Global Development Insights: Analysis of Development Worldwide

Introduction

This report addresses the critical need to understand global development trends, aiming to provide insights into the economic, social, and environmental factors that influence the well-being of societies worldwide. By analyzing key socioeconomic and demographic indicators, this report seeks to uncover meaningful patterns and relationships that can inform decision-making and promote sustainable growth.

The ultimate goal of this report is to bridge the gap between data and actionable knowledge. Through clear and accessible analysis, we aim to provide valuable perspectives for policymakers, researchers, and the general public. By focusing on diverse development metrics, this report emphasizes the benefits of data-driven insights in shaping strategies to address global challenges, reduce inequalities, and foster resilience in the face of economic, health, and environmental uncertainties.

The data analyzed in this report is sourced from the **World Development Indicators (WDI)** database, a comprehensive and trusted resource developed by the World Bank. The WDI database is renowned for its high-quality, consistent data spanning over 1,600 indicators and more than 200 countries. However, we have selected a subset of countries for this report based on data completeness, geographic diversity, and relevance to the key global development trends being analyzed. This approach allows us to highlight meaningful patterns while ensuring the reliability and comparability of the insights presented.

In this report, we focus on a curated subset of indicators, including:

- **Access to Electricity**: Measuring the percentage of a population with electricity, a critical driver of modernization and quality of life.
- **Agricultural and Arable Land Use**: Highlighting agriculture's role in economies, particularly in developing regions.
- **Economic Metrics**: Such as GDP (Gross Domestic Product), income levels, and sectoral contributions like tourism and forestry.
- **Education and Health Expenditures**: Reflecting investments in human capital, essential for long-term societal progress.
- **Demographic Trends**: Including birth and mortality rates, which provide insights into population health and dynamics.

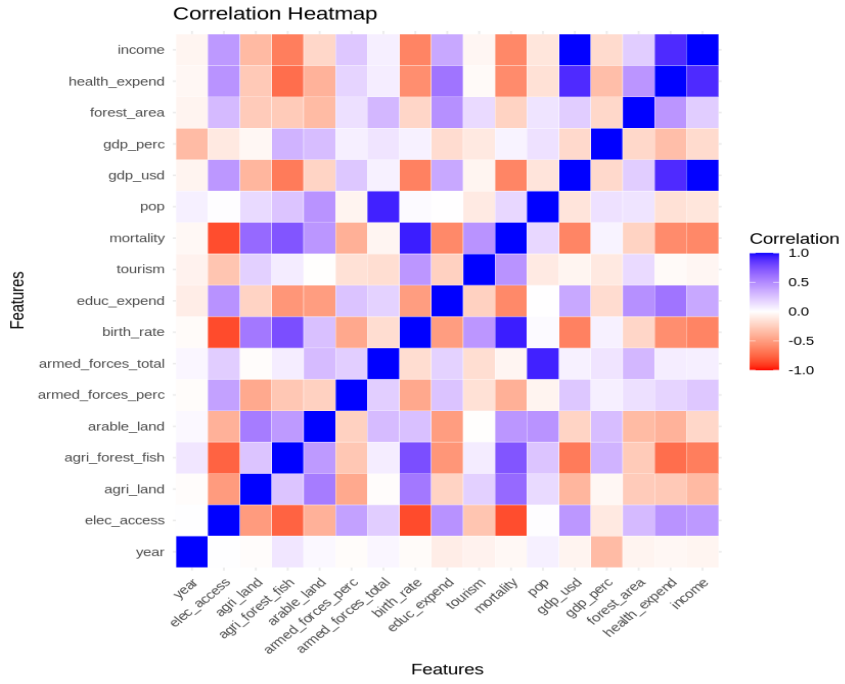
By leveraging the power of data from the **World Development Indicators**, this report fosters a deeper understanding of global development trends and equips readers with the knowledge needed to contribute to a more equitable and sustainable future.

Data Methodology

Initially, the columns that likely contain numeric data might be imported as different data types, so these columns are converted to numeric. The ‘year’ column is converted to integer type. Next for the imputation of the missing values, a Kalman Filter is primarily used for the data as the data is a time-series. Try Catch mechanisms are used for error handling. The primary imputation uses the Kalman filter if there are at least 3 non-missing points. The fallback uses forward fill when not enough data points are available. In case of an error during the Kalman filter application, forward fill is applied again. If a warning arises, linear interpolation is used to fill gaps.

The dataset is first grouped by country name so that each country’s data is treated independently for imputation. The imputation process as described is applied to all numeric columns within each group. Once the imputation is done, the dataset is ungrouped to return to the initial structure.

Below heatmap shows that Income, gdp_usd, and health/education expenditures are positively correlated, while they negatively correlate with mortality and birth rates. Electricity access and gdp_usd are negatively correlated to birth rate and mortality, while Birth rate and mortality show a strong positive relationship.



Insights

First, the population growth of the selected countries is evaluated. Figure 1 shows the percentage change in the population of each of the select countries from 2010 to 2022. The data set provided the population count for each year and to produce a percentage change value, the log is taken and then differenced the value, which is the current population - previous population.

It is a violin plot, which shows the distribution of percentage changes for each country. It cannot tell when the percentage changes are but gives a sense of the population changes across this time. For example, of all the countries, Germany experienced the widest range of change in population, from a decrease of almost 2% to an increase of 1%. In comparison, Ethiopia's change in population during this period of time, remained more stable, somewhere between 2.5% to 3%.

