basis for deeper comparative analysis across socio-political and economic indicators.

B. R Visualization: Trust vs. Democracy Boxplot

The boxplot was created using R's ggplot2 to analyze the relationship between Trust in Government and the Freedom House Democracy Index.

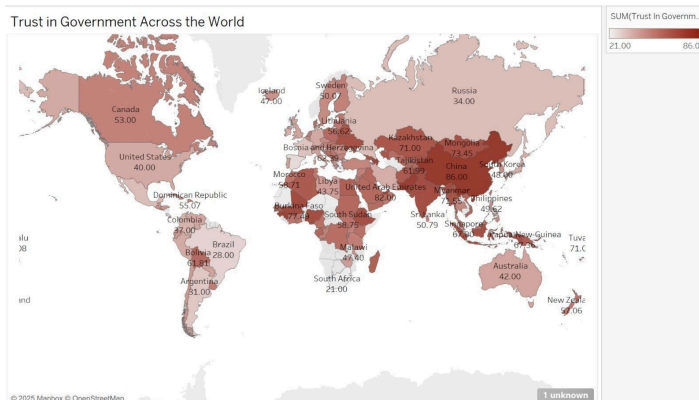
This box plot highlights significant correlations:

- Median trust in government is typically higher in nations with low democracy scores (Index = 1).
- Trust tends to decrease as the democracy score rises (Index = 2 or 3).
- This pattern points to a negative correlation between popular faith in government institutions and democratic freedom.

This graph suggests that in less democratic regimes, the absence of free speech or state-controlled narratives may be the source of trust. Increased transparency in democracies could reveal governmental inadequacies and erode popular confidence.

C. Tableau Visualization: Public Confidence in National Leadership

A choropleth map created in Tableau illustrates public confidence levels across countries using the Government Confidence Index.



This choropleth map highlights significant correlations:

- Countries with high levels of confidence like Burkina Faso (77.40), China (86.00), the United Arab Emirates (82.00), and Mongolia (73.45) are colored in darker tones, indicating great institutional credibility and public support.
- The lighter shading of countries with low confidence levels such as South Africa (21.00), Brazil (28.00), and Russia (34.00) indicates popular discontent or diminished leadership credibility.
- Significant regional differences are depicted in the graphic, with Latin America, Africa, and certain Western countries showing lower levels of confidence than Asia and the Middle East.

IV. TOOLS USED

A. R

R's statistical power and specialized charting skills led to its adoption for data analysis and visualization. While dplyr made data manipulation and aggregation easier, the ggplot2 package made it possible to create informative visualizations like bar charts and boxplots. Clarity and accessibility were improved by Viridis and other visual programs. R's data-centric architecture made it ideal for identifying trends in public opinion, development, and government.

B. Tableau

The choropleth maps showing global variances in public confidence and development indexes were made possible by Tableau's strong geographic visualization features. It was perfect for drawing attention to regional differences because of its user-friendly design and interactive capabilities, which allowed for cross-national comparisons with no technical difficulty.

V. CONCLUSION

This analysis demonstrates the value of global indices to uncover subtle trends in public opinion, development, and governance is highlighted by this analysis. We discovered important discoveries, including the inverse relationship between democracy and public confidence, regional differences in HDI, and the intricate role of healthcare coverage in influencing trust, using R for statistical visualization and Tableau for spatial analysis. These results highlight the multifaceted nature of effective governance and the close connections between public perception, development outcomes, and institutional trust. The visualizations also highlighted the fact that high development measures do not always correspond to high levels of trust in leadership, especially in democracies where institutional flaws can be revealed through transparency. Historical, economic, and political contexts' long-lasting effects were also represented in the observed grouping of nations by HDI and trust levels. The importance of accountability in building institutional legitimacy is further supported by the close relationships among press freedom, democracy, and the efficacy of governance. High public confidence may result from perceived stability rather than participatory processes, according to patterns seen in areas with centralized governance. However, despite robust institutional structures, democratic countries may see a decline in trust, which reflects the complexity of political activity and civic expectations. Even in nations with relatively high development indices, income inequality as measured by the Gini Index remains a chronic problem. This emphasizes how crucial it is to take equality into account in addition to overall success. The investigation uncovered latent conflicts between public satisfaction, representation, and service delivery by combining several indices.

ACKNOWLEDGMENT

The authors are grateful to Rochester Institute of Technology for providing resources for this analysis and to Professor Ezgi Siir Kibris for her advice and assistance.

REFERENCES

- [1] H. Ritchie and M. Roser, "Human Development Index (HDI)," *Our World in Data*, 2019. Available: <https://ourworldindata.org/human-development-index>
- [2] Santander Bank, "Democracy and trust in governments," *Santander Insights*, 2023. <https://www.santander.com/en/press-room/insights/democracy-and-trust-in-governments>
- [3] How do you measure corruption? Transparency International does its best," *Post on Corruption*, Jan. 2016. Available at <https://www.washingtonpost.com/news/monkey-cage/wp/2016/01/27/how-do-you-measure-corruption-transparency-international-does-its-best-and-thats-useful/>. Accessed: Dec. 2024.
- [4] Press Freedom as a Catalyst for Accountable Governance, "The socio-economic impact of press freedom on governance," 2024. <https://www.tandfonline.com/doi/full/10.1080/23311886.2024.2342513>, accessed Dec. 2024.
- [5] IEEE manuscript template. Available: <https://www.ieee.org/conferences/publishing/templates.html>, accessed Dec. 2024.