The Effect of Institutional Quality on Renewable Energy: Evidence from Developing Countries

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ABSTRACT

Renewable energy has changed the development paradigm by prioritizing environmental sustainability in every stage of the country development. Therefore, this research specifically provides an overview of how the institutional quality is used as a basis for policy in developing countries. The research results show that the institutional quality with indicators of government effectiveness, voice and accountability have a significant effect, while regulatory quality and rule of law do not have a significant effect on renewable energy. Then, tax revenue, foreign direct investment, domestic credit has a significant effect, but government expenditure does not have a significant effect on renewable energy. These results are proof that every country must have strong quality institutions with a clear and comprehensive policy scheme considering that energy transition targets are not carried out easily, so they require large amounts of financing, especially from the private sector. The government fiscal space tends to be narrow, which is an obstacle in developing countries in allocating costs for the energy transition, so it must be directed at financing strategies contained in appropriate policies.

Keywords: Institutional Quality, Government Expenditure, Renewable Energy
JEL Classifications: G28, H50, E22, Q20

1. INTRODUCTION

Climate change has various mechanisms, actions and strategies for developing countries to mitigate and adapt to climate conditions. The 2005 Kyoto Agreement emphasized that developed countries reduce carbon emissions by 5.2% by 2012, although developing countries are not required to reduce emissions, but are encouraged to adopt policies and mechanisms that encourage a green economy. Then, the Paris Climate Change Conference in 2015 gave birth to C0P21 by holding a cooperation agreement for UN member countries to unite in reaching a legal and universal agreement towards reducing global warming. There are many efforts that have been made to address climate conditions to prepare for a better future as well as removing obstacles and working to support this

agreement (Banday and Aneja, 2020; Cozza et al., 2020; Dube and Horvey, 2023).

Researchers and policymakers have focused on environmental issues in seeking to increase sustainable production and consumption as a means of avoiding environmental degradation (Buhari et al., 2020; Gyamfi et al., 2022; Amar et al., 2024). Each country has different temperature levels with extreme weather as an impact arising from changes in the atmospheric layers as a result of global warming. However, the ecological response remains constant and has not moved in the right direction. Social development indicators, monetary policy, s openness, fossil fuels, industrial expansion have influenced the level of energy use (Alabi et al., 2017; Gil-Alana et al., 2020).

Even though there are big challenges faced, there is optimism that global warming can be overcome to a critical point with large financial resources from collaboration between countries, so that the use of renewable energy can be implemented (Adams et al., 2020; Banday and Aneja, 2019). Renewable energy is believed to be able to become the basis for addressing climate issues because it encourages overall energy efficiency with a green energy approach, such as electric vehicles, electric stoves, hydroelectric, wind and solar power plants, emission tax policies and recycling waste into energy. This effort aims to prevent obstacles from undisciplined human behavior and a lack of political support to support renewable energy policies that require consistency and become a driving force so that this program can run so that alternatives to the availability of natural resources for energy development further increase the need and demand for environmentally friendly products (Akçay and Demirtaş, 2015; Xie et al., 2020).

The promotion of renewable energy technology from developing countries has attracted the attention of stakeholders, the use of renewable energy encourages diversification of energy supplies while reducing the impact of carbon emissions resulting from fossil fuels requiring the adoption of technology with performance systems that will mitigate climate change. Even though these results have been acknowledged, there are still obstacles in strengthening energy security, both domestically produced and imported, so that this resolution process can be supported by coherent policies (Liu et al., 2020).

A country's policies related to renewable energy have the potential to influence natural resource exploitation, investment and economic growth with different conceptual frameworks. Energy policy will affect the economy in general in all aspects through the level of input-output, consumption, capital, state revenue and the government's commitment to implementing a policy (Kolawole et al., 2024; Meressa, 2022). The target of achieving renewable energy must be mandated by political policy with majority of effective government governance to maintain and achieve long-term solutions for the accessibility of the benefits of renewable energy. This should show that developing countries must concentrate on improving the quality of both political and non-political institutions in order to increase the stability and effectiveness of government performance, law, control of corruption and the quality of regulations (Imran et al., 2024; Kou et al., 2024).

