Could E-Government Development Reduce Corruption in South America?

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ABSTRACT

This paper analyzes the United Nations (UN)'s e-government development index (EGDI) and the Transparency International (TI)'s corruption perception index (CPI) of South American countries and identifies weather or not a Pearson "r" correlation exists between these two indexes. To do so, we have analyzed indexes from the years 2003, 2004, 2005, 2008, 2010, 2012, 2014 and 2016. Our findings show that a high positive annual correlation does exist, and the respective conclusions and recommendations are drawn from the findings. They showed a general correlation average of 0.701 (high correlation) between the EGDI and CPI indexes studied, therefore it would stand to reason that e-government development does indeed contribute to the factors that could reduce corruption in South America. Making this analysis not a causality study.

Keywords: e-government, corruption, transparency, United Nations e-government development index, Transparency International corruption perception index, Pearson correlation coefficient, South America.

1. INTRODUCTION

The aim of this paper is to make a comparative analysis on South American countries and to represent their UN's e-government development index (EGDI) [1] evolution results with their TI's perception of corruption's index (CPI) [2] between the years of 2003, 2004, 2005, 2008, 2010. 2012, 2014 and 2016. It also, determines its Pearson "r" correlation coefficient [3] between these two indexes, their evolution and their tendencies during the years.

To demonstrate this, it is important to firstly define a few crucial terms like e-government, corruption and transparency.

Electronic Government

"E-Government" defined by the World Bank refers to the use of information technologies (such as Wide Area Networks, the Internet, and mobile computing) by government agencies that have the ability to transform relations with citizens, businesses, and other arms of government [4].

The United Nation's Public Administration Network (UNPAN) gives an overview of e-government as a conceptual framework embedded in the paradigm of human and social development. In that sense, e-Government encompasses the capacity and the willingness of the public sector to deploy ICT to improve knowledge and information for service of citizens [5].

Therefore, an important characteristic of e-government is the use of technology on governmental services. Regarding this, [6] denoted the following about technology:

> *"Similarly, "[…] the Internet could be seen either as a possibility for citizen empowerment or, as a hegemony factory for companies and governments" allowing electronic government to develop right on the edge between the instrumental model of public administration and the unidirectional model (corresponding to democracy)."*

The e-government survey taken by the UN every 2[1] years in "support of sustainable development" offers an immediate and up to date image of worldwide tendencies in the development of e-government. The formation of this e-government development index (EGDI) involves: online services index, telecommunication infrastructure index and human capital index.

For the purposes of this study the definition most accurate and used is the one provided by the UNPAN.

Corruption

Another important term to define is corruption. [5] states different definitions by different institutions beginning with [2] which defines it:

> *"As the abuse of entrusted power for private gain". Corruption brings out improper and illegal behaviors where the public-sector functionaries and their associates tend to get enriched with the abuses or misuses of entrusted power. … For the most part, grand scale corruption usually involves public functionaries in high levels of position and implicate international briberies and shell accounts on foreign banks."*

The United Nations Development Program [6] also mentioned corruption as something that:

> *"undermines human development by impeding access to public services through diversions of those resources for private gain. Corruption steals resources and opportunities to improve the lives of the higher ups while the most vulnerable citizens suffer. It hinders economic development by distorting markets and damaging private sector integrity. It strikes at the heart of democracy by corroding rule of law,*

[1] This is the reason why we are not using consecutive years data to do this research, but using almost every 2 years data

democratic institutions and destroying public trust in governments and leaders."

Transparency

The international leader on the fight against corruption, International Transparency [2], is the institution currently undertaking the analysis for the corruption perception indexes previously mentioned (CPI). International Transparency's CPI positions each country on a scale from 0-100 where 0 is extremely corrupt and 100 is completely transparent. Using these scores, it allows it to portray a world ranking of corruption perception.

A point to take into consideration is the fact that International Transparency only considers the perception of corruption rather than the corruption as a real effect.

It is necessary to highlight the relationship between e-government and transparency, which is achieved through a real access to the information of the State by the citizens, which according to [7] "it is a fundamental tool for the construction of citizenship". Hence, the importance of this paper when trying to determine the correlation between the e-government development index (EGDI) and the corruption perception index (CPI) for the years of 2003 to 2016 of the South American countries.

