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An Empirical Analysis of Natural Gas as an Alternative Fuel for Internal Transportation

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Abstract— *This study aimed to measure the usage natural gas can be an effective alternative fuel for internal transportation. In order to interpret the present analysis, a quantitative approach was used. The current research focused on assessing the usage of natural gas as an alternative fuel for internal transportation. The present research was analyzed using a questionnaire. Sample design is the technique or process that the researcher is able to accept in selecting objects for the survey is referred to as sample design. The research sample was chosen using a random sampling method and carried out in various locations in Kurdistan region of Iraq. A total of 125 questionnaires were issued, but only 111 participants completed them correctly. Participants were asked to rate the value of each object on a five-point scale ranging from unimportant to highly important. The findings revealed that the usage of Natural Gas Fuel strongly predicts internal transportation, implying that the usage natural gas can be an effective alternative fuel for internal transportation.*

Keywords— ***Natural Gas Fuel, Internal Transportation, Economic, Kurdistan region of Iraq.***

I. INTRODUCTION

Fossil fuels are now the main source of electricity for the world's energy needs. Nonetheless, these fuel supplies have a number of drawbacks, including a decrease in air quality, the production of hazardous waste, and the depletion of natural resources (Pfoser et al. 2018). As a result of these issues, a great deal of study has been undertaken on renewable energy options, including an emphasis on pollution and fuel economics. Several studies have been undertaken around the world to preserve the atmosphere and reduce the rapid depletion of fossil oil supplies. Alternative energy options are the most environmentally sustainable energy sources available, as well as the safest way to avoid over-reliance on fossil fuels (Dyr et al. 2019). In light of this, natural gas is being seen as a viable renewable energy option due to its many advantages. These include ease of use in conventional internal combustion engines, low carbon content in comparison to other hydrocarbon fuels, and widespread availability (Yaqoob et al. 2021). The perfect clean fuel options for today's global energy needs are hydrogen and natural gas. Natural gas is known as a fossil fuel, although it can be produced using renewable resources. In general, natural gas continues to have higher thermal efficiency to internal combustion engines (Anwar, 2017). Natural gas has a lower carbon content and a higher methane content than diesel fuel, allowing vehicles to run at higher compression ratios. Furthermore, since natural gas has a lower carbon content than gasoline, it has better “anti-knocking” properties (Khan, 2017). Natural gas is compressed and used as a transportation fuel in most countries. The benefits of CNG over diesel or gasoline-powered cars have been discovered in several trials. Because of its safe origin, natural gas emits less nitric oxide (NO), hydrocarbon (HC), and carbon monoxide (CO). However, the main disadvantage of using CNG in internal combustion engines is its sluggish rate of combustion. As a result of "misfires" and incomplete combustion, unutilized methane is released into the atmosphere. Methane gas adds by a factor of twenty to global warming impacts as compared to global warming gases like carbon dioxide (Rahman & Ahmad, 2019).

The number of natural gas-powered vehicles has increased dramatically over the last decade, especially in Latin America and Asia-Pacific countries. This has been made possible by the renewable quality of natural gas, which results in lower combustion pollution from natural gas-powered cars. Furthermore, natural gas has a greater global supply than oil and is not subject to volatility in global oil markets (Anwar, 2016). Abdullah et al. (2017), tested the durability of a passenger car that ran on compressed natural gas. It was discovered that driving a vehicle on CNG reduces formaldehyde, PAHs, HC, NOx, and CO emissions as opposed to driving a vehicle on gasoline (Anwar & Balcioglu, 2016). The only disadvantage of using natural gas is the highest spark advance, which is caused by natural gas's slower laminar combustion speed. Hydrogen is blended with natural gas to improve combustion efficiency, which solves this issue. As hydrogen is added to natural gas, the result is HCNG, or Hydrogen Compressed Natural Gas (Shrivastava et al. 2020).