From the fiscal side, a comprehensive system includes a framework with revenue and expenditure obligations carried out from the central government which are channelled to lower regional levels (Liu and Chu, 2019). This policy is seen as equalizing economic and social conditions considering the importance of high development standards in achieving progress (Zhao, 2020). One of the fiscal indicators, namely taxes, aims to obtain development costs from levies on tax objects as a budget ceiling for running government (Agbanike et al., 2019).

In this case, the government plays a direct role in implementing development and is responsible for the availability of public goods as physical and non-physical infrastructure whose cost sources are obtained from fiscal allocations from the government as funding (Iheonu et al., 2020; Khan et al., 2020). Not only that, private participation is needed as a balance to development so that involvement in providing infrastructure is in harmony and has an impact on the distribution of funding for the energy transition (Aboul-Atta and Rashed, 2021; Deka et al., 2023). Government institutions must make efforts to establish legislation that is committed to the public sector as a form of concern for improving structures, incentives and reducing risks as well as maximizing productivity to achieve high levels of output. This concept is needed to ensure that institutions encourage the use of renewable energy and increase energy efficiency to avoid climate change (Ben Jebli et al., 2019; Goyal et al., 2023; Udeagha and Breitenbach, 2023). Figure 1 displays renewable energy data for developing countries 2003-2022.

Figure 1 presents the use of renewable energy from total energy use in developing countries. If you refer to the picture above, there are several countries that have not achieved a high energy transition, such as Egypt, Arab Republic, Jordan, Lebanon, Mongolia and Ukraine, only under 10% per year. Meanwhile, countries such as Cameroon, Cote d'Ivoire, Zambia and Zimbabwe have reached more than 70% per year energy transition. Of these developing countries, Zambia had the highest level of renewable energy use in 2007 at 90.32%, Cameroon in 2005 at 86.31% and Zimbabwe in 2022 at 87.41%. The countries with the lowest use of renewable energy were Ukraine in 2003 at 0.99%, Jordan in 2003 at 1.98% and Lebanon in 2016 at 3.96%.

In terms of increasing use of renewable energy, India and Sri Lanka had a high increase between 2017 and 2022, however Bangladesh, Morocco and Vietnam had increasing levels of renewable energy at the beginning of the research year and then tended to decrease

Figure 1: Renewable energy consumption (% total of final energy consumption)
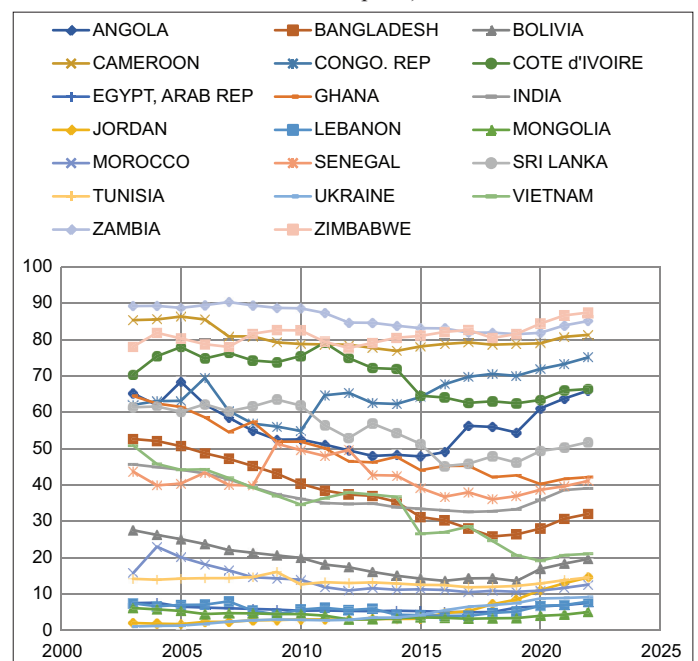
Source: World Bank, World Development Indicator (WDI) 2024

in 2019-2022. This condition shows that the use of renewable energy in developing countries tends to not be optimal due to the lack of sufficient funding to carry out the energy transition, besides that it also takes a long time so that assistance from international institutions is still needed in the transition mechanism.

