14th International Conference on Humanities and Social Sciences, 14th ICHiSS 2022
19th May 2022-20th May 2022
Theme: Global Security & International Relation

TREADMILL OF DESTRUCTION THEORY: AN EMPIRICAL EVIDENCE FROM MALAYSIA

Nur Surayya Mohd Saudi[1], Rogis Baker[1], Haliza Mohd Zahari[1], Aida Nasirah Abdullah[1], Amnah Saayah Ismail[1], Hasan Al-Banna Mohamed[1], Muzafar Shah Habibullah[2]

[1]National Defence University of Malaysia
[2] Putra Business School, Kuala Lumpur Malaysia

Abstract
This study will evaluate the interlinked between military activities and CO2 emissions which may provide a basis on developing monitoring framework in conserving the environment, leading towards sustainable development and long-term economic growth for Malaysia. The framework of climatization on the military sector filled in the limited research gap from existing literature that relates military with environment while most of it relates military with securitization. In addition, the issues of militarian and environmental still scares in developing countries while in western countries, the defence sector has imposed environmental consideration either on defence operation and defence insurgencies. The treadmill of destruction theory will be tested to answer the questions on how does military activities impacted the environment in Malaysia economies and how does it affect CO2 emissions. These fundamental questions are pertinent for sustainable development and long-run economic growth. Research methodology proposed is based on econometrics analysis and the framework were based on the treadmill of destruction theory. The outcome of the study will contribute to formulate Macro Defence policy under pillar 3 of National Defence Interest of "Protecting Economic prosperity and growth. The proposed framework is line with Sustainable Development Goals (SDGs) 12 that endeavor a responsible consumption and production. This study is vital and may contributes to the primary objective of the National Defence Policy to protect and defend national interests in the form the foundations of Malaysia's sovereignty, territorial integrity and economic prosperity that is also in line with National Priority Area (NPA).

Keywords: treadmill of destruction, CO2 emissions, GDP, Military Expenditure Military Operations

1. Introduction

The study on the awareness of climate change from the perspectives of military may provide a basis for recommendation of the Military Environmental Standard and offer an insight to the National Defence policy in mitigating climate change. Environmental degradation in relation to climate change may lead to natural disaster, which involves a large number of fatalities and economic losses. The framework of climatization on the military sector addresses the limited research gap from the existing literature that relates military with environment. However, most studies relate military with securitization. In addition, issues associated to military and environment are scarce in developing countries while in western countries, the defence sector has imposed

environmental consideration either on defence operation or defence insurgencies. Plentyof studies has been done by the previous researchers on the impact of Gross Domestic Products (GDP) withMilitary expenditure (Ridzuan, 2019;Saudi,2019; Almajdob &Marikan,2021) but less study on the militaryactivities and climate change nexus.

The aims of the study are to investigate the impact of military activities on climate change. These fundamental questions are pertinent for sustainable development and long-run economic growth. The proposed framework is relevant in supporting the SDG 12 and SDG 13 that embrace responsible consumption and production as well as climate change that is in line with the National Priority Area (NPA). This study can shed light on the environmental consideration on military operation that involves high energyconsumption in day to day operation. Climate issues are vital as ASEAN countries have experienced three catastrophic natural disasters namely Tsunami (2004), Cyclone Nargis (2008), and Typhoon Haiyan (2013)while 5 most occurred natural disasters in ASEAN are flood, tornadoes, local storm, landslide, and earthquake. This study is expected to strengthen the ASEAN macro defence policy by considering the climatized issues on military operations in mitigating the natural disaster and to embark the development of a new framework in the aspects of military operation on the environment. Figure 1 display a declined trend of Malaysia's military expenditure from 1980 to 2019.The value taken is on the percentage of Gross Domestic Products (GDP). GDP and CO2 emissions level for Malaysia's shows an upward trend and the CO2 emissions graph is steeper compared to GDP.This can translate that as Malaysia's economics increased, the level of CO2 emissions moves tandemly in a faster rate.This imply that when the counry reaching an industrial growth and production increased there will be more CO2 emissions that may lead toenviromental degradation.In Malaysia perspectives, the Militray expenditure is not tandem with GDP as anincrease level of GDP did not increase the level of military expenditure.

