*Advanced Production and Industrial Engineering*
*R.M. Singari and P.K. Kankar (Eds.)*


*doi:10.3233/ATDE220725*

# Investigating the Economic and Environmental Sustainability of Logistic Operations in India Using ARDL Procedure

Akanksha SINGH[1], Shweta KUMARI[2], Sanjay kumar PANDEY[3], Bharat SINGH[4], Nand KUMAR[5]

[1]*Research Scholar, Department of Humanities, Delhi Technological University,*
[2]*Research Scholar, Department of Humanities, Delhi Technological University,*
[3]*Associate Professor, Department of Economics, College of Commerce, Arts & Science, Pataliputra University,*
[4]*Professor, Satyawati College, University of Delhi,*
[5]*Professor & Head of Department of Humanities, Delhi Technological University,*

**Abstract.** The study aims to examine the effect of environment and economic variables on logistic performance in India. In order to study the long run and short run association between the variables the study employed auto regressive distribution lag (ARDL) approach on a time series data from 2007 to 2018. The result revealed that foreign direct investment (FDI) has a positive relation with LPI whereas fossil fuel consumption in both the short and long run has a negative relation. On the other hand, GDP per capita has a negative relation with LPI while total greenhouse gas emissions has a positive relation, which is a sign of concern for environment sustainability. In the recent report published by the World Bank India's rank has slipped down from 35th to 44thposition worldwide whereby all the six dimensions have shown a downward trend. India being one of the largest customer oriented market would negatively affect the world economy if its logistics operation are poorly driven. This study highlights few reason why India lacks behind in its logistics performance and provide suggestion how India can improve its logistic operation at global level.

**Keywords:** Logistic performance index, ARDL, total greenhouse gas emission, foreign direct investment, GDP per capital

## 1. Introduction

In the 21st century, logistics assumes an indispensable part in associating urban communities, nations, and landmasses all around the world [Khan et al., 2018]. As of late, logistic industry has pulled in much consideration in academic studies because of its focal points and inconveniences on nations' monetary development and ecological execution. Firms around the world have begun to implement green practices in their logistics tasks to accomplish social, economic and environmental sustainability, while in many countries green practices have a negative impact on the firm's profit. In an

[5]Corresponding author: Nand Kumar
E-mail: nandkumar@dce.ac.in

examination to discover the influence of green supply chain network on firms' financial and natural exhibition, it was establish that green experiments including an environmental plan of items, participation with clients, green buying of crude materials and segments, green transportation, and dispersion have a critical positive relationship with nature. It was also analyzed that green practices particularly green buying, adversely affects a company's productivity because of weighty charges and import obligations on material and segments [Khan et al 2017]. Undeniably, worldwide logistics tasks intensely rely upon energy, particularly petroleum derivative, bringing about natural crumbling and grave repercussion on general wellbeing. An investigation on European nations to examine the connection between logistics and energy request, the outcomes indicated that logistical tasks have a solid relationship with energy interest [Zaman et al., 2017]. Logistics industry plays a critical role in the monetary advancement of a nation yet nations do not invest the required time and energy on the other hand green practices in logistical tasks are the lone answer to bring about control in air contamination, environmental change and a worldwide temperature alteration issue[Li et al., 2018] and [Khan et al., 2017].The BRICS nations should develop a model for green practices and business through appropriation green practices in logistics activities, [Aldakhil et al., 2018].

### *1.1 Research motivation and objective*

Logistic operation play's a critical role in the economic development of the country but its percentage contribution in the GDP is comparatively less, the government need to focus on measures which promotes logistic performance as countries like Germany, Sweden and Belgium are leading the list of logistic performance index whereas India far lack behind. The motive behind the study is to highlight the parameter, which are good for logistics operation so that logistic operation can move forward in a sustainable manner.

