The Impact of Industry on the Environment

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Abstract—The direct environmental aspects are basically emissions to the atmosphere, discharges into the aquatic environment, waste management, exploitation of natural resources and contamination of soil, utilization of natural resources and row material, local nuisance, transportation problem, environmental accident and effects on biological diversity. Activities, products and services of a company may cause significant environmental aspects that are beyond its control. Those are named indirect environmental aspects. In this context, the goal of our study is to show annual greenhouse gases emitted by industrial activities in the European Union countries for the period 2008-2016 and to develop recommendations for reducing environmental damage. Our approach goes to make statistical analysis and we will first examine greenhouse gas emissions by source sector and greenhouse gas emissions intensity of energy consumption. European environment agency and Eurostat data will be our main data in our statistical analysis.

Keywords—Environment, Industry, Pollution,Statistics

I. INTRODUCTION

The direct environmental aspects are basically emissions to the atmosphere, discharges into the aquatic environment, waste management, exploitation of natural resources and contamination of soil, utilization of natural resources and row material, local nuisance, transportation problem, environmental accident and effects on biological diversity. Activities, products and services of a company may cause significant environmental aspects that are beyond its control. Those are named indirect environmental aspects. For this reason, Industrial process need to be part of the sustainable development which means the satisfaction of present needs without compromising the ability of future generations to meet their own needs (WCED,1987).

An industry is a group of businesses that are related in terms of their main activity. In this context, industry grouping can be classified as energy-intensive manufacturing, nonenergy-intensive manufacturing, and nonmanufacturing. During this process, using only fossil resources on business create negative effects on environment but also a bigger problem in the future (Öncel A.G,Tzanakis T.2018). In this purpose, environmental corporate social responsibility has a target to minimize any damaging effects on the environment from the business processes. Corporate social responsibility is necessarily a concept whereby companies decide intentionally to commit to a cleaner environment.

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II. INDUSTRIALISATION AND CORPORATE SOCIAL RESPONSABILITIES

The essential origin of Greenhouse gases are mainly burning of fossil fuels, deforestation, transportation, electricity production, industry, agriculture and increase in population. Carbondioxyde (CO_2), Methane (CH_4), Nitrous Oxide (N_2O) and Fluorinated gases are basic greenhouse gases. Carbon dioxide increase in the atmosphere through burning fossil fuels like oil, coal or natural gas, waste and also as a result of certain chemical reactions. For example, manufacture of cement has big share in chemical reactions reason. Carbondioxide is sequestered from the atmosphere via photosynthesis (EPA,2018). Methane is mostly exhaled during the extraction of coal, natural gas and oil. Some agricultural process and also corrosion of solid waste in disposal area can create methane emissions. Agricultural and some industrial process are some of the reasons of nitrous oxide emissions. Fluorinated gases are produced by industrial process. Despite the fact that they don't harm the atmospheric ozone layer however their global warming effect is 23000 times greater than carbon dioxide (European Commission, 2018)

Generally, the average citizen has developed a culture that create or tolerates environmental pollution until some major environmental event occurs. However not all citizens have the same capacity to generate pollution. Many criteria affect on each country's share of CO_2 emissions. Data collected by the International Energy Agency (IEA) measure worldwide carbon dioxide emissions for year 2015. This one is composed of oil and other fuels, including industrial waste and non-renewable municipal waste, the coal, the natural gas. In first 3 ranking of 2015 total carbondioxyde emissions (MMT-million metric tons) from fuel combustion, we see in order China (9040,74 MMT), United States (4997,50 MMT) and India (2066,01 MMT). We observe from the rest of data that principal carbon dioxide emmiting countries are the developed and major emerging economy ones. At this point, one of the opinions is that the capitalocene is a concept that takes as a starting point the idea that capitalism is the main cause of current environmental imbalances. This concept alternative to the concept of anthropocene and first time proposed in 2009 by Andreas Malm, a PhD student at Lund university in

Sweden. The Capitalocene signifies capitalism as a way of organizing nature (Moore J.W. 2016) and Malm clearly precise that "Blaming all of the humanity for climate change lets capitalism off the hook" (Malm A.,2015). From that point of view, we can say that we would no longer speak only of living the era of the anthropocene, but of the capitalocene, as they are more responsible than others in the use of fossil fuels. Environmental footprint per each country appears to be one of the supporting argument of this idea for the reason that not all countries pollute the environment on same level. On this stage, for each industrialized country, corporate social responsability becomes an important key for a the sustainability of all economic activities.