2. LITERATURE REVIEW

This section will explain previous research regarding institutional quality and renewable energy. Sahara et al. (2022) explained that good government governance consisting of accountability, capacity and government performance is the key to successful development. With this, government effectiveness has a positive influence on renewable energy as a form of bureaucratic certainty that facilitates access in the development of the energy transition. Mahat et al. (2019) said that public services for the business sector have a positive influence on the progress of renewable energy with bureaucratic reforms carried out as a form of effective government performance in being serious about building an energy transition that is responsible for ensuring energy availability. Hart et al. (2022) and Hassan and Mhlanga (2023) produced different research with the conclusion that government effectiveness has no significant effect on renewable energy. Because, the poor level of service from the bureaucracy means that the alignment of government policies and private investors in developing renewable energy does not reach the maturity stage so it still depends on fossil energy.

Ogarenko and Hubacek (2013) explains that regulatory quality has a positive effect on renewable energy. These results provide evidence that improving public sector services in the context of improving the bureaucratic system will realize the privatization of business from the private sector as a form of confidence in improving regulations that simplify permits and tax services, thus supporting the creation of good corporate governance. Kolawole et al. (2024) believes that the bureaucratic sector has proven capable of providing a sustainable business climate as an effort to develop the energy transition in the right direction. The research results show that the quality of regulations has a positive effect on renewable energy in the form of distributing clean energy needs to households which will guarantee participation in encouraging climate change as contained in state agreements throughout the world. Li et al. (2022) and Meressa (2022) provides evidence that renewable energy can be achieved if transparency, predictability and regulatory burdens are adhered to by the private sector. Compliance is a special requirement for the energy transition to run optimally. The implementation of regulations is also carried out by the government itself in the form of providing research costs and funds for the development of renewable energy, all in an effort to avoid climate change in the future which will certainly endanger health and safety.

Liu and Gao (2007) Patra and Krishna (2015) provides evidence that the rule of law adheres strictly to applicable laws in running the government as well as the business cycle. The research results show that countries that have strong legal umbrellas will find it easier to implement sustainable programs, including renewable energy which has become an important issue recently. Renewable energy targets can be achieved with clear legal guarantees for the private sector in placing capital for energy transition needs. Legal protection will generate high trust with quality institutional factors that are considered capable of helping the birth of targeted policies. Kolawole et al. (2024) and Wiryawan and Otchia (2022) in her research found that legal regulations have a positive influence on renewable energy. Legislation acts as a foundation that leads to state institutions providing services that are not selective in making regulations as to guarantee justice for the private sector in order to avoid acts of corruption that will damage the legal order.

Jiang et al. (2020) and Wiryawan and Otchia (2022) shows the importance of institutional quality in addressing important issues such as climate change which is the main focus in all countries. Voice and accountability indicators are a form of bureaucratic reform so that accountability in exercising authority in government and the private sector runs optimally. Accountability has a positive influence on renewable energy by prioritizing performance that consistently manages existing resources in accordance with applicable regulations. Commitment from government institutions guarantees confidence for the private sector to be involved in development leading to the energy transition. Prempeh (2023) found research results that voice and accountability has a significant effect on renewable energy. The function of accountability is as a means of controlling abuse of authority that often occurs in the bureaucratic sector. Increasing efficiency and effectiveness in carrying out procedures and complying with laws has an impact on government programs that are working towards an energy transition so that climate change efforts can be anticipated before adverse impacts occur in the long term.

Wiryawan and Otchia (2022) investigated how government expenditure has a positive effect on renewable energy. Government expenditure is part of fiscal policy to regulate the course of the economy in determining the amount of state revenues and expenditures which are indicated in the allocation of funds for the development of renewable energy in a country which is expected to be able to encourage appropriate technology for environmental sustainability. Ullah and Inaba (2014) believes that government expenditure plays an important role in the allocation of funds in the energy sector by prioritizing the needs and services of the fiscal sector so that it is responsible for determining the size of the budget needed to achieve the energy transition. Al-Ghaili et al. (2022) and Atuahene and Sheng (2023) stated that tax revenue have a positive effect on renewable energy. For several decades, taxes have been used as the main source of state revenue with the aim of absorbing the budget from tax objects. This condition also refers to the country's large economic level which will also produce large taxes, for this reason this tax revenue will be directed towards renewable energy development strategies. However, research from Frutos-Bencze et al. (2020) has different results, tax revenue have no effect on renewable energy, indicating that the tax realization target in a country experiences stagnation or a decline in tax revenues experienced by developing countries, because the economic level is not too large, making budget allocations to sectors energy decreases.