At the same time, another important pillar is open government, which according to the same author mentioned previously; it is: "A new way of articulating efforts of transparency, citizen participation and collaboration of various actors for co-design and/or collaboration." [8] .

Previous Related Studies

Within the related studies we referred to [9], [10], and [11]; regarding the relations between e-government and corruption index variables. We have observed that [9] revealed the possible links between corruption and the lack of trust inside democratic institutions as well as the links between corruption and poverty.

On [10]'s studies, on the other hand, who conducted a correlation analysis between numerous factors related to e- government such as: E-Government - Corruption, Corruption - Instituting, Corruption - Accountability, E-Government – Instituting, E-Government – Accountability, E-Government – Political Participation, E-Government – Democratic Maturity, Corruption – Democratic Maturity, and Corruption – Political Participation. His study determined the Pearson correlations between all these factors. As our study, confirming our findings. The third study, Abu's, a relation between e-government and Transparency is analyzed. The transparency variable is given by using the corruption perception index with the open budget index. Both of which were of major significance and indicated a high prediction between themselves and the e-government one.

In respects to our paper, the scientific analysis done to the South American countries were of the two indexes previously mentioned: The e-government development index (EGDI) and the corruption perception index (CPI). The aim is to determine their evolution, finding and analyzing the leaders and their last roles during the years of 2003, 2004, 2005, 2008, 2010. 2012, 2014 and 2016. The index means or averages and dispersion figures between the indexes through the years were established. Distinctions between countries who improved on both indexes and the ones who improved in only one was also determined.

2. SOUTH AMERICAN COUNTRIES EGDI'S AND CPI'S EVOLUTIONARY TENDENCIES

South American Countries EGDI Data

The 10 South American countries considered on this analysis are: Uruguay, Argentina, Chile, Brazil, Colombia, Ecuador, Perú, Venezuela, Paraguay and Bolivia.

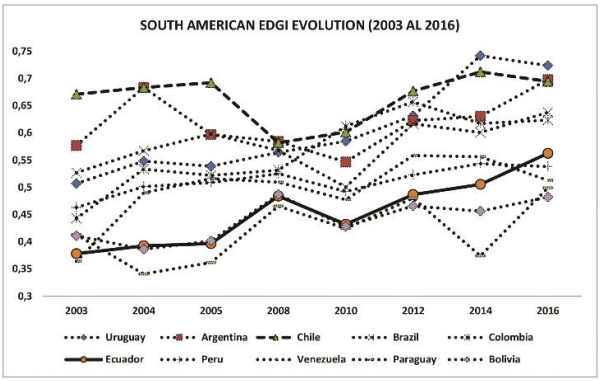

Fig. 1. Source: [1]. Writers: Authors

South American EGDI Evolution: As Figure 1 shows, the leading country on the e-government development index was Uruguay who passed from a 0.507 to 0.724 score throughout the course of the studies making it have a 0.217 points of positive improvement tendency. Uruguay, in this case, is the country who has had the biggest growth in the South American region. The second leading country, according to the 2016 data, is Argentina who went from 0.577 in 2003 to 0.698 in 2016. Argentina's significant effort is shown by its growth of 0.121 points also by 2003, Argentina passed the current leader. Chile follows on the list with 0.671 in 2003 to 0.695 in 2016 having just 0.024 points of growth even though it was leading the charts in 2003. Brazil went from 0.527 in 2003 to 0.638 in 2016 with 0.111 points of growth; Colombia on the other hand went from 0.443 in 2003 to 0.624 in 2016 making it one of the countries with the biggest growth tendency with 0.181 points of growth.

Another of the countries with the biggest growth tendency from 2003 to 2016 is Ecuador having 0.185 in growth points in its EGDI. Ecuador went from 0.378 (2003) to 0.563 (2016). In continuance with the data, Perú went from 0.463 (2003) to 0.538 (2016); Venezuela from 0.364 (2003) to 0.513 (2016); Paraguay from 0.413 (2003) to 0.499 (2016) and in last place comes Bolivia who went from 0.411 (2003) to 0.482 (2016).
It is note-worthy to mention that each of these countries has had a down fall in their indexes between the years of 2008 and 2010 except for Bolivia and Paraguay.

EGDI leading and last countries throughout the study years: As shown on Table I, the leading countries on EGDI are Chile and Uruguay and the last countries are Paraguay and Bolivia.