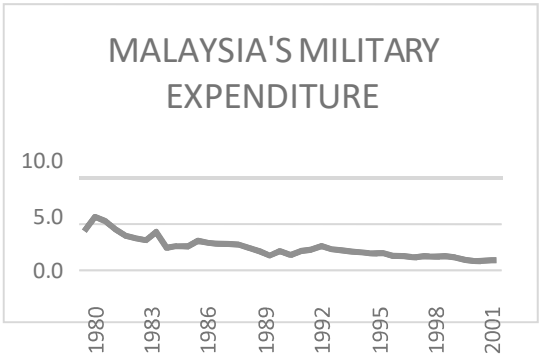


Figure 1: Malaysia's Military

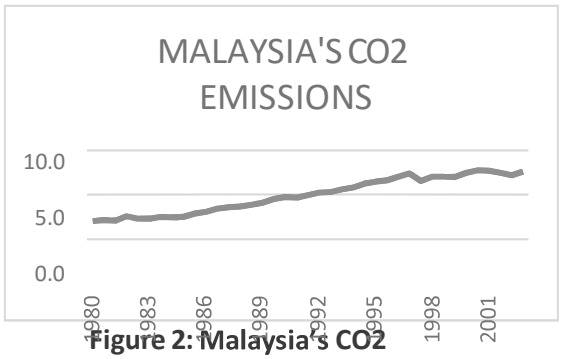


Figure 2: Malaysia's CO2

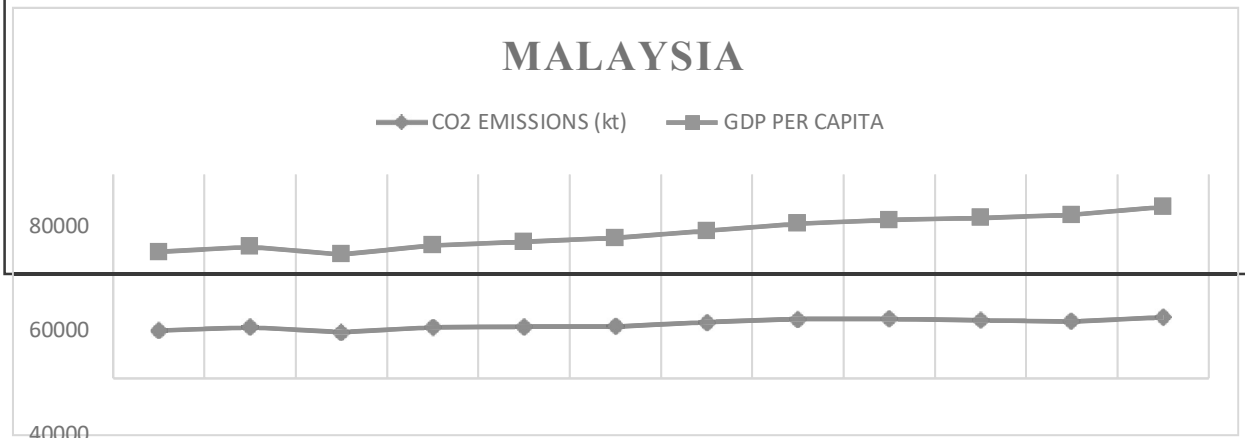


Figure 3: Malaysia's CO2 emissions and GDP per

2. Literature Reviews

The occurrence of air pollution in Malaysia is primarily caused by the emissions from motor vehicles, aircrafts, industries and high-density population areas (Moreno et al., 2009; Dominick et al., 2012). Above all, traffic is the highest contributing source of urban air pollution in developing countries including Malaysia (Afroz, Hassan & Ibrahim, 2003). Therefore, with the increasing number of car users on the road due to the growing national car manufacturing and imported car tax reduction, Malaysian awareness towards air quality deterioration and haze hindrance is affirmed. Air pollution degrades the quality of life and hinders economic growth as it eventually weakens the health conditions of people in Malaysia (Borhan, et al., 2013).

