

# TOWARDS A TYPOLOGY OF COUNTRIES ACCORDING TO THEIR GREENHOUSE GASES EMISSION BEHAVIOUR

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The starting point of this paper is the fact that greenhouse gases (GHG) emissions are determined by numerous socioeconomic variables, being a melting pot that brings together and reflects the behaviour of all of them. Consequently, it presents undeniable spatial variability and territorial extent, showing the same kind of disparities characterising the remaining socio-economic aspects. Moreover, in view of all those characteristics, it could even be ventured that GHG emissions can become a priority variable for showing complexities of the territories and it could therefore be used to build territorial classifications in an easier way than considering a great number of variables. The aim of our work is to go further along this line from the development of a countries typology according to their GHG emission behaviour and socio-economic variables causing these emissions.

To do that 12 variables have been selected (table 1). All of them have been provided by the World Resources Institute through the Climate Analysis Indicator Tool (CAIT), which can be accessed via web (<http://cait.wri.org>).

Main Component Analysis has been used to reduce information from the original data. As a result of the analysis the 12 original variables have been reduced to 3 components, explaining 74,4 % of the total variance: C1 (use of energy and carbon intensity of economy), C2 (development) and C3 (emissions related to land use changes) (table 2).

Table 1  
USED VARIABLES

Indicator	Nº	Variables	Units	Year	Nº of countries
Emissions	1	Total GHG emissions per capita	tCO <sub>2</sub> e	2000	185
	2	Energy CO <sub>2</sub> emissions per capita	tCO <sub>2</sub> e	2004	131
	3	Industrial processes CO <sub>2</sub> emissions per capita	tCO <sub>2</sub> e	2004	184
	4	Agriculture CH <sub>4</sub> emissions per capita	tCO <sub>2</sub> e	2000	185
	5	Land-use change CO <sub>2</sub> emissions per capita	tCO <sub>2</sub> e	2000	149
	6	Total CO <sub>2</sub> cumulative emissions per capita	tCO <sub>2</sub> e	1850-2004	185
	7	Land-use change cumulative CO <sub>2</sub> emissions per capita	tCO <sub>2</sub> e	1850-2000	149
Socio-economic	8	Energy use per capita	toe	2004	129
	9	Carbon intensity of economy	tCO <sub>2</sub> / Mill. Intl \$	2004	183
	10	Carbon intensity of energy	tCO <sub>2</sub> / toe	2004	129
	11	Income per capita (GDP PPP)	Intl \$	2004	183
	12	Governance index	Index (0-100)	2006	185

Table 2  
CORRELATION COEFFICIENT BETWEEN ANALYZED VARIABLES AND SELECTED COMPONENTS

Variables	Components		
	C1 (41,4%)	C2 (21%)	C3 (12%)
GDP per capita	0,423	0,847	0,017
Energy use per capita	0,759	0,497	0,064
Governance index	0,124	0,894	-0,004
Total GHG emissions per capita	0,423	0,251	0,833
Energy CO <sub>2</sub> emissions per capita	0,813	0,447	0,055
Industrial processes CO <sub>2</sub> emissions per capita	0,644	0,383	-0,017
Agriculture CH <sub>4</sub> emissions per capita	0,028	0,354	-0,017
Land use change CO <sub>2</sub> emissions per capita	-0,149	-0,110	0,970
Total CO <sub>2</sub> cumulative emissions per capita	0,632	0,573	-0,001
Land use change CO <sub>2</sub> cumulative emissions per capita	-0,136	-0,080	0,972
Carbon intensity of economy	0,757	-0,403	0,028
Carbon intensity of energy	0,685	0,088	-0,107

The application of Cluster Analysis to the three selected components leads to a typology consisting of 12 types of countries that can be grouped into 5 main blocs. The average component scores of the 12 types can be seen in figure 1, and the countries belonging to each type in table 3.

The **first bloc** includes those countries with a clear dominance of the first component, which is positive in all cases and holds the highest value of them all, as a result of a high carbon intensity and/or a high energy consumption. Subsequently, nuances in the values of this component, together with variations in development levels, will establish different types within this bloc. The **second bloc** of countries is associated with wealth and high level of development, so the dominance of the second component is a common rule in all of