TABLE I. ACCORDING TO EGDI: LEADING AND LAST COUNTRIES

	2003		2004		2005		2008		2010		2012		2014		2016	
LEADING (EGDI)	CH	0,67	CH	0,68	CH	0,69	ARG	0,58	COL	0,61	CH	0,68	URU	0,74	URU	0,72
LAST (EGDI)	VEN	0,36	PAR	0,34	PAR	0,36	PAR	0,47	PAR	0,42	BOL	0,47	PAR	0,37	BOL	0,48

Source: [1]. Writers: Authors

EGDI Index average (2003 to 2016): On Figure 2, the EGDI index mean evolution showed a growth tendency demonstrating a collective growth of 0.475 (2003) to 0.597 (2016) on average value.

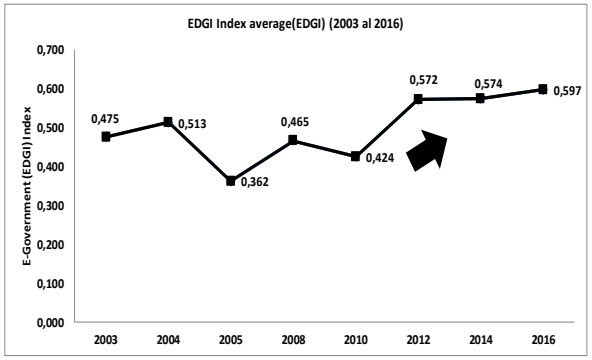

Figure No.2. Source: [1]. Writers: Authors

South American Countries CPI Data.

South American CPI ranking: Table II shows the 2016 South American countries CPI ranking.

TABLE II. 2016 CPI COUNTRY RANKING

	2003		2016	
	EDGI	RANK	EDGI	RANK
Uruguay	0,507	55	0.724	71
Argentina	0,577	25	0.698	36
Chile	0,671	74	0.695	66
Brazil	0.527	39	0.638	40
Colombia	0443	37	0624	37
Ecuador	0,378	22	0.563	31
Perú	0,463	37	0.538	35
Venezuela	0.364	24	0.513	17
Paraguay	0.413	16	0.499	30
Bolivia	0.411	23	0.482	33

Source: [1]. Writers: Authors

According to this Table, the leading country on CPI is Uruguay who went from 55 (2003) to 71 (2016) increasing 16 points. The second leading country is Chile who went from 74 (2003) to 66 (2016) even though it decreased rather than increase. Paraguay went from 16 (2003) to 30 (2016) making of one of the countries with the most improvement from 2003 after Uruguay; lastly Bolivia went from 23 (2016) to 33 (2016) increasing only 10 points making it the country with the least improvement.

CPI leading and last countries throughout the study years: As Table III and Figure 3 show, the leading countries on CPI are Chile and Uruguay and the last countries are Paraguay, Bolivia and Venezuela.

TABLE III. CPI: LEADING AND LAST COUNTRIES

	2003		2004		2005		2008		2010		2012		2014		2016	
LEADING (CPI)	CH	74	CH	74	CH	73	URU	69	CH	72	CH	72	URU	73	URU	71
LAST (CPI)	PAR	16	PAR	19	PAR	21	VEN	19	VEN	20	VEN	19	PAR	19	BOL	17

Source: [13]. Writers: Authors

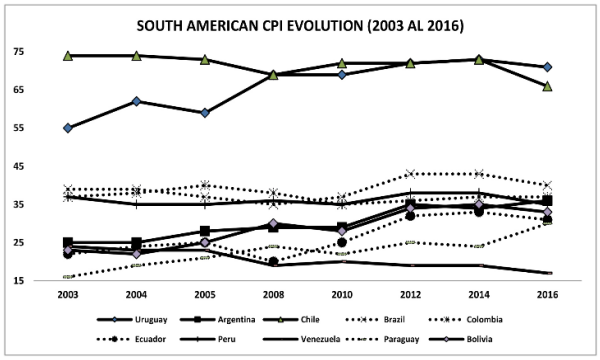

Figure 3. Source: [13]. Writers: Authors

CPI Index average (2003 to 2016): On Figure 4, the CPI index average evolution showed a growth tendency demonstrating a collective increase of 35 (2003) to 40 (2016) in average value.