## 2. Review of Literature

[Khan et al., 2019; Zhang et al., 2019; Khan et al., 2017; Mensah et al., 2020] studied the relationship among GLP and social, environmental and economic factors and suggested that constructive policy that promotes the logistic industry without compromising the Environment sustainability should be encouraged. [Yadav et al., 2016] examined the intension of the young consumer towards buying a green product. The research carried out in India using Theory of Planned Behavior (TPB) to check environmental concern and environmental knowledge. [Chhabra et al., 2017;Pishvaee et al., 2012] used MDCM to analyze the alternatives for green practices in the assembly and packaging processes, to obtain best alternative solution for the logistic company particularly in India. They concluded the best packing alternative is carbon positive material whereas the best alternative for assembly operation is clinch joint.[Karaman et al., 2020] investigates the relation between GLP and sustainability drawing from the signaling theory and tested the link with the corporate governance. [Zhang et al., 2020; Oliverira et al., 2016] used LCA for a better understanding of remanufacturing and assessment of 3Es. [Kilkis et al., 2017] introduced the nearly zero exergy airport and used the law of thermodynamics to analyze the relationship between the 3 Es. [Pao et al., 2015] employed Lotkae Volterra model to examine the competitive interaction among the three Es and laid emphasis on EKC hypothesis. [Sarkodie et al., 2019;Wang

et al., 2019] revealed the existence of inverse U-shaped relationship between the increasing population's increasing demand for energy consumption, food production and economic development that has triggered climate change. [Menash et al., 2020, Kwak et al., 2020] employed partial least square structural equation modeling to check the relationship among green logistics management practices, social-environmental sustainability and business performance (BP). [Karaman et al., 2020] employed the signaling theory to analyze the relationship between GLP and sustainability reporting, it was discovered there is positive and relevant relationship between them. [Mensah et al., 2020] used Heterotrait- Monotrait ratio and Fornell-Larcker criteria to analyze the relationship among GLMP on social, environmental, market and financial performance and it was noted that environmental performance was positively impacted by GLMP whereas, social, market and financial performance has insignificant impact on EP. [Baah et al., 2019] employed partial least square structural equation modeling to analyze the effects of regulatory stakeholder pressure and organizational stakeholder pressure on financial performances and GLP. The results revealed GLP was influenced by organizational stakeholders and regulatory stakeholder's pressure. [Gupta et al., 2020] applied graph theory matrix approach to analyze the sustainability index of the logistics service provider and concluded that green procurement, renewable energy sources, recyclable packaging, carbon emission reduction, rainwater harvesting, use of CNG fleets, reduction in fuel consumption and resources optimization plays a major role in sustainable practices. [Zhang et al., 2020] conducted interviews based on the grounded theory method and concluded that the development level of logistics industry, the level of social supervision, the perfect of GLP system, the level of perception of logistics enterprises on GLP and the green governance capacity of government have a great influence on GLP.[Menash et al., 2020] employed partial least square structural equation model software to study the impact of green warehousing logistics optimization and social values and ethics on economic performances and supply chain sustainability. [Abdullahi et al., 2020] proposed a weighted sum model and an opsilion-constraint model that combines three dimensions of the 3Es. [Paul D.larson., 2021] employedHayes Process macro to analyze the indirect effects of LPI on economic and environment. [Richnak et al., 2021] used Pearson chi-square test to test the hypothesis. A total of 165 enterprises were surveyed and the result indicated that environmental policy were used by large enterprises in Slovakia. [Chawla et al., 2021] deployed fuzzy AHP to analyze green operations management practices and operation management. It laid emphasis that through GOM both nature and man-made world can coexist.[Stekelorum etal., 2020] used fuzzy set comparative analysis to survey 232 third party logistic provider to analyze the internal and external green supply chain management practices that influences TPLs operational and financial performances.[Nair et al., 2021] reviewed papers from 2000 to 2020 and collected data through survey and found that very few literature exist on social sustainability and also identified twenty six social issues in supply chain exist in two different economy USA and India.[Zhanget al., 2021;Guirong et al 2012; Alexandrova et al., 2021] used Grey relation analysis method GRA to predict urban logistic demand and concluded that subway can promote sustainability in urban logistic they highlighted the importance of government in order to achieve a circular economy. [Li et al., 2021] employed two stages least square and generalized method to analyze the environment and economic effects of green logistics and the results indicated that green logistics positively impact the economies of MENA, Asian and OBRI countries but promote environmental pollution. [Caggiani et al., 2021] proposed a two-echelon electric vehicle routing

