PROBLEMY EKOROZWOJU/ PROBLEMS OF SUSTAINABLE DEVELOPMENT
SUBMITTED:24.09.2024, ACCEPTED: 4.10.2024, PUBLISHED ON-LINE: 10.01.2025
2025, 20(1): 288-309
DOI: 10.35784/preko.6620

Economic Growth and Sustainable Development in Asia: The Role of Political Institutions and Natural Resources

Wzrost gospodarczy i zrównoważony rozwój w Azji: rola instytucji politycznych i zasobów naturalnych

Li Guo[1*], Romanus Osabohien[2,3], Armand Fréjuis Akpa[3,4], Mamdouh Abdulaziz Saleh Al-Faryan[5]

[1]Liaoning University, School of Finance and Trade, ShenYang,110000, China
[2]Universiti Tenaga Nasional (UNITEN), Institute of Energy Policy and Research (IEPRe), Kajang, Malaysia
[3]DEPECOS Institutions and Development Research Centre (DIaDeRC), Ota, Nigeria
[4]Institut Supérieur Agronomique et Vétérinaire de Faranah (ISAV/F), Faranah, Guinea
[5]Board Member and Head of the Scientific Committee at The Saudi Economic Association, Riyadh, Saudi Arabia
**E-mail (Corresponding Author): Gllndx86@163.com*

Abstract
While economic growth will help to achieve individuals' welfare by increasing their capita income sustainable development must made safe the environment in which individuals live. To achieve these goals, nations must extract their natural resource and need strong institutions. The goals of this paper are to analyse the effects of political institutions and natural resource on economic growth by one side and by the other on sustainable development. Data are collected from world bank development on Asian countries during the period 2002-2023 and both POLS, FEM and GMM are used for estimate. Outcomes suggest that political institutions and natural resource effects on economic growth and sustainable development are mixed. This means that there is a need to reinforce institutions in Asian nations if they want that the extraction of their natural resource alleviates poverty, achieves people's welfare while ensuring the sustainable development.

Key words: political institutions, natural resource, economic growth, sustainable development
JEL Codes: Q01, Q28, P28, F43

Streszczenie
Podczas gdy wzrost gospodarczy pomaga osiągnąć dobrobyt jednostek poprzez zwiększenie ich dochodu na mieszkańca, zrównoważony rozwój musi uczynić środowisko, w którym żyją jednostki, bezpiecznym. Aby osiągnąć te cele, narody muszą wydobywać swoje zasoby naturalne i potrzebują silnych instytucji. Celem tego artykułu jest analiza wpływu instytucji politycznych i zasobów naturalnych na wzrost gospodarczy z jednej strony i z drugiej na zrównoważony rozwój. Dane są zbierane ze Światowego Banku Rozwoju dotyczące krajów azjatyckich w okresie 2002-2023, a do oszacowania wykorzystano zarówno POLS, FEM, jak i GMM. Wyniki sugerują, że wpływ instytucji politycznych i zasobów naturalnych na wzrost gospodarczy i zrównoważony rozwój jest zróżnicowany. Oznacza to, że istnieje potrzeba wzmocnienia instytucji w krajach azjatyckich, jeśli chcą, aby wydobywanie ich zasobów naturalnych łagodziło ubóstwo, osiągało dobrobyt ludzi, zapewniając jednocześnie zrównoważony rozwój.

Słowa kluczowe: instytucje polityczne, zasoby naturalne, wzrost gospodarczy, zrównoważony rozwój

1. Introduction

Sustainable development has been of paramount importance to economies around the world since the United Nations adopted the SDGs to consider an inclusive perspective of economic growth. Countries have considered meeting the needs of present generations without compromising the ability of future generations to meet their own. Countries have placed sustainable development at the heart of economic policies for several decades, which has taken on significant importance with environmental protection, integration and social equity, the desertion of public utilities and the resilience of economies. Indeed, sustainable development encompasses economic sustainability, social sustainability and environmental sustainability. The countries of the world in general and the most vulnerable countries in particular are concerned with sustainable development, particularly because of resource constraints.

The Asian region, composed of a mix of countries at different levels of development, is not far behind in ensuring sustainability. It is the most dynamic, innovative and rapidly developing region in the world. On average, countries have made remarkable progress over the last two decades, with annual GDP growth higher than that of regions in the rest of the world (ESCAP, 2024). Some countries are well advanced in achieving the Sustainable Development Goals (UN, 2024). Indeed, some countries such as China and Japan have significantly improved their public utility services, unlike countries such as Mongolia or Pakistan. In middle-income economies, nearly 40% of the region's population lives below the poverty line (USD 1.25 per day). In low-income countries, at least 20% of the population does not have access to safe drinking water (ESCAP, 2023).

Energy consumption per capita is also the lowest in the world with population growth. Households do not have the resilience capacities needed in vulnerable environments. Faced with this situation, Asian economies continue to regress climate action, and it is becoming increasingly urgent to act to reverse this trend (ESCAP, 2024). In high-income countries, economic growth comes at the cost of environmental degradation. In China, for example, most greenhouse gas emissions from industrialization are gradually becoming a growing threat (UN, 2024). In addition, inequalities in these economies are widening.

Various economic, social and environmental challenges persist in Asian economies. Progress towards the implementation of the 2030 Agenda for Sustainable Development remains uneven and insufficient in Asian countries (ESCAP, 2024; Osabohien et al., 2024; Osabohien et al., 2024b). The prospects discussed are causing a brake on growth dynamics. An unfavorable global context undoubtedly contributes to the decline in the dynamics of progress. The poly-crisis context has disrupted lives, pushing millions into poverty and widening inequalities. Successive crises have had significant social, economic and environmental consequences that are gradually reflected in economic performance (ESCAP, 2023; Imeokparia et al, 2023; Osabohien et al., 2024c). In this context, the use of natural resources, the state of the environment and intergenerational equity become important to improve the resilience of economies. In addition, countries have diverse institutional environments.

However, despite peace, stability and various positive achievements, economic difficulties and slowing democratization have deepened the unequal distribution of power and resources, leading to a wide range of inequalities, tensions and conflicts between different social groups in the region (Sharimova et al., 2023). This situation can make it difficult to include the fruits of growth. The succession of social and economic crises has been a test for the institutional environment of the countries of the subregion, particularly for democracies seeking a balance between the principles of democratic governance and the preservation of their political subject (Natalina, 2022).

The COVID-19 pandemic, for example, has only reinforced doubts about the ability of modern institutions of representative democracy to discern articulated public interest and accountability (Farrell & Han, 2020). Political and institutional volatility can disrupt economic policies that aim to sustainably develop economies based on dynamic and innovative growth. The COVID-19 has severely affected the economics of Asian countries because estimations revealed that real GDP of the developing Asian region is contracted by 0.4% in 2020 (Sawada & Sumulong, 2021). Similarly, the COVID-19 has seriously impacted Asian institutions such as healthcare systems, education and Labor markets (Osabohien et al., 2024c).

In the realm of literature, numerous studies have primarily focused on the factors contributing to the sustainable development of economies in Asian countries (Bartniczak & Raszkowski, 2019; Wei & Huang, 2022; Cheng & Adejumo, 2021; Khan et al., 2022; Pardi et al., 2021; Pandey & Asif, 2022; Jiang & Chang, 2022; Latif et al., 2017; Asghar et al., 2023; Zheng et al., 2023). However, only a few studies have taken into consideration the significance of the institutional environment. Younis & Chaudhary (2017) demonstrated that the quality of institutions has no significant effect on sustainable development. Conversely, in South Asian countries, Ahmed et al. (2022) discovered that financial development and political institutions collectively have a positive and significant effect on green growth.

This study seeks to bridge this gap in the literature by contributing to the existing research on three aspects. The first aspect is to consider political institutions as factors that could make the growth of Asian economies sustainable. Indeed, the quality of institutions can render growth dynamics more inclusive and sustainable. As a second original contribution, we also consider the natural resources possessed by the country. Empirical studies have

indicated that the sustainable use of natural resources and regulatory pressure from institutions have an insignificant effect on economic growth (SAR Khan et al., 2020).
Therefore, it would be interesting to explore the effect of natural resource wealth on the relationship between growth and sustainable development. As a final original aspect, we consider the development mix of Asian economies. Specifically, we segment Asian economies by income level into three groups: Lower Middle Income, Upper Middle Income, and High Income. (Younis & Chaudhary, 2017) conducted a similar analysis, but it focused on geographic aspects due to its emphasis on natural environments. However, considering income levels enables us to examine groups facing similar institutional challenges.
The objective of this study is to determine the role of the institutional environment and natural resources in the relationship between growth and sustainable development in Asian countries. To achieve this, we utilize linear regression with pooled OLS and instrumental regression by the generalized method of moments for robustness. We conduct estimations for all countries and marginalize estimations by groups of countries according to their income levels. This paper aims to contribute to policy debate for the actualization of Sustainable development goals (SDG) achievement, notably SDG 8 which consider economic growth aspects, SDG 13 which climate action including environment protection and SDG 16 in which strong institutions building is an indicator. The subsequent sections of the paper are organized as follows: Section two presents a literature review, Section three explains the empirical modelling, data, and estimation methods, Section four details the empirical results and discussion, and Section five offers conclusions and policy implications

2. Methodology

In this section, we present the methodology of the study in two steps. First, we present the variables and data sources. Then, we present the estimation methods.

2.1. Data and variables

The secondary data used in the paper are extracted from the annual data of the Asian Development Bank and the World Bank for Asian countries. The data covers the period from 2002 to 2023. The choice of data and the number of countries is conditioned by the availability of data. We divide the countries into three groups[1] according to the income level of the economies. The explained variable of the study is SD (Sustainable Development) measured by the adjusted net savings. As variables of interest, we have growth by capital (GDPPC), natural resource capacity (TNR) and the institutional environment contains control of corruption (CC), government effectiveness (GE), political stability (PS), regulatory quality (RQ), voice and accountability (VA) and law and order (RL). The control variables are composed of technology (Tec) and the labour force in the country (Lovcha and Perez-Laborda). The institutional policy indicators come from the World Bank's World Government Indicator database. In Table 1, we present the descriptive statistics of the variables for all countries, low-income, middle-income and high-income countries.