As a control variable in this research, Gochero and Boopen (2020) and Tanaya and Suyanto (2022) provides evidence that foreign

direct investment has a positive effect on renewable energy, which indicates the need for large costs in the energy transition, especially from investors in developed countries which have done a lot of environmental damage. In the economic sphere, the addition of foreign capital will improve the balance of payments on the capital side as a contribution to the open economic policy, especially as it will also help with the technology transfer process. Research from Arif-Ur-Rahman and Inaba (2020) and Dada and Akinlo (2021) found that foreign direct investment results did not have a significant effect on renewable energy. Because, the varying distribution of investment from various sectors means that the energy sector does not necessarily receive large amounts of capital, but is also realistic in the use of renewable energy. Huang et al. (2020) provides evidence that domestic credit has no significant effect on renewable energy. The small allocation of costs from private financial institutions and the government is an obstacle for the private sector in obtaining capital to spur the energy transition. Gatzert and Kosub (2017) emphasized that domestic credit does not have a significant effect on renewable energy with the lack of trust in financial institutions in developing countries making it difficult for the private sector to obtain investment costs.

3. METHODOLOGY

3.1. Panel Data Model
Statistical method analysis with panel data able to build to analyse the role of institutional quality on renewable energy. Estimates from panel data are as follows:

$$Y_{it} = \alpha_i + \beta_1 X_{it} + \varepsilon_{it} \tag{1}$$

Where Y is dependent variable, β is variable coefficient, X is independent variable, i is denote a country (where $i = 1, 2… N$), and t is time period (where $t = 1, 2… N$), and ε is error terms. Based on equation 1, the panel data regression equation model in this study can be seen in equation 2:

$$RE_{it} = \beta_0 + \beta_1 GE_{1it} + \beta_2 RQ_{2it} + \beta_3 RL_{3it} + \beta_4 VA4_{it} + \beta_5 GGF_{5it} + \beta_6 TR_{6it} + \beta_7 FDI_{7it} + \beta_8 DC_{8it} + \varepsilon_{it} \tag{2}$$

Where:
RE_{it}: Renewable energy
GE_{1it}: Government effectiveness
RQ_{2it}: Regulatory quality
RL_{3it}: Rule of law
VA_{4it}: Voice and accountability
GGF_{5it}: Government expenditure
TR_{6it}: Tax revenue
FDI_{7it}: Foreign direct investment
DC_{8it}: Domestic credit

This research covers 20 developing countries 2003-2022. These countries include Angola, Bangladesh, Bolivia, Cameroon, Cote d'Ivoire, Egypt, Arab Rep, Ghana, India, Jordan, Lebanon, Mongolia, Morocco, Senegal, Sri Lanka, Tunisia, Ukraine, Vietnam, Zambia and Zimbabwe. The data in this research was obtained from World Bank publications via the World Development Indicator (WDI). Table 1 shows the definition of each research variable.

3.2. Panel Data Selection Method
Common effect model (CEM) is the first approach in the panel data method. In simple terms, this approach combines time series data and cross section. In addition, the data is assumed so it does not show the time dimension. Fixed effect model (FEM) is the second approach in the panel data method. Assuming that data between countries can be accommodated as an intercept. In this approach, the dummy variable technique can be used to assume if there are differences in the results obtained. Random effect model (REM) is the last approach in the panel data method. In this approach, the model has the possibility that data between countries is related so that the results of the analysis can be accommodated by intercepts and errors from each country studied (Satrianto et al., 2024).

Analysing using panel data required several stages to select the most appropriate model to be used in this research (Satrianto and Ikhsan, 2023). *First*, the Chow test was used to select the common effects model or fixed effects model (H_0 = CEM dan H_1 = FEM); *second*, the Hausman test was carried out to choose a fixed effects model or a random effects model (H_0 = REM dan H_1 = FEM); and *third* was the Lagrange multiplier test to select the common effects model or random effects model (H_0 = CEM dan H_1 = REM).