Natural gas is a hydrocarbon, which means it is made up of hydrogen and carbon compounds. Methane (CH4) is the most basic type of hydrocarbon, containing one carbon and four hydrogen atoms. Natural gas is located deep under the earth's atmosphere, deep within the earth. Natural gas, like any other electricity source, can be used for both residential and industrial heating. It can also be used as a transportation substitute fuel (Mohsin et al. 2019).

Natural gas is becoming more common as a transportation/vehicle fuel, despite the importance of other energy sources. This is due to the fact that natural gas is the cleanest burning fossil fuel and, as a result of lower carbon dioxide emissions, has a much better environmental efficiency than palm oil, diesel, and coal (Hameed & Anwar, 2018). Furthermore, natural gas is readily available and less expensive than other fossil fuel energy sources. Furthermore, since natural gas is silent, it can significantly decrease noise pollution from car engines. As a result of these features, natural gas has improved its status as one of the most widely consumed energy sources (Liu, 2019).

II. LITERATURE REVIEW

HCNG as an Alternative Fuel

It's worth noting that hydrogen is well-known for having a quick flame propagation rate and a wide flammability range. Because of these characteristics, HCNG produces less emissions, has a higher thermal efficiency, and burns cleanly (Anwar & Ghafoor, 2017). Because of its higher performance and clean features, hydrogen has a greater potential for use as an alternative energy source (Osorio-Tejada et al. 2017). As a result, hydrogen is predicted to be used as an alternative energy supply in the future. However, various conditions must be met before it can be licensed for general use in internal combustion engines. Inadequate refueling stations and facilities, for example, are major roadblocks to the widespread use of hydrogen cars (Murshed, 2020). A lot of studies has been done on the effects of combining hydrogen with natural gas to reduce the enormous need for pure hydrogen. This mix, without requiring any key hardware modifications, requires current CNG engines and natural gas systems to be used. As a result, HCNG has been accepted as a viable replacement for fossil fuels in current combustion engines (Wang & Su, 2020).

Assessment of Emissions between Natural Gas Engines and Diesel Engines

The Supreme Court of India ordered all public vehicles in Dehli to switch from gasoline and diesel to compressed natural gas (CNG) (Abdullah & Othman, 2016). As a result, Dehli is the city with the greatest number of CNG-powered public transportation vehicles. Following this decision, SO2, NOx, and TSP levels were reduced by 22 percent, 6 percent, and 14 percent, respectively. The Dutch government funded a campaign in 1993 to equate the amount of emissions emitted by natural gas to those produced by diesel and gasoline. Natural gas, it was observed, produced less emissions than diesel and gasoline (Ahmed et al. 2020). Similarly, Anwar & Qadir, (2017) performed an experiment to assess the amount of pollution emitted by four garbage collection trucks in Milan. One truck was powered by a Euro V diesel engine, while the other three were powered by a Euro V CNG engine. A portable measuring device was mounted in each of these trucks to calculate the amount of pollution. The findings showed that CNG vehicles emitted significantly less PM and NOx than diesel vehicles. However, they had a lower average output reliability than diesel cars (Prabhu et al. 2019). Wang & Zhan, (2019) tested the performance of a Proton Magma12-Valve 1468cc engine with four cylinders. Its engine was fitted with a bi-fueling unit and then converted from a gasoline form. It was discovered that when the engine was run at 1500 to 5500 rpm, CO2, CO, and HC were reduced by 20%, 80%, and 50%, respectively, when compared to fuel. NOx emissions, on the other hand, increased by 33%. (Ahmed et al. 2019). In Tehran, Khan, (2018) tested the exhaust emissions and efficiency of a B2000i Mazda bi-fuel engine that runs on gasoline and natural gas. The authors discovered that the quantity of HC, CO2, and CO pollutants decreased significantly. NOx emissions were the only ones that rose in quantity (Othman & Abdullah, 2016).