2.2. Estimation method

In this paper, we opted for two estimation methods to ensure the robustness of the results obtained. We use panel data to combine cross-sectional and time-series information. The incorporation of these two dimensions of the panel increases the coverage of available data and provides an advantage in terms of information and more careful estimations in our case study which involves several variables of interest. We can use several estimation techniques commonly used in the literature (Wei & Huang, 2022; Cheng & Adejumo, 2021; Khan et al., 2022; Jiang & Chang, 2022; Latif et al., 2017; Asghar et al., 2023).
The recurrent estimation methods are fixed effects (FE), random effects (RE), two-stage least squares (2SLS) and generalized methods of moments (GMM). Each approach has its strengths and limitations. Two methods address anomalies associated with panel data, such as heteroscedasticity, endogeneity, and serial correlation. Therefore, we use pooled GCMs and the generalized method of moments. This choice is consistent with subsequent investigations that have demonstrated the importance of using these models with the heterogeneity of Asian economies in terms of sustainability (Hameed et al., 2023; Ilyas et al., 2024). The estimating equation in this paper is:

$$SD_{it} = \beta_0 + \sum \beta_{it} PI_{it} + \beta_1 TNR_{it} + \beta_2 tec_{it} + \beta_3 Labor + \varepsilon_{it} \quad (1)$$

With this in mind, we present the estimation methods used in the article.

[1] The three income groups are 1) Lower-middle-income countries which Bangladesh, Bhutan, Cambodia, India, Kyrgyzstan, Laos, Myanmar, Nepal, Pakistan, Philippines, Tajikistan, Timor-Leste, Uzbekistan and Vietnam; 2) upper-middle income countries are – Armenia, Azerbaijan, China, Indonesia, Iraq, Jordan, Kazakhstan, Lebanon, Malaysia, Maldives, Mongolia, Sri Lanka and Thailand; 3) upper middle-income countries are Bahrain, Brunei, Israel, Japan, Kuwait, Oman, Qatar, Saudi Arabia, Singapore and South Korea

2.2.1. Generalized OLS estimator

The estimation of the generalized OLS model follows the empirical equation 2, n_i is the time-invariant unobserved effect specific to each country that satisfies my following condition$n_i \sim iid(0, \sigma_n)$; $\varepsilon_{it} \sim$ idd$(0, \sigma_\varepsilon)$; $E(n_i\, \varepsilon_{it}) = 0$. In the panel, the generalized OLS method is used as an improved version of ordinary least squares (OLS) to deal with endogeneity and provide more consistent estimates with heterogeneous data. However, the application of linear estimation models entails some complexities.

Approaches such as fixed effects (FE) and random effects (RE) have their strengths and limitations, requiring careful consideration depending on the research context. FE estimation is well suited when cross-sectional samples are selected with certainty, but becomes less useful when dealing with variables that are constant over time. In contrast, the RE approach assumes no correlation between the fixed effects of the cross-sectional samples and the independent variables, making it suitable for situations where cross-sectional samples are selected randomly.

$$\Delta SD_{it} = \beta_0 + \sum \beta_{it} PI_{it} + \beta_1 TNR_{it} + \beta_2 tec_{it} + \beta_3 Labor + n_i + \varepsilon_{it} \quad (2)$$

In the case of study, we use both approaches for three reasons. First, none of the chosen variables is constant over time. Second, no correlation is possible between the cross-sectional fixed effects, because there is a mix of income levels of the economies, and the governance models of the economies are disparate. Finally, even if our sample is not chosen randomly, we use both approaches to ensure the robustness of the results.

2.2.2. The GMMs estimator

The GMM estimation follows the empirical equation 3. Unlike generalized OLS, GMM is an instrumental auto-regressive estimation, which conforms us to lagged dependent variables. Lags of the regressor have some impact on the estimation. These impacts mean that country-specific fixed effects may be correlated with the lagged dependent variable and some explanatory variables may be endogenous. This can lead to inconsistency of linear regressions and bias in the estimates. However, the panel difference generalized method of moments (GMM) estimator, developed by (Arellano & Bover, 1995) and Blundell & Bond (1998), addresses these issues. It uses the lagged differences of the predetermined variable as instruments for their levels and the differences of the strictly exogenous variables.

It presents at least three advantages in the case study: it allows to obtain, in the presence of delayed variables, unbiased, convergent and efficient estimators which allows to correct the presence of endogeneity (Arellano & Bover, 1995); it takes into account the unobservable factors which can have an impact both on the sustainable development of economies and the explanatory variables through the instruments (Younis & Chaudhary, 2017); finally, it allows to correct the simultaneity bias between the variables of interest and control (Wooldridge, 2013).

$$SD_{it} = SD_{it-1} + \beta_0 + \sum \beta_{it} PI_{it} + \beta_1 TNR_{it} + \beta_2 tec_{it} + \beta_3 Labor + n_i + \varepsilon_{it} \quad (3)$$

3. Results and discussion

3.1. Descriptive statistics

Table 1 summarises the descriptive statistics of the variables included in the regression. For all countries, the mean value of sustainable development is around 8.79e+10 current dollars. Given that the heterogeneity among nations, an analysis based on income is done. We remark a difference between income level group. For example, the highest sustainable development is observed in high income countries (8.89e+10 current dollars) when the lowest is recorded in upper-middle income nations (1.48e+11 current dollars). The remark done for all Asian countries is that all governance indicator is less than 50%, indicating that low governance performance.

Indeed, the mean values of control of corruption, government effectiveness, political stability, regulatory quality, rule and law and voice and accountability is 40.491%, 47.526%, 38.064%, 44.946%, 42.860% and 29.801%, respectively. Outcomes based on income level nations showed that control of corruption (73.007%), government effectiveness (74.528%), political stability (60.741%), regulatory quality (74.110%), rule and law (73.292%) and voice and accountability (38.192%) are all recorded in high income nations. Similarly, the lowest mean values of control of corruption (26.239%), government effectiveness (32.038%), political stability (25.134%), regulatory quality (26.304%), rule and law (28.026%) and voice and accountability (26.188%) are all recorded in lower-middle income nations. These outcomes showed that there is a heterogeneity among the different Asians income levels nations. The mean value of economic growth (GDPPC) for the all nations is 11169.72 US dollars, with a standard deviation of 15119.6. The highest mean GDPPC is found in high income nations at 33194.66 dollars, while the lowest is in lower-middle income nations at 1979.023 dollars, indicating heterogeneity within income level groups.

The mean value of labor force participation rate (Labor) for the all nations is 60.670% of total population ages 15+, with a standard deviation of 10.555. The highest mean Labor is found in high income nations at 66.322%, while the lowest is in lower-middle income nations at 56.641, indicating heterogeneity within income level groups. The mean value of mobile cellular subscriptions (TEC) for the all nations is 84.461 per 100 people, with a standard deviation of 49.514. The highest mean TEC is found in high income nations at 116.84, while the lowest is in lower-

middle income nations at 60.922, indicating heterogeneity within income level groups. The mean value of total natural resources rents (TNR) for the all nations is 11.234% of GDP, with a standard deviation of 14.938. The highest mean TNR is found in high income nations at 19.285, while the lowest is in lower-middle income nations at 5.528, indicating heterogeneity within income level groups.

Table 1. Summary statistics of variables, source: Authors' own work

	ALL countries		**Lower-middle income**		**Upper-middle income**		**High income**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Var	**Mean (Std. Dev.)**	**Min [Max]**	**Mean (Std. Dev.)**	**Min [Max]**	**Mean (Std. Dev.)**	**Min [Max]**	**Mean (Std. Dev.)**	**Min [Max]**
SD	8.79e+10 (2.90e+11)	-1.33e+10 (2.40e+12)	3.66e+10 (9.09e+10)	-1.33e+10 (5.08e+1)	1.48e+11 (4.77e+11)	-1.25e+10 (2.40e+12)	8.89e+10 (1.11e+11)	-6.81e+0 (4.29e+1)
CC	40. 491 (26.593)	0.476 (99.047)	26.239 (19.715)	0.476 (93.333)	32.397 (18.668)	1.463415 (67.724)	73.007 (13.693)	43.333 (99.04)
GDPPC	11169.72 (15119.6)	364.002 (73493.27)	1979.023 (1720.897)	364.00 (9037.0)	5069.857 (2794.198)	542.655 (11402.7)	33194.66 (13767.12)	15561.4 (73493.2)
GE	47.526 (25.115)	0 (100)	32.038 (18.956)	1.905 (72.857)	45.676 (19.857)	0 (85.436)	74.528 (15.285)	42.647 (100)
Labor	60.670 (10.555)	36.4 (87.615)	56.641 (9.896)	39.674 (77.2)	61.331 (10.849)	36.4 (76.165)	66.322 (8.237)	52.058 (87.615)
Tec	84.461 (49.514)	0 (212.453)	60.922 (43.922)	0 (154.49)	88.756 (48.585)	0.076 (190.525)	116.84 (38.161)	19.830 (212.45)
Ps	38.064 (27.117)	0 (99.048)	25.134 (21.554)	0 (94.685)	36.405 (20.261)	0 (88.359)	60.741 (27.896)	7.109 (99.047)
RQ	44.946 (24.542)	0 (100)	26.304 (15.639)	0 (60)	45.498 (16.097)	1.0810 (78.378)	74.110 (13.420)	46.19 (100)
RL	42.860 (25.1227)	.48 077 (98.571)	28.026 (18.230)	0.952 (73.33)	37.279 (18.458)	0.481 (71.153)	73.292 (11.967)	52.153 (98.57)
TNR	11.234 (14.938)	0. 0001 (79.430)	5.528 (8.798)	0.001 (79.43)	11.858 (14.939)	0.002 (65.318)	19.285 (18.290)	0.0002 (59.070)
VA	29.801 (20.307)	0.00 (84.972)	26.188 (18.683)	0 (63.184)	27.627 (15.303)	0.497 (59.203)	38.193 (25.196)	2.347 (84.976)

Note: SD means sustainable development, CC means control of corruption, means GDP per capita, GE means government effectiveness, Labor means labour, Tec means technology, Ps means political stability, RQ means regulatory quality, RL means rule of law, VA means voice and accountability

3.2. Economic growth, institutions and natural resources

To analyse the effect of institution and natural resource on economic growth in Asian nation, three kinds of estimation are used to check for the robustness of the outcomes. The findings using POLS, fixed effect model and GMM are reported in Tables 2, 3 and 4 respectively. On one side, we presented the outcomes of the effect of natural resource on all Asian countries together as well as within income group and on the other side the outcomes of the effect of institutional quality on all Asian countries together as well as within income group.