problem (2E-EVRPTW-PR) model for last-mile urban deliveries where e-vans and e-cargo bikes can be used for customers' deliveries in the urban zone and second restricted traffic zone, respectively. [Adams et al., 2021] Concludes that firms cannot expertise in supply chain and sustainability at the same time and managers should have qualification and background of both. [Zheng et al., 2021] employed fuzzy AHP and analyzed that the growth of different logistic models has negative affect on agricultural product cold chain. [Managi et al., 2021] viewed that science, technology and innovation plays an important role in achieving the SDGs. [Naqvi et al., 2010] correlated renewable energy consumption, financial development and real income to ecological footprint by augmented panel algorithm method and concluded that financial development is positively related however per capita income for real income and high-income group have a negative outcome. [Majid, M. A., 2020] [Harjanne et al., 2019] objective was to present challenges, investment and employment opportunities in the field of renewable energy in India. [Zhang et al., 2019] examined the relationship between tourism, environment degradation and logistics in a time series data in Thailand using ARDL model.

## 3. Methodology

Logistic performance index was first calculated in 2007 by the world Bank based on the six key indicator i.e. speed of custom clearance process, quality of infrastructure related to trade and transport, ease of competitive price shipment, quality of logistic service, ability to track and trace consignments and expected delivery time of goods and services to destination. This study draws the relationship between India's logistic operations with economic (GDPPC, FDI) and environmental factor (TGHGE, Fossil). Undoubtedly logistic operation are very important for a country's economic growth but due to their high dependence on fossil fuel they enhances carbon emission and global warming, a sustainable policies in the field of logistics operation is needed to solve the various environmental and social problems[Khan et al.,2018]. In this study, we have used secondary data downloaded from the World Bank development indicators (WDI) for testing hypothesis and achieving research objective. Equation: 1 is formulated to check the relationship of overall logistic operation with environment and economic factors in the context of India during the period 2007-2018.

$$\ln LPI = f(\ln GDPPC, \ln FDI, \ln TGHGE, \ln FOSSIL) \quad \text{.....(1)}$$

In the above equation, ln is the natural log and the descriptions of the variables are in table 1.

$$\Delta \ln LPI_t = a_0 + \sum_{i=1}^{n_1} a_{1i} \Delta \ln GDPPC_{t-i} + \sum_{i=1}^{n2} a_{2i} \Delta FDI_{t-i} + \sum_{i=1}^{n3} a_{3i} \Delta \ln TGHGE_{t-i}$$
$$+ \sum_{i=1}^{n4} a_{4i} \Delta \ln FOSSIL_{t-i} + \beta_1 \ln GDPPC_{t-1} + \beta_2 \ln FDI_{t-1} + \beta_3 \ln TGHGE_{t-1} + \beta_4 \ln FOSSIL_{t-1} + \mu_t \quad \text{.....(2)}$$

In equation 2 the short run relationship is represented by $\alpha_1$ to $\alpha_4$ whereas the long run relationship is presented by $\beta_1$ to $\beta_4$ and the drift component is$\alpha_0$.While $n_i$ is the optimal lag and $\mu_t$ is the error term.

$$\Delta \ln LPI_t = \beta_0 + \sum_{i=1}^{n_1} \beta_{1i} \Delta \ln GDPPC_{t-i} + \sum_{i=1}^{n2} \beta_{2i} \Delta \ln FDI_{t-i} + \sum_{i=1}^{n3} \beta_{3i} \Delta \ln TGHGE_{t-i}$$
$$+ \sum_{i=1}^{n4} \beta_{4i} \Delta \ln FOSSIL_{t-i} + \theta ECM_{t-1} + \mu_t \quad (3)$$

Co- integration among the variables was tested and then the error correction model was developed whereas θ is the speed of adjustment of the long run equilibrium.

**Table 1:** List of variables

| Variables | Description |
|---|---|
| LPI | Logistics performance index(1=low to 5=high) |
| GDPPC | GDP per capita, PPP (constant 2017 international $) |
| TGHGE | Total greenhouse gas emissions (kt of $CO_2$) |
| FDI | Foreign direct investment, net inflows (% of GDP) |
| FOSSIL | Fossil fuel energy consumption (% of total) |

**Source:** [World Bank Database, 2020]

As some variables were stationary at level and some at first difference, we found ARDL (autoregressive distribution lag) technique to be most appropriate for our research. Table 1 indicates the variable description where GDPPC, FDI represents the economic factor affecting LPI on the other hand TGHGE and FOSSIL are the factors affecting environment sustainability.