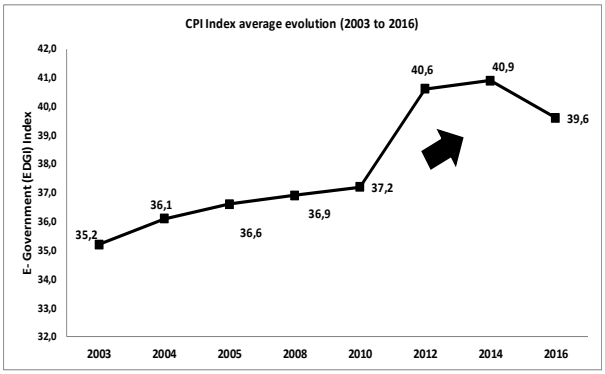

Figure No.4. Source: [12]. Writers: Authors

3. SOUTH AMERICAN COUNTRIES EGDI'S AND CPI'S EVOLUTIONARY TENDENCIES COMPARATIVE ANALYSIS

Dispersion of EGDI and CPI indexes, years 2003, and 2016

Figures 5 and 6 show the dispersion between EGDI and CPI indicators during 2003 and 2016 years:

In our analysis we observed that Uruguay's evolution stood out showing improvement on both indexes, EGDI and CPI during the studied years. Countries like Venezuela, Colombia and Perú have worked on improving their EGDI but unfortunately have instead maintained stagnant on their CPI since 2003 all the way to 2016.

On the other hand, Chile, a country with a slight improvement in its EGDI (0.67 in 2003 to 0.70 in 2016) has maintained itself in a good ranking surpassing the global average (74 to 66) even though it decreased in its CPI during the studied years.

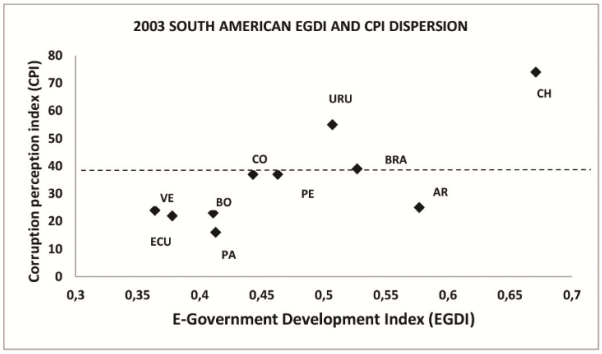

Figure No.5. Source: [1] and [12]. Writers: Authors

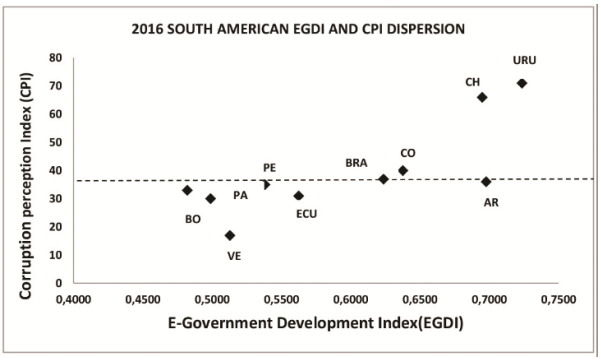

Figure No.6. Source: [1] and [12]. Writers: Authors

Therefore, we can observe at Table IV the EGDI improvement, generally:

TABLE IV. COUNTRIES WITH IMPROVEMENT ONLY ON THEIR EGDI

	2003	2016	2003	2016
Country	**EGDI**	**EGDI**	**CPI**	**CPI**
Colombia	0.44	0.62	37	37
Perú	0.46	0.54	37	35
Venezuela	0.36	0.51	24	17
Chile	0.67	0.70	74	66

Source: [1] and [12]. Writers: Authors

Table V shows that Uruguay has the best improvement among the years going from 0.51 (2003) a 0.72 (2016) in its EGDI and going from 55 (2003) to 71 (2016) in its CPI.

TABLE V. COUNTRIES WITH IMPROVEMENT ON BOTH EGDI AND CPI

	2003	2016	2003	2016
País	**EGDI**	**EGDI**	**CPI**	**CPI**
Uruguay	0.51	0.72	55	71
Argentina	0.58	0.70	25	36
Brazil	0.53	0.64	39	40
Ecuador	0.38	0.56	22	31
Paraguay	0.41	0.5	16	30
Bolivia	0.41	0.48	23	33

Source: [1] and [12]. Writers: Authors

In conclusion, from the 100% of the countries studied, only 60% improved on both indexes and from the years analyzed 40% improved only on the 1st. index. The rest, 3 deteriorated on their CPI and only 1 maintained constant. Nevertheless, except for Chile and Uruguay, the rest of the countries have maintained themselves below the average of 40 for the CPI index.