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistic
Descriptive statistics are used to obtain detailed characteristics of research data in order to describe projected research results. The results of this calculation can be seen in Table 2. The renewable energy variable has an average of 24.85, median 37.92, maximum 90.32 and minimum 0.99. This data shows that there is still a lack of use of renewable energy in developing countries and it must be developed in the long term as a form of environmental concern. Independent variable government effectiveness with an average of −0.56, median −0.52, maximum 0.68 and minimum −1.55, regulatory quality with an average of −0.57, median −0.50, maximum 0.34 and minimum −2.20, rule of law average of −0.60, median −0.60, maximum 0.47 and minimum −1.87, voice and accountability average of −0.59, median −0.63, maximum 0.60 and minimum −1.67, average government expenditure of 13.31, median 13.28, maximum 38.24 and minimum 2.05, average tax revenue of 12.90, median 12.64, maximum 31.09 and minimum 0.89 shows that a bad bureaucratic system will certainly affect services and legal certainty in policy making as well as fiscal allocations which must be greater than the achievements for renewable energy programs.

Variable control foreign direct investment average of 35.50, median 11.63, maximum 64.36 and minimum −7.39, domestic credit average of 40.11, median 38.96, maximum 126.38 and minimum 2.01 has shown that private financing schemes are able to encourage greater cost allocation for renewable energy.

Table 1: Variable measurement

Variable	Indicator	Acronym	Measurement
Renewable energy	Renewable energy consumption % total final energy consumption	RE	%
Institutional quality	Government effectiveness	GE	Scale
Institutional quality	Regulatory quality	RQ	Scale
Institutional quality	Rule of law	RL	Scale
Institutional quality	Voice and accountability	VA	Scale
Government expenditure	General government final consumption expenditure	GGF	% of GDP
Tax	Tax revenue	TR	% of GDP
Investment	Foreign direct investment	FDI	BOP current US$
Domestic credit	Domestic credit to private sector	DC	% of GDP

Table 2: Variable description

Variable	RE	GE	RQ	RL	VA	GGF	TR	FDI	DC
MEAN	24.85	−0.56	−0.57	−0.60	−0.59	13.31	12.90	35.50	40.11
MEDIAN	37.92	−0.52	−0.50	−0.60	−0.63	13.28	12.64	11.63	38.96
MAX	90.32	0.68	0.34	0.47	0.60	38.24	31.09	64.36	126.38
MIN	0.99	−1.55	−2.20	−1.87	−1.67	2.05	0.89	−7.39	2.01
STDV	28.34	0.44	0.47	0.53	0.58	4.73	5.69	83.24	25.77
KOV	7.04	0.02	0.02	0.03	0.03	0.63	0.73	29.55	10.33

Table 3: Chow test

Effect test	Statistic	d. f.	Probability
Cross-section F	364.7402	(29.672)	0.0000
Cross-section Chi-square	1190.8074	29	0.0000

Table 4: Hausman test

Test summary	Chi. sq statistic	Chi-sq df	Probability
Cross-section random	13.1394	9	0.1071

Table 5: Lagrange multiplier test

Null hypotheses: No effects alternative hypotheses Two sided (Breusch pagan) and one sided (all others) alternative	Test hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	2618.451 (0.0000)	6.729945 (0.0000)	2625.181 (0.0000)
Honda	51.17081 (0.0000)	−2.594214 (0.9953)	34.34884 (0.0000)
King-Wu	51.17081 (0.0000)	−2.594214 (0.9953)	34.34884 (0.0000)
Standardized Honda	63.84604 (0.0000)	−2.505411 (0.9939)	34.42791 (0.0000)
Standardized King-Wu	63.84604 (0.0000)	−2.505411 (0.9939)	34.42791 (0.0000)
Gourierioux et al.*	--	--	2618.451 (0.0000)

4.2. Result

4.2.1. Chow test
The results of Chow test show that this study uses the fixed effect model (FEM) as seen in Table 3. This can be seen from the probability value of the Chi-square of 0.000 which is <0.05 in Table 4. Based on this, the choice of the best approach is the fixed effect model (FEM) compared to the common effect model (CEM).