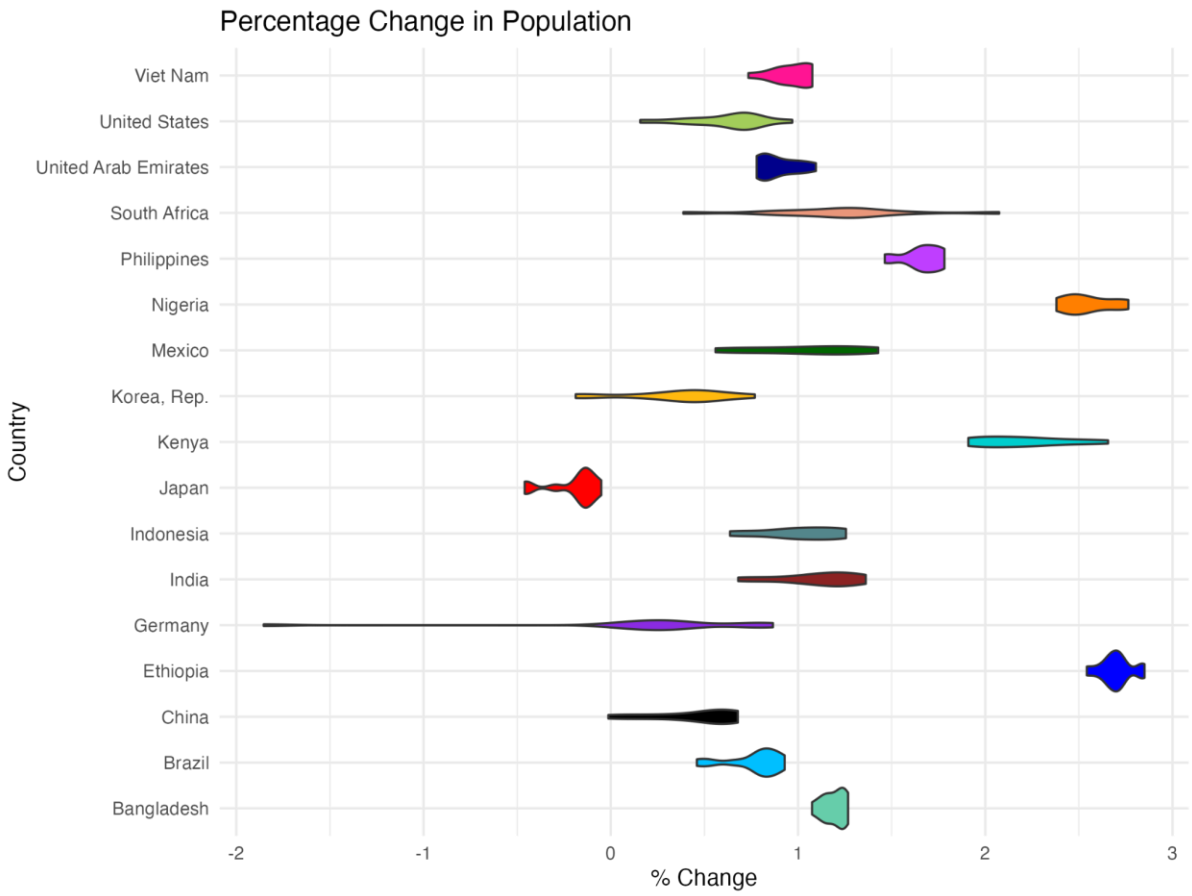


Figure 1

Figure 2 gives an idea in terms of changes in the population. It illustrates the changes in birth rates (per 1,000 population) from 2010 to 2022 for different countries. A general decline in birth rates

is evident across most countries, reflecting global trends such as increased access to education, healthcare, and family planning services. For example, Ethiopia demonstrates a steep decline, while Germany maintains consistently low birth rates.

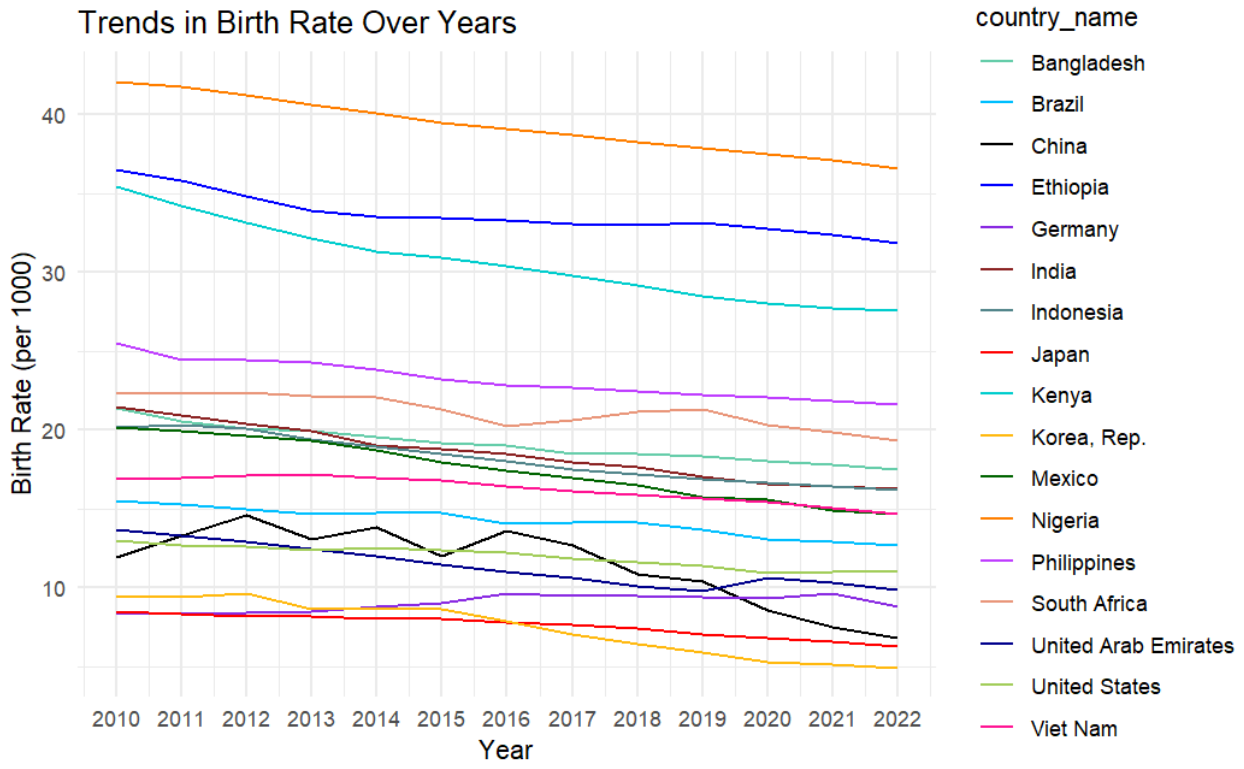


Figure 2

One indicator of quality of life and economic development is access to electricity. Higher levels of access correlate to a more developed country, a more developed infrastructure, and higher levels of productivity. Figure 3 shows the percentage of the population that had access to electricity across time, from 2010 to 2022. More developed countries such as the United States and Japan have mostly achieved 100% access for their entire population during this time period. Other countries such as Ethiopia and Kenya are still increasing access to electricity. The line plot allows us to compare how quickly this change in access to electricity is happening among the countries that have not achieved 100% access. For example, comparing the steepness of the lines, the increase in access in Kenya has been much more rapid than in Mexico. Indonesia started at a higher percentage of access than India during this time period, but it is reaching 100% access at a slower pace than India. At the end of this time period, both countries had nearly 100% access to electricity.