"There is one and only social responsibility of business: to use its resources and engage in activities designed to increase its profits" stated Milton Friedman, a Nobel laureate (Friedman, 1970). Whereas he stated that the main responsibility for a company was to make money and increase profits, David Packard, Hewlett Packard (HP) is of the view that a company needs to do more than just to make money: The company needs to contribute to society (Young S.T., Dhanda K.K, 2013). From this second point of view, Corporate Social Responsibility (CRS) is also known by other terms, some of which are business or corporate citizenship, strategic philosophy (Werther and Chandler, 2011).

According to Wilson(200) roots of CRS go back to early Greek society. The first formal definition of formal definition of social responsibility was given by Howard R. Bowen (1953): " It refers to the obligations of businessmen to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of the objectives and values of our society" (Caroll, 1999).

Corporate Social Responsibility (CSR) is to take into account the expectations of various stakeholders, to identify those that the company wants or may seek to satisfy and to be publicly accountable for its actions and performance. Today, stakeholders' expectations which the company must address are: customers, employees, community, shareholders, governments, suppliers and competitors. In other words, The concept of corporate social responsibility essentially means that they decide on their own initiative to help improve society and a cleaner environment. A company is putting pressure on the environment, both direct and indirect. This pressure is created of its activity, the products it makes or the services it produces (Więcek-Janka E., Jaźwińska D.,2019). The direct environmental aspects are given as follow:

- Emissions to the atmosphere,
- Discharges into the aquatic environment;
- Waste management,
- Exploitation of natural resources and contamination of soil,
- Utilization of natural resources and row material,
- Local Nuisance,
- Transportation problem,
- Environmental accident,
- Effects on biological diversity.

Activities, products and services of a company may cause significant environmental aspects that are beyond its control. Those indirect environmental aspects are given as follow:

- Issues related to the product,
- Investments, Lending and Insurance Services,
- New markets,
- Choice and composition of the services,
- Executive decisions and planification,
- Composition of the product range,
- Outcomes and practices observed by environmental contractors, subcontractors and suppliers.

In case of all this direct and indirect environmental aspect are not taken under consideration by enterprises, we see their effects as a pollution. On this view, on the next section, we focus on the relation between pollution quantities and economic activities.

III. POLLUTION AND ECONOMIC ACTIVITIES

In the table 1, we show annual greenhouse gases emitted by economic activities for year 2015. Data extracted from Eurostat include agriculture, forestry and fishing; mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; transportation and storage; other services, water supply and construction and also households.

In this paper, multiple linear regression model is used for analyzing the relationship among CO_2 emissions based on the industrial consumption in EU using the time series data for the period 2008-2016. When applying multiple regression, we construct a model to explain variability in the dependant variable. In order to do this we want to include the simultaneous and individual influences of several independent variables (Newbold P.,at all,). Regression analysis is used to predict the future on the basis of data collected from the past.

The standardized beta coefficient (β) measures the effect of each independent variable on the dependent variable to compare the effects across independent variables. In our study, β was used to generate regression equations to retrieve the CO_2 emissions over the study area using different greenhouse gas emissions by different economic activity of the 28 EU countries.

A predictive equation for total CO_2 emissions was obtained by using the terms of β. The multiple regression equation for a response variable Y with monitor values $Y_1,Y_2,..,Yn$. Here n is the sample size. The equation is:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_q X_{qi} \qquad (1)$$

where q refers to explanatory variables X_1 ,X_2,…X_q with observed values X_{1i},X_{2i},…X_{qi} for i=1,…,n β_0 is a regression equation constant, and $\beta_0, \beta_1,…\beta_n$ are explanatory variable constants.

Multiple linear regression modelling of CO_2 emissions was carried out to generate regression equation for calculating the CO_2 emissions in European Union countries from 2008 to

TABLE I: GREENHOUSE GAS EMISSIONS BY ECONOMIC ACTIVITY

(thousands tonnes of CO_2 equivalents)