Natural resource has a positive effect on economic growth for all Asian countries when using the POLS estimation (Table 2). Similarly, we got the same results for fixed effect model except for the specification with voice and accountability, where there is no effect (Table 3). For the GMM, natural resource effects on economic growth are mixed (Table 4). For the specifications with control of corruption, political stability, regulatory quality and voice and accountability, natural resource increases economic growth, while specifications with government effectiveness and rule and law decrease economic growth.

For lower-middle income nations, the effects of natural resources on economic growth are mixed depending on the specifications. For example, according to the POLS regression outcome and with specifications including control of corruption, political stability, rule and law and voice and accountability, natural resource negatively affects economic when positively influences economic growth with regulatory quality and government effectiveness. The results using fixed effect model showed that the effect of natural resource with all specifications on economic growth is negative and positive when using GMM technique except for control of control result which is insignificant.

In the upper-middle income Asian countries, the effects of natural resources on economic growth are mixed, depending on the specifications and the estimation techniques. For example, the POLS and GMM regression outcomes both showed that natural resource positively influences economic growth. However, the outcome when using fixed effect negatively influence economic growth for all specifications. Finally, in the high-income Asian countries, results with POLS regression showed that except for political stability where natural resource negatively affects economic growth and for and voice and accountability where natural resource has insignificant effect on economic growth, outcomes with the other institutional quality indicators are positive. Fixed effect model and GMM regression outcomes both showed that natural resource positively influences economic growth.

Overall, we can summarize that the outcomes of the effect of natural resource are mixed in all Asian nations as well as within the income levels groups, showing a heterogeneity across Asian nations. This also shows that the association amongst natural resource and economic growth is not linear and that from a level of natural resource extraction this leads to environment degradation and in turn have consequences on human activities and on economic growth. The positive results show that natural resource is beneficial for economic growth, indicating that natural resource is a blessing for Asian nations. This means that rents from natural resources is re-allocated in other sectors like education for example, this improving population welfare (Akpa, 2023).

Similarly, the negative outcomes show that natural resources can constitute a malediction for Asian nations which do not well use it for development. This can be due to low performance of institutions to re-allocate the rents from natural in another productive sector. The outcome for the positive effect is in line with Erum & Hussain (2019) in OIC countries and Tahir et al. (2023) in Brunei Darussalam when those with negative outcome is conformed to Singh et al. (2024) in P5 + 1 countries namely: US, UK, France, China, Russia, and Germany and Aslan & Altinoz (2021) in Europe, Asia, Africa, and America nations.

When interested to examine how institutional quality indicators impact growth, we found that all the indicators of institutional quality positively affect economic growth for all Asian countries when using the POLS estimation (Table 2). Similarly, we got the same results for fixed effect model except for the specification with voice and accountability, where there is no effect (Table 3). For the GMM, institutional quality effects on economic growth are mixed (Table 4). When Control of corruption, political stability, regulatory quality and voice and accountability increase economic growth, government effectiveness decreases economic growth and rule and law has no effect on economic growth. For lower-middle income nations, the effects of all institutional quality indicator on economic growth are positive.

The results using fixed effect model showed that except for control of corruption and voice and accountability where the effects are insignificant, the effects of the other institutional quality variable are positive. The findings when using GMM technique are negative for all indicators. In the upper-middle income Asian countries, except for voice and accountability where it decreases economic growth, all the other institutional quality indicators improve economic when using the POLS regression. Similarly, the outcome when using fixed effect positively influence economic growth for all specifications except for political stability where the effect is negative and voice and accountability where the effect is insignificant.

The outcomes with GMM regression showed that voice and accountability positively influence economic growth, while government effectiveness and regulatory quality decrease economic growth, and the other indicator did not affect economic growth. Finally, in the high-income Asian countries, results with POLS and fixed effect model regressions showed that all institutional quality indicators positively affect economic growth except for voice and accountability results in the fixed effect model where it effects on economic growth is insignificant. However, the results of GMM regression are mixed. The effects of rule and law on economic growth are positive when those of government effectiveness, political stability and voice and accountability are negative. Furthermore, control of corruption and regulatory quality has no effect on economic growth.

As in the case of natural resource, we can summarise that, institutions have a mixed effect in all Asian nations as well as within the income levels groups, showing a heterogeneity across Asian nations. This also shows that the association amongst institutional quality and economic growth is not linear and that a level of institutional quality is needed to achieve economic growth. The positive results show that institutions are beneficial for economic growth, indicating that strong institutions are favourable to economic growth. This means that an improvement in institutions allow for example to decrease additional fees generated by corruption and avoid financial mismanagement, this can increase economic growth. Similarly, the negative outcomes show that there is a need to improve institutions within Asian countries. The outcome for the positive effect is in line with Mehmood et al. (2023) in South-Asian countries and Hayat (2019) in 104 nations when those with negative outcome is conform to Abate (2022) in emerging nations and Erum and Hussain (2019) in OIC nations.

Table 2. Economic growth, institutions and natural resources – pooled OLS estimate dependent variable: GDP PC, source: Authors' own computation

	ALL Asian countries					
Var	**1**	**2**	**3**	**4**	**5**	**6**
cons	-24115.3*** (0.000)	-24486.2*** (0.000)	-19719.1*** (0.000)	-25823.46*** (0.000)	-26683.9*** (0.000)	-3356 4.22 (0.000)
Tnr	212.3*** (0.000)	311.009*** (0.000)	145.156*** (0.000)	254.453*** (0.000)	263.536*** (0.000)	272.49*** (0.000)
tec	34.696 *** (0.000)	28.806*** (0.000)	75.707 (0.000)	14.601 (0.211)	25.247*** (0.005)	79.102*** (0.000)
Labor	254.352*** (0.000)	186.307*** (0.000)	231.933*** (0.000)	239.197*** (0.000)	261.965*** (0.000)	471.46*** (0.000)
cc	362.013*** (0.000)					

ge		386.549*** (0.000)				
PS			233.688*** (0.000)			
RQ				408.202*** (0.000)		
RL					393.663*** (0.000)	
VA						222.60*** (0.000)
obs	710	710	710	710	710	710
Prob	0.0000***	0.0000***	0.0000***	0.000***	0.0000***	0.0000***
R-sq.	0.6474	0.6052	0.4518	0.6287	0.6475	0.947
Lower-middle income Asian countries						
Var	**7**	**8**	**9**	**10**	**11**	**12**
cons	2683.392 (0.000)	2853.232 (0.000)	2920.718 (0.000)	1833.981 (0.000)	2473.65 (0.000)	2175.608 (0.000)
Tnr	-25.16*** (0.000)	5.700*** (0.513)	-32.23*** (0.000)	4.996*** (0.600)	-9.328*** (0.070)	-28.254*** (0.000)
tec	7.310*** (0.000)	5.579*** (0.000)	7.390*** (0.000)	3.723*** (0.139)	7.189*** (0.000)	6.747*** (0.001)
Labor	-23.837* (0.015)	-45.57*** (0.000)	-25.091** (0.010)	-24.82*** (0.000)	-27.648 (0.001)	-13.818 (0.148)
cc	13.766*** (0.000)					
ge		41.011*** (0.000)				
PS			9.019*** (0.000)			
RQ				48.989*** (0.000)		
RL					24.613*** (0.000)	
VA						14.109*** (0.000)
obs	292	292	292	292	292	292
Prob	0.0000***	0.0000***	0.000***	0.000***	0.0000***	0.0000***
R-sq.	0.998	0.742	0.870	0.892	0.5316	0.0984
Upper-middle income Asian countries						
Var	**13**	**14**	**15**	**16**	**17**	**18**
cons	-3510.655 (0.035)	-2768.89** (0.006)	1089.393 (0.108)	-1325.472** (0.041)	-225.488 (0.087)	2175.608 (0.000)
Tnr	70.038*** (0.000)	81.288*** (0.000)	22.608*** (0.003)	52.660*** (0.000)	60.065*** (0.000)	-28.254*** (0.000)
tec	29.742*** (0.000)	27.225*** (0.000)	30.733*** (0.000)	29.289*** (0.000)	28.669*** (0.000)	6.747*** (0.001)
Labor	45.359*** (0.005)	8.7648 (0.114)	-2.116 (0.817)	6.242 (0.391)	29.039* (0.019)	-13.818 (0.148)
cc	71.867*** (0.000)					
ge		85.842*** (0.000)				
PS			30.612*** (0.000)			
RQ				61.286*** (0.000)		
RL					60.556*** (0.000)	
VA						14.109*** (0.000)
obs	228	228	228	228	228	292

Prob	0.0000***	0.0000***	0.0000***	0.000***	0.0000***	0.0000***
R-sq.	0.4193	0.5 083	0.3297	0.3597	0.3778	0.0984
High Income Asian countries						
Var	**19**	**20**	**21**	**22**	**23**	**24**
cons	-86893.6*** (0.000)	-99732.32 (0.000)	-47318.95 (0.000)	-84522*** (0.000)	-1 06611*** (0.000)	-56700*** (0.000)
Tnr	138.494*** (0.000)	349.328 (0.000)	-153.355 (0.016)	137.437*** (0.002)	307.678 *** (0.000)	-47.702 (0.447)
tec	8.474 (0.455)	-20.533 (0.020)	-11.465 (0.551)	-28.339** (0.015)	-33.258*** (0.003)	-27.893 (0.174)
Labor	1054.08*** (0.000)	1103.1*** (0.000)	1146.12*** (0.000)	1195.99*** (0.000)	1096.333*** (0.000)	1348.11*** (0.000)
cc	637.158*** (0.000)					
ge		743.71*** (0.000)				
PS			144.819*** (0.000)			
RQ				527.004*** (0.000)		
RL					887.498*** (0.000)	
VA						122.121 (0.000)
obs	190	190	190	190	190	190
Prob	0.0000***	0.0000***	0.0000***	0.000***	0.0000	0.0000***
R-sq.	0.8094	0.8014	0.6616	0.6871	0.7842	0.6082