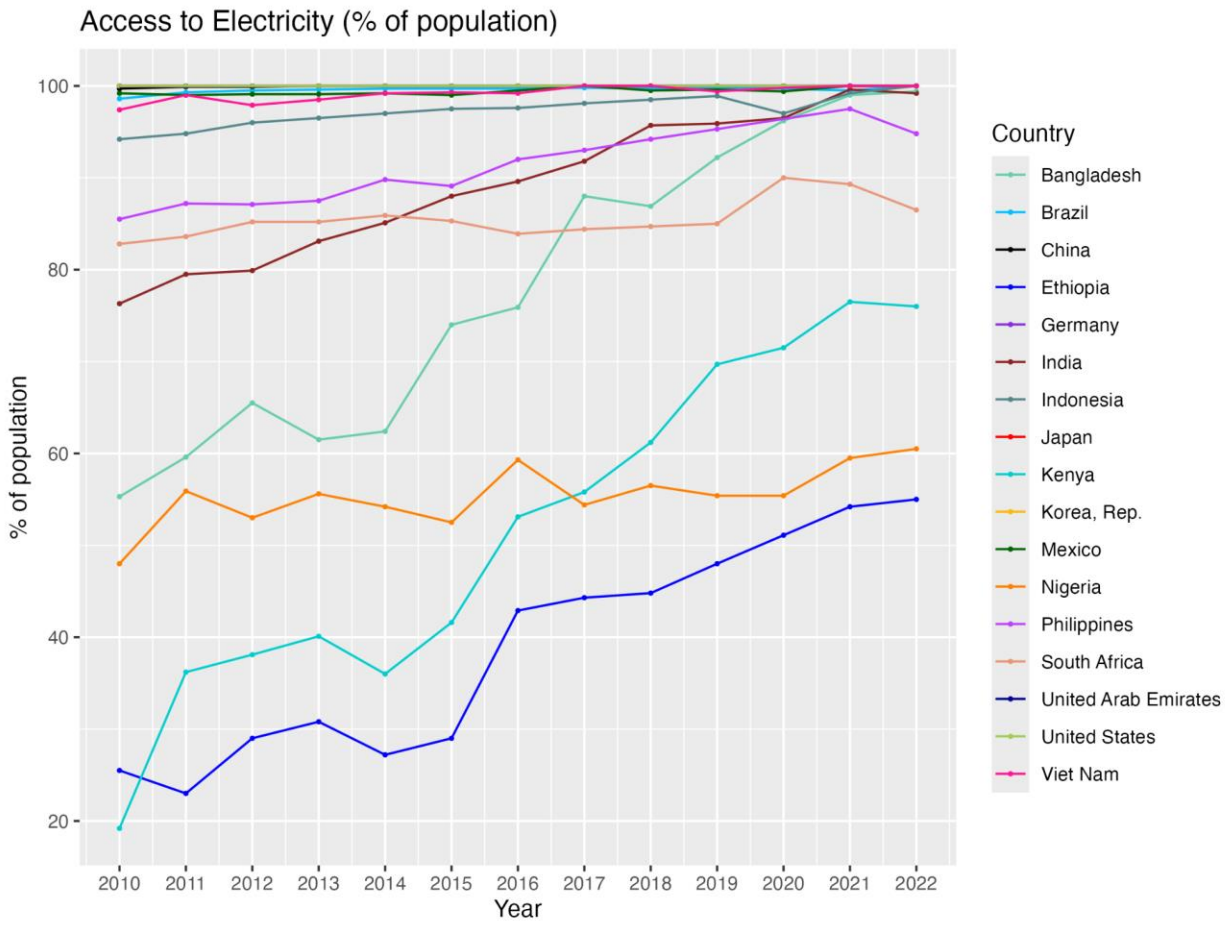


Figure 3

Harvesting, natural resources, and land use can be useful indicators of economic productivity and food security. Figure 4 shows the distribution of the average percentage of total land use for agriculture reported for all countries across time. This plot shows that the most frequently reported average falls between 40% and 50%. Additionally, there is a high frequency of reports in the 30%-40% and 70%-80% ranges for agricultural land use.

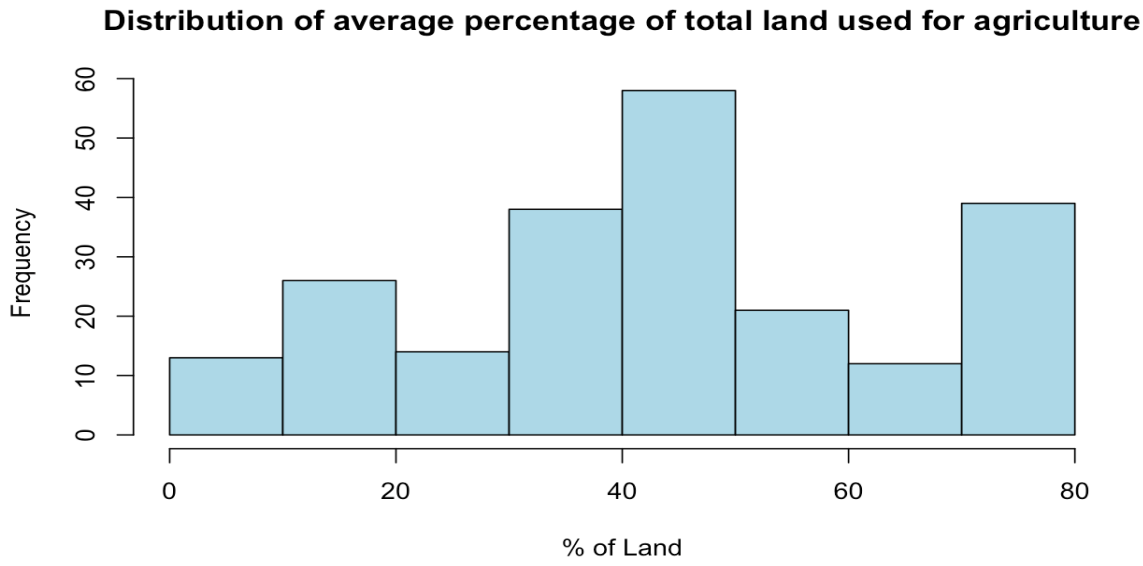


Figure 4

Figure 5 shows the % of GDP that Agriculture, Forestry & Fishing contributed to a country's GDP, over the years and for each country. In this plot, some countries such as South Africa have seen an increase in value added from these industries to their GDP, while other countries such as Kenya and China are seeing a decrease. An increase for a developing country could be a sign of productivity growth, possibly growing efficiencies in production. A decrease for the developed countries such as China could indicate economic diversification, growth in other sectors such as technology or manufacturing.