EGDI and CPI correlation coefficient evolution during the studied years.

A Pearson "r" [3] correlation coefficient has been analyzed linking the two indexes (EGDI and CPI) of all the countries with the all the studied years. Shown as follows:

TABLE VI. STUDIED YEARS CORRELATION COEFICIENTS

Year	Number	Meaning
2003	0.768	*High positive correlation*
2004	0.627	Medium positive correlation
2005	0.720	*High positive correlation*
2008	0.597	Medium positive correlation
2010	0.718	*High positive correlation*
2012	0.622	Medium positive correlation
2014	0.783	*High positive correlation*
2016	0.774	*High positive correlation*
Average	0.701	*High positive correlation*

Source: [1] and [13]. Writers: Authors

Figure 7 shows the evolution of these correlation Pearson coefficients.

In the Table VI the evolution can be observed going from 0.768 (2003) to 0.774 (2016) demonstrating a positive correlation in between the 2 years. Concluding then that high percentages of EGDI encompass high per-centages of CPI. In the last 2 years, it especially shows how these strong correlations mark a compelling tendency in which countries that have improved in their EGDI tend to improve in their CPI.

As a specific case we have Uruguay, as it has al-ready been noted, has high positive correlations in its EGDI and CPI from 2003 to 2016. The other countries although they do have a good positive correlation from 2003 to 2016, they improved a great deal from the years 2003 to 2006 on EGDI and from 2008 to 2016 on CPI. Uruguay (EGDI: 0.565 – 0.724; CPI: 69 – 71); Argentina (EGDI: 0.584 – 0.698; CPI: 29 – 36), Brazil (EGDI: 0.568 – 0.638; CPI: 35 – 40), Ecuador (EGDI: 0.484 – 0.563; CPI: 20 - 31), Paraguay (EGDI: 0.465 – 0.499; CPI: 24 – 30).

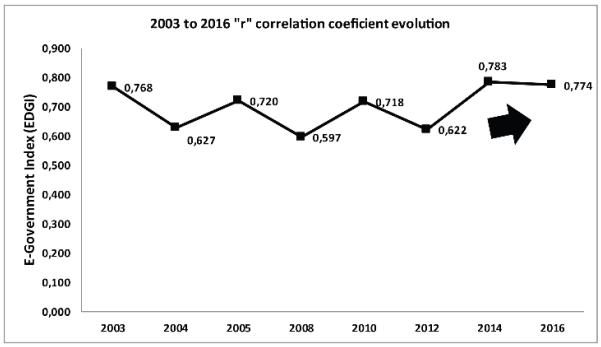

Figure 7. Source: [1] and [12]. Writers: Authors

Regardless of this positive tendency, there are a couple of exception groups: The first, who have improved their EGDI's but have not improved their CPI's during 2008, 2010. 2012, 2014 and 2016 are Perú (EGDI: 0.525 – 0.538; CPI: 36 – 35), Colombia (EGDI: 0.532 – 0.624; CPI: 38 – 37), Venezuela (EGDI: 0.510 – 0.513; CPI: 19 -17), Chile (EGDI: 0.582 – 0.695; CPI: 69 – 66). The second one, who has deteriorated on its EGDI's but have improved on its CPI's during the years of 2008, 2010. 2012, 2014 and 2016 is Bolivia (EGDI: 0.487 – 0.482; CPI: 30 – 33). Hence, the above-mentioned conclusion does not apply in its entirety.