	All economic activities	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Transportation and storage	Other services, water supply and construction	Households	Economic activities plus households
EU-28	3.563.578	530.948	79.518	843.475	1.144.807	492.506	472.325	868.828	4.432.406
Belgium	88.086	12.139	29	35.306	17.030	10.396	13.186	26.625	114.711
Bulgaria	50.508	3.988	447	6.543	31.773	6.005	1.753	9.804	60.312
Czech Republi	99.161	8.602	8.157	18.244	48.039	6.130	9.990	13.460	112.621
Denmark	74.662	12.344	1.883	5.654	9.664	38.750	6.367	8.263	82.925
Germany	768.074	78.384	6.677	165.993	345.517	86.209	85.294	184.338	952.412
Estonia	17.270	1.414	87	2.388	10.388	1.723	1.271	1.040	18.310
Ireland	50.830	19.946	236	6.869	11.253	8.303	4.223	12.165	62.995
Greece	74.244	9.102	399	13.030	35.621	6.778	9.315	15.475	89.719
Spain	265.266	48.300	1.076	79.049	73.703	35.795	27.342	68.352	333.619
France	324.750	92.323	992	90.918	26.298	44.295	69.925	123.836	448.586
Croatia	17.609	3.339	716	4.453	3.834	1.074	4.192	5.468	23.077
Italy	324.436	38.521	3.650	94.962	95.168	47.054	45.081	103.653	428.090
Cyprus	6.377	644	12	1.526	3.036	224	935	1.719	8.096
Latvia	10.710	3.234	41	1.324	1.952	2.702	1.457	1.968	12.678
Lithuania	21.566	5.000	12	5.585	2.048	7.450	1.472	3.247	24.813
Luxembourg	8.246	730	7	1.460	533	4.553	963	1.683	9.929
Hungary	47.946	8.724	720	10.408	12.905	4.828	10.361	14.853	62.800
Malta	3.229	68	3	28	502	2.383	244	221	3.450
Netherlands	182.018	29.466	2.769	44.679	52.808	28.951	23.344	34.252	216.270
Austria	59.895	8.666	1.242	27.359	7.888	6.671	8.068	14.166	74.061
Poland	337.556	44.213	21.557	61.299	160.098	16.858	33.531	48.295	385.851
Portugal	59.950	9.232	259	17.950	15.759	6.022	10.728	8.473	68.423
Romania	103.472	19.897	5.362	23.383	33.713	7.746	13.370	15.992	119.464
Slovenia	14.272	1.986	302	2.192	4.649	4.089	1.054	3.229	17.501
Slovakia	37.632	3.198	530	13.920	9.953	3.373	6.658	2.880	40.512
Finland	50.957	8.053	397	14.150	13.770	9.014	5.573	6.488	57.445
Sweden	51.355	9.081	1.511	14.215	6.540	12.848	7.160	9.792	61.147
United Kingdor	413.501	50.354	20.445	80.586	110.364	82.284	69.468	129.090	542.591
Norway	54.774	6.102	15.662	11.986	1.760	16.125	3.138	5.115	59.889
Switzerland	32.586	6.945	60	7.171	690	7.811	9.909	18.732	51.318
Turkey	393.978	67.891	2.094	117.778	133.177	26.792	46.246	74.168	468.146

2016 which corresponding to a period of 9 years. Data on all economic activities which are agriculture, forestry and fishing; mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; transportation and storage; other services, water supply and construction and also households were utilized as independent variables to generate the regression equation for CO_2 emissions by multiple regression. The equation was shown as below:

CO_2 emission = β_0+β_1 Agriculture, forestry and fishing+β_2 Mining and quarrying+β_3 Manufacturing+ β_4Electricity, gas, steam and air conditioning supply+ β_5Transportation and storage+ β_6Construction+ β_7Water supply, sewerage, waste management and remediation activities   (2)
The regression equation derived as below:

CO_2 emission = -435046160 +2,85 Agriculture, forestry and fishing+1,72 Mining and quarrying+0,77 Manufacturing+1,10 Electricity, gas, steam and air conditioning supply+1,34 Transportation and storage+2,44 Construction+8,20 Water supply; sewerage, waste management and remediation activities   (3)

From the obtained result, the predicted regression equation for CO_2 emissions yielded strong $R^2 = 0,9999$ with measured CO_2 emissions. The high correlation confirmed that the predicted CO_2 emission was accurate and efficient.

IV. CONCLUSION

In our study, we focused on the relationship between CO_2 emissions and various industrial consumption in EU using the time series data for the period 2008-2016. We constructed a multiple regression equation depending Eurostat data. We found that Water supply, sewerage, waste management and remediation activities have the highest value of 8,20 showing biggest effect on CO_2 emissions. Reasons of this one need to be studied on a further study.

The results of the validation of CO_2 emissions showed also a high correlation coefficient of R2 = 0,9999. This one confirm the efficiency of the model. In the context of CO_2 emissions based on the industrial consumption, global corporations, governments of countries and individual citizens need to have their responsibility to protect the environment.

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