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# The Contribution of Agriculture to GDP

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## The Contribution of Agriculture to GDP

It decreased by 4.3% between 2013 and 2021

The World Bank analyzes data on the percentage of GDP that comes from agriculture. The variable also includes forestry, hunting, fishing and livestock farming. Value added is determined as the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for the depreciation of manufactured assets or the depletion and degradation of natural resources.

*Ranking of countries by value of the percentage of GDP produced by agriculture.* Sierra Leone is in first place by value of the percentage of GDP produced by agriculture with a value of 57.45%, followed by Chad with a value of 53.99%, Ethiopia with 37.57%, Liberia with 36.96 %, and Niger with a value of 36.48%. In the middle of the table are Peru with an amount of 6.97%, St Vincent and the Grenadines and Uruguay with an amount of 6.91 %, Brazil with an amount of 6.89%, Belarus with an amount of 6, 80%, Georgia with an amount of 6.47%. The Bahamas close the ranking with a value of 0.49%, followed by Malta with a value of 0.41%, Qatar with 0.30%, Bahrain with 0.28%, Luxembourg with a value of 0.20% , Singapore with 0.03%.

*Ranking of countries by the value of the percentage change in GDP produced by agriculture between 2013 and 2021.* Qatar ranks first by the value of the percentage change in the percentage of GDP produced by agriculture with a value of 210.64%. followed by Congo with the amount of 123.28%, Equatorial Guinea with the amount of 120.68%, Oman with the amount of 85.66%, Brunei Darussalam with the amount of 83.49%. In the middle of the table are Finland with an amount of -3.02%, Ghana with an amount of -3.25%, Bulgaria with an amount of -3.30%, Tanzania with an amount of -3, 38%, Austria with a value of -3.38%, Rwanda with an amount of -3.49%. The ranking is closed by Zambia with a value of -58.75%, East Timor with a value of -59.49%, Malta with a value of 61.55%, Lebanon with a value of -64.60%, Cuba with a value of -77.53%, Sudan with a value of 78.53%. Overall, between 2013 and 2021, the average value of the percentage change in GDP produced by agriculture decreased by an amount equal to -4.26%.

*Machine learning and predictions.* A predictive analysis is proposed below through the use of machine learning algorithms to predict the future value of the percentage of GDP produced by agriculture. The algorithms were analyzed according to their ability to maximize the R-Squared and to minimize the statistical errors, i.e. MAE-Mean Average Error, MSE-Mean Squared Error, RMSE-Root Mean Squared Error. 80% of the data was used to train the algorithms while the remaining 20% was used for actual prediction. Thus an ordering of the algorithms is determined as follows:

- ANN-Artificial Neural Network with a payoff value of 6;
- Polynomial Regression and Gradient Boosted Tree with a payoff value of 10;
- Simple Regression Tree with a payoff value of 16;

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- Linear Regression with a payoff value equal to 21;
- Tree Ensemble Regression with a payoff value of 23;
- Random Forest with a payoff value of 28;
- PNN-Probabilistic Neural Network with a payoff value of 30.

By applying the ANN-Artificial Neural Network it is possible to predict the future trend of the value of the percentage of GDP deriving from agriculture. In particular, it is possible to identify winners and losers countries. The winning countries are those countries in which the percentage of GDP deriving from agriculture has grown. Loser countries are countries in which the share of GDP from agriculture has decreased.

*The winning countries.* The winning countries, i.e. the countries for which a growth in the percentage of GDP produced by agriculture is predicted, are: Switzerland with a value of 283.54%, United Kingdom with 253.87%, Sudan with 193.76%, United Arab Emirates with 163.77%, Trinidad and Tobago with a value of 155.8%, United States with a value of 150.93%, Sweden with 94.27%, St. Kitts and Nevis with 68.56%, Timor Leste with 61.67%, Slovenia with 58.11%, Slovak Republic with 49.05%, St. Lucia with 46.31%, Sierra Leone with a value of 26.79%, St. Vincent and the Grenadines with a value of 17.06%, Turkey with a value of 14.75%, Tanzania with 12.09%, South Africa 11.64%, Tonga 11.09%, Spain with 10.83%, Uzbekistan with 8.8% , Suriname with 6.08%, Zimbabwe with 5.42%, Thailand with 1.47%, Tunisia with 1.37%.

*Losing countries.* The losers countries or the countries for which a reduction in the value of agriculture as a percentage of GDP is predicted are: Uganda with -1.14%, Uruguay with -2.42%, Seychelles with -2.73%, Vietnam with -3.54%, Ukraine -4.3%, Singapore -7.87%, Sri Lanka -8.15%, Togo -9.02%, Zambia -9.11%.

*Conclusions.* The percentage of GDP deriving from agriculture decreased between 2013 and 2021 by an amount equal to a value of -4.26%. It is well known that in countries with a high gross domestic product, the percentage of GDP deriving from agriculture should be reduced, between 1% and 2%. Countries that have more than 2-3% of GDP from agriculture tend to be economies that lack the ability to perform effectively. If agriculture exceeds 3% of GDP then it is likely that those economies really have low to medium incomes per capita and are characterized by underdevelopment, underemployment and a growing output gap. However, to better understand the contribution of agriculture to a nation's GDP, it is necessary to introduce new indicators that take into consideration not only agricultural production, but also the GDP deriving from the processing of agricultural products, from research and development in agriculture and agro -industrial and from the transport and agricultural logistics sector. Only by putting these elements together could it be possible to effectively estimate the global impact of the agricultural sector and its manufacturing and logistics derivations on GDP.

## Declarations

*Data Availability Statement.* The data presented in this study are available on request from the corresponding author.

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*Declaration of Competing Interest.* The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication.

*Software.* The authors have used the following software: Gretl for the econometric models, Orange for clusterization and network analysis, and KNIME for machine learning and predictions. They are all free version without licenses.

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