[IMPACT OF INNOVATIVES ON RENEWABLE ENERGY PRODUCTION IN BREZIL: USE, COMPETİTİON AND SUSTAINABILITY OF BIOFUEL ENERGY]

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# Overview

# In addition to being a need of social life, energy is seen as the most basic source of production, consumption and welfare of economic sustainability. In this regard, countries may engage in fierce competition and even war in order to possess, ensure accessibility and obtain energy, which has become a vital element. This political and economic competition, which has been going on for many years for access to fossil fuels, has changed direction as a result of the production of renewable energy resources obtained through innovation-based production, in terms of global climate change, environmental disinformation and consumability. With this new situation, geopolitical position has begun to lose its importance and the importance of countries with innovation power has increased. Within the scope of this opportunity provided by innovation, the production and consumption of environmentally friendly and recyclable renewable energy resources have led to a change in global energy demand and therefore economic policies.

# One of the renewable energy sources that emerged as a result of the change in energy demand is biofuel energy. Biofuels, in which CO2 emissions are minimized through biomass production, are a type of fuel obtained by converting organic substances into fuel (Işık and Yavuz, 2022; 194). In other words, it is a fuel produced by the use of agricultural products. Biofuel energy, which has a global value within energy agriculture, is increasing its importance day by day as it provides environmental and cost advantages. Within the scope of this importance, the study aimed to determine the impact of innovation activities on the production of biofuel, which is a renewable energy source. This determination will be made specifically for Brazil, which was unrivaled in the world until 2005 and the second highest producer after 2005 (BP, Access Date: 04.03.2024). Brazil is a country that directs world biofuel production in terms of production, development and competition of biofuel energy and is an exemplary country in this regard. Another purpose of the study in line with this value of the country is to present a detailed research on the development of biofuel production, initiatives implemented in Brazil, policies, commercial competition, consumption and future.

# With this study, it is aimed to increase awareness of biofuels, to develop competitive awareness in biofuel production of agricultural countries, to make inferences about energy policies and to adopt a sustainable production approach for renewable energy resources. At the same time, by determining the innovation resources required in biofuel production, it will be possible to determine the source of innovation gap in other countries. On the other hand, this study will be able to provide an economic and political guide to the process for countries that will compete in biofuel production in line with the objectives discussed.

**Methods**

The study will be based on an econometric model, and the effect of innovation indicators on biofuel will be tested with time series VAR analysis. Since the time constraint in time series analysis is determined as minimum 30, the analysis includes the years 1990 and 2021. The equational representation of the analysis made specifically for Brazil is as follows.

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BP: Biofule Production (kboe/d) (Renewable Energy Indicator) / Source: BP (https://www.bp.com/).

BC: Biofuel consumption (Kboe/d) (Innovation-Commercial Indicator) / Source: BP (https://www.bp.com/).

GE: Government Expenditure (Dollar) (Innovation-Corporate Indicator) / Source: The World Bank (https://databank.worldbank.org/source/world-development-indicators)

CO2: Carbon Dioxide Emission from Energy (Innovation-Environmental Indicator) / Source: BP (https://www.bp.com/).

IVE: Industry Value Added (Dollar) (Innovation-Technological Indicator) / Source: The World Bank (https://databank.worldbank.org/source/world-development-indicators)

PPP: GDP Per Capita (Dollar) (Innovation-Prosperity Indicator) / Source: The World Bank (https://databank.worldbank.org/source/world-development-indicators)

# Results

# It was determined that all variables included in the analysis were stationary at I(1) level.

# The analysis using the Inverse Roots of the AR Characteristic Polynomial determined that the model was stationary and stable.

# According to LM Autocorrelation Test Results, it was determined that the model did not contain an autocorrelation problem.

# In line with the results of the impulse response analysis, the reaction of BP to a one standard deviation shock in the independent variables is generally positive, although it may vary periodically. Although the highest positive impulse response function among the variables is seen in the GE indicator, the degree of impulse reaction in all variables is low.

# According to the variance decomposition results, it was observed that a variance change in the BP variable, that is, the shock, was caused by GE, CO2, BC, IVE and PPP variables, respectively.

# At the same time, Toda-Yamamoto causality test was also performed to make a different inference between the variables. According to the test results, a causal relationship was determined between BC, CO2 and GE variables and BP.

**Conclusions**

As a result of the analysis, it was observed that government expenditures have a large share among the innovation indicators in Biofuel production. This situation was also supported by the Toda-Yamamoto test. On the other hand, it has been observed that CO2 and biofuel consumption encourages the production of renewable energy sources. Since Brazil is a leading competitive country in renewable energy resources and energy agriculture, it maintains its current position with the initiatives and policies it implements. Brazil, which is an example to all world countries, especially agricultural countries, can maintain its power in renewable energy with collaborations and win-win policies to ensure the spread of biofuel production. On the other hand, this initiative can provide efficiency in many areas of economic growth and development, such as reskilling the employment involved in biofuel production, innovation trade, cost advantage, benefiting from economies of scale and increasing knowledge. When the country interacts with other countries with this power, it can benefit from positive externality opportunities for all sectors.

# References

# Işık, S., & Yavuz, S. (2022). Biyokütleden Elde Edilen Biyoyakıtlara Genel Bir Bakış. *Avrupa Bilim ve Teknoloji Dergisi*, 193-201. https://dergipark.org.tr/en/download/article-file/2275690.