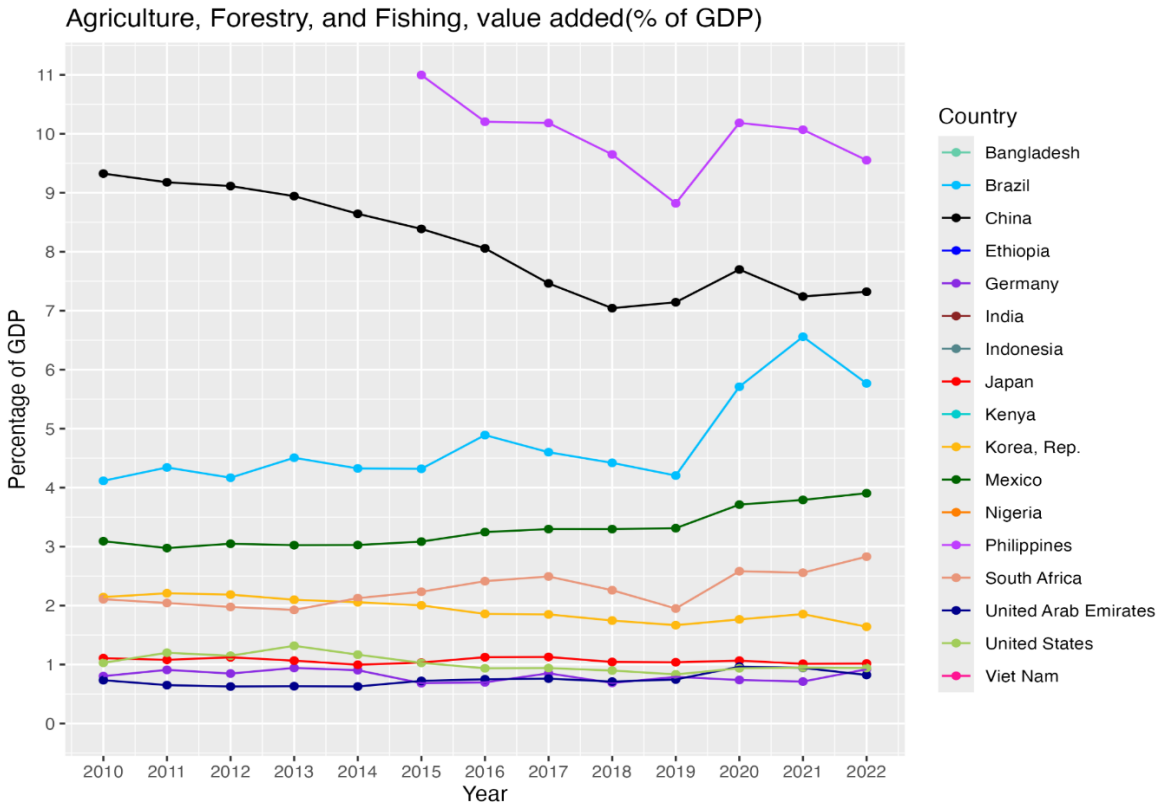


Figure 5

Government expenditures in conjunction with other variables is also explored. Figure 6 shows the % of the country's GDP that the government spends on Health, over Years, and for each country. Health expenditure can be an indicator of the well-being and productivity of the population. Higher health expenditures can result in better health outcomes, longer life expectancy, and a more productive workforce. From this line plot, the variability within each country indicates the range of spending over time or in different contexts. Germany and United States, for example, show consistently high health expenditure, whereas Bangladesh and India reflect significantly lower health spending. Outliers suggest occasional deviations from typical spending levels.

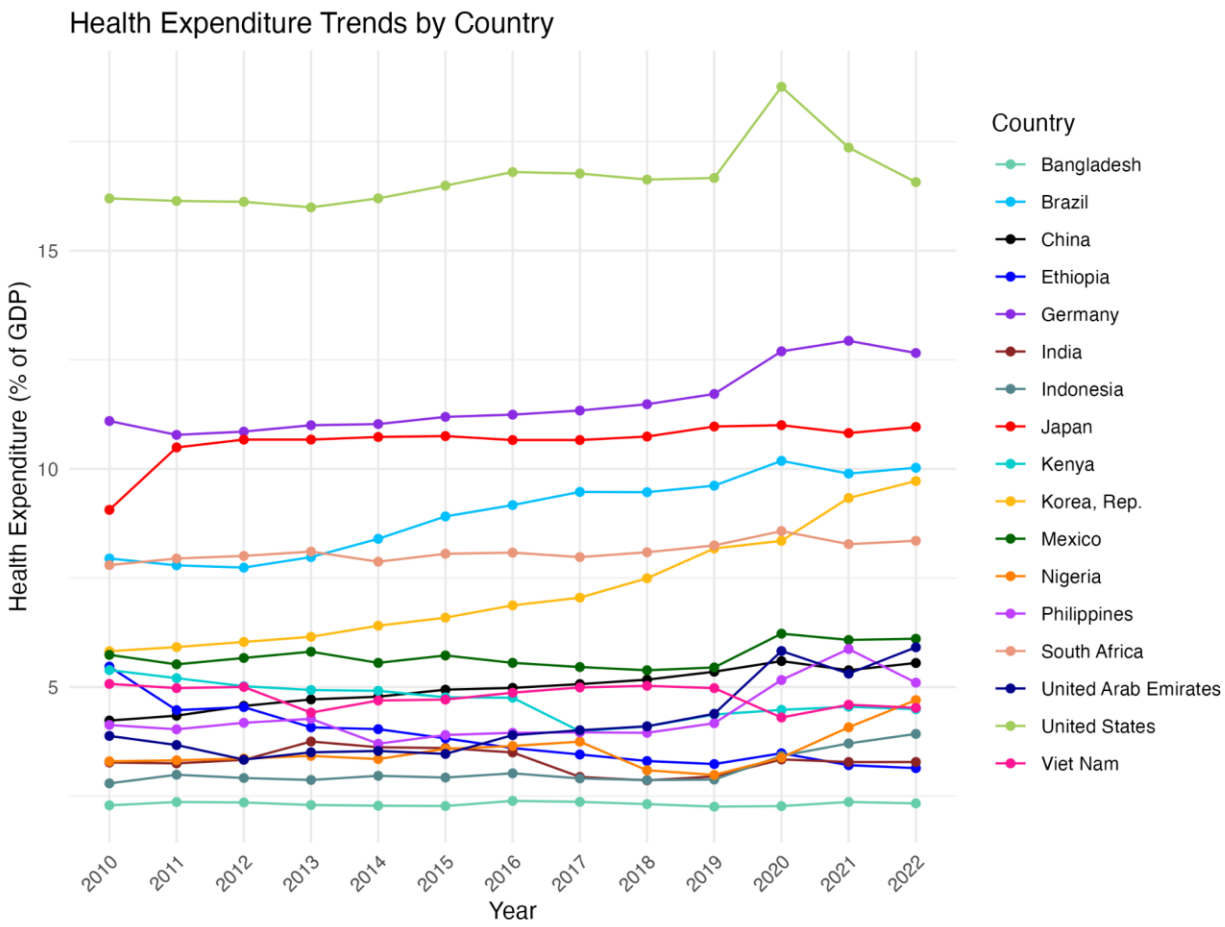


Figure 6

Figure 7 depicts the relationship between mortality rates and health expenditure as a percentage of GDP across various countries. A clear inverse correlation is evident - countries with higher health spending tend to have lower mortality rates, while those with lower health expenditures generally exhibit higher mortality. The clusters with high-spending, low-mortality countries are like Germany and the United States, and low-spending, high-mortality countries are such as Ethiopia and Bangladesh. This highlights the significant global disparities in healthcare systems and funding. Importantly, many countries display a distribution of data points rather than a single value. This indicates variation in health expenditure and mortality over time within those nations. Examining this within-country variation provides additional insights beyond just cross-country comparisons. Overall, the figure offers a compelling visual representation of the relationship between a country's investment in healthcare and the resulting population-level health outcomes as measured by mortality rates. It underscores the global disparities and complexities inherent in healthcare systems and their impacts.

