



GRAPHICAL ANALYSIS OF STATISTICAL DATA USING MATHEMATICAL MODELS

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Abstract. *This article highlights the content of statistical data and its importance today. analyzes the interrelationship of statistical data with mathematical models and the representation of data in various graphical forms through them.*

Keywords: *Statistical data, mathematical models, graphical analysis, line graph, bar graph, pie chart, scatter plot, time series, regression, visualization, forecasting, decision making, data analysis.*

Introduction

In today's globalization process, statistical data are used in all spheres of human life - economics, ecology, law, medicine, education, and other important professions. The sources of statistical data are diverse and include a large amount of data collected from state statistical committees, international organizations, scientific research, and even social networks. Based on this information, a deep analysis of the current situation is carried out, forecasts for the future are made, and strategic decisions are developed. For example, in the economy, indicators are used to determine the level of inflation, the volume of domestic statistical output, or budget policy planning, while in healthcare, they are important for the effective elimination of the state of morbidity of the population and healthcare programs.

Therefore, it is a statistical task to present data not only as a sum of numbers, but also in a systematized, understandable, and visual graphical form through mathematical models. Graphical visualization allows researchers and researchers, as well as for a wide range of processes, to represent complex processes in a simple and understandable form.

MAIN PART

Statistical data is a set of official reports, measurements, and collected information reflecting quantitative and qualitative indicators of events and processes in society, the economy, nature, and other spheres. Their significance today is multifaceted and manifests itself in the following main directions:

In the analysis and decision-making of economic acceptance processes

Statistical indicators (for example, gross domestic product - GDP, inflation rate, employment and unemployment, industrial production volume) are the most important tool for calculating economic trends and dynamics. Central banks, ministries of finance, and policymakers develop monetary, fiscal, and structural structures based on this





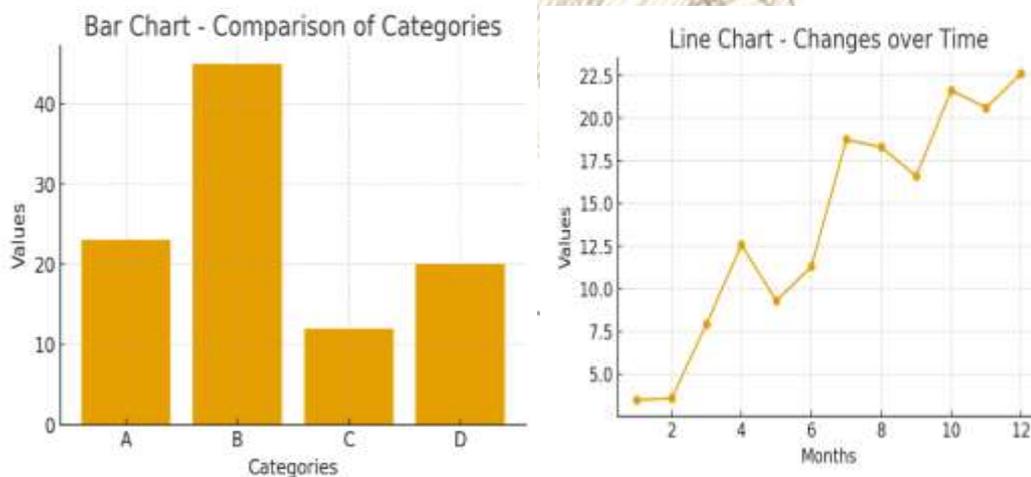
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information. For example, if the inflation rate is rising - there may be a need to tighten monetary policy or revise subsidies. At the same time, statistical analyses serve as a basis for economic models and forecasts - scenarios for the future are created for series analysis, regression, and scenario models.

Population incomes, employment status, poverty, and inequalities (e.g., the Gini coefficient) work to measure the quality of life and social security of humanity. Through this data, governments manage social protection programs, targeted assistance, and education and healthcare infrastructure. Also, environmental statistics (water quality, air pollution, biodiversity, dispatch indicators from water and land resources) are necessary to ensure the production and purification of natural resources. Water distribution, management, recreation, and injury assistance through continuous monitoring. Trends in statistical data sources assess the impact of human activity on data and natural systems.

Comparison of national and international statistical data, cooperation with investors in accordance with international legislation, participation in the submission of reports to donors. Transparent and reliable statistics determine the accountability of government work.