The roles of military sector are not limited to only protecting the national security from international and local threats, but their roles also include observing the environmental and climate change through various frames and lenses (Jayaram, 2020). Landscape damages due to contamination from operation activities and high resource consumptions are just few factors that have historically underpinned arguments that military activities should be exempted from environmental protections (CEO,2018). The military's role in the climate change discourse can arguably be operationalized only through the securitization process, considering that military is essentially a security actor. According to (CEO,2020), military training creates emissions, disruption to landscapes and terrestrial and marine habitats, and creates chemical and noise pollution from the use of weapons, aircraft and vehicles.

According to Tol (2009) climate change is the mother of all externalities and have a profound impact on biodiversity not only through changes in temperature and precipitation, but also the ways climate change might affect ocean acidification, land use and nutrients, and also the proliferation of invasive alien species into new habitats. On the other hand, Thomas et al. (2004) point out that climate change could result in the extinction of more than a million terrestrial species in the next 50 years.

Thus, human civilization today is facing global climate change as one of the greatest challenges that need greatest attention. The Intergovernmental Panel of Climate Change (IPCC, 2007) reiterates that human activities as primary contributors are undeniable responsible for the warming of the earth's atmosphere, and the burning of fossil fuels and deforestation. Studies have identified that the military institutions have long involved the degradation of land and ecosystem (Clark & Jorgenson, 2012). The scorching of earth practices, the diversion of rivers, the destruction of plants and animals, the burning of oil wells, and the use of chemical and biological weapon impacted the ecosystem that we live in and depend on. The destruction of the earth ecosystem and the consumption of fossil fuels generates ecological degradation. And yet, as despites military activities pose a constant and health threat to the citizens of militarized countries; the environmental scholars, development experts and political scientists to, for whatever reasons, refrain from carrying out such environmental assessment studies on military activities (Biswas, 2000).

Climate change may cause biodiversity loss and disruptions on natural ecosystems. According to the Convention on Biological Diversity (CBD) the definition of biodiversity includes diversity at the gene, species and ecosystem levels; the types of species; and the habitats and ecosystems within which they live. This includes the terrestrial rainforests, the freshwater lakes, the river systems, the coral reefs and the marine ecosystems. The healthy ecosystems provide food, clean air and water for human to consume and survive. The rainforest, although cover less than 2% of Earth's surface, support the greatest diversity of living organisms on Earth – housed more than 50% of the plants and animals on the planet (Butler, 2014). Biodiversity is very important for the tourism sector. Biodiversity enhances the pleasure of visitors to an area and as such comprises an economic resource. It has been an important sector to both the developed and the developing economies. The main positive impacts of tourism relate to its contribution to government revenues, national income, foreign exchange earnings as well as generation of job opportunities and business opportunities.

Nevertheless, studies have reiterated that one of the most important drivers of the current loss of biodiversity is climate change (Guo et al., 2016). Climate change has both direct and indirect effects on the ecosystem. Direct effects include those arising from increased temperature and increased CO2 levels associated with global climate change. These direct effects give rise to several potentially major indirect effects such as changes in hydrologic cycles (precipitation and evaporation) and an increasing magnitude and frequency of extreme weather such as floods, cyclones and droughts that will have a profound negative impact on biodiversity (Adler et al., 2009; Rinawati et al., 2013). This study applied a treadmill of production theory that defines an economic exchange that argues that rapid economic development and growth after World War II led to a huge demand for natural resources and new technologies required more

and more energy use.In response to these challenges, this study aims to investigate the interlinked between military activitiesand CO2 emissions which may provide a basis on developing monitoring framework in conserving the environment, leading towards sustainable development and long-term economic growth for Malaysia's economies.