4.2.2. Hausman test
The results of Hausman test show that this study uses the random effect model (REM). This can be seen from the probability value

of the Chi-square of 0.1071 >0.05. Based on this, the choice of the best approach is the random effect model (REM) compared to the fixed effect model (FEM). These results can be seen in Table 5.

4.2.3. Lagrange multiplier test
The results of Lagrange Multiplier test indicate that this study uses the random effect model (REM). This can be seen from the probability value of the Chi-square of 0.0000 which is <0.05. Based on this, the choice of the best approach is the random effect model (REM) compared to the common effect model (CEM).

4.3. Panel Data Estimation Results
The statistical estimation results below will describe the condition of the renewable energy as the dependent variable, which is analysed with institutional quality as independent variables and variable control by foreign direct investment and domestic credit. After testing the model, the correct model to use is the Random Effects Model approach.

Based on the Table 6, the results of the panel data regression equation are as follows:

$$RE_{it} = 38.08472 - 5.341103\ GE - 1.045175\ RQ - 2.876438\ RL - 2.345662\ VA + 0.063271\ GFF + 0.131866\ RA - 2.100639\ FDI - 0.201272\ DC \tag{3}$$

On estimate get government effectiveness has a regression coefficient of −5.341103. These results show that there is a negative influence on renewable energy. That is, if 1% increase government effectiveness will decrease renewable energy by −5.341103. Regulatory quality has a regression coefficient of −1.045175. These results show that there is a negative influence on renewable energy. That is, if 1% increase regulatory quality will decrease renewable energy by −1.045175. Rule of law has a regression coefficient of −2.876438. These results show that there is a negative influence on renewable energy. That is, if 1% increase rule of law will decrease renewable energy by −2.876438. Voice and accountability has a regression coefficient of −2.345662. These

Table 6: Panel data estimation result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RE	38.08471	4.894260	7.781508	0.0000
GE	−5.341102	1.565402	−3.411968	0.0007
RQ	−1.045175	1.654362	−0.631769	0.5279
RL	−2.876438	1.670512	−1.721890	0.0859
VA	−2.345662	1.060302	−2.212258	0.0275
GFF	0.063271	0.079794	0.792923	0.4283
TR	0.131866	0.049909	2.642126	0.0086
FDI	−2.100639	5.671825	−3.703638	0.0002
DC	−0.201272	0.021614	−9.311966	0.0000
Effects specification				
Cross-section fixed (dummy variables)				
R-squared	0.339267	Mean dependent var		1.718191
Adjusted R-squared	0.325749	S.D. dependent var		5.053640
S.E. of regression	4.149686	Sum squared resid		6732.979
F-statistic	25.09529	Durbin-Watson stat		0.328870
Prob (F-statistic)	0.000000			

results show that there is a negative influence on renewable energy. That is, if 1% increase voice and accountability will decrease renewable energy by −2.345662.

Government expenditure has a regression coefficient of 0.063271. These results show that there is a positive influence on renewable energy. That is, if 1% increase government expenditure will increase renewable energy by 0.063271. Tax revenue has a regression coefficient of 0.131866. These results show that there is a positive influence on renewable energy. That is, if 1% increase tax revenue will increase renewable energy by 0.131866. Foreign direct investment has a regression coefficient of −2.100639. These results show that there is a negative influence on renewable energy. That is, if 1% increase foreign direct investment will decrease renewable energy by −2.100639. Domestic credit has a regression coefficient of −0.201272. These results show that there is a negative influence on renewable energy. That is, if 1% increase domestic credit will decrease renewable energy by −0.201272.

