

**ABSCHNITT 1.**

WIRTSCHAFTSTHEORIE, MAKRO- UND REGIONALWIRTSCHAFT

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# MODELING THE IMPACT OF DIGITAL TRANSFORMATION ON THE ECONOMIC DEVELOPMENT OF THE COUNTRY<sup>1</sup>

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Digital transformation is the process of introducing digital technologies into various aspects of organizations' and societies' activities to optimize, automate, and improve efficiency. It includes adapting business models, changing management processes, and integrating new tools for data collection and analysis. As a result of digital transformation, enterprises gain the opportunity to respond faster to market changes, reduce costs, improve the quality of products and services, and create new products and services, focusing on consumer needs.

Digital transformation is extremely important for economic processes, as it allows companies to increase their competitiveness, contributes to increased labour productivity, and opens new opportunities for innovation and integration into global markets. It can ensure more efficient use of resources, optimize production processes and improve interaction between all participants in economic systems. In addition, digitalization allows for the creation of new economic models that provide greater resilience to external risks and rapid adaptation to change.

Modelling the impact of digital transformation on the economies of countries allows us to accurately assess how the integration of new technologies changes

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various economic processes and institutions. This analysis helps governments and businesses predict possible consequences for productivity, employment, investment flows and social inequality. Understanding these impacts allows us to develop effective policy regulation strategies, determine priorities for investments in infrastructure, education and scientific and technological development, as well as adapt laws and regulations to new realities. Modelling also allows us to identify possible risks associated with digital inequality or technological security, which is important for ensuring stable and sustainable economic development. To analyse how digital transformation affects economic development, two groups of indicators were selected. The first group included the indicators of the European Commission's Digital Economy and Society Index (DESI) [1], as they characterize a country's readiness for automation, and its readiness to implement digital technologies, and characterize the ease and accessibility of interaction with government agencies. The second group included data on economic development indicators of the World Development Indicators, namely GDP per capita [2] and average life expectancy [3] for different countries of the world, as they are key indicators for assessing the level of economic development, well-being of the population, and quality of life in the country. The study used data from 27 European countries in 2017-2022.

The research methodology included the following steps:

- 1) conducting a primary analysis of input data and preparing them for modelling;
- 2) studying multicollinearity of input variables and eliminating it by conducting hierarchical clustering;
- 3) conducting factor analysis to eliminate the final effects of multicollinearity, as well as forming groups of the most influential factors;
- 4) building mathematical models and making forecasts using Ridge and Lasso regressions, Random Forest, XGBoost, and Support Vector Regression.

Ridge and Lasso regressions, Random Forest, XGBoost, and Support Vector Regression are powerful tools for modelling and forecasting panel data due to their specific characteristics and advantages. Ridge regression penalizes large coefficients in the model, which helps stabilize parameter estimates, while Lasso regression additionally performs variable selection, eliminating less important ones, which helps simplify the model without losing accuracy. Random Forest and XGBoost handle nonlinear relationships between variables well and can effectively handle panel data with a large number of variables and complex interdependencies. XGBoost, due to its regularization ability, is very resistant to overfitting, which is important when working with large data sets. Support Vector

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Regression is effective in problems where the data are mixed or unevenly distributed, which is often the case in panel data.

All of these methods have high robustness to noise in the data and the ability to find hidden patterns, which makes them suitable for forecasting and analyzing complex economic, social, or environmental systems represented in the form of panel data.

As a result, it was found that Lasso regression and Support Vector Regression are effective for modelling the impact of digital transformations on GDP per capita. The coefficient of determination and MAPE for the first model were equal to 0.9892 and 6.1795% and for the second model 0.983 and 6.577%. These characteristics were calculated for the test data set, which indicates the high quality of predicting changes in GDP per capita using these models.

In the process of modelling the impact of digital transformations on average life expectancy, it was determined that the most qualitative are Ridge Regression and Support Vector Regression. The corresponding values of the coefficient of determination and MAPE error for Ridge Regression are 0.9662 and 0.7351%. Forecasting using Support Vector Regression allowed us to obtain the following values of quality criteria, such as 0.951 and 0.677%.

As a result of the study, it was found that digital transformation has a significant impact on the economic development of countries, GDP per capita and average life expectancy. The use of various mathematical models, such as Lasso regression, Support Vector Regression and Ridge regression, made it possible to achieve high accuracy in predicting these changes, which confirms the effectiveness of the methods used. The results obtained indicate the importance of the development of digital technologies for increasing economic stability and well-being of the population. Modelling the impact of digital transformation allows us to more accurately assess its potential in different countries and develop effective strategies for further economic growth.

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