3. Research Methodology

This study employs an econometrics analysis time series technique based on Autoregressive Distribute Lags (ARDL) model. All data were extracted from Stockholm International Peace Research Institute (SIPRI) and World Bank Indicators (WDI). The model developed incorporates macroeconomic variables namely military expenditures, military expenditures per GDP, number of armed forces personnel, CO2 emissions per capita, GDP per capita, trade openness, urbanization, manufacturing output, financial development, income inequality, and foreign direct investment. The underlying theory for this study is treadmill of destruction.

The model developed is as follow:

LCO2et = f1(LMILEX, LMPR, LMES, LTO, LUR,LTO, et)

In this study we use the CO2 emissions per capita the total carbon dioxide emissions (as scale emissions) measured in thousands of metric tons. To evaluate the treadmill of destruction theory of military impact on CO2 emissions, we measure military expenditures (MILEX) as percentage to gross domestic product (GDP), military expenditure per soldier and military participation rate. For the control variables we will include Trade Openness, Urbanization and Foreign Direct Investment and et is the error term. All data were transform into logarithm. To estimate the long-run model as per Equations (1) we adopt four long-run estimators, namely Autoregressive Distributed Lag (ARDL) modelling approach proposed by Pesaran et al. (2001).

Table 1: Source of Data Variables Description

Variables	Descriptions	Sources
CO2	CO2 emissions per capita	CO2
MILEX	Military Expenditure percentage of GDP	WDI
MPR	Military Participation Rate	SIPRI
MES	Military Expenditure per Soldier	SIPRI
TO	Trade Openness	SIPRI
UR	Urbanization	WDI
FDI	Foreign Direct Investment	WDI

4. Emprical Findings

Firstly, we test for the stationary of all variables to determine their order of integration. This is to ensure that the variables are not I(2) to avoid spurious results. To test the order of integration of the variables we use the standard tests for unit root, namely the Augmented Dickey- Fuller (ADF) and PP (Phillips-Perron).When the unit root results shows all the variables are stationary at I(0) and I(1) then we proceed with ARDLanalysis and ensure the serial correlation is clear. Next is to test the existence of a long-run and short-run relationship among variables, it is important to decide the order of the lag of the ARDL. We have selectedlags based on Schwarz Criterion (SC). F-test used for this procedure has a non-standard distribution. Thus,two sets of critical values are computed by (Pesaran et al., 2001) for a given significance level. Critical values for the I(1) series are referred to as upper bound critical values, while the critical values for I(0) series are referred to as the lower bound critical values. If the computed F-statistic exceeds the upper criticalbounds value, we can conclude that there is evidence of a long-run relationship between the variables regardless of the order of integration of the variables. If the F-statistic is below the lower critical bounds value, it implies no co- integration. If the F-statistic falls into the bounds, a conclusive inference cannot bemade without knowing the order of integration of the underlying repressors. Finally, Figure 2 displays the CUSUM and CUSUMQ test proof that all models are reliable and stable, where all the variables plots are inside the critical bound.

The empirical findings of the impact of military activities on the climate change based on treadmills o destruction theory indicated that in the long-run (refer Table 3) Military Expenditure percentage of GDP, Military Participation Rate, Military Expenditure per Soldier are positively related with CO2 emissions. The results are significance at 10% probability level. Nevertheless, the percentage are smaller compared