Dondero et al. (2005) looked at the pollution of CNG-powered vehicles as well. NMHCs, CO, and CO2 emissions

were reduced by 66 percent, 53 percent, and 20 percent, respectively, as compared to gasoline cars. NOx pollution, on the other hand, increased by 171 percent. In addition, the pollutants emitted by 37 CNG-powered vans were analyzed by two separate laboratories (Anwar & Shukur, 2015). When compared to diesel, emissions were found to be 70 percent lower (NMHC), 31 percent lower (NOx), 18 percent lower (CO2), and 40 percent lower (CO) (Fang et al. 2018). The amount of emissions emitted by a gasoline and a CNG engine were compared by Abdullah & Abdul Rahman, (2015). The findings revealed that CNG vehicles produced less CO2, CO, and HC emissions, but higher NOx emissions as compared to gasoline vehicles. Special organic compounds such as ethylbenzene, mp-xylene, toluene, and benzene, as well as NOx and CO emissions, were tested in automobiles that ran on various fuels. As compared to diesel, CNG equivalents resulted in a 90% reduction in ozone contaminants and CO (Poruschi & Ambrey, 2018).

III. METHOD

In order to interpret the present analysis, a quantitative approach was used. The current research focused on assessing the usage of Natural Gas as an Alternative Fuel for Internal Transportation. The present research was analyzed using a questionnaire. Sample design is the technique or process that the researcher is able to accept in selecting objects for the survey is referred to as sample design. The research sample was chosen using a random sampling method and carried out in various locations in Kurdistan region of Iraq. A total of 125 questionnaires were issued, but only 111 participants completed them correctly. Participants were asked to rate the value of each object on a five-point scale ranging from unimportant to highly important.

Research hypothesis

Hypothesis: The usage natural gas can be an effective alternative fuel for internal transportation.

IV. FINDINGS

The current research focused on assessing the usage of Natural Gas as an Alternative Fuel for Internal Transportation in Kurdistan region of Iraq. In order to measure the usage of Natural Gas, the researchers a main research hypothesis which stated that the usage natural gas can be an effective alternative fuel for internal transportation The researchers applied a simple regression analysis to measure the usage natural gas can be an effective alternative fuel for internal transportation in Kurdistan region of Iraq.

Table 1: KMO and Bartlett Sphericity Test of Self-rating Items

No	Factors	N of items	Sample	KMO	Bartlett test	
					Chi-Square	Sig
1	Natural Gas Fuel	12	111	.795	4514.2	.000
2	Internal Transportation	12	111			

As we can see in table (1), the outcome of KMO is .795 which is higher than .001 this indicates that the sample size used for the current study was more than adequate. Furthermore, the result of Chi-Square is 5127.2 with the significant level .000.

Table 2: Factor Analysis

No	**Components**	**N of Items**	**N**	**Eigenvalue**	**Rotation Sums of Squared Loadings**	
					% of Variance	**Cumulative**
1	Natural Gas Fuel	12	111	1.258	12.528	39.632
2	Internal Transportation	12	111	2.74	12.251	41.012

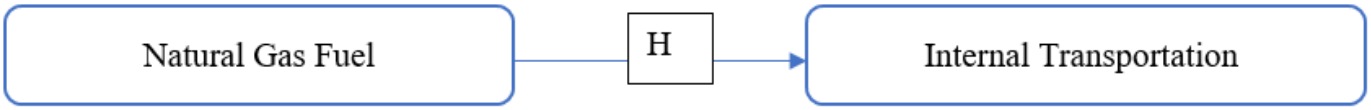
Table (2) demonstrates the usage of natural gas fuel as independent variable and internal transportation as dependent variable. As for the usage of natural gas fuel as independent variable, which had twelve item explained 12.528% of the total variance. As for Natural Reward Strategies as second skill of self-leadership, which had twelve items explained 12.251% of the total variance.