## 4. Results and discussion

Table 2: Illustrates the result of unit root test. Augmented Dickey Fuller (ADF) test was employed to check the stationarity at level and 1st difference. The results proved the stationarity of the dependent variable LPI at level whereas the independent variables were stationary at 1st difference. ARDL model allows having a mixture of variables at level and first difference, therefore, ARDL model is most appropriate for our study. Before applying ARDL co-integration, ARDL bound test is used to check the long run association between the dependent and independent variables. The bound test shows two critical values the upper bound and the lower bound where upper bound assumes all variables are at first difference and lower bound assumes that all variables are at level. If the value of upper bound is less than F statistic the null hypothesis is rejected showing the presence of co-integration vice-versa.

**Table 2:** ADF Unit Root test

| Variables | level t-statistics | level Prob. | 1st diff t-statistics | 1st diff Prob. |
|---|---|---|---|---|
| LPI | -3.937927 | 0.0169 | -4.092602 | 0.0156 |
| GDPPC | -2.736086 | 0.2449 | -4.064610 | 0.0531 |
| TGHT | -2.555023 | 0.1324 | -4.644740 | 0.0061 |
| FOSSIL | -1.768203 | 0.3745 | -3.162729 | 0.0539 |
| FDI | -1.891757 | 0.3234 | -4.761373 | 0.0052 |

Table 3:shows the results of ARDL bound test, the results indicates that there existence a significant co-integration between the dependent and the independent variables as F statistics is much greater than the upper bound statistic.

**Table 3:** Auto Regressive Distributed Lag bond test for co-integration

| Variable | F statistics | Co-integration | |
|---|---|---|---|
| F(LPI,GDPPC,FDI,GHGE,FOSSIL) | 23.16019*** | | |
| Critical value | 1% | 5% | 10% |
| Lower bound | 3.29 | 2.56 | 2.2 |
| Upper bound | 4.37 | 3.49 | 3.09 |

*significant at 10% level, **significant at 5%, ***significant at 1%

Table 4: illustrates ARDL short run results where the findings indicates that total greenhouse gas emission (TGHGE) and FDI are significant and has positive correlation with LPI (0.07<0.1,0.25<0.05) whereas fossil fuel emission has a negative relation with the logistic performance and is significant at 5% (0.04<0.05). On the other hand GDP per capita is significant and have a negative relation with the LPI (0.02 <0.05) indicating that government policies are not aligned with the logistic performance index in India.

**Table 4:** Auto Regressive Distributed Lag short-run estimates

| Variables | Probability | t-statistic | Coefficient |
|---|---|---|---|
| GDPPC | 0.0255* | -6.144854 | -1.180468 |
| FDI | 0.0421** | 4.720288 | 0.259092 |
| TGHGE | 0.0713* | 3.540824 | 3.180970 |
| FOSSIL | 0.0650* | -3.727804 | -2.924298 |

Note: Adjusted $R^2 = 0.90$ *significant at 10%, **significant at 5%, ***significant at 1%

Table 5: demonstrates long run result of ARDL, findings suggest that the value of F statistic is much greater than upper bound hence there exist a long run relationship at 5% level of significance between the dependent and independent variable. Total greenhouse gas emission (TGHGE) is statistically significant and is positively correlated with the logistic performance index which is a sign of concern for human health. On the other hand FDI is significant and have a positive impact on LPI performance in the long run. On the other hand Gross Domestic Product per capita (GDPPC) has a negative relation with the LPI performance and is significant in the long -run. This is mainly because government policies are notallied with logistic operations (World Bank, 2018). Lastly, in long-run Fossil fuel consumption has a negative relation with the logistic performance index, which has a positive sign for environmental sustainability.