4.4. Discussion

Renewable energy highlights the importance of institutional quality, public services and legal certainty as the basic foundation for policy formulation so that the energy transition runs well. The research results show that government effectiveness has a significant effect on renewable energy. The service quality parameters from the government as support for the bureaucracy must operate in accordance with independence and credibility. Research from Gyamfi et al. (2022) and Meressa (2022) shows that the results of government effectiveness have a significant effect on renewable energy in developing countries. Strategic policies in the field of reform must be implemented sustainably, massively and simultaneously at all levels of government, including professional institutional quality that must bring clear results in the form of digitalization, business simplification and procurement of government goods and services that can be accessed by the private sector as a form of government commitment in supporting renewable energy. Kou et al. (2024) stated that good, accountable, merit-based government and excellent public service performance will give birth to quality public services as a form of connecting the government's hand to the private sector which requires policy

certainty and special attention that will have an impact on the economy, investment and energy transition. Access that focuses on energy transition goals leads to awareness of the importance of maintaining environmental quality so that the use of renewable energy can increase every year.

The regulatory quality does not have a significant effect on renewable energy in developing countries. This result indicates that regulations or rules have not been planned, integrated and sustainable in directing services towards the use of renewable energy. Kirikkaleli et al. (2021) and Lwesya (2022) stated that the lack of digitalization of regulations from governments in developing countries is an obstacle in the accuracy and quality implementation of regulations which will slow down the process of formulating policies in realizing the energy transition. The important thing about regulations is the active role of the private and public sectors to utilize regulations as a response to policy documentation from the government so that they are adhered to and adhered to regularly in order to produce innovation towards the use of renewable energy with a wider scope with the aim of being able to meet climate change targets. Ogarenko and Hubacek (2013) and Zhao (2020) emphasized that the regulatory quality has not been able to have a significant influence on renewable energy. Regulations must be formulated with simplicity to avoid conflicts of interest within the bureaucratic sphere so as not to interfere with the goals of environmental sustainability. The need for proper planning and implementation with a comprehensive, systematic and strong institutional approach in formulating regulations and resource capacity are determining factors for renewable energy programs to be achieved with clear goals and direction.

The rule of law does not have a significant effect on renewable energy in developing countries. These results provide evidence that sectoral legal institutions do not yet have full and comprehensive legal force in order to provide clear legal protection for the private sector. Acheampong (2019) and Fisseha (2023) states that legal principles in developing countries do not guarantee the supremacy of law which is vulnerable to abuse of authority that does not provide justice. For this reason, implementing a renewable energy program requires a clear relationship between policies and legal principles that clearly regulate and well-functioning implementation and structure. Ammann and Ehmann (2017) and Bannò and Redondi (2014) emphasizes that the economic achievements of developing countries must be based on legal regulations that can accommodate the needs of the private sector in carrying out the business cycle so that investment is channel to the productive sector, creating employment opportunities, reducing inequality and poverty. Efforts made to use renewable energy also experience obstacles and have the potential to reduce technological innovation, because there is no serious support or commitment from the relevant institutions in providing regulations based on a fair framework.

Voice and accountability have a significant influence on renewable energy in developing countries. Governments that have high accountability and credibility are characterized by responsibility, commitment and power and able to provide conducive conditions in the institutional environment. Harnesk and Brogaard (2017)

and Jiang and Chen (2020) states that the use of renewable energy needs to be a special concern for governments of all countries, this is no exception for the government environment to ensure activities that focus on goals and targets in realizing the energy transition. The relationship between the government and the private sector to maintain harmony in economic development includes an orientation towards accountability for each sector in maintaining trust in policy performance and is implemented by the private sector to develop the economy at large, such as international trade, mastery of technology, investment and others. It should be remembered that the gradual use of renewable energy must reduce fossil energy a whole, from the micro to macro use as a form of seriousness in responding to the challenge of climate change. Jibran et al. (2024) voice and accountability play an important role in forming a system and governance in implementing good governance, consistently implementing applicable laws and regulations honestly, objectively, transparently and innovatively as a catalyst for change in government management. This condition will provide structural benefits for the private sector to realize investment activities for the development of renewable energy with the aim that the use of this energy will have a good impact on the economy and maintain environmental quality.