Table 3: Reliability analysis

Reliability Statistics			
Factor	n	Cronbach's Alpha	N of Items
Natural Gas Fuel	111	.749	12
Internal Transportation	111	.801	12

As seen in table (3), the reliability analysis for 24 items used to measure the usage natural gas can be an effective alternative fuel for internal transportation in Kurdistan region of Iraq. The above 24 questions were distributed as follow; 12 items for the usage natural gas, and 12 items for internal transportation. The researchers applied reliability analysis to find out the reliability for each factors, the findings revealed as follow: as for the usage natural gas was found the Alpha to be .749 for 12 questions which indicated that all 12 questions used to measure the usage natural gas were reliable for the current study, and as for internal transportation was found the Alpha to be .801 for 12 questions which indicated that all 12 questions used to measure internal transportation were reliable for the current study.

First Research Hypothesis



Research Hypothesis: The usage natural gas can be an effective alternative fuel for internal transportation.

Table 4: Correlation analysis

Correlations			
Variables	Pearson Correlation	Natural Gas Fuel	Internal Transportation
Natural Gas Fuel	Pearson Correlation	1	.776**
	Sig. (2-tailed)		.000
	N	228	228
Internal Transportation	Pearson Correlation	.776**	1
	Sig. (2-tailed)	.000	
	N	228	228
**. Correlation is significant at the 0.01 level (2-tailed).			

As it can be seen in table (4), the correlation analysis between the usage of natural gas fuel as independent variable and internal transportation as dependent variable in Kurdistan region of Iraq. The finding revealed that the value of Pearson correlation ($r= .776^{**}$, $p<0.01$), this indicated that there is positive and strong correlation between the usage of natural gas fuel and internal transportation.

Table 5-Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.711	.703	.732	.25221
a. Predictors: (Constant), Natural Gas Fuel				

Regression analysis is the study of interactions between variables. Y=f(x1,x2,...Xc) The aim of regression analysis is to determine how Y can affect and alter X. The natural gas fuel approach is treated as an independent variable in this section, while sustainable competitive advantage is treated as a dependent variable. The volatility of a comparative advantage will be used to calculate its total difference. The variations are determined by calculating the sum of the squares of the expected competitive advantage values by the overall mean divided by the number of participants. After dividing the variance by the overall variance of comparative benefit, the researcher discovered the sum or percentage of total differences or variances that are compensated for using regression analysis. The number can range from 0 to 1 and is defined by R Square. The value of R square =.732 as seen in Table (5), indicating that 73 percent of total variation has been clarified.

Table 6-ANOVA

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	121.214	1	124.212	121.221	.000[b]
	Residual	25.225	621	.035		
	Total	146.439	622			
a. Dependent Variable: Internal Transportation						
b. Predictors: (Constant), Natural Gas Fuel						

Table (6) shows that the F value for the usage of natural gas fuel as an independent variable =121.221, indicating that there is a significant relationship between the usage of natural gas fuel (121.221>1).

Table 7-Coefficients

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.312	.014		2.524	.000
	Natural Gas Fuel	.732	.035	.736	25.41	.000
a. Dependent Variable: Internal Transportation						

Table (7) shows the implications of the first hypothesis: the usage of Natural Gas Fuel strongly predicts Internal Transportation (Beta is weight 0.732, p.001), implying that the usage natural gas can be an effective alternative fuel for internal transportation.

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V. CONCLUSION

The use of fossil fuels as primary energy sources has had detrimental consequences for the atmosphere, including inadequate air quality, the production of hazardous waste, and the depletion of natural resources. As a result, several research on renewable energy sources have been conducted, with a focus on carbon and fuel costs. As a result of its wide supply, higher methane content, and low carbon composition, natural gas is favoured as a good replacement for fossil fuels. Furthermore, since natural gas has a lower carbon content than oil, it has lower anti-knocking properties. As a result of these benefits, most countries have turned to CNG as their main transportation fuel. This transition has been aided by the lower levels of NO, HC, and CO emissions generated by CNG vehicles. Furthermore, the low levels of ozone pollutants emitted by CNG vehicles have prompted countries like India and Italy to move from diesel to CNG engines in order to minimize emissions. The only disadvantage of CNG is the sluggish rate of combustion in engines. Hydrogen can be combined with natural gas to increase combustion efficiency and thereby eliminate this issue.