The success of statistical data in all the above-mentioned areas depends on its quality. Statistical data and mathematical models are inextricably linked - data is "entered" into the models. In the figure below, we can see the graphs of statistical data depicted using mathematical models. **(Fig. 1)**



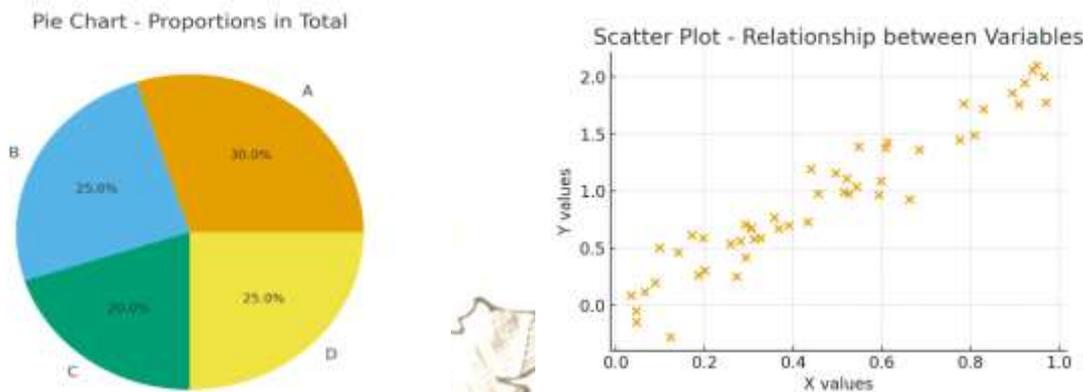


Figure 1. Graphical representation of statistical data using mathematical models

DISCUSSION AND RESULTS

Graphical representation of statistical data using mathematical models makes the analysis process effective and understandable.

1. Line chart

Linear graphs are widely used in the analysis of time series data. With their help, it is possible to monitor the dynamics of economic growth rates, population growth, water consumption, or environmental indicators. When preparing the data, it is necessary to convert the time column to datetime format and, if necessary, aggregate it by month or year. With the help of a line graph, it is possible to quickly determine trends, seasonality, and sharp changes.

2. Bar chart (Column chart)

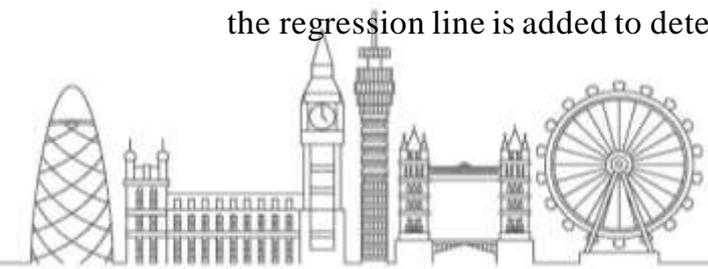
Bar graphs are used for comparing categorical data. For example, it is effective in showing water consumption in different regions or production volumes in economic sectors. To create it, the data is grouped by categories and the sum or average value is taken. The bar chart clearly shows which category is leading and which has a low indicator.

3. Pie chart (circular diagram)

Pie graph is used to show the proportion of data in the total sum. For example, it can represent the distribution of the state budget, the share of companies in the market, or the composition of resource use. When compiling it, sums are taken by categories and calculated as a percentage of the total. However, a pie chart is effective only when the number of segments is small (no more than 5-6).

4. Scatter plot

A scatterplot is used to determine the relationship between two variables. For example, it is possible to compare data such as income and expenses, water consumption and productivity, population size and energy consumption. To create the graph, two numerical columns (x and y) are selected. If a linear or other trend is observed at points, the regression line is added to determine the degree of dependence.





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CONCLUSION

The general result is that statistical data can be used more effectively not only in the form of numbers, but also by reflecting them in various graphs. Each type of graph has its own area of application: line chart - dynamics over time, bar chart - comparison of categories, pie chart - shares, and scatter plot plays an important role in determining relationships.

Thus, the analysis of statistical data in graphical forms based on mathematical models makes them more understandable, visual, and scientifically based, and makes it possible to make correct decisions.

In conclusion, statistical data play an important role in all spheres of human life in today's globalization process. They serve as the main source for making economic, environmental, social, legal, and scientific decisions. Analysis of statistical data not only in the form of numbers, but also in graphical form using mathematical models allows for a clearer and more accurate representation of their content.

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