Note: P-values are in brackets ( ), ****, **, and * means significance at 1%, 5% and 10%

Table 3. Economic growth, institutions and natural resources – fixed effects estimate, source: Authors' own computation

	ALL Asian countries					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
cons	185.986 (0.944)	-1903.54 (0.617)	2308.191 (0.425)	518.412 (0.833)	-251.427 (0.910)	6581.275** (0.004)
Tnr	43.318 (0.023)	48.843** (0.018)	26.852* (0.078)	34.888 (0.080)	51.717** (0.010)	24.709 (0.153)
tec	15.700*** (0.000)	14.508*** (0.000)	15.966*** (0.000)	14.534*** (0.000)	14.789*** (0.000)	15.599*** (0.000)
Labor	111.068 (0.013)	123.722** (0.026)	97.199** (0.031)	95.925** (0.014)	93.483** (0.010)	59.632 (0.104)
cc	64.086*** 0.000)					
Ge		82.476*** (0.000)				
PS			38.831*** (0.000)			
RQ				74.341*** (0.000)		
RL					94.435*** (0.000)	
VA						-15.590 (0.295)
obs	710	710	710	710	710	710
Prob > F	0.0000***	0.0000***	0.0000***	0.000***	0.0000***	0.0000***
R-sq	0.1095	0.1270	0.1001	0.1166	0.1245	0.0799
Lower-middle income Asian countries						
Variable	**7**	**8**	**9**	**10**	**11**	**12**
cons	2755.08*** (0.001)	1312.345 (0.119)	2087.66** (0.015)	1909.41*** (0.009)	2048.02*** (0.006)	2716.91*** (0.003)

Tnr	-17.663*** (0.000)	-15.808*** (0.001)	-15.475 (0.001)	-16.538*** (0.000)	-13.301*** (0.006)	-17.486*** (0.000)
tec	8.013*** (0.000)	8.192*** (0.000)	7.606*** (0.000)	7.919*** (0.000)	8.149*** (0.000)	8.013*** (0.000)
Labor	-19.946 (0.128)	-3.828 (0.780)	-13.143 (0.320)	-10.880 (0.341)	-14.686 (0.212)	-19.536 (0.158)
cc	- 0.664 (0.850)					
Ge		15.207*** (0.000)				
PS			11.245*** (0.007)			
RQ				11.848* (0.067)		
RL					12.691*** (0.003)	
VA						-0.128 (0.955)
obs	292	292	292	292	292	292
Prob > F	0.0000***	0.0000***	0.0000***	0.000***	0.0000***	0.0000***
R-sq	0.4983	0.5364	0.5385	0.5186	0.5221	0.4983
Upper-middle income Asian countries						
Variable	**13**	**14**	**15**	**16**	**17**	**18**
Cons	8225.229*** (0.001)	6336.2*** (0.002)	9720.7*** (0.001)	8015.60*** (0.003)	6979.81** (0.010)	9256.66*** (0.001)
Tnr	-20.487 (0.042)	-16.564* (0.078)	-34.048*** (0.000)	-28.989*** (0.000)	-22.395** (0.025)	-32.275*** (0.000)
tec	18.369*** (0.000)	18.258*** (0.000)	18.237*** (0.000)	18.345*** (0.000)	17.988*** (0.000)	18.525*** (0.000)
Labor	-89.871** (0.019)	-64.834** (0.043)	-90.727** (0.036)	-81.107** (0.039)	-72.473* (0.072)	-90.044** (0.026)
cc	29.911*** (0.001)					
Ge		28.152*** (0.000)				
PS			-8.279* (0.094)			
RQ				16.354* (0.060)		
RL					32.294** (0.035)	
VA						2.684 (0.799)
obs	228	228	228	228	228	228
Prob > F	0.000***	0.000***	0.000***	0.00***	0.000***	0.000***
R-squared	0.6168		0.5950	0. 6001	0.6075	0.5916
High Income Asian countries						
Variable	**19**	**20**	**21**	**22**	**23**	**24**
Cons	-3750 8.9** (0.022)	-52453.1*** (0.004)	-15108.75 (0.109)	-26868.49** (0.013)	-42108*** (0.005)	5425.375 (0.332)
Tnr	208.756*** (0.005)	215.307*** (0.001)	118.429*** (0.005)	163.107*** (0.003)	232.835*** (0.007)	150.739*** (0.005)
tec	15.262* (0.089)	-11.840 (0.152)	22.063 (0.034)	8.288 (0.296)	-3.896 (0.558)	6.641 (0.485)
Labor	661.855*** (0.001)	735.454*** (0.001)	466.83*** (0.001)	379.393*** (0.004)	505.211*** (0.000)	389.815*** (0.000)
cc	287.615 (0.000)					
Ge		457.563*** (0.000)				

PS			205.458*** (0.000)			
RQ				415.417*** (0.000)		
RL					515.208*** (0.000)	
VA						-46.275 (0.365)
obs	190	190	190	190	190	190
Prob > F	0.000***	0.000***	0.000***	0.00***	0.000***	0.000***
R-squared	0.822	0.901	0.903	0.623	0.832	0.873

Note: P-values are in brackets ( ), ****, **, and * means significance at 1%, 5% and 10%

Table 4. Economic growth, institutions and natural resources – GMM Estimate, source: Authors' own computation

	ALL Asian countries					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
_cons	-55358.81*** (0.000)	-75 294.1*** (0.000)	-51229.58*** (0.000)	-55547.19*** (0.000)	-63466.21*** (0.000)	-600139.31*** (0.000)
Tnr	13.805** (0.041)	-117.54*** (0.000)	19.721*** (0.002)	1 6.921*** (0.006)	-37.560*** (0.000)	119.312*** (0.000)
tec	-16.099*** (0.000)	-25.844*** (0.000)	-17.420*** (0.000)	-14.758*** (0.000)	-20.156*** (0.000)	-14.746 (0.000)
cc	49.049*** (0.000)					
Ge		-78.531*** (0.000)				
PS			134.707*** (0.000)			
RQ				57.292*** (0.000)		
RL					-8.527 (0.117)	
VA						179.948*** (0.000)
obs	613	613	613	613	613	613
Wald	889.2	486.49	111.38	589 3.47	99.79	10.34
Prob > chi2	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(1)	9.69*** (0.000)	4.18*** (0.000)	3.25*** (0.001)	9.81*** (0.000)	8.82 *** (0.000)	5.44*** (0.000)
AR(2)	5.15 (0.000)	0.44 (0.659)	2.80 (0.005)	5.59 (0.000)	4.57 (0.000)	1.26 (0.207)
Sargan (1)	920.08*** (0.000)	809.92*** (0.000)	421.82*** (0.000)	913.24*** (0.000)	850.71*** (0.000)	600.09*** (0.000)
Sargan (2)	2057.45*** (0.000)	1494.66*** (0.000)	939.94*** (0.000)	1084.40*** (0.000)	1407.78*** (0.000)	769.08*** 0.000
	Lower-middle income Asian countries					
Variable	**7**	**8**	**9**	**10**	**11**	**12**
_cons	- 18602.8*** (0.000)	-17928.01*** (0.000)	-18689.93*** (0.000)	-16882.7*** (0.000)	-17606.32 (0.000)	-16388.64*** (0.000)
Tnr	1.976 (0.598)	12.357*** (0.001)	36.744*** (0.000)	28.467*** (0.000)	6.544* (0.083)	35.670*** (0.000)
tec	-4.176*** (0.000)	-6.104*** (0.000)	-4.295*** (0.000)	-6.285*** (0.000)	-5.950*** (0.000)	-5.857*** (0.000)
cc	-23.230*** (0.000)					
Ge		-12.235*** 0.000				
PS			-18.554*** 0.000			
RQ				-10.017*** (0.000)		
RL					-15.396*** (0.000)	

VA						-5.650*** (0.000)
obs	244	244	244	244	244	244
Wald.	389.61	52.31	5.70	7893 5.85	97.44	74610.86
chi2	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(1)	2.24 0.025	3.66 0.000	0.79 0.430	2.54 0.011	4.14 0.000	1.74 0.082
AR(2)	0.15 (0.877)	0.65 (0.519)	-1.89 (0.058)	-0.79 (0.429)	-0.36 (0.719)	-1.63 (0.103)
Sargan (1)	472.80*** (0.000)	581.00*** 0.000	420.65*** (0.000)	483.44*** (0.000)	594.55*** (0.000)	457.53*** (0.000)
Sargan (2)	492.65*** (0.000)	665.26*** (0.000)	449.62*** (0.000)	564.39*** (0.000)	585.26*** (0.000)	430.01*** (0.000)
Upper-middle income Asian countries						
Variable	**13**	**14**	**15**	**16**	**17**	**18**
cons	-31365.1*** (0.000)	-32163.91*** (0.000)	-31040.6*** (0.000)	-31349.14 0.0000	-31167.5*** (0.000)	-31706.5*** (0.000)
Tnr	1 2.805** (0.010)	5.776 (0.233)	18.930*** (0.000)	6.794 0.028	15.512*** (0.000)	21.263*** (0.000)
tec	2.408*** (0.001)	1.631** (0.024)	3.008*** (0.000)	2.450*** (0.000)	2.789*** (0.000)	2.903*** (0.000)
cc	-4.676 0.226					
Ge		- 9.956*** (0.004)				
PS			1.709 (0.450)			
RQ				-12.801*** (0.000)		
RL					-2.273*** (0.408)	
VA						6.032** (0.010)
Wald Chi2(5)	106811.52	1060.50	108367.38	104793.14	109088.32	108213.41
Prob>Chi2	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(1)	0.04 (0.972)	0.23 0.820	0.44 0.662	0.20 0.845	0.39 0.698	0.51 0.610
AR(2)	-0.17 (0.866)	-0.25 (0.802)	-0.23 (0.818)	-0.10 (0.920)	-0.16 (0.873)	-0.07 (0.944)
Sargan (1)	554.81 (0.000)	554.95 (0.000)	447.64 (0.000)	501.30 (0.000)	563.62 (0.000)	525.48 (0.000)
Sargan (2)	567.07*** (0.000)	555.51*** (0.000)	598.79*** (0.000)	573.55*** (0.000)	497.66*** (0.000)	548.49*** (0.000)
High-income countries						
	19	**20**	**21**	**22**	**23**	**24**
Variable	-341389*** (0.000)	-346919*** (0.000)	-367009*** (0.000)	-343946*** (0.000)	-334909*** (0.000)	-3591 67.1 (0.000)
cons	67.079*** (0.000)	38.855*** (0.003)	49.750*** (0.000)	50.877*** (0.000)	91.072*** (0.000)	21.006*** (0.038)
Tnr	5.513*** (0.080)	4.021 (0.162)	-5.317 (0.162)	3.458 (0.252)	4.124 (0.143)	2.042 (0.503)
tec	11.207 (0.585)					
cc		-36.468** (0.029)				
Ge			-81.860*** (0.000)			
PS				-21.410 (0.216)		
RQ					69.924** (0.026)	
RL						-70.527*** (0.000)
VA	26654 7.33	256 491.08	205166.38	259577.17	2664 76.69	230126.06