Government expenditure is part of fiscal policy as a form of government intervention in the economy. The function carried out by the government is in the form of government expenditure or spending in order to obtain goods and services to meet public needs. Government spending does not have a significant effect on renewable energy in developing countries. These results are in line with Joshi et al. (2019) and Sarker (2024) who revealed that government expenditure has not supported the energy transition, because the government is more focused on social changes in society such as education, health, poverty, inequality and welfare. Therefore, the budget allocation from the government to answer the challenges of renewable energy is inadequate with mechanisms for procuring goods and services and focuses more on other sectors. In fact, by looking at budget proportions, almost many countries have allocated large budgets to achieve the energy transition so that anticipation of climate change can occur. Okere et al. (2022) sees that there are obstacles from developing countries in allocating climate change budgets, limited state revenues are a particular obstacle in developing countries when the economic scale is not too large. For this reason, developing countries need sufficient time to achieve energy transition over a long period of time with assistance from developed countries.

Tax revenue has a significant influence on renewable energy in developing countries. As a form of concern for climate change, the tax sector also plays an important role in fulfilling the renewable energy budget. This result is in line with Zhao and Zhao (2023) who stated that tax revenues play a role in fiscal needs so that the allocation space can be wider. The existence of tax incentives for the private sector eases the government burden in setting tax revenue targets by reducing private sector obligations which are expected to be able to increase state revenues. If tax incentives are used well by the government, then fiscal allocations for renewable energy development have a good future for environmental safety. Padhan et al. (2020) and Wang et al. (2020) believes that the use

of renewable energy will have an impact on a large scale over the next few years. Tax realization is considered to still be able to be a determining factor in budget allocation in technological innovation efforts, market expansion and providing solutions to environmental damage that continues to occur so that renewable energy products will provide solutions for the world.

Foreign direct investment has a significant influence on renewable energy in developing countries, this indicates that financing from the private sector is a support for achieving renewable energy goals. Foreign direct investment should receive special attention from stakeholders to provide space for the private sector to innovate as widely as possible in efforts to develop renewable energy. This method is considered to reduce risk, encourage diversification and managerial exchange as a form of sustainable capital flow growth. The private sector ability to manage business covers all aspects that are useful for the transfer of technology and human resources which are very necessary in the production process. The costs obtained from foreign direct investment can provide certainty for the development of renewable energy as commercialization and abandon fossil energy which tends to be environmentally unfriendly. For this reason, all efforts and utilization of investment must be directed appropriately and carefully as to achieve the target of reducing environmental impacts (Chica-Olmo et al., 2020; Fletcher, 1999; Kurtenbach et al., 2012).

Domestic credit has a significant influence on renewable energy in developing countries. Referring to private capital flows, domestic credit can provide broad benefits for the availability of capital needed for the energy transition. The results of this research are in line with stated that countries that have strong financial institutions can stimulate the flow of domestic and foreign capital into a country. This condition is also influenced by several factors, such as loan interest rates, inflation, exchange rates and fiscal policy. Economic development will improve if domestic credit levels are able to channel capital into productive sectors as a form of production of goods and services. If we refer to the goal of the energy transition, this condition guarantees the availability of capital from financial institutions by making it easier for services to provide a larger portion specifically for the development of renewable energy so that incentives are given so that credit distribution has an impact on activities in preserving environmental quality (Kung et al., 2021; Lehtovaara et al., 2012; Olujobi, 2020; Sweidan, 2012).

5. CONCLUSION

This research focuses on the quality of institutions regarding renewable energy in 20 developing countries. The research results show that institutional quality with indicators of government effectiveness and voice and accountability have a significant influence on renewable energy, indicating that government policies in encouraging renewable energy are still responding positively as a form of support for the energy transition. Meanwhile, regulatory quality and rule of law do not have a significant effect on renewable energy, which is interpreted in the form of a lack of support from a strong legal system, especially in developing countries that do not yet have a legal system that is based on targeted policy foundations.

The variables tax revenue, foreign direct investment and domestic credit have a significant effect, but government expenditure does not have a significant effect on renewable energy. The private financing sector plays an important role in efforts to support the energy transition, so the allocation of costs from the private sector is directed at an incentive concept specifically for renewable energy financing which will have an impact on the private sector massive contribution in saving the environment in order to prepare for good environmental conditions in the future. For this reason, all parties, both government and private, are expected to collaborate with the principle of providing mutual benefits based on the role of each party so that policy harmony can run well.

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