than Urbanization, Trade Openness and Foreign Direct Investment. The empirical findings are supported by the previous study (Jorgenson et al., 2010) that indicated military operations is associated with environmental degradation. Instead, the short-run (refer Table 2) magnitude did not show any relationship between CO2 with military activities. To sum up, the impact of military activities on CO2 are positively associated but in a small scale. The most highly correlated with the environmental degradation are Urbanization, Trade Openness and Foreign Direct Investment. Despite the empirical findings shows a low correlation between CO2 emissions with military activities the country should developed a new eco-system in military operation with highly environmental consideration. It has been mentioned in treadmill of destruction theory that a country with technologically advanced and labor-intensive militaries require enormous amounts of resources for their infrastructures and research and development, as well as to maintain their relative size and power. The amount of land used by armed forces for bases and other forms of installations has increased steadily in spite of changes in the overall geopolitical structure of the world, which partly accounts for the positive associations between both aspects of militaries and the consumption-based environmental demands of nations. Even during peacetime, the armed forces consume large amounts of fossil fuels, a trend that is likely to continue as high-tech militaries develop and deploy new vehicles and machinery. This equipment must be constantly maintained and tested, increasing the environmental demands of militarization. While these continual changes contribute to the use of fossil fuels and subsequent anthropogenic carbon dioxide emissions, the scale and intensity of the latter are both influenced by labor intensive militaries, given the volume of fuels used for the movement, training, and protection of troops and support personnel. Nevertheless, the empirical findings for this study shows a low relationship between military operation with environmental degradation and the level of Trade Openness, Urbanization and Foreign Direct Investment displayed a greater effects to CO2 emissions. This indicates that the higher the industrial development for a country, the more CO2 combusted to the air. This is in line with (Saudi et al.,2020) that mentioned economic growth of the countries impels an intensive use of energy which results in growing CO2 missions, and the pollution is directly linked to economic growth. Urbanization and industrial revolution increase the level of regional energy consumption and mutually influenced the level of CO2 emission that can edge to environmental degradation.

IV	DV	Coefficient	Error Correction Term
LMILEX	CO2	-0.150	-0.340**
LMPR	*CO2*	-0.163	-0.533*
LMES	*CO2*	-0.398	-0.2918*
LTO	*CO2*	+1.333	-0.2222*
LUR	*CO2*	+2.345	-0.1675**
LFDI	*CO2*	+1.2333	-0.3987*

Table 2: Short-Term Magnitude

IV	DV	Coefficient
LMILEX	*CO2*	+0.01507*
LMPR	*CO2*	+0.01636*
LMES	*CO2*	+0.0563
LTO	*CO2*	+0.1112**
LUR	*CO2*	+0.3222***
LFDI	*CO2*	+0.1112**

Note: Note: ***, ** and * are 1%, 5% and 10% of significant levels, respectively

Table 3: Long-Run Magnitude

Note: Note: ***, ** and * are 1%, 5% and 10% of significant levels, respectively

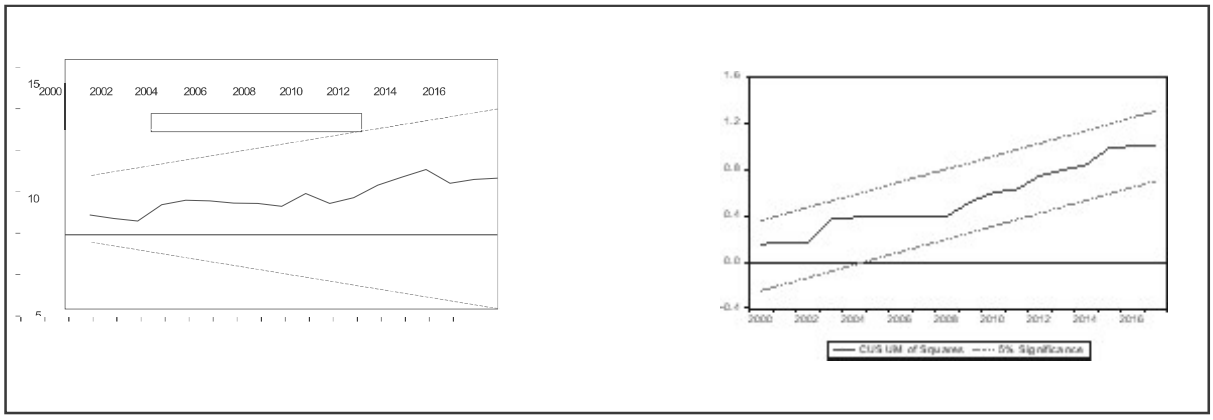
Table 4: Bound Test

Model	AIC (Lag order)	F-statistics
LIMEX		
LCO2	(1, 0, 0, 0,1,1)	5.220***
LMPR		
LCO2	(1, 0, 1, 1,0,0)	6.443***
LMES		
LCO2	(1, 1, 1, 1,0,0)	6.135***
LTO		
LCO2	(1 ,0, 0, 0,0,0)	9.319***
LUR		
LCO2	(1, 0, 0, 0,1,0)	1.984
LFDI		
LCO2	(1,0,1,1,1,0,1)	3.5111*