REFERENCES

[1] Pfoser, S., Schauer, O., & Costa, Y. (2018). Acceptance of LNG as an alternative fuel: Determinants and policy implications. *Energy Policy*, *120*, 259-267.

[2] Dyr, T., Misiurski, P., & Ziółkowska, K. (2019). Costs and benefits of using buses fuelled by natural gas in public transport. *Journal of Cleaner Production*, *225*, 1134-1146.

[3] Yaqoob, H., Teoh, Y. H., Goraya, T. S., Sher, F., Jamil, M. A., Rashid, T., & Yar, K. A. (2021). Energy evaluation and environmental impact assessment of transportation fuels in Pakistan. *Case Studies in Chemical and Environmental Engineering*, *3*, 100081.

[4] Anwar, K. (2017). Analyzing the conceptual model of service quality and its relationship with guests'satisfaction: a study of hotels in erbil. *The International Journal of Accounting and Business Society*, *25*(2), 1-16.

[5] Khan, M. I. (2017). Policy options for the sustainable development of natural gas as transportation fuel. *Energy Policy*, *110*, 126-136.

[6] Rahman, Z. U., & Ahmad, M. (2019). Modeling the relationship between gross capital formation and CO 2 (a) symmetrically in the case of Pakistan: an empirical analysis through NARDL approach. *Environmental Science and Pollution Research*, *26*(8), 8111-8124.

[7] Anwar, K. (2016). Comparison between cost leadership and differentiation strategy in agricultural businesses. *Custos E Agronegocio on Line*, *12*(2), 212-231.

[8] Abdullah, M. S., Toycan, M., & Anwar, K. (2017). The cost readiness of implementing e-learning. *CUSTOS E AGRONEGOCIO ON LINE*, *13*(2), 156-175.

[9] Anwar, K., & Balcioglu, H. (2016). The relationship between transformational leadership characteristics and effectiveness: A case study of construction companies in Erbil. *International Journal of Science Technology and Management*, *5*(2), 250-256.

[10] Shrivastava, P., Salam, S., Verma, T. N., & Samuel, O. D. (2020). Experimental and empirical analysis of an IC engine operating with ternary blends of diesel, karanja and roselle biodiesel. *Fuel*, *262*, 116608.

[11] Mohsin, M., Abbas, Q., Zhang, J., Ikram, M., & Iqbal, N. (2019). Integrated effect of energy consumption, economic development, and population growth on CO 2 based environmental degradation: a case of transport sector. *Environmental Science and Pollution Research*, *26*(32), 32824-32835.

[12] Anwar, K. (2017). The Role of Effective Leadership in Crisis Management: Study of Private Companies in Kurdistan. *Qalaai Zanist Scientific Journal*, *2*(4), 326-338.

[13] Liu, Z. (2019). The optimal biopower capacity in co-firing plants–An empirical analysis. *Energy Economics*, *78*, 392-400.

[14] Hameed, A. A., & Anwar, K. (2018). Analyzing the Relationship between Intellectual Capital and Organizational Performance: A Study of Selected Private Banks in Kurdistan. *International Journal of Social Sciences & Educational Studies*, *4*(4), 39.

[15] Anwar, K., & Ghafoor, C. (2017). Knowledge management and organizational performance: A study of private universities in Kurdistan. *International Journal of Social Sciences & Educational Studies*, *4*(2), 53.

[16] Osorio-Tejada, J. L., Llera-Sastresa, E., & Scarpellini, S. (2017). Liquefied natural gas: Could it be a reliable option for road freight transport in the EU?. *Renewable and Sustainable Energy Reviews*, *71*, 785-795.