Wald	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Prob>Chi2	- 0.63 0.528	-0.93 0.351	-0.77 0.443	- 0.80 0.422	- 0.64 0.519	-0.28 0.783
AR(1)	- 0.63 0.528	-0.93 0.351	-0.77 0.443	- 0.80 0.422	- 0.64 0.519	-0.28 0.783
AR(2)	-2.07 (0.038)	-2.03 (0.042)	-0.81 (0.416)	-1.90 (0.057)	-2.08 (0.037)	-1.51 (0.131)
Sargan (1)	165.15 (0.000)	158.62 (0.000)	101.05 (0.000)	152.10 (0.000)	152.88 (0.000)	102.77 (0.000)
Sargan (2)	133.07*** (0.000)	124.72*** (0.000)	110.98*** (0.000)	134.26*** (0.000)	136.54*** (0.000)	106.25*** (0.000)

Note: P-values are in brackets ( ), ****, **, and * means significance at 1%, 5% and 10%

As synthesis, institutions and natural resources have mixed effects on economic growth within all Asian countries, indicating that none of the income group did better that another. These mitigated outcomes can be explained by the COVID 19 pandemic that fragilized the institutions of different countries. Similarly, during COVID-19 pandemic, lockdown measures didn't allow to continue extracting natural resources in the countries, this can explain the mixed relationship. Currently, in the context of post-pandemic, most of the countries look for putting in place re-launch measures to advance their economy.

3.3. Sustainable development, institutions and natural resources

To analyse the effect of institution and natural resource on sustainable development in Asian nations, three kinds of estimation are used to check for the robustness of the outcomes. The findings using POLS, fixed effect model and GMM are reported in Tables 5, 6 and 7 respectively. On one side, we presented the outcomes of the effect of natural resource on all Asian countries together as well as within income group and on the other side the outcomes of the effect of institutional quality on all Asian countries together as well as within income group

Natural resource has a negative effect on sustainable for all Asian countries when using the POLS estimation (Table 5) and GMM technique (Table 7) with all models' specifications, indicating that a rise in control of corruption, government effectiveness, political stability, regulatory quality, rule and law and voice and accountability increases sustainable development. Then, for lower-middle income nations, the effects of natural resources on sustainable development are only significant in the GMM model specifications. Except for control of corruption, all the models specified with the other institutional variables improve sustainable development, indicating that a rise in government effectiveness, political stability, regulatory quality, rule and law and voice and accountability increases sustainable development.

In the upper-middle income Asian countries, the effects of natural resources on sustainable development are mixed depending on the specifications and the estimation techniques. For example, the POLS regression outcomes showed that natural resource positively influences sustainable development except for government effectiveness specifications where the findings is negative. However, the outcome when using fixed effect negatively influence sustainable development for all specifications. For GMM technique, the outcomes showed natural resource improves sustainable development except for the model specification with voice and accountability where the effect is negative. Finally, in the high-income Asian countries, results with POLS and GMM regressions showed that natural resource negatively affects sustainable development except for government effectiveness for the GMM where the outcome is not significant. However, fixed effect model regression outcomes showed that natural resources positively influence sustainable development.

Overall, the effect of natural resource is mixed in all Asian nations as well as within the income levels groups, showing a heterogeneity across Asian nations. This also shows that the association amongst natural resource and sustainable development is not linear and that there is a level of natural resource extraction which is harmful for sustainable development achievement. For this, Asian nations must transition in green energy to continue to benefit from safe environment. The positive results show that natural resource ensures sustainable development ins Asian nations. This means that by operating their environment for economic development, Asian nations also take actions to protect environment by investing for example in green energy. Similarly, the negative outcomes show that natural resource is harmful for sustainable development in Asian nations. This means that Asian nations by operating environment for economic development do not care for environment protection. The outcome for the positive effect is in line with Adebayo et al. (2023) and Baloch et al. (2019) when those with negative outcome is conform to Balsalobre-Lorente et al. (2023) and Iqbal et al. (2022).

When interested in examining how institutional quality indicators impact sustainable development, we found that the indicators such as control of corruption, government effectiveness, regulatory quality, and rule and law are positively affected sustainable development except for political stability which has negative effect and voice and accountability which impact is insignificant among all Asian countries when using the POLS estimation (Table

5). Similarly, with fixed effect model, we found that only political stability and voice and accountability are significant (Table 6). When political stability improves sustainable development, voice and accountability lessens sustainable development.

For the GMM, all the institutional quality indicators lessen sustainable development (Table 7). Then, for lower-middle income nations, the outcome with POLS technique all the institutional quality variables effects on sustainable development are positive except the government effectiveness which effect is negative. The results using fixed effect model showed that government effectiveness, regulatory quality and rule and law improve sustainable development when political stability worsens sustainable development. The findings when using GMM technique show that government effectiveness reduces sustainable development when regulatory quality and voice and accountability increase sustainable development.

In the upper-middle income Asian countries, except for control of corruption which increases sustainable development, government effectiveness, political stability, regulatory quality and voice and accountability lessen sustainable development when using the POLS regression. Similarly, fixed effect model shows that only voice and accountability is significant and negatively influence sustainable development. The outcomes with GMM regression showed that voice and accountability negatively influence sustainable sustainability when control of corruption, regulatory quality and rule and law increase sustainable development.

Finally, in the high-income Asian countries, results with POLS regression showed political stability and rule and law positively affect sustainable development when government effectiveness and regulatory quality lessens sustainable development. The results with fixed effect model regression showed that institutional quality indicators such as political stability and regulatory positively affected sustainable development. The results of GMM regression showed that political stability improves sustainable development when control of corruption, government effectiveness, regulatory quality and voice and accountability lessen sustainable development.

As in the case of natural resource, we can summarize that, institutions have a mixed effect in all Asian nations as well as within the income levels groups, showing a heterogeneity across Asian nations. This also shows that the association amongst institutional quality and sustainable development is not linear and that a level of institutional quality is needed to achieve sustainable development. The positive results show that institutions are beneficial for sustainable development, indicating that strong institutions are favourable to sustainable development. This means that an improvement in institutions allow the government to decree needed environmental rules that are favorable to carbon emission reduction (Bhattacharya et al., 2017; Degbedji et al., 2024). Similarly, the negative outcomes show that there is a need to improve institutions within Asian countries. The outcome for the positive effect is in line with Degbedji et al. (2024) in WAEMU and Azam et al. (2021) who found that good institutional quality allows to act to protect environment and in turn ensure sustainable development. Similarly, the negative result can be explained by the recent COVID-19 pandemic, which called into question, the role of institutions in ensuring sustainable development. Our outcome is supported by the argument of Farrell & Han (2020) who stated that the COVID-19 pandemic, for example, has only reinforced doubts about the ability of modern institutions of representative democracy to discern articulated public interest and accountability.

Table 5. Sustainable development, institutions and natural resources – pooled OLS estimate, source: Authors' own computation

	ALL Asian countries					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
Cons	17.78*** (0.000)	19.178*** (0.000)	14.206*** (0.000)	17.794*** (0.000)	18.539*** (0.000)	17.294*** (0.000)
Tnr	-0.101*** (0.000)	-0.079*** (0.001)	-0.182*** (0.000)	-0.116*** (0.000)	-0.086*** (0.000)	-0.160*** (0.000)
Tec	0.358** (0.002)	0.321*** (0.005)	0.566*** (0.000)	0.395*** (0.001)	0.392*** (0.000)	0.488*** (0.000)
Cc	0.469*** (0.000)					
Ge		0.828*** (0.000)				
PS			-0.424*** (0.000)			
RQ				0.395*** (0.002)		
RL					0.555*** (0.000)	
VA						-0.042 (0.677)
Obs	554	554	553	554	554	554
Prob > F	0.000***	0.000***	0.000***	0.0000***	0.000***	0.0000***