Note: ***, ** and * are significant at the 1%, 5% and 10% levels, respectively.

Figure 4: Stabilty Test

CUSUM TEST CUSUMQ TEST



5. Conclusions and Recommendations

Most studies linking military and the environment were conducted in developed and western countries in which the study on ASEAN economies still scares. The results obtained from such study is an average of the sample countries and it does not reflect the effects of military on the environment on ASEAN perspectives. Thus, there is a lack of study that investigates the link between militarization and the environmental degradation in ASEAN. This study, therefore, would fill these research gaps by integrating military and the environmental degradation in Malaysia perspectives. This study widens our collective understanding of the human dimensions of global environmental change by considering the impact of military institutions on carbon dioxide emissions. The empirical findings for this study shows a low relationship between military operation with environmental degradation and the level of Trade Openness, Urbanization and Foreign Direct Investment displayed a greater effect to CO2 emissions. This indicates that the higher the industrial development for a country, the more CO2 combusted to the air. Thus the treadmill of destruction theory in Malaysia is still unclear. Nevertheless, as the expansion of militarism influenced by both geopolitics and domestic interests that involved the development of high-tech weaponry and vehicles that consume massive quantities of fossil fuels and emit large quantities of carbon dioxide the sustainable Development Goals cannot be ignored. Way forward, the development of military operation framework must be based on sustainable eco-systems. This study would help policy maker to formulate

the defence macro policy that addressed the environmental consideration alongside with other social economic benefits through a responsible consumption and productions towards a sustainable and resilience economy.

6. Acknowledgements

This research is for the UPNM Special Grant UPNM/2021/GPJP/SS/2.

7. References

Adler, P.B., Leiker, J., & Levine, J.M. (2009). Direct and indirect effects of climate change on a Prairie plant community. PLoS ONE, 4(9), e6887. doi:10.1371/journal.pone.0006887

Afroz R, Hassan MN, Awang M, Ibrahim NA (2007) Benefits of air quality improvement in Klang Valley Malaysia. Intern J Environ Pollut 30:119–136. doi:10.1504/IJEP.2007.014507.

Almajdob, M. S., & Marikan, D. A. A. (2021). The Impact of Military Spending on The Economic Growth of Arab Spring Countries. International Journal of Academic Research in Business and Social Sciences, 11(3), 1436-1451.

Andrew K. Jorgenson, Brett Clark, Jeffrey Kentor; Militarization and the Environment: A Panel Studyof Carbon Dioxide Emissions and the Ecological Footprints of Nations, 1970–2000. Global Environmental Politics 2010; 10 (1): 7–29.

Ali, S. H., & Pincus, R. (2018). The role of the military in environmental peacebuilding. Routledge Handbook of Environmental Conflict and Peacebuilding, 306-314.

Biswas, Asit. K., 2000. 'Scientific Assessment of the Long-Term Environmental Consequences of War', in Jay E. Austin & Carl E. Bruch, eds., The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives. Cambridge: Cambridge University Press (303-315).

Borhan, H., Ahmed, E. M., & Hitam, M. (2013). CO2, quality of life and economic growth in Ea st Asian 8. Journal of Asian Behavioural Studies, 3(8), 14-24.

Butler, R. (2014). Rainforest. Retrieved 1/22/2014 from http://rainforests.mongabay.com/

Clark, B., & Jorgenson, A.K. (2012). The treadmill of destruction and the environmental impacts of militaries. Sociology Compass, 6/7, 557-569.