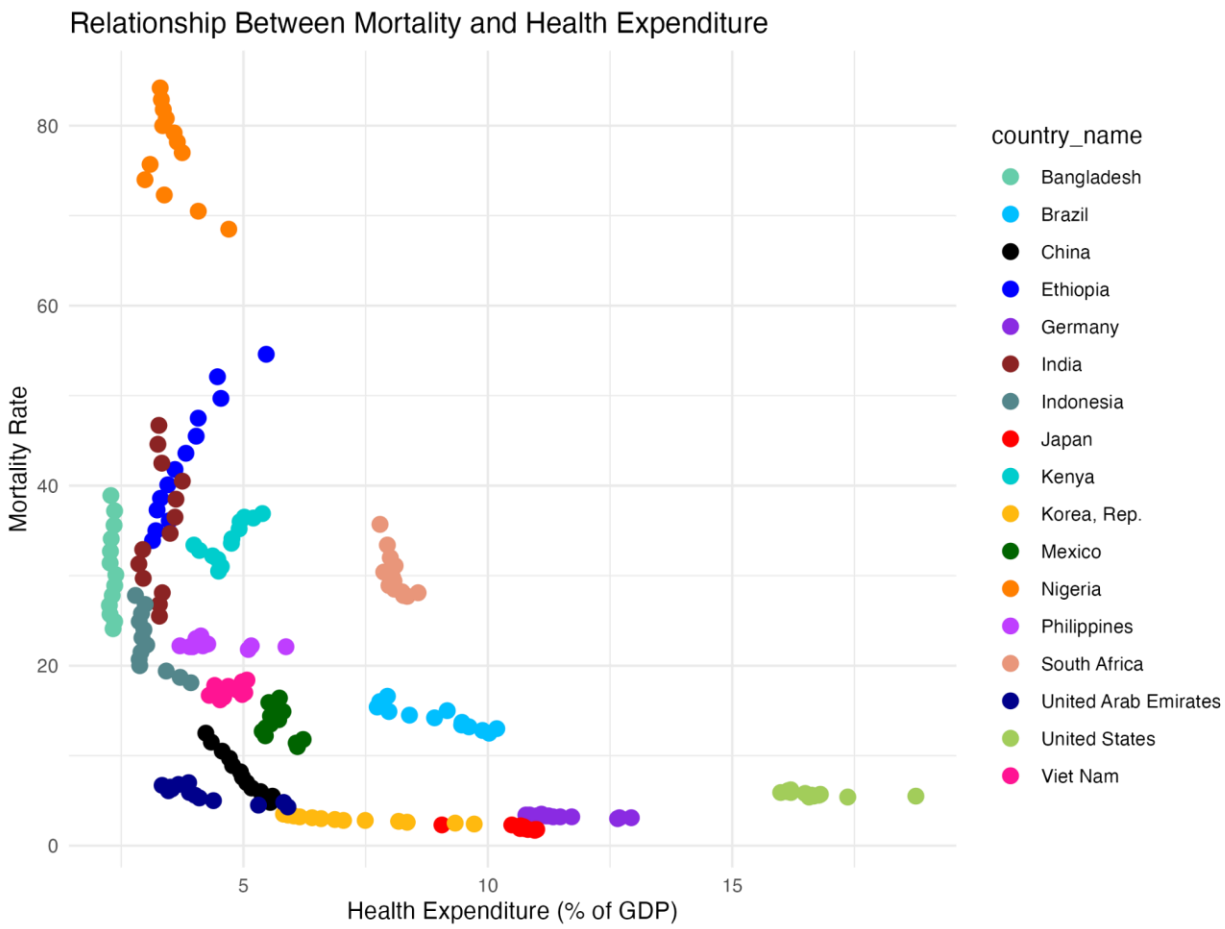


Figure 7

In Figure 8 each plot is year vs infant mortality rate, each plot has a line color based on Current Health Expenditure (% of GDP). Overall each country has a decreasing trend in Infant Mortality Rate as years pass, indicating improvements in health outcomes. Nigeria has a lower health expenditure than a few other countries and a significantly higher IMR than in other countries in the early years. Nigeria's IMR steadily decreases with time but not to a significantly low level. Japan has a high health expenditure compared to a few other countries and a comparably lower IMR. Countries like Indonesia, India, & Philippines have lower health expenditures, the IMR is moderately high in the early years, it decreases with time to a lower level as compared to before, but also indicates a need for a rise in health expenditure.