Figure 1  
AVERAGE COMPONENT SCORES OF THE 12 COUNTRY TYPES

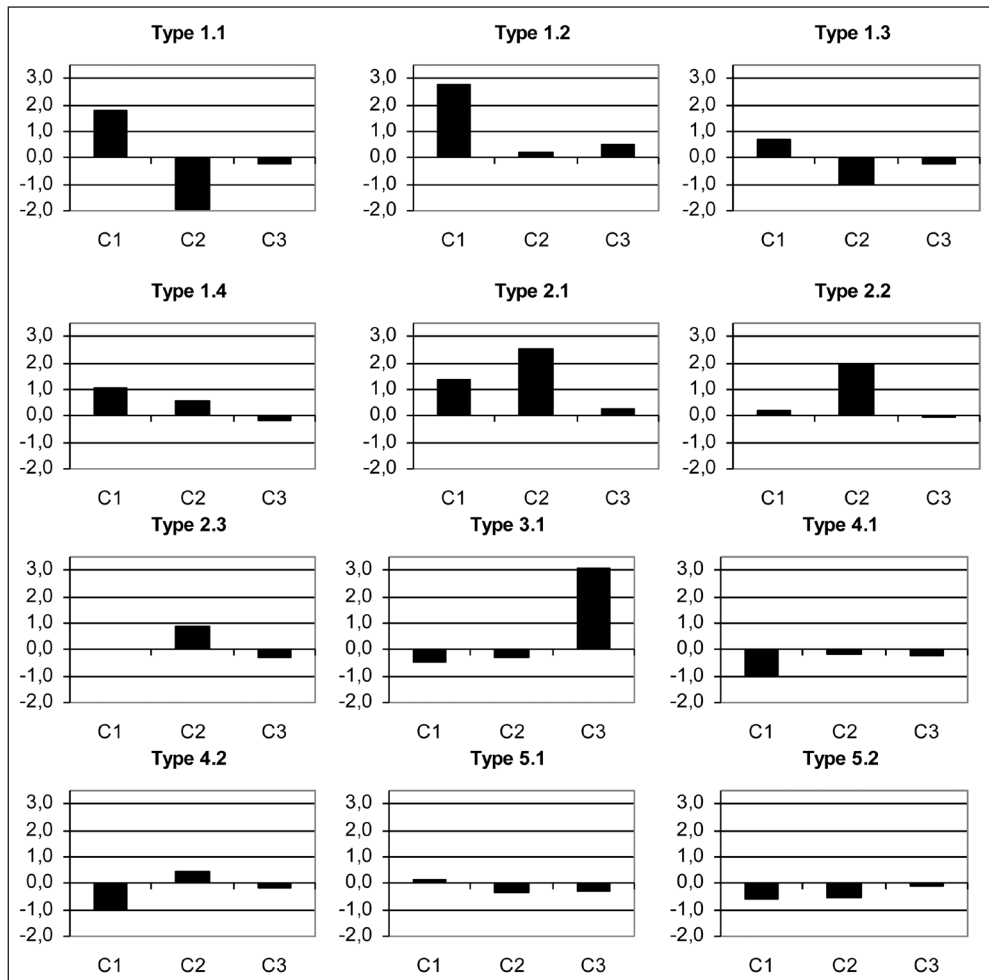


Table 3  
 TYPOLOGY OF COUNTRIES ACCORDING TO THEIR EMISSION BEHAVIOUR

Type	Country	Type	Country	Type	Country	Type	Country
1.1	Libya	2.2	Germany	4.1	Sao Tome and Principe	5.2	Myanmar
	Serbia		Netherlands		Tanzania		Dem. Republic Congo
	Kazakhstan		Denmark		Nepal		Benin
	Turkmenistan		United Kingdom		Laos		Cameroon
	Uzbekistan		Austria		Madagascar		Paraguay
	North Korea		Belgium		Cambodia		Guatemala
	Iraq		Singapore		Bhutan		Cote d'Ivoire
1.2	Trinidad and Tobago	2.3	Sweden	4.2	Bahamas	5.2	Nigeria
	Saudi Arabia		Switzerland		Barbados		Zimbabwe
	Brunei		France		Saint Kitts and Nevis		Pakistan
	Bahrain		Ireland		Seychelles		Bangladesh
	United Arab Emirates		Norway		Kiribati		Haiti
	Kuwait		Ireland		Vanuatu		Togo
	Qatar		New Zealand		Cook Islands		Sudan
1.3	Tajikistan	2.3	Chile	4.2	Brazil	5.2	Sierra Leone
	Kyrgyzstan		Latvia		Grenada		Central African Rep.
	Angola		Lithuania		Cape Verde		Eritrea
	Syria		Malta		Samoa		Guinea-Bissau
	Moldova		Argentina		Mauritius		Guinea
	Cuba		Hungary		Saint Lucia		Chad
	Congo		Portugal		Saint Vincent and Grenadines		Burundi
	Yemen		Slovenia		Dominica		Palau
	Macedonia		Italy		Brazil		Surinam
	Jordan		Spain		Botswana		Colombia
	China		Taiwan		Honduras		Namibia
	Ukraine		Uruguay		Vietnam		Maldives
	Byelorussia		3.1		Belize		5.1
	Iran	Guyana		Dominican Republic	Mauritania		
	Azerbaijan	Zambia		India	Kenya		
	Jamaica	Papua New Guinea		Armenia	Niue		
	Lebanon	Malaysia		Morocco	El Salvador		
	Nauru	Nicaragua		Bosnia and Herzegovina	Filipinas		
	Venezuela	Bolivia			Georgia		
	Russia	Indonesia		Senegal			
Equatorial Guinea	Panama						

Type	Country	Type	Country	Type	Country	Type	Country
1.4	Estonia	4.1	Antigua		Egypt		
	Oman		Costa Rica		Algeria		
	Czech Republic		Malawi		Ecuador		
	Cyprus		Mali		Mongolia		
	Israel		Uganda		Gabon		
	Estonia		Rwanda		Bulgaria		
	South Korea		Mozambique		South Africa		
	Greece		Gambia		Croatia		
	Poland		Burkina Faso		Tunis		
			Swaziland		Mexico		
2.1	Luxembourg	Djibouti		Romania			
	Canada	Salomon Islands		Turkey			
	Australia			Thailand			
	United States	Ethiopia					
2.2	Japan	Comoros	5.2	Liberia			
	Finland	Niger		Peru			

them. A typology is established here according to the C2 value and the energy consumption, which can be very variable from one country to another. The **third bloc** consists of all those countries where the third component, ie, the one associated with land use change, is the most significant; the two remaining components being slightly negative. The **fourth bloc** is composed of countries with a low energetic component, as results of a reduced energy use and, above all, low carbon and energy intensities. They also present a variable level of development, but with values next to zero, and slightly negative C3 values. The **fifth and last bloc** integrates most of underdeveloped countries. Energetic and, especially, development components present low values in these countries, and they do not even produce strong emissions from land use changes.

The results confirm the territorial importance currently acquired by the variables associated with GHG emissions, configuring a typology of countries which basis goes beyond the mere reality of these emissions.