Chaturvedi, S., & Doyle, T. (2015). Climate terror: A critical geopolitics of climate change. London: Palgrave Macmillan.

Dixon, R. K., Solomon, A. M., Brown, S., Houghton, R. A., Trexier, M. C., & Wisniewski, J. (1994). Carbon pools and flux of global forest ecosystems. Science, 263(5144), 185-190.

Dominick, D., Juahir, H., Latif, M. T., Zain, S. M., & Aris, A. Z. (2012). Spatial assessment of air quality patterns in malaysia using multivariate analysis. Atmospheric Environment, 60, 172-18.

Floyd, R. (2010). Security and the environment: Securitisation theory and US environmental security policy. Cambridge University Press.

Guo, D., Arnolds, J.L., Midgley, G.F. and Foden, W.B. (2016) Conservation of Quiver Trees in Namibia and South Africa under a Changing Climate. Journal of Geoscience and Environment Protection, 4, 1-8. https://doi.org/10.4236/gep.2016.4700.

Jayaram, D. (2020). The Indian military and environmental affairs: an analysis through the lens of military change. Contemporary South Asia, 28(3), 288-303.

Jorgenson, A. K., Clark, B., & Kentor, J. (2010). Militarization and the environment: a panel study of carbon dioxide emissions and the ecological footprints of nations, 1970–2000. Global Environmental Politics, 10(1), 7-29.

Moreno, T., Lavín, J., Querol, X., Alastuey, A., Viana, M., & Gibbons, W. (2009). Controls on hourly variations in urban background air pollutant concentrations. Atmospheric Environment, 43(27), 4178-4186.

Saudi, N.S.B.M., Ismail, A.B., Baker, R.B, Rafiuddin, N.B.M., Sulaiman, A.B (2019). Military expenditure and economic growth empirical evidence from Malaysia.International Journal of Recent Technology and Engineering, 2019, 8(2 Special Issue 9), pp. 1–5

Saudi M, H,Saudi ,Baker R, and Ismail A.(2021).Regional Energy Consumptions and Economic Growth: Geographical Origin Study on 10 Asean Economies.Review of International Geographical Education(RIGEO), 11(1),668-676.doi:10.48047/rigeo.11.1.53

Saudi, H. A., Abd-Allah, W. M., & Shaaban, K. S. (2020). Investigation of gamma and neutron shielding parameters for borosilicate glasses doped europium oxide for the immobilization of radioactive

waste. *Journal of Materials Science: Materials in Electronics*, *31*(9), 6963-6976.
Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.
Rinawati, F., Stein, K., & Lindner, A. (2013). Climate change impacts on biodiversity – The setting ofa lingering global crisis. Diversity, 5, 114-123.
Ridzuan, A.R., Shaari, M.S., Saudi, N.S.M., Kumaran, V.V. and Razak, M.I.M. (2020) 'Macroeconomic determinants of military expenditure in Malaysia', Int. J. Economic Policy in Emerging Economies, Vol. 13, No. 6, pp.675–690.
Sarfraz, M., Shah, S. G., Fareed, Z., & Shahzad, F. (2020). Demonstrating the interconnection of hierarchical order disturbances in CEO succession with corporate social responsibility and environmental sustainability. *Corporate Social Responsibility and Environmental Management*, *27*(6),2956-2971.
Thomas, C.D., Cameron, A., Green, R.E., Bakkenes, L., Beaumont, J., Collingham, Y.C., Erasmus, B.F.N., et al. (2004). Extinct ion risk fromclimate change. Nature, 427, 145-148.
Tol, Richard S. J. 2003. "Is the Uncertainty about Climate Change Too Large for ExpectedCost–Benefit Analysis?" Climatic Change, 56(3):265–89.The Intergovernmental Panel on Climate Change (IPCC)n(2007).https://www.ipcc.ch/site/assets/uploads/2018/03/ar4-wg2-intro.pdf