[17] Murshed, M. (2020). An empirical analysis of the non-linear impacts of ICT-trade openness on renewable energy transition, energy efficiency, clean cooking fuel access and environmental sustainability in South Asia. *Environmental Science and Pollution Research*, *27*(29), 36254-36281.

[18] Anwar, K. (2017). factors affecting stock exchange investment in kurdistan. *The International Journal of Accounting and Business Society*, *25*(1), 32-37.

[19] Wang, Q., & Su, M. (2020). Drivers of decoupling economic growth from carbon emission–an empirical analysis of 192 countries using decoupling model and decomposition method. *Environmental Impact Assessment Review*, *81*, 106356.

[20] Abdullah, N. N., & Othman, M. (2016). The contribution of human capital investment in the growth of East Asian economy–A literature review. *Journal of Economic and Business Research*, *22*(1), 190-203.

[21] Ahmed, Z., Zafar, M. W., & Ali, S. (2020). Linking urbanization, human capital, and the ecological footprint in G7 countries: an empirical analysis. *Sustainable Cities and Society*, *55*, 102064.

[22] Anwar, K., & Qadir, G. H. A (2017). Study of the Relationship between Work Engagement and Job Satisfaction in Private Companies in Kurdistan. *International Journal of Advanced Engineering, Management and Science*, *3*(12), 239944.

[23] Anwar, K. (2017). Leading Construction Project Teams: The Effectiveness of Transformational Leadership in Dynamic Work Environments in Kurdistan. *International Journal of Advanced Engineering, Management and Science*, *3*(10), 239925.

[24] Wang, Q., & Zhan, L. (2019). Assessing the sustainability of renewable energy: An empirical analysis of selected 18 European countries. *Science of the Total Environment*, *692*, 529-545.

[25] Prabhu, M., Abdullah, N. N., & Madan Mohan, G. (2019). An Empirical Study on the Satisfaction Level of National and International Tourists towards Natural Attractions in Kurdistan. *African Journal of Hospitality, Tourism and Leisure*, *8*(2), 1-8.

[26] Ahmed, Z., Wang, Z., & Ali, S. (2019). Investigating the non-linear relationship between urbanization and CO 2 emissions: An empirical analysis. *Air Quality, Atmosphere & Health*, *12*(8), 945-953.

[27] Anwar, K., & Louis, R. (2017). Factors Affecting Students' Anxiety in Language Learning: A Study of Private Universities in Erbil, Kurdistan. *International Journal of Social Sciences & Educational Studies*, *4*(3), 160.

[28] Khan, M. I. (2018). Evaluating the strategies of compressed natural gas industry using an integrated SWOT and MCDM approach. *Journal of Cleaner Production*, *172*, 1035-1052.

[29] Othman, M., & Abdullah, N. N. (2016). The conceptual assessment of Malaysian entrepreneurship environment and EO economic contribution. *Othman, M., Saud, MB, Mat Isa, MA, & Abdullah, NN (2015). The Conceptual Assessment of Malaysian Entrepreneurship Environment and EO Economic Contribution. Journal of Resources Development and Management*, *20*, 15-20.

[30] Fang, D., Shi, S., & Yu, Q. (2018). Evaluation of sustainable energy security and an empirical analysis of China. *Sustainability*, *10*(5), 1685.

[31] Anwar, G., & Shukur, I. (2015). The Impact of Training and Development on Job Satisfaction: A Case Study of Private Banks in Erbil. *International Journal of Social Sciences & Educational Studies*, *2*(1), 65.

[32] Abdullah, N. N., & Abdul Rahman, M. (2015). The use of deliberative democracy in public policy making process. *Abdullah, NN & Rahman, MFA (2015). The Use of Deliberative Democracy in Public Policy Making Process. Public Policy and Administration Research*, *5*(3), 221-229.

[33] Poruschi, L., & Ambrey, C. L. (2018). Densification, what does it mean for fuel poverty and energy justice? An empirical analysis. *Energy Policy*, *117*, 208-217.