R-squared	0.5215	0.6360	0.8215	0.7072	0.7256	0.6965
Lower-middle income countries						
Variable	**7**	**8**	**9**	**10**	**11**	**12**
Cons	21.241*** (0.000)	23.255*** (0.000)	18.707*** (0.000)	21.325*** (0.000)	22.368 (0.000)	21.321*** (0.000)
Tnr	-0.241 (0.168)	-0.161 (0.432)	-0.269 (0.103)	-0.109 (0.653)	0.029 (0.892)	-0.006 (0.983)
Tec	0.234** (0.022)	0.205** (0.031)	0.351** (0.024)	0.230** (0.029)	0.239** (0.022)	0.240** (0.022)
Cc	0.298* (0.051)					
Ge		0.826* (0.066)				
PS			-0.463*** (0.001)			
RQ				0.558* (0.067)		
RL					1.128*** (0.007)	
VA						0.565* (0.073)
Obs	206	206	206	206	206	206
Prob > F	0.004***	0.0159***	0.0003***	0.0093***	0.0002***	0.0011***
R-squared	0.8743	0.9109	0.993	0.877	0.657	0.9102
Upper income countries						
Variable	**13**	**14**	**15**	**16**	**17**	**18**
Cons	9.263*** (0.000)	43.960 (0.000)	5.485*** (0.000)	10.153*** (0.000)	9.985*** (0.000)	17.713*** (0.000)
Tnr	0.354*** (0.000)	-0.333*** (0.000)	0.115* (0.077)	0.239*** (0.003)	0.268*** (0.002)	0.195*** (0.004)
Tec	0.688*** (0.004)	0.805*** (0.005)	0.905*** (0.000)	0.835*** (0.000)	0.794*** (0.001)	0.801*** (0.000)
Cc	0.581*** (0.001)					
Ge		-2.284** (0.038)				
PS			-1.023*** (0.000)			
RQ				-0.396 (0.057)		
RL					0.018 (0.884)	
VA						-1.567*** (0.000)
Obs	191	157	190	191	191	191
Prob > F	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R-squared	0.6830	0.5661	0.7495	0.5821	0.5401	0.8161
High-income countries						
Variable	**19**	**20**	**21**	**22**	**23**	**24**
Cons	40.692*** (0.000)	43.960*** (0.000)	39.666*** (0.000)	49.295*** (0.000)	30.587*** (0.000)	38.382*** (0.000)
Tnr	-0.256*** (0.000)	-0.333*** (0.000)	-0.212*** (0.000)	-0.400*** (0.000)	-0.090 (0.237)	-0.245*** (0.001)
Tec	0.687*** (0.008)	0.805*** (0.005)	0.975*** (0.002)	0.587*** (0.062)	0.656*** (0.006)	0.683 (0.015)
Cc	-0.749 (0.330)					
Ge		-2.284** (0.038)				
PS			0.465** (0.027)			

RQ				-4.424*** (0.002)		
RL					3.312** (0.025)	
VA						-3.121*** (0.000)
Obs	157	157	157	157	157	157
Prob > F	0.000***	0.000***	0.0000***	0.0000***	0.0000***	0.0000***
R-squared	0.7338	0.9661	0.6591	0.6342	0.7561	0.8371

P-values are in brackets ( ), ****, **, and * means significance at 1%, 5% and 10%

Table 6. Sustainable development, institutions and natural resources – fixed effects estimate, source: Authors' own computation

	ALL Asian countries					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
_cons	33.039*** (0.000)	31.518*** (0.000)	28.722*** (0.000)	33.365*** (0.000)	32.001*** (0.000)	34.748 0.000
Tnr	-0.005 (0.936)	0.0007 (0.992)	0.009 (0.883)	-0.003 (0.966)	0.001 (0.983)	-0.009 (0.895)
tec	0.503*** (0.000)	0.480*** (0.000)	0.467*** (0.000)	0.497*** (0.000)	0.482*** (0.000)	0.512*** (0.000)
cc	-0.090 (-1.33)					
Ge		0.195 (1.06)				
PS			0.388*** (0.000)			
RQ				-0.095 (0.653)		
RL					0.179 (0.407)	
VA						-0.407 (0.067)
obs	554	554	553	554	554	554
Prob > F	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R-squared	0.648	0.663	0.924	0.639	0.647	0.803
Lower-middle income Asian countries						
Variable	**7**	**8**	**9**	**10**	**11**	**12**
_cons	30.758*** (0.000)	23.255*** (0.000)	18.707*** (0.000)	21.325 0.000	22.368 (0.000)	32.564*** (0.000)
Tnr	-0.052 (0.692)	-0.161 (0.432)	-0.269 (0.103)	-0.109 (0.653)	0.0294 (0.892)	-0.086 (0.470)
tec	0.442*** (0.000)	0.205 (0.031)	0.351** (0.024)	0.230** (0.029)	0.239** (0.022)	0.453 (0.057)
cc	-0.083 (0.433)					
Ge		0.826** (0.066)				
PS			-0.463*** (0.001)			
RQ				0.558* (0.067)		
RL					1.128*** (0.007)	
VA						-0.274 (0.240)
obs	206	206	206	206	206	206
Prob > F	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R-sq.	0.507	0.7097	0.993	0.877	0.656	0.812

Upper-middle income Asian countries						
Variable	**13**	**14**	**15**	**16**	**17**	**18**
Cons	48.021*** (0.000)	48.059*** (0.000)	47.499*** (0.000)	46.193*** (0.000)	47.873*** (0.000)	47.874*** (0.000)
Tnr	-0.210*** (0.020)	-0.203* (0.046)	-0.208** (0.018)	-0.211** (0.018)	-0.217** (0.014)	-0.200* (0.053)
tec	0.658*** (0.000)	0.640*** (0.000)	0.658*** (0.000)	0.631*** (0.000)	0.668*** (0.000)	0.617*** (0.000)
cc	0.159 (0.380)					
Ge		0.149 0.402				
PS			0.076 0.566			
RQ				0.633 (0.130)		
RL					-0.049 (0.865)	
VA						-0.597* (0.051)
obs	191	191	190	191	191	191
Prob > F	0.0000***	0.000***	0.000***	0.000***	0.000***	0.000***
R-squared	0.844	0.843	0.818	0.900	0.825	0.975
High income Asian countries						
Variable	**19**	**20**	**21**	**22**	**23**	**24**
Cons	18.364*** (0.004)	15.602** (0.020)	13.392** (0.011)	15.749*** (0.005)	3.115 (0.519)	18.791*** (0.002)
Tnr	0.117*** (0.005)	0.116*** (0.005)	0.087*** (0.009)	0.108** (0.010)	0.134*** (0.000)	0.115*** (0.006)
tec	0.653*** (0.004)	0.602** (0.025)	0.753*** (0.002)	0.665** (0.003)	0.511 (0.038)	0.685*** (0.004)
cc	0.133 (0.828)					
Ge		0.684 (0.344)				
PS			0.749*** (0.001)			
RQ				0.686 (0.441)		
RL					3.200*** (0.003)	
VA						0.148 (0.336)
obs	157	157	157	157	157	157
Prob > F	0.000***	0.000***	0.000***	0.000***	0.000***	0.008***
R-sq.	0.675	0.742	0.603	0.725	0.557	0.693

P-values are in brackets ( ), ****, **, and * means significance at 1%, 5% and 10%

Table 7. Sustainable development, institutions and natural resources – GMM estimate, source: Authors' own computation

	ALL Asian countries					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
_cons	-12.60*** (0.002)	-6.592** (0.031)	-12.620** (0.014)	-9.449** (0.021)	-7.556 (0.023)	-1.684** (0.354)
Tnr	-0.094*** (0.006)	- 0.063 (0.044)	-0.086** (0.021)	-0.072** (0.033)	-0.073** (0.029)	-0.110* (0.011)
tec	-0.132*** (0.001)	-0.163*** (0.000)	-0.100** (0.042)	-0.156*** (0.000)	-0.164*** (0.000)	-0.134*** (0.001)
cc	-0.475*** (0.001)					

Ge		-0.303*** (0.006)				
PS			-0.605*** (0.008)			
RQ				- 0.446*** (0.008)		
RL					-0.310*** (0.005)	
VA						-0.389*** (0.007)
obs	507	507	506	507	507	507
Wald	879252.40	849314.40	834820.87	856747.64	849640.32	917869.73
Prob > chi2	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(1)	-8.88*** (0.000)	-9.12*** (0.000)	-9.03 *** 0.000	- 9.06*** (0.000)	-9.09*** 0.000	-9.09*** (0.000)
AR(2)	3.82*** (0.000)	3.91 *** (0.000)	3.89 (0.000)	3.88 (0.000)	3.90 (0.000)	3.91*** (0.000)
Sargan (1)	40.55 (0.828)	41.74 0.791	36.89 (0.916)	40.61 (0.826)	40.95 (0.815)	41.53 (0.797)
Sargan (2)	42.39 (0.736)	38.56 (0.858)	38.70 (0.854)	41.42 (0.771)	41.63 (0.763)	44.04 (0.674)
Lower-middle income countries						
Variable	7	8	9	10	11	12
_cons	8.807*** (0.000)	10.013*** (0.000)	0.789 (0.732)	10.965*** (0.000)	13.549*** (0.000)	10.190*** (0.000)
Tnr	0.165 (0.119)	0.212** (0.046)	0.163* (0.095)	0.326*** (0.004)	0.420*** (0.001)	0.348 (0.001)
tec	0.301*** (0.000)	0.283*** (0.000)	0.386*** (0.000)	0.278*** (0.000)	0.285*** (0.000)	0.272 (0.000)
cc	-0.171 (0.156)					
Ge		-0.061 (0.531)				
PS			-0.730*** (0.000)			
RQ				0.112 (0.269)		
RL					0.290** (0.039)	
VA						0.166* (0.055)
obs	194	194	194	194	194	194
Wald	350278.56	344223.97	2930 51.09	335342.84	332 070.10	32924 2.26
Prob.	0.000***	0.000***	0.000***	0.000***	0.000***	0.00***
AR(1)	-4.55 (0.000)	-4.65*** (0.000)	-3.64*** (0.000)	-4.74*** (0.000)	-4.65*** (0.000)	-4.66*** (0.000)
AR(2)	2.69*** (0.007)	2.96*** (0.003)	2.83*** (0.000)	3.03*** (0.002)	3.12*** (0.002)	2.95*** (0.003)
Sargan (1)	257.66*** (0.000)	249.67*** (0.000)	212.66 *** (0.000)	246.63 0.000	243.97 0.000	240.24 (0.000)
Sargan (2)	197.75*** (0.000)	197.66*** (0.000)	190.41*** (0.000)	139.06*** (0.000)	143.27 (0.000)	96.11*** (0.000)