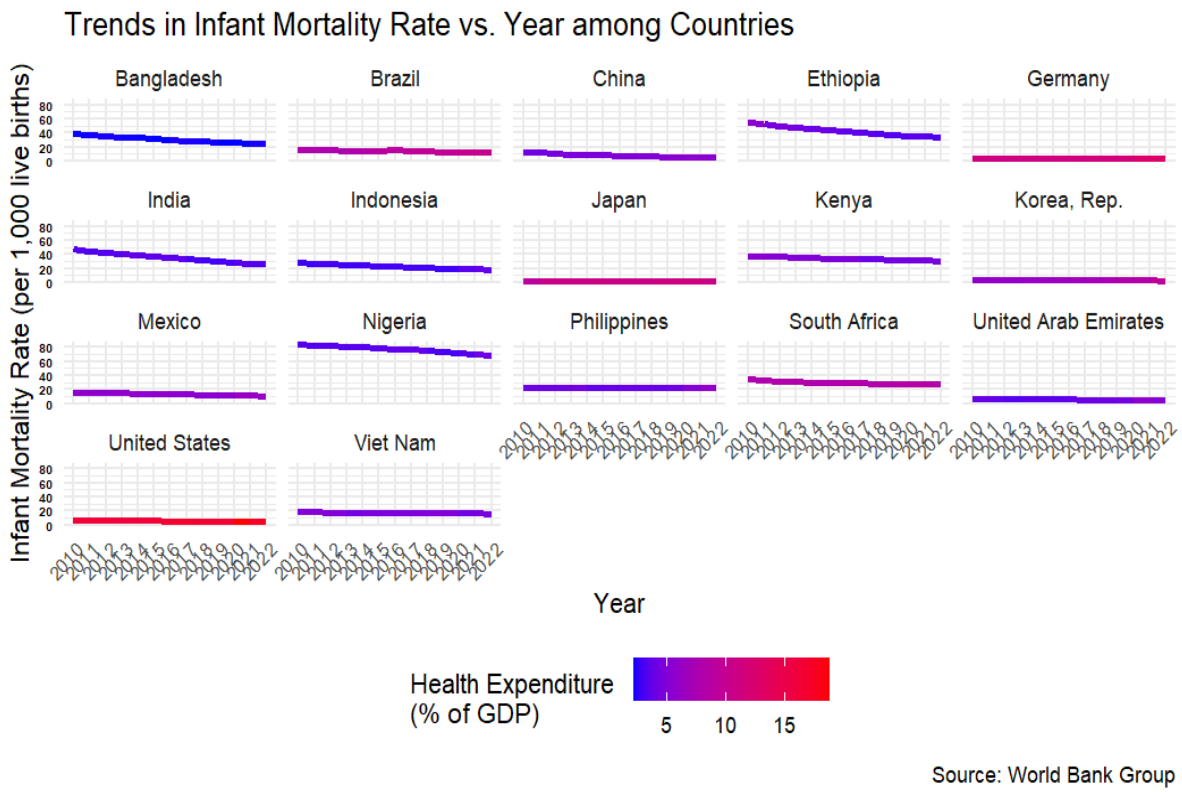


Figure 8

Other government expenditures such as education are a key indicator of a country's development. Higher levels of education can lead to a more skilled and knowledgeable workforce, which is necessary for innovation and productivity. Education can lead to greater economic opportunities for a population increasing upward mobility and increased wellbeing. Figure 9 shows the distribution of government expenditure on education, total (% of GDP) by country. This boxplot visualizes the distribution of government expenditure on education as a percentage of GDP for different countries. Indonesia has the widest spread, indicating significant variation in education spending as a percentage of GDP. Countries like Nigeria and China have relatively compact distributions, suggesting consistent expenditure levels. Brazil and South Africa show relatively high median spending compared to other countries. Outliers are observed in some countries, such as Kenya and China, suggesting occasional deviations in spending.

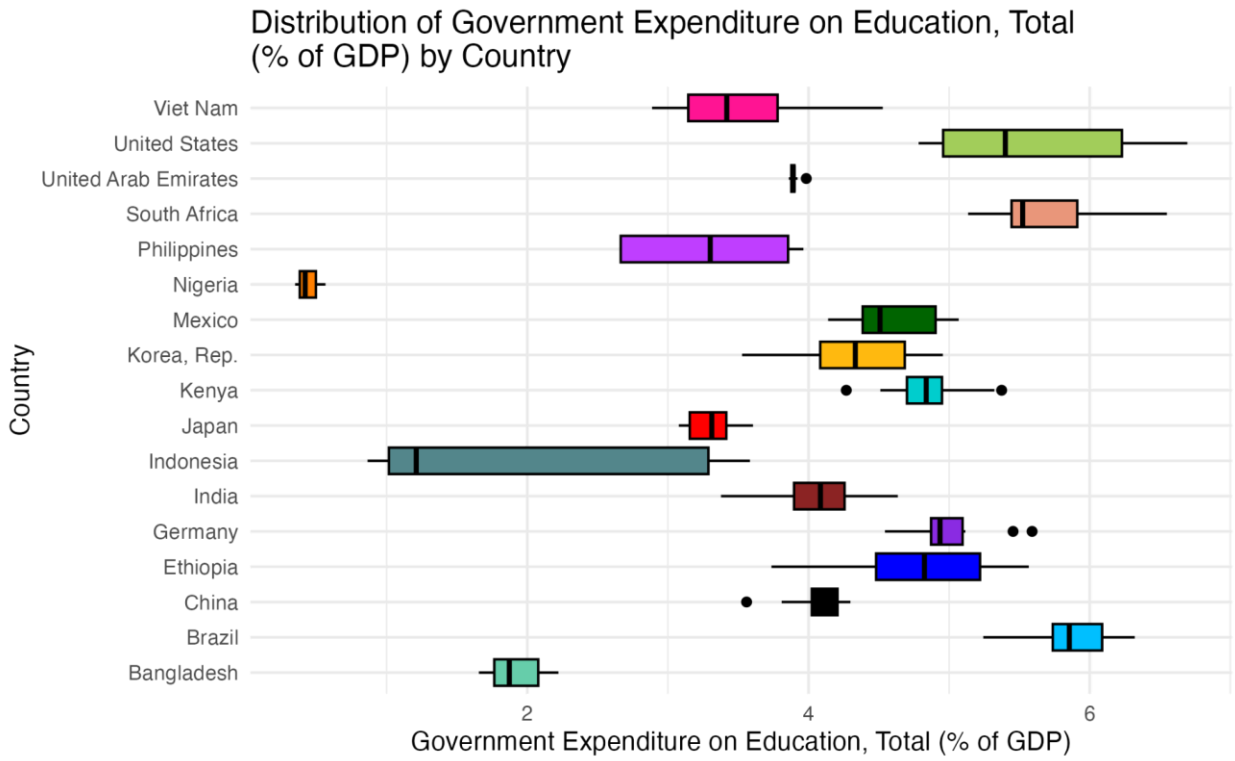


Figure 9

In Figure 10 correlation between government expenditure on education and infant mortality rate is explored. This graph suggests that investment in education may have an impact on reducing infant mortality, but it also highlights that other factors (e.g., healthcare access, and socioeconomic conditions) likely play a role. Countries with high education spending and low infant mortality are likely to benefit from a combination of factors that support better child health outcomes.