**Table 5:** Auto Regressive Distributed Lag long-run estimates

| Variables | Probability | t-statistic | Coefficient |
|---|---|---|---|
| GDPPC | 0.0678* | -3.640979 | -0.694821 |
| FDI | 0.0602* | 3.888108 | 0.117010 |
| TGHGE | 0.0462** | 4.488684 | 1.241758 |
| FOSSIL | 0.1064* | -2.422927 | -1.096131 |

Note: Adjusted $R^2 = 0.90$ *significant at 10%, **significant at 5%, ***significant at 1%

Table 6: Illustrates the results of diagnostics test, we have used Jarque Bera test and results shows that residuals are normally distributed. In addition heteroscedasticity

Breusch – Pagan Godfrey test has been deployed to check where the data are homoscedastic or heteroskedastic the results indicates that the dataset is homoscedastic. Further Ramsey RESET test was employed and the result shows that the model is free from specification error. Lastly, Breush Godfrey serial correlation LM test revealed that there exists no serial correlation among the error terms in our model

**Table 6:** Daignostic tests

| | | |
|---|---|---|
| Jarque-Bera Normality Test, JB stat | 0.6024 | 0.7399 |
| Ramsey RESET test,Log likelihood ratio | 61.2801 | 0.6646 |
| Breusch-Godfery serial Correlation ,LM test | 4.9906 | 0.5295 |
| Heteroskedasticity Breusch-Pagan-Godfery test, Obs R-squared | 5.9676 | 0.6509 |

Table 7 shows the results of Granger causality test. The test is used in time series data to assess whether there exits any potential predictability power from one variable to the other. The result indicates that there exists a unidirectional causality between LPI and FDI, FOSSIL and GDPPC, FDI and TGHDE and FOSSIL and FDI.

**Table 7:** Granger causality test

| Direction of causality | F-statistics | probability |
|---|---|---|
| LPI-FDI | 5.8833 | 0.0415* |
| FDI-TGHGE | 4.3049 | 0.071** |
| FOSSIL-GDPPC | 5.1398 | 0.053** |
| FOSSIL-FDI | 4.6485 | 0.063** |

Note: **significance at 10%,*significance at 5%

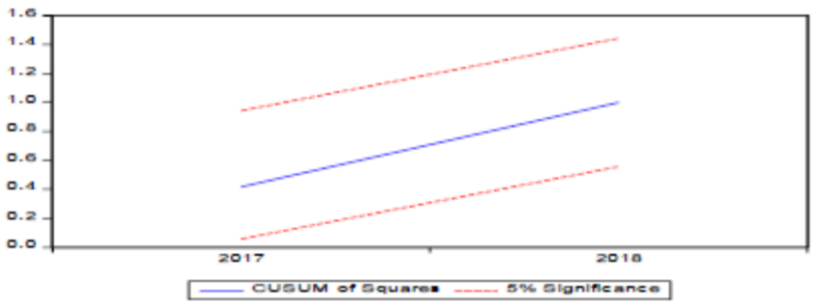


**Figure 1:** Cumulative sum of Square of recursive residuals

The model's stability was checked by cumulative sum of the recursive residuals stability test figure 1 suggest that model is stable. The findings reveal that foreign direct investment and total greenhouse emission are positively correlated with the logistic operation whereas fossil fuel consumption and GDP per capita have a negative relation.

## 5. Conclusion

The World Bank reports logistic performance index (LPI) at an interval of every two years. It is the weighted averages of six key dimensions i.e. speed of custom clearance process, quality of infrastructure related to trade and transport, ease of competitive price shipment, quality of logistic service, ability to track and trace consignments and expected delivery time of goods and services to destination. Logistic operation measures the relative ease and efficiency with which products can move inside a country, countries can compete globally by maintaining a good logistic as it would help to reduce the trade cost. The focus of this study is to find out is logistic performance index in India environmentally-economically sustainable during the period 2007-2018.To find the short run and long run relation among the dependent (LPI) and independent variables i.e. GDP per capita, FDI inflow (economic variable) and fossil fuel consumption, greenhouse gas emission (environmental variable) we employed ARDL technique. The findings confirmed that both in the short and long run foreign direct investments (FDI) are significant and are positively co-related with the LPI, which is a positive sign for the growth of an economy. Whereas Total greenhouse gas emission (TGHGE) is also significant and has a positive relation with the LPI, which is a sign of concern, as they are harmful for humanity and effect environment sustainability negatively, which is not the case in many other country like UK (Khan et al., 2017).GDP per capita being significant and having a negative relation highlights the ignorance from the government side. In the recent report India rank have slipped down from $35^{th}$ to $44^{th}$ position in the world LPI ranking were by all the six dimensions have fallen down (World Bank, 2018). This is mainly because of government policies are not primarily focus on logistic operations. With the ongoing expansion of the logistic industry government need to focus on efficient and effective policies in order to curb the pollution and waste generated by the logistic industries as countries like Germany, Sweden and Belgium are leading the list of logistic performance index whereby India lacks behind.