[34] Anwar, G., & Shukur, I. (2015). Job satisfaction and employee turnover intention: A case study of private hospital in Erbil. *International Journal of Social Sciences & Educational Studies*, *2*(1), 73.

[35] Park, Y., Meng, F., & Baloch, M. A. (2018). The effect of ICT, financial development, growth, and trade openness on CO 2 emissions: an empirical analysis. *Environmental Science and Pollution Research*, *25*(30), 30708-30719.

[36] Abdullah, N. N., & Othman, M. B. (2019). Examining the effects of intellectual capital on the performance of Malaysian food and beverage small and medium-sized enterprises. *Technology (IJCIET)*, *10*(2), 135-143.

[37] Orlov, A., & Kallbekken, S. (2019). The impact of consumer attitudes towards energy efficiency on car choice: Survey results from Norway. *Journal of cleaner production*, *214*, 816-822.

[38] Anwar, G., & Shukur, I. (2015). the impact of recruitment and selection on job satisfaction: Evidence from private school in Erbil. *International Journal of Social Sciences & Educational Studies*, *1*(3), 4-13.

[39] Guo, J., Zhang, X., Gu, F., Zhang, H., & Fan, Y. (2020). Does air pollution stimulate electric vehicle sales? Empirical evidence from twenty major cities in China. *Journal of Cleaner Production*, *249*, 119372.

[40] Prabhu, M., Abdullah, N. N., Ahmed, R. R., Nambirajan, T., & Pandiyan, S. (2020). Segmenting the manufacturing industries and measuring the performance: Using interval-valued triangular fuzzy TOPSIS method. *Complex & Intelligent Systems*, *6*, 591-606.

[41] Anwar, G., & Abd Zebari, B. (2015). The Relationship between Employee Engagement and Corporate Social Responsibility: A Case Study of Car Dealership in Erbil, Kurdistan. *International Journal of Social Sciences & Educational Studies*, *2*(2), 45.

[42] Shen, N., Liao, H., Deng, R., & Wang, Q. (2019). Different types of environmental regulations and the heterogeneous influence on the environmental total factor productivity: Empirical analysis of China's industry. *Journal of Cleaner Production*, *211*, 171-184.

[43] Prabhu, M., Nambirajan, T., & Abdullah, N. N. (2020). Analytical review on competitive priorities for operations under manufacturing firms. *Journal of Industrial Engineering and Management*, *13*(1), 38-55.

[44] Anwar, G., & Surarchith, N. K. (2015). Factors Affecting Shoppers' Behavior in Erbil, Kurdistan–Iraq. *International Journal of Social Sciences & Educational Studies*, *1*(4), 10.

[45] Khan, I., & Hou, F. (2021). The dynamic links among energy consumption, tourism growth, and the ecological footprint: the role of environmental quality in 38 IEA countries. *Environmental Science and Pollution Research*, *28*(5), 5049-5062.

[46] Khan, S., & Abdullah, N. N. (2019). The impact of staff training and development on teachers' productivity. *Economics, Management and Sustainability*, *4*(1).

[47] Anwar, G., & Shukur, I. (2015). The Impact of Service Quality Dimensions on Students' Satisfaction. *International Journal of Social Sciences & Educational Studies*, 76.

[48] Shahbaz, M., Raghutla, C., Chittedi, K. R., Jiao, Z., & Vo, X. V. (2020). The effect of renewable energy consumption on economic growth: Evidence from the renewable energy country attractive index. *Energy*, *207*, 118162.

[49] Ağbulut, Ü., & Bakir, H. (2019). The investigation on economic and ecological impacts of tendency to electric vehicles instead of internal combustion engines. *Düzce Üniversitesi Bilim ve Teknoloji Dergisi*, *7*(1), 25-36.

[50] Li, Z. G., Cheng, H., & Gu, T. Y. (2019). Research on dynamic relationship between natural gas consumption and economic growth in China. *Structural Change and Economic Dynamics*, *49*, 334-339.