Upper-middle income Asian countries						
Variable	**13**	**14**	**15**	**16**	**17**	**18**
cons	16.924*** (0.000)	13.693*** (0.000)	13.693*** (0.000)	16.112*** (0.000)	16.839*** (0.000)	24.008*** (0.000)
Tnr	0.720 (0.000)	0. 392*** (0.000)	0. 392*** (0.000)	0.602*** (0.000)	0.619*** (0.000)	-0.031 (0.516)
tec	0.575*** (0.000)	0.814*** (0.000)	0.814*** (0.000)	0.687*** (0.000)	0.692*** (0.000)	0.688*** (0.000)
cc	0.885*** (0.000)					
Ge		-0.061 (0.576)				
PS			-0.061 (0.576)			
RQ				0.823*** (0.000)		
RL					0.409*** (0.000)	
VA						-2.282*** (0.000)
Wald	28356 3.01	342126.54	342126.54	307110.31	304 765.17	3850 17.26
Prob>chi2	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(1)	5.16*** (0.000)	4.25*** (0.000)	4.25*** (0.000)	4.99*** (0.000)	4.90*** (0.000)	1.80* (0.071)
AR(2)	0.93 (0.354)	0.18 (0.859)	0.18 (0.859)	0.51 (0.610)	0.77 (0.440)	-1.16 (0.245)
Sargan(1)	334.19*** (0.000)	444.57*** (0.000)	444.57*** (0.000)	395.37*** (0.000)	390.70*** (0.000)	317.93*** (0.000)
Sargan(1)	244.30*** (0.000)	203.05*** (0.000)	203.05*** 0.000	237.21*** (0.000)	242.06*** (0.000)	92.83*** (0.000)
High income Asian countries						
Variable	**19**	**20**	**21**	**22**	**23**	**24**
cons	17.675*** (0.000)	22.480 *** (0.000)	32.871*** (0.000)	25.952*** (0.000)	17.535*** (0.000)	13.786*** (0.000)
Tnr	-0.120*** (0.001)	-0.281*** (0.000)	-0.004*** (0.770)	-0.320*** (0.000)	-0.100** (0.061)	-0.229*** (0.000)
tec	0.165 (0.299)	0.684*** (0.000)	1.356*** (0.000)	0.386** (0.020)	0.213 (0.235)	-0.066 (0.703)
cc	-1.026 (0.076)					
Ge		-3.124*** (0.000)				
PS			1.991*** (0.000)			
RQ				-4.484*** (0.000)		
RL					-0.835 (0.423)	
VA						-0.843 (0.000)
Wald	234 930.58	2096 26.21	2510 26.02	224124.93	228905.82	20769 4.10
Prob>chi2	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
AR(1)	-2.38** (0.018)	-2.23** (0.026)	-2.88*** (0.004)	-2.04** (0.042)	-2.39** (0.017)	-1.87* (0.062)

AR(2)	-0.73 (0.464)	- 0.12 (0.902)	- 0.65 (0.516)	-0.20 (0.843)	-1.04 (0.298)	-0.91 (0.365)
Sargan(1)	191.44*** (0.000)	161.99*** (0.000)	91.76*** (0.000)	157.32*** (0.000)	185.35*** (0.000)	168.63*** (0.000)
Sargan(1)	69.77** (0.027)	58.92 (0.157)	72.32** (0.017)	65.56* (0.057)	61.48 (0.109)	55.37 (0.247)

P-values are in brackets ( ), ****, **, and * means significance at 1%, 5% and 10%

As synthesis, institutions and natural resources have mixed effects on sustainable development within all Asian countries, indicating that none of the income group did better that another. Overall, we can summarize that there is an inefficiency of institutions to protect the environment, that leads countries to an abusive exploitation of natural resources. They generate pollution and participate in increasing the emissions of greenhouse gas and in turn increase the negative impact of climate change on agriculture, health and other vital sectors. This represents an obstacle to the actualization of the sustainable development goals 13 (fight against climate change).

4. Conclussions

The findings of this study highlight the complex and often contradictory relationships between natural resources, institutional quality, economic growth and sustainable development in Asian countries. These relationships vary significantly depending on the income level of the countries and the estimation techniques used. Natural resources demonstrate a generally positive impact on economic growth, particularly in high-income Asian countries. However, their effect on sustainable development is predominantly negative, especially when considering all Asian countries collectively. This suggests a potential trade-off between short-term economic gains from natural resource exploitation and long-term sustainable development goals.

Institutional quality indicators generally show a positive relationship with economic growth, particularly in the POLS and FE models. However, the results become more mixed when using the GMM technique, indicating potential endogeneity issues or dynamic effects that are not captured by simpler models. The varying results across income groups underscore the importance of considering a country's development stage when analyzing these relationships. High-income countries seem to benefit more consistently from their natural resources and institutional quality in terms of economic growth, while lower-income countries show more mixed and often negative effects.

The findings of this study make significant contributions to the ongoing policy discourse on achieving the Sustainable Development Goals (SDGs). Specifically, they emphasize the importance of SDG 8, which focuses on promoting sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. The study also aligns with SDG 13 by addressing climate action through strategies for environmental protection, mitigation of climate risks, and fostering resilience against environmental challenges. Furthermore, it highlights the essential role of SDG 16, which advocates for building effective, accountable, and inclusive institutions at all levels, as a foundation for achieving sustainability and fostering socio-economic stability.

Based on the findings of this study, several policy implications can be drawn. First, countries should develop natural resource management strategies that are tailored to their specific economic contexts and development stages. While high-income countries might be able to leverage their resources for economic growth more effectively, lower and middle-income countries need to be more cautious about potential negative impacts on sustainable development. Second, the generally positive relationship between institutional quality and economic growth underscores the importance of strengthening governance structures. Countries should focus on improving control of corruption, government effectiveness, political stability, regulatory quality, rule of law, and voice and accountability.

Third, policymakers need to be aware of the potential trade-offs between economic growth and sustainable development, particularly in resource-rich countries. Policies should aim to strike a balance between exploiting natural resources for short-term economic gains and ensuring long-term sustainable development. Given the varying results across income groups, policies should be tailored to the specific needs and contexts of countries at different development stages. For instance, lower-middle income countries might need to focus more on improving the efficiency of resource use and strengthening institutions to mitigate negative impacts on sustainable development. Given the mixed results for voice and accountability, there is a need for enhanced transparency in resource management and institutional processes. This could help ensure that the benefits of natural resources and good governance are more equitably distributed and contribute to sustainable development.

While this study provides valuable insights, it's important to acknowledge its limitations. While the study employs multiple estimation techniques, each has its own limitations. For instance, POLS may not account for country-specific effects, while GMM results can be sensitive to the choice of instruments. Also, grouping countries by income levels may obscure important differences within these groups. Countries within the same income category may have vastly different resource endowments, institutional structures, and development challenges. There may

be other important factors influencing the relationships between natural resources, institutions, economic growth, and sustainable development that are not included in the model.

Based on the findings and limitations of this study, several avenues for further research can be identified. Future studies could disaggregate natural resources into different types (e.g., oil, minerals, forests) to examine whether the impacts on growth and sustainable development vary by resource type. Further investigation into the interaction effects between natural resources and institutional quality could reveal important nuances in their combined impact on growth and sustainability. Also, further studies should focus on incorporating spatial dimensions into the analysis, as this could help account for potential spillover effects between neighbouring countries.

References

1. ABATE C. A., 2022, The relationship between aid and economic growth of developing countries: Does institutional quality and economic freedom matter?, *Cogent economics & finance* 10: 2062092, https://doi.org/10.1080/23322039.2022.2062092.
2. ADEBAYO T. S., ULLAH S., KARTAL M. T., ALI K., PATA U. K., 2023, Endorsing sustainable development in BRICS: The role of technological innovation, renewable energy consumption, and natural resources in limiting carbon emission, *Science of the Total Environment* 859: 160181, http://dx.doi.org/10.1016/j.scitotenv.2022.160181.
3. ADEREMI T. A., OLANIPEKUN W. D., BAMIDELE A. G., HASSAN C. O., OSABOHIEN R., AZUH D. E., 2021, Role of agriculture in poverty reduction in Nigeria: An implication for sustainable development goals (SDGs), *African Journal of Business and Economic Research 2021*(si1): 267, https://hdl.handle.net/10520/ejc-aa_ajber_v2021_nsi1_a13.
4. AHMED F., KOUSAR S., PERVAIZ A., SHABBIR A., 2022, Do institutional quality and financial development affect sustainable economic growth? Evidence from South Asian countries, *Borsa Istanbul Review* 22 (1): 189-96, https://doi.org/10.1016/j.bir.2021.03.005.
5. AKPA A. F., 2023, Effect of Natural Resources Rents on Income Inequality in Sub-Saharan Africa: Exploring the Direct and Indirect Transmission Mechanisms, *International Journal of Development Issues* 22(2): 167-181, https://doi.org/10.1108/IJDI-11-2022-0244.
6. ARELLANO M., BOVER O. 1995, Another Look at the Instrumental Variable Estimation of Error-component Models, *Journal of Econometrics* 68(1): 29–51, https://doi.org/10.1016/0304-4076(94)01642-D.
7. ASLAN A., ALTINOZ B, 2021, The impact of natural resources and gross capital formation on economic growth in the context of globalization: evidence from developing countries on the continent of Europe, Asia, Africa, and America, *Environmental Science and Pollution Research* 28: 33794–33805, https://doi.org/10.1007/s11356-021-12979-7.
8. ASGHAR N., MAJEED M. T., KHAN M. W., ANWAR A., 2023, Biomass energy consumption and sustainable development: empirical evidence from Asian economies, *Environmental Science and Pollution Research* 30 (1): 145-60, https://doi.org/10.1007/s11356-022-22132-7.
9. AZAM M., HUNJRA A. I., BOURI E., TAN Y., AL-FARYAN M. A. S., 2021, Impact of institutional quality on sustainable development: Evidence from developing countries, *Journal of Environmental Management* 298: 113465, https://doi.org/10.1016/j.jenvman.2021.113465.
10. BALOCH M. A., MAHMOOD N., ZHANG J. W., 2019, Effect of natural resources, renewable energy and economic development on CO_2 emissions in BRICS countries, *Science of the Total Environment* 678: 632-638, https://doi.org/10.1016/j.scitotenv.2019.05.028.
11. BALSALOBRE-LORENTE D., ABBAS J., HE C., PILAR L., SHAH S. A. R., 2023, Tourism, urbanization and natural resources rents matter for environmental sustainability: The leading role of AI and ICT on sustainable development goals in the digital era, *Resources Policy* 82: 103445, https://doi.org/10.1016/j.resourpol.2023.103445.
12. BARTNICZAK B., RASZKOWSKI A., 2019, Sustainable development in Asian countries-Indicator-based approach, *Problemy Ekorozwoju/ Problems of Sustainable Development* 14 (1): 29-42.
13. BHATTACHARYA M., AWAWORYI C. S., PARAMATI S. R., 2017, The dynamic impact of renewable energy and institutions on economic output and CO_2 emissions across regions, *Renewable Energy* 111: 157-167, https://doi.org/10.1016/j.renene.2017.03.102.
14. BLUNDELL R., BOND S., 1998, Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics* 87 (1): 115-143, https://doi.org/10.1016/S0304-4076(98)00009-8.
15. DEGBEDJI D. F., AKPA A. F., CHABOSSOU A. F., OSABOHIEN R., 2024, Institutional quality and green economic growth in West African economic and monetary union, *Innovation and Green Development* 3(1): 100-108, https://doi.org/10.1016/j.igd.2023.100108.
16. CHENG W., ADEJUMO O. O., 2021, Entrepreneurship channels and sustainable development: Directions for the Asian economy, *Journal of Business Economics and Management* 22 (3): 799-822, https://doi.org/10.3846/jbem.2021.14252.
17. ERUM N., HUSSAIN S., 2019, Corruption, natural resources and economic growth: Evidence from OIC countries, *Resources Policy* 63: 101429, https://doi.org/10.1016/j.resourpol.2019.101429.
18. ESCAP, 2023, *Asia and the Pacific SDG Progress Report 2024: Showcasing Transformative Actions*, https://unescap.org/kp/2024/asia-and-pacific-sdg-progress-report-2024.
19. FARRELL H., HAN, H., 2020, *Public governance and global politics after COVID-19*, https://oa.mg/work/3112985967.
20. HAMEED S., WEI W., FARRUKH M. U., LI S., ILYAS M., UL-HAQ I., 2023, Revisiting the asymmetric outcome of renewable and nonrenewable energy on environmental quality in South and East Asia: An application of a broad-spectrum approach, *Renewable Energy* 203: 81-88, https://doi.org/10.1016/j.renene.2022.11.032.
21. HAYAT A., 2019, Foreign direct investments, institutional quality, and economic growth, *The Journal of International Trade & Economic Development* 28(5): 561-579, https://doi.org/10.1080/09638199.2018.1564064.