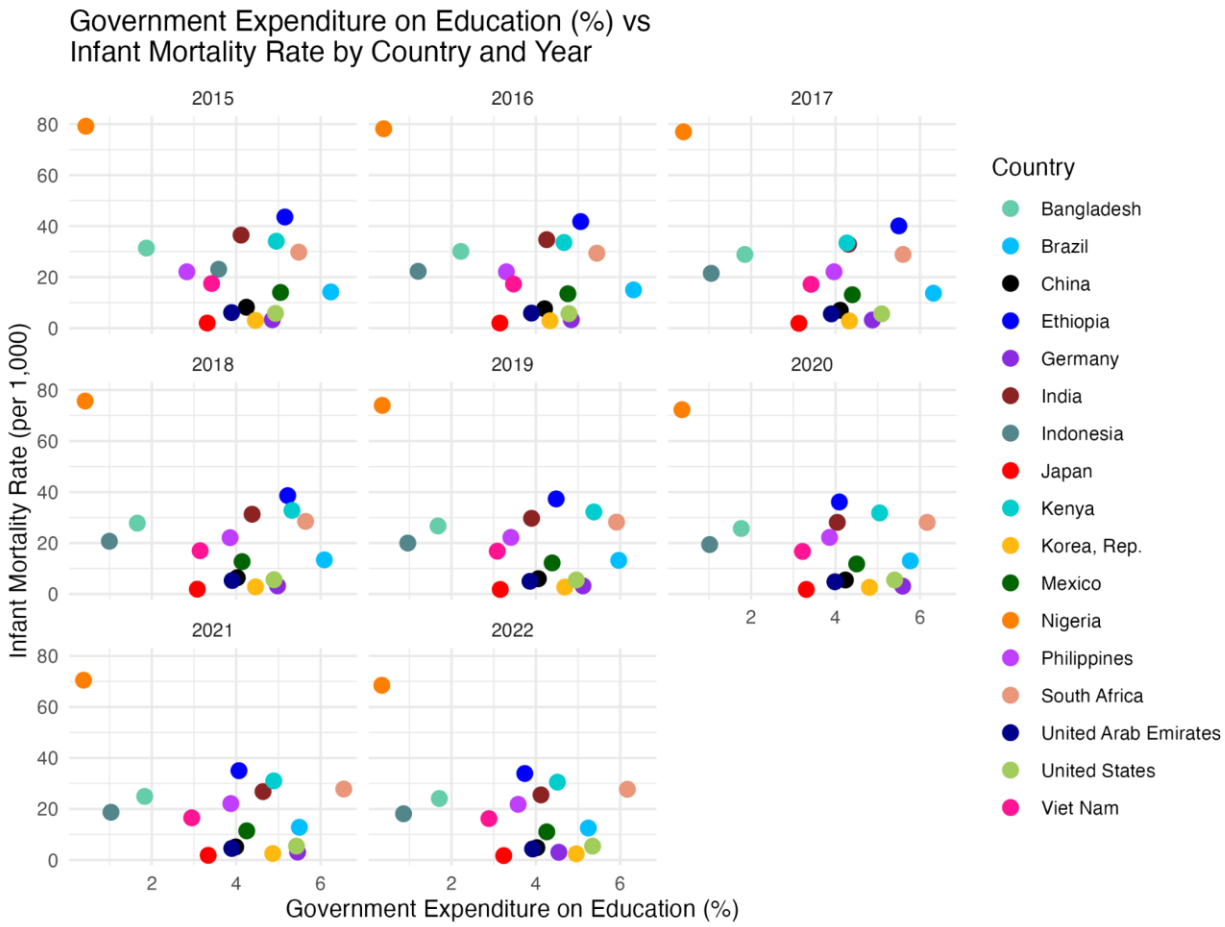


Figure 10

This next indicator explored is tourism expenditures. It can be a critical indicator of development for some countries. Tourism drives revenue and growth by creating employment and fosters cultural exchange and relations with the global economy. Figure 11 is a faceted bar chart showing tourism expenditure trends for various countries over recent years. Tourism expenditure is typically measured as a percentage of a country's GDP, reflecting the economic importance and impact of the tourism industry. Each facet represents a country, with bars illustrating annual expenditures. The graph reveals diverse patterns across the countries. Some, like India and Indonesia, exhibit consistent growth in tourism expenditure. Others, such as Mexico and South Africa, show more fluctuating trends. The independent y-axes highlight differences in the magnitude of tourism expenditure between nations, with countries like Nigeria and the Philippines having significantly higher values compared to China and Japan.

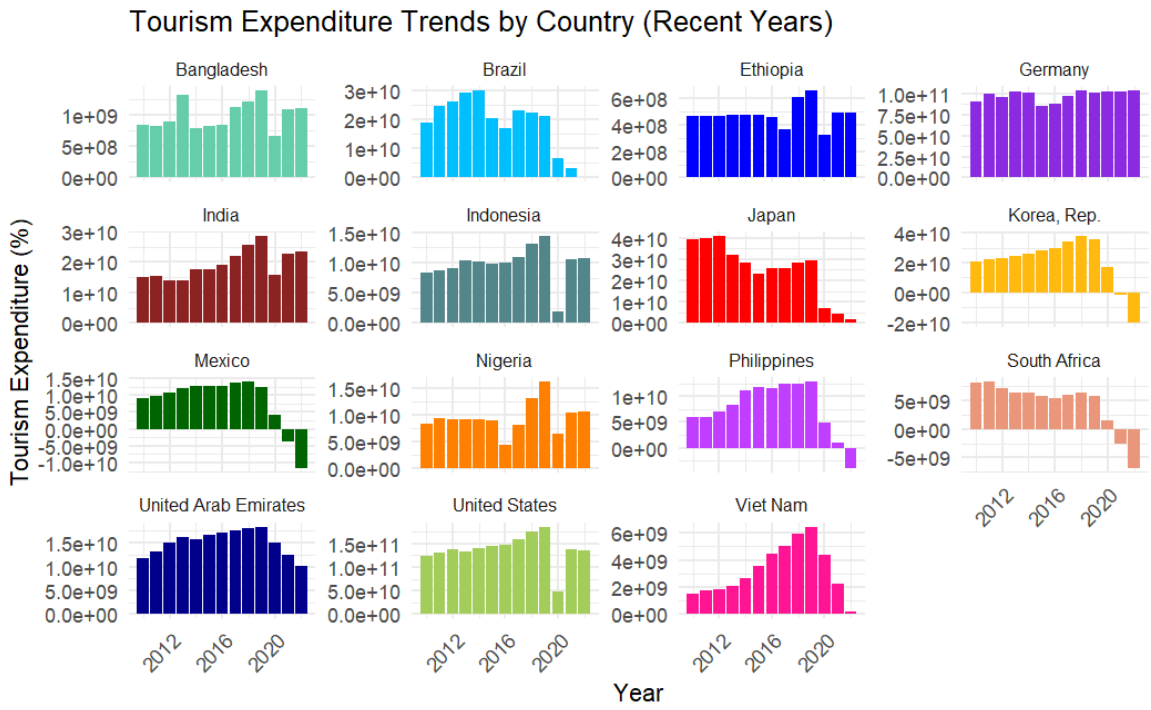


Figure 11

Investment in armed forces can reflect different aspects of development which can be complex and influenced by history and geo-political relations. Some developed countries invest less in armed forces and while others will invest more. The level of investment can depend on the need for internal stability or the presence of external threats. Less developed countries generally lack the resources to invest in armed forces. Figure 12 shows the trends in the number of active duty military personnel from the years 2010 to 2022 for each country. India has an increasing trend of armed forces personnel over the years, reaching its highest number of military personnel in 2022. China has had a gradual decline in personnel starting in 2015. The number of military personnel in the United States have been relatively stable throughout the years, it has the 3rd largest army force among the select countries. Brazil shows a slight increase in personnel numbers. Indonesia has maintained a relatively steady trend over the years. Countries like Bangladesh, Japan, and Germany have relatively flat trends, indicating little change in their personnel numbers. A large group of countries (e.g., Ethiopia, Mexico) cluster in the lower range of personnel numbers, showing minor year-to-year variation.