## 6. References

[1] Aldakhil, A. M., Nassani, A. A., Awan, U., Abro, M. M. Q., & Zaman, K. (2018). Determinants of green logistics in BRICS countries: An integrated supply chain model for green business. *Journal of Cleaner Production*, *195*, 861-868

[2] Abdullahi, H., Reyes-Rubiano, L., Ouelhadj, D., Faulin, J., & Juan, A. A. (2022). Modelling and multi-criteria analysis of the sustainability dimensions for the green vehicle routing problem. *European Journal of Operational Research*, *292*(1), 143-154.

[3] Baah, C., Jin, Z., & Tang, L. (2020). Organizational and regulatory stakeholder pressures friends or foes to green logistics practices and financial performance: investigating corporate reputation as a missing link. *Journal of cleaner production*, *247*, 119125.

[4] Chawla, V. K., Chhabra, D., Gupta, P., & Naaz, S. (2021). Evaluation of green operations management by fuzzy analytical hierarchy process. *Materials Today: Proceedings*, *38*, 274-279.

[5] Caggiani, L., Colovic, A., Prencipe, L. P., & Ottomanelli, M. (2021). A green logistics solution for last-mile deliveries considering e-vans and e-cargo bikes. *Transportation Research Procedia*, *52*, 75-82.

[6] Gupta, A., & Singh, R. K. (2020). Developing a framework for evaluating sustainability index for logistics service providers: graph theory matrix approach. *International Journal of Productivity and Performance Management*.

[7] Guirong, Z., Qing, G., Bo, W., & Dehua, L. (2012, October). Green logistics and Sustainable development. In *2012 International Conference on Information Management, Innovation Management and Industrial Engineering* (Vol. 1, pp. 131-133). IEEE.