22. ILYAS M., MU Z., AKHTAR S., HASSAN H., SHAHZAD K., ASLAM B., MAQSOOD S., 2024, Renewable energy, economic development, energy consumption and its impact on environmental quality: New evidence from South East Asian countries, *Renewable Energy* 223: 119961, https://doi.org/10.1016/j.renene.2024.119961.
23. IQBAL S., WANG Y., SHAIKH P. A., MAQBOOL A., HAYAT K., 2022, Exploring the asymmetric effects of renewable energy production, natural resources, and economic progress on CO_2 emissions: fresh evidence from Pakistan, *Environmental Science and Pollution Research* 29 (5): 7067-7078, https://doi.org/10.1007/s11356-021-16138-w.
24. IMEOKPARIA L., PETER O. O., BELLO B. A., OSABOHIEN R., ADEREMI T. A., GERSHON O., AARON D., ABIDEMI A., 2023, A panel analysis of crude oil exports and poverty reduction in African oil producing countries: implication for the sustainable development goal one, *International Journal of Energy Economics and Policy* 13(4): 169-174, https://doi.org/10.32479/ijeep.14579.
25. JAAFFAR A. H., RASIAH R., OSABOHIEN R., AMRAN A., 2024, Do CEOs' and board directors' environmental governance experience, corporations' age and financial performance influence adoption of green management practices? A study of energy-intensive industries in Malaysia, *Energy Efficiency* 17(7): 82, https://doi.org/10.1007/s12053-024-10257-2.
26. JIANG C., CHANG Y., 2022, Clean energy projects in Asian economies: does FDI and stock market matter for sustainable development?, *Economic research-Ekonomska Istraživanja* 35 (1): 5843-57, https://doi.org/10.1080/1331677X.2022.2038650.
27. KHAN S., YAHONG W., ZEESHAN A., 2022, Impact of poverty and income inequality on the ecological footprint in Asian developing economies: Assessment of Sustainable Development Goals, *Energy Reports* 8: 670-79, https://doi.org/10.1016/j.egyr.2021.12.001.
28. KHAN S. A. R., YU Z., SHARIF A., GOLPIRA H., 2020, Determinants of economic growth and environmental sustainability in South Asian Association for Regional Cooperation: evidence from panel ARDL, *Environmental Science and Pollution Research* 27 (36): 45675-87, https://doi.org/10.1007/s11356-020-10410-1.
29. LATIF Z., XIN W., KHAN K., IQBAL K., PATHAN Z. H., SALAM S., JAN N., 2017, ICT and sustainable development in South Asian countries, *Human Systems Management* 36 (4): 353-62, https://doi.org/10.3233/HSM-17166.
30. LOVCHA Y., PEREZ-LABORDA A., 2018, Monetary policy shocks, inflation persistence, and long memory, *Journal of Macroeconomics* 55: 117-27, https://doi.org/10.1016/j.jmacro.2017.10.006.
31. MEHMOOD W., UL DIN S. M., AMAN-ULLAH T., KHAN, A. B. FAREED, M., 2023, Institutional quality and economic growth: Evidence from South-Asian countries, *Journal of Public Affairs*, 23(1): e2824, https://doi.org/10.1002/pa.2824.
32. MOHAMED E. F., ABDULLAH A., JAAFFAR A. H., OSABOHIEN R., 2024, Reinvestigating the EKC hypothesis: Does renewable energy in power generation reduce carbon emissions and ecological footprint?, *Energy Strategy Reviews* 53: 101387, https://doi.org/10.1016/j.esr.2024.101387.
33. NATALINA N., 2022, Democracy and Institutional Political Subjectness: Comparative Study for Europe and Central Asia, *Przegląd Politologiczny* 3: 17-34, https://doi.org/10.14746/pp.2022.27.3.2.
34. OSABOHIEN R., JAFFAR A. H., ADELEKE O. K., KARAKARA A. A. W., 2024a, Global value chain participation, globalisation-Energy Nexus and sustainable development in ASEAN, *Research in Globalization* 9: 100253, https://doi.org/10.1016/j.resglo.2024.100253.
35. OSABOHIEN R., ZOGBASSÉ S., JAAFFAR A. H., IDOWU O. O., AL-FARYAN M. A. S., 2024b, Renewable energy, carbon footprints, natural resources depletion and economic growth in Africa, *International Journal of Energy Sector Management*, ahead of print, https://doi.org/10.1108/IJESM-07-2024-0030.
36. OSABOHIEN R., JAAFFAR A. H., AKPA A. F., JAKOVLJEVIC M., 2024c, Mobile money, medical cost anxiety and welfare of individuals within the reproductive age in Malaysia, *Humanities and Social Sciences Communications* 11(1): 1-10, https://doi.org/10.1057/s41599-024-02767-2.
37. SAWADA Y., SUMULONG L. R., 2021, *Macroeconomic Impact of COVID-19 in Developing Asia*, ADBI Working Paper 1251, Asian Development Bank Institute, Tokyo, https://www.adb.org/publications/macroeconomic-impact-covid-19-developing-asia.
38. SINGH S., SHARMA G. D., RADULESCU M, BALSALOBRE-LORENTE D, BANSAL P., 2024, Do natural resources impact economic growth: An investigation of P5 + 1 countries under sustainable management, *Geoscience Frontiers*, 15(3): 101595, https://doi.org/10.1016/j.gsf.2023.101595.
39. PANDEY A., ASIF M., 2022, Assessment of energy and environmental sustainability in South Asia in the perspective of the Sustainable Development Goals, *Renewable and Sustainable Energy Reviews* 165: 112492, https://doi.org/10.1016/j.rser.2022.112492.
40. PARDI F., SAHUDIN Z., MAJID M.A., JUNOS S., AZILLAH N., ALI M., 2021, Digital economy and sustainable development path in selected Asian countries, *Global Business and Management Research* 13 (4): 167-80.
41. SHARIMOVA A. DURRANI N., THIBAULT H., 2023, Understanding the Political Economy of Education: Exploring Debates in Central Asia, *The Political Economy of Education in Central Asia*, The Steppe and Beyond: Studies on Central Asia, eds. Durrani, N., Thibault, H., Palgrave Macmillan, Singapore, https://doi.org/10.1007/978-981-99-8517-3_1.
42. TAHIR M., BURKI U., HAYAT A., 2023, Natural resources and economic growth: evidence from Brunei Darussalam, *International Journal of Emerging Markets* 18(10): 4252-4269, https://doi.org/10.1108/IJOEM-05-2021-0762.
43. UN, 2024, *The Sustainable Development Goals Report 2024*, https://www.un.org/sustainabledevelopment/blog/2024/06/media-advisory-sdg-report-2024/.
44. WOOLDRIDGE J., 2013, *Introductory Econometrics: A Modern Approach*, Fifth Edition, Cengage Learning Custom, Boston.
45. YOUNIS F., CHAUDHARY M. A., 2017, *Sustainable development: Economic, social, and environmental sustainability in Asian economies*, MPRA Paper No. 100551, https://mpra.ub.uni-muenchen.de/100551/.

46. WEI Z., HUANG L., 2022, Does renewable energy matter to achieve sustainable development? Fresh evidence from ten Asian economies, *Renewable Energy* 199: 759-767, https://doi.org/10.1016/j.renene.2022.07.101.
47. ZHENG R., OSABOHIEN R., MADUEKE E., JAAFFAR A. H. B., 2023, Renewable energy consumption and business density as drivers of sustainable development, *Frontiers in Energy Research* 11: 1268903, https://doi.org/10.3389/fenrg.2023.1268903.

APPENDIX A

Countries used for the analysis and their income classification, source: Authors' own work, using World Bank income classification

Income Group	**Countries**
Lower-Middle Income	Bangladesh, Bhutan, Cambodia, India, Kyrgyzstan, Laos, Myanmar, Nepal, Pakistan, Philippines, Tajikistan, Timor-Leste, Uzbekistan, Vietnam
Upper-Middle Income	Armenia, Azerbaijan, China, Indonesia, Iraq, Jordan, Kazakhstan, Lebanon, Malaysia, Maldives, Mongolia, Sri Lanka, Thailand
High Income	Bahrain, Brunei, Israel, Japan, Kuwait, Oman, Qatar, Saudi Arabia, Singapore, South Korea