Figure No. 8 and 9 demonstrates the previous argument:

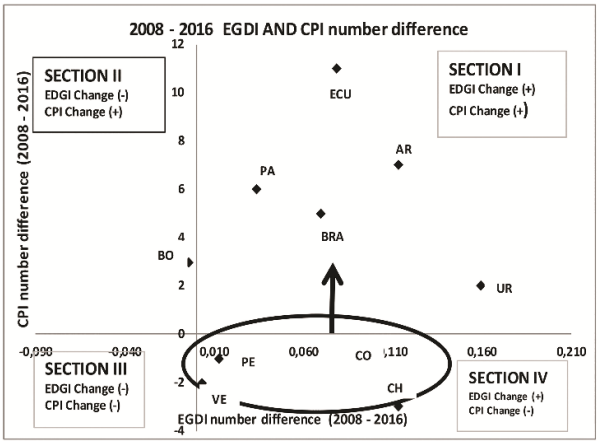

Figure 8. EGDI and CPI number difference. Source: [1] and [12]. Writers: Authors

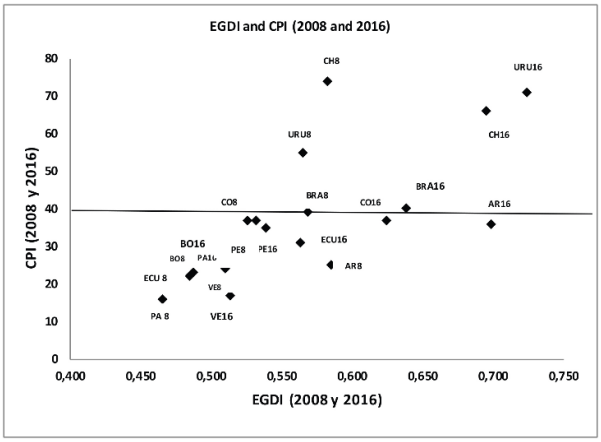

Figure 9. EGDI (2008 – 2016) and CPI (2008-2016). Source: [1] and [12]. Writers: Authors

4. CONCLUSIONS AND RECOMENDATIONS

Conclusions.

1) As we have stated in the beginning of our paper, our objective was to demonstrate the existence of a positive Pearson "r" correlation or relationship between South American countries e-government development index (EGDI) and Corruption Perception index (CPI). As an annual average, we saw an outcome of 0.701 which is a high positive correlation. The 5 countries with the greatest contribution to this outcome were Uruguay, Argentina, Brazil, Ecuador and Paraguay; the same countries which had positive tendency evolution on their EGDI's and CPI's in the years of 2008 and 2016. In 2008 it is considered that all South American countries started promoting and taking on e-government as a public policy. Uruguay being the clear example of our findings since it has improved in both indexes making its citizen participation improve as well.

2) The 2008-2016 positive "r" correlation could not advance more than 0.8 since there are countries that instead of improving on their CPI, it deteriorated despite improving on their EGDI. These countries are Perú, Colombia, Chile and Venezuela. Their contribution would have allowed for a higher outcome than 0.7 if they were able to improve on their CPI making it obvious the fact that there are other factors affecting citizen perception of corruption for example laundering, bribes, accountability, proper access to justice and others.

3) It was also observed that during 2003-2016 and more so during 2008-2016, a group of countries have maintained stagnant in both indexes neither improving nor deteriorating and who haven't passed from 40 in their ranking, inserting them in a systematic state of corruption [13].

4) Relationships between public institutions and citizens should be done with the use of and the advantage of new technological advances, but their use should lead to an overall improvement of corruption perceptions. The existence of other variables that could influence the improvement of these institutions should also be taken into considerations when trying to improve e-government policies is a must. Trained human capital on elevated levels of ethics in the public sector is a good example. As [14] mentions and supports: "The European experience and especially the North American experience show that training in ethics is fundamental. In the United States more than 20.000 federal officials serve this function and there has been remarkable progress in a country where corruption was massive. In short, administrative strategy has proven to be the most feasible and successful one".

Recommendations.

- Taking into consideration everything shown above, the prime recommendation we can give to any country in South America who wishes to lower their corruption levels, would be to develop political policies supportive of e-government development.
- To develop another study like this but with updated data to the year 2018 and observe the Pearson "r" correlation and analyze if the behavior matches our conclusions with the new updated data.
- Also, among the recommendations of the International Conference "The 22nd World Multi-Conference on Systemics, Cybernetics and Informatics"; to repeat this analysis not only with South American countries but with other regions of the world such as North America, including United States, Central America, Africa and other regions, then to arrange a comparative analysis between regions of the world. All of this in addition to a paper already published by the authors called "Could e-government development contributes to reduce corruption globally?" [15].
- To recreate this analysis using the World Economic Forum (WEF) indicators and later form a comparative analysis between our results and theirs.
- This study could open the door into finding other corruption correlations variables related to e-government such as education levels (primary, secondary and higher education) or analyze it with each country's GDP.

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