[8] Harjanne, A., & Korhonen, J. M. (2019). Abandoning the concept of renewable energy. *Energy policy*, *127*, 330-340.
[9] https://lpi.worldbank.org/international/
[10] https://data.worldbank.org/
[11] Karaman, A. S., Kilic, M., & Uyar, A. (2020). Green logistics performance and sustainability reporting practices of the logistics sector: The moderating effect of corporate governance. *Journal of Cleaner Production*, *258*, 120718.
[12] Kwak, S. Y., Cho, W. S., Seok, G. A., & Yoo, S. G. (2020). Intention to Use Sustainable Green Logistics Platforms. *Sustainability*, *12*(8), 3502.
[13] Khan, S. A. R., Sharif, A., Golpîra, H., & Kumar, A. (2019). A green ideology in Asian emerging economies: From environmental policy and sustainable development. *Sustainable Development*, *27*(6), 1063-1075.
[14] Karaman, A. S., Kilic, M., & Uyar, A. (2020). Green logistics performance and sustainability reporting practices of the logistics sector: The moderating effect of corporate governance. *Journal of Cleaner Production*, *258*, 120718.
[15] Kwak, S. Y., Cho, W. S., Seok, G. A., & Yoo, S. G. (2020). Intention to Use Sustainable Green Logistics Platforms. *Sustainability*, *12*(8), 3502.
[16] Khan, S. A. R., & Qianli, D. (2017). Does national scale economic and environmental indicators spur logistics performance? Evidence from UK. *Environmental Science and Pollution Research*, *24*(34), 26692-26705
[17] Khan, S. A. R., Zhang, Y., Anees, M., Golpîra, H., Lahmar, A., & Qianli, D. (2018). Green supply chain management, economic growth and environment: A GMM based evidence. *Journal of Cleaner Production*, *185*, 588-599.
[18] Larson, P. D. (2021). Relationships between Logistics Performance and Aspects of Sustainability: A Cross-Country Analysis. *Sustainability*, *13*(2), 623.
[19] Li, X., Sohail, S., Majeed, M. T., & Ahmad, W. (2021). Green logistics, economic growth, and environmental quality: evidence from one belt and road initiative economies. *Environmental Science and Pollution Research*, 1-11.
[20] Managi, S., Lindner, R., & Stevens, C. C. (2021). Technology policy for the sustainable development goals: From the global to the local level.
[21] Majid, M. A. (2020). Renewable energy for sustainable development in India: current status, future prospects, challenges, employment, and investment opportunities. *Energy, Sustainability and Society*, *10*(1), 1-36.
[22] Naqvi, S. A. A., Shah, S. A. R., & Mehdi, M. A. (2020). Revealing empirical association among ecological footprints, renewable energy consumption, real income, and financial development: a global perspective. *Environmental Science and Pollution Research*, *27*(34), 42830-42849.
[23] Nair, P. U., & Thankamony, P. (2021). Social Issues in Supply Chain Sustainability–Focus Areas for Energy and Manufacturing sectors in India and USA. *European Journal of Sustainable Development*, *10*(1), 495-495.
[24] Oliveira, C., Coelho, D., & Antunes, C. H. (2016). Coupling input–output analysis with multiobjective linear programming models for the study of economy–energy–environment–social (E3S) trade-offs: a review. *Annals of Operations Research*, *247*(2), 471-502.
[25] Pishvaee, M. S., Torabi, S. A., & Razmi, J. (2012). Credibility-based fuzzy mathematical programming model for green logistics design under uncertainty. *Computers & Industrial Engineering*, *62*(2), 624-632.
[26] Pao, H. T., Chen, H. A., & Li, Y. Y. (2015). Competitive dynamics of energy, environment, and economy in the US. *Energy*, *89*, 449-460.
[27] Richnák, P., & Gubová, K. (2021). Green and Reverse Logistics in Conditions of Sustainable Development in Enterprises in Slovakia. *Sustainability*, *13*(2), 581.
[28] Stekelorum, R., Laguir, I., Gupta, S., & Kumar, S. (2021). Green supply chain management practices and third-party logistics providers' performances: A fuzzy-set approach. *International Journal of Production Economics*, *235*, 108093.
[29] Sarkodie, S. A., Strezov, V., Weldekidan, H., Asamoah, E. F., Owusu, P. A., & Doyi, I. N. Y. (2019). Environmental sustainability assessment using dynamic autoregressive-distributed lag simulations—nexus between greenhouse gas emissions, biomass energy, food and economic growth. *Science of the total environment*, *668*, 318-332.
[30] Wang, S., Song, J., Wang, X. E., & Yang, W. (2019). The spatial and temporal research on the coupling and coordinated relationship between social economy and energy environment in the Belt and Road Initiatives. *Sustainability*, *11*(2), 407.
[31] Yadav, R., & Pathak, G. S. (2016). Young consumers' intention towards buying green products in a developing nation: Extending the theory of planned behavior. *Journal of Cleaner Production*, *135*, 732-

739.
[32] Zhang, Q., Yang, M., & Zhou, X. (2021, April). Sustainable Development Analysis of Urban Green Logistics Based on Subway Transportation. In *2021 IEEE 8th International Conference on Industrial Engineering and Applications (ICIEA)* (pp. 601-606). IEEE.
[33] Zheng, L. (2021). Construction of Green Logistics Evaluation System for Agricultural Products Cold Chain Based on Data Analysis. In *2020 International Conference on Data Processing Techniques and Applications for Cyber-Physical Systems* (pp. 431-437). Springer, Singapore.
[34] Zhang, Z. (2020). Energy and environment issues in carbon capture, utilization and storage. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 1-4.
[35] Zhang, Y., Khan, S. A. R., Kumar, A., Golpîra, H., & Sharif, A. (2019). Is tourism really affected by logistical operations and environmental degradation? An empirical study from the perspective of Thailand. *Journal of Cleaner Production*, *227*, 158-166.
[36] Zhang, W., Zhang, M., Zhang, W., Zhou, Q., & Zhang, X. (2020). What influences the effectiveness of green logistics policies? A grounded theory analysis. *Science of the Total Environment*, *714*, 136731.