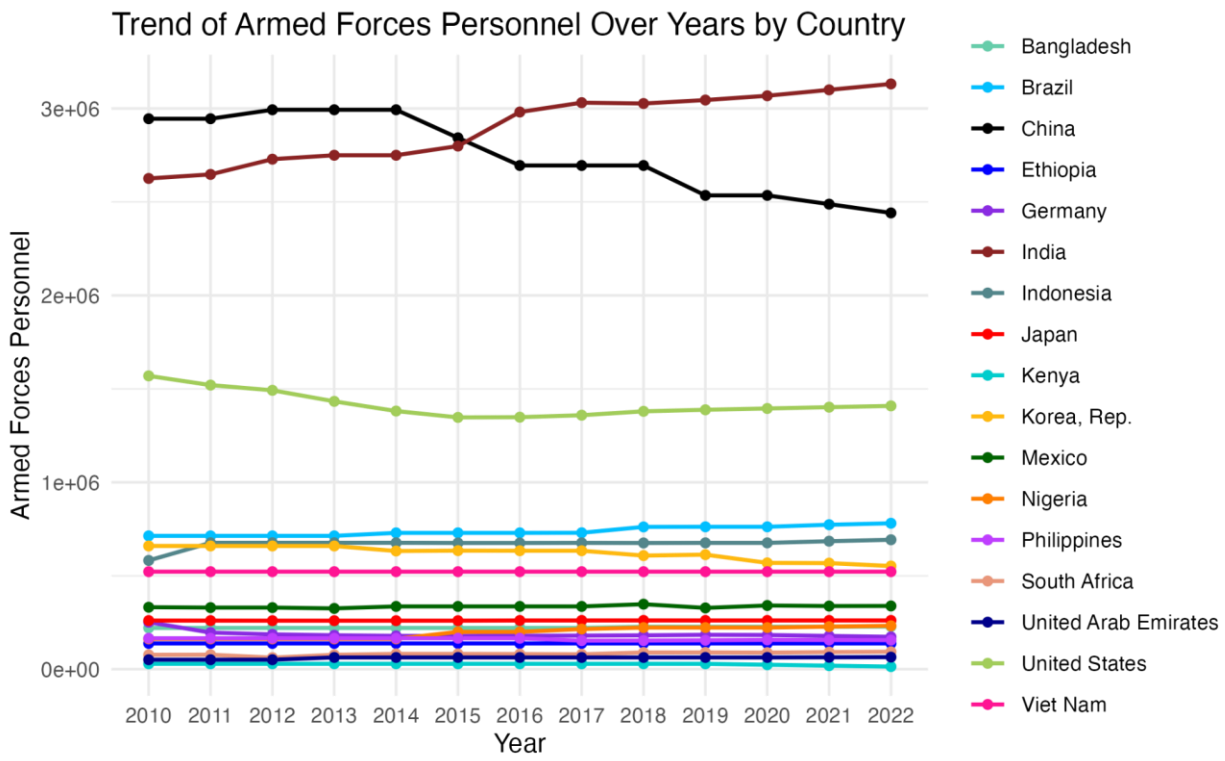


Figure 12

This final plot shows the total armed forces personnel for each country for the year 2020 using a bar graph, where each bar represents a country and is ordered in descending order. The country having the highest total armed forces personnel is India, followed by China and the United States.

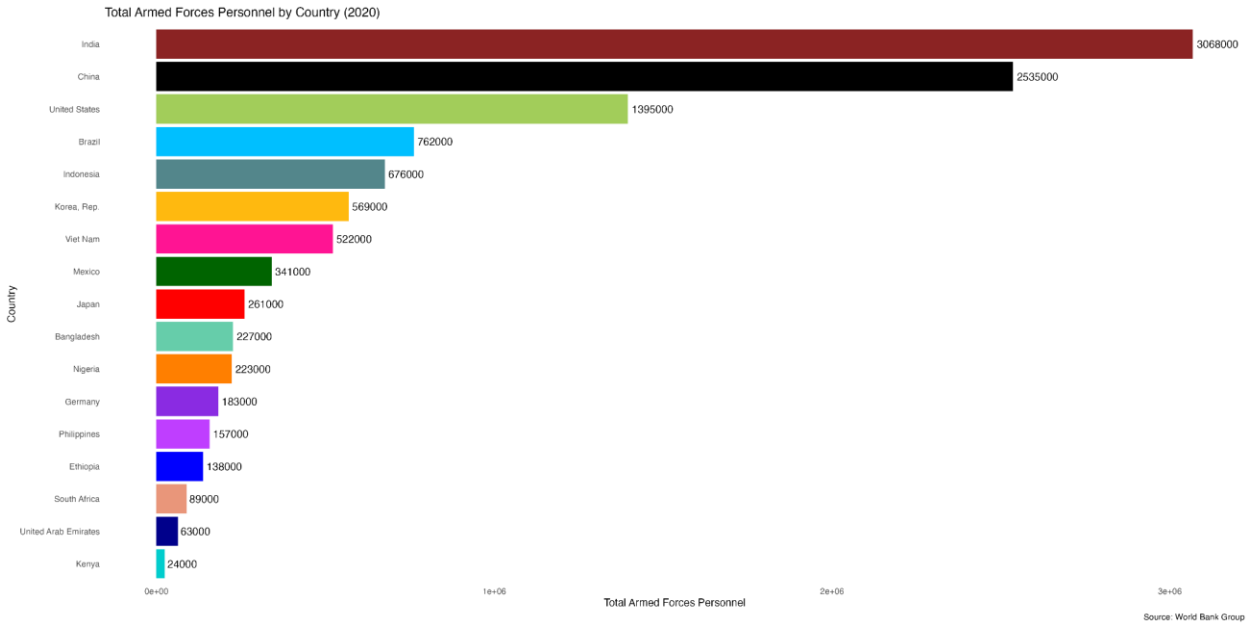


Figure 13

Discussion

The analysis of global development trends using the World Development Indicators database offers valuable insights into the socioeconomic and environmental factors shaping the trajectory of nations. Several key takeaways emerge from this study:

1. **Access to Essential Resources:** Progress in providing universal access to electricity highlights the success of infrastructure initiatives, particularly in countries like Kenya and India. However, disparities persist, emphasizing the need for targeted investments in regions with slower progress.
2. **Economic Diversification and Growth:** Trends in agricultural land use and the economic value-added by agriculture, forestry, and fishing underscore the shift from agrarian economies to diversified industrial sectors in many nations. While this signals economic growth, it also raises questions about the sustainability of land use and food security.
3. **Investments in Human Capital:** The correlation between government expenditures on health and education and improved outcomes, such as reduced mortality and infant mortality rates, demonstrates the transformative impact of investing in human capital. However, the variability in spending across countries suggests that additional factors, such as governance and healthcare access, play critical roles.
4. **Population and Demographics:** A decline in birth rates across most countries reflects global trends in healthcare and education. While lower birth rates are often associated with improved quality of life, they also pose challenges such as aging populations and workforce shortages in developed nations.
5. **Tourism and Economic Development:** Tourism expenditures reveal the sector's potential as an economic driver, particularly in emerging economies. The variability observed across nations highlights the influence of factors like global economic conditions, political stability, and infrastructure development.

Future Directions

To build on these findings, future research could explore the following areas:

1. **Localized Analyses:** Examining development trends at a regional or subnational level to identify intra-country disparities and tailor policy interventions accordingly.
2. **Sustainability Metrics:** Integrating environmental indicators, such as carbon emissions and renewable energy adoption, to evaluate the sustainability of development trajectories.
3. **Impact of External Shocks:** Assessing how global challenges like pandemics, climate change, and geopolitical conflicts affect development metrics and the resilience of countries.

4. **Causal Relationships:** Employing advanced econometric or machine learning techniques to determine causal relationships between investments in health, education, and observed socioeconomic outcomes.
5. **Cross-Sector Interdependencies:** Investigating how sectors like tourism, agriculture, and technology interact and influence overall development.

This study underscores the importance of data-driven policymaking to address global inequalities and promote sustainable development. By building on these insights and addressing emerging challenges, stakeholders can better navigate the complexities